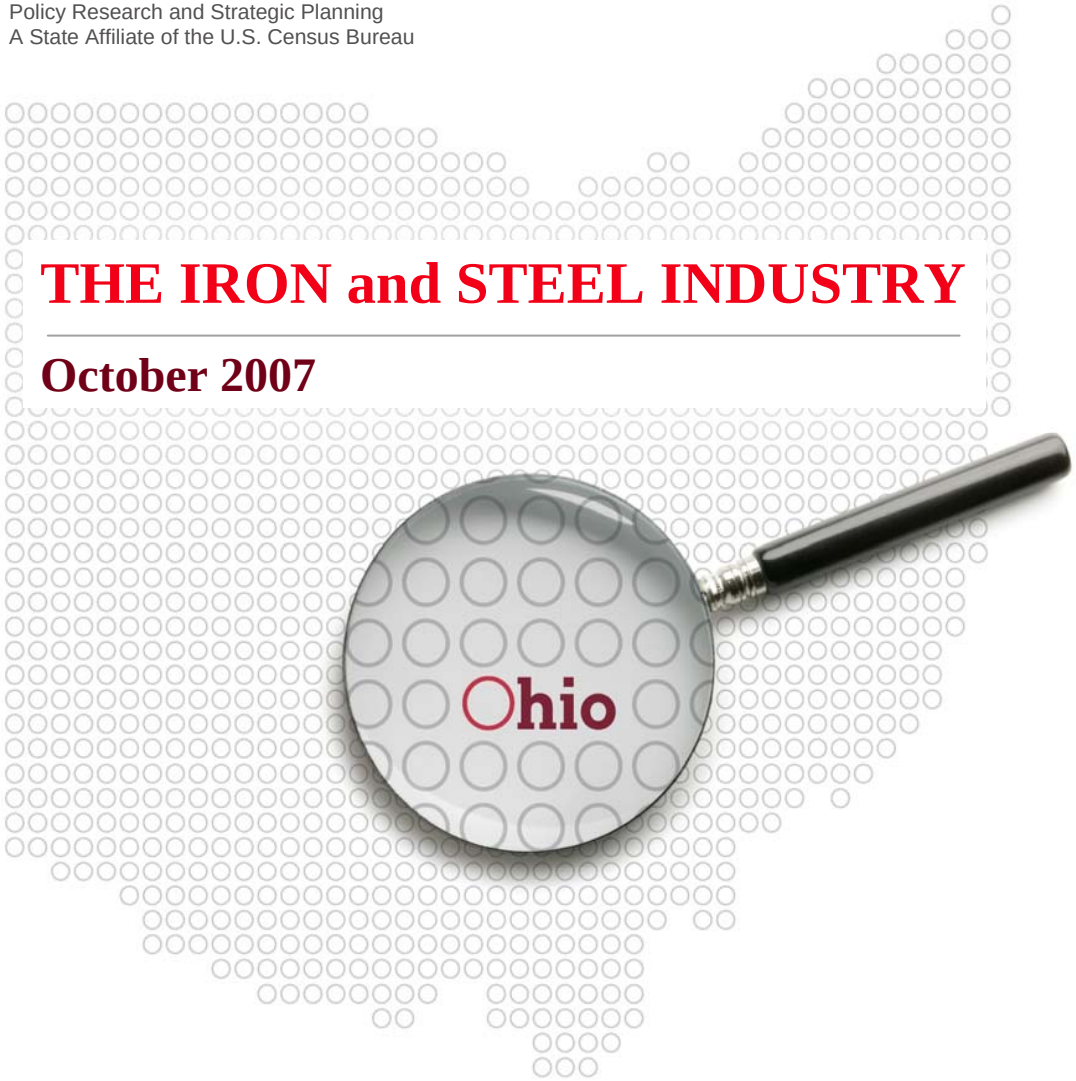
Ohio | Department of Development

Policy Research and Strategic Planning
A State Affiliate of the U.S. Census Bureau

THE IRON and STEEL INDUSTRY

October 2007



Ted Strickland, Governor of Ohio
Lee Fisher, Lt. Governor of Ohio
Director, Ohio Department of Development

Ohio | Department of Development

THE OHIO IRON AND STEEL INDUSTRY

OCTOBER 2007

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TABLE OF CONTENTS

Page

Executive Summary 1

Description of Ohio's Iron and Steel Industry - 4

Notable Iron and Steel Industry Manufacturers 6

Recent Expansion and Attraction Announcements - 10

The Composition of Ohio's Iron and Steel Industry: Value-Added 12

The Composition of Ohio's Iron and Steel Industry: Employment- 14

Industry Wages 16

The Distribution of Industry Establishments in Ohio - 18

The Distribution of Industry Employment in Ohio 20

Foreign Investment in Ohio - 21

Trends 22

Establishments - 24

Employment 26

Raw Steel Production - 28

Value-Added – a Broader Measure of Economic Output 30

Capital Expenditures by Group - 32

Exports and Imports of Steel Mill Products 34

Overview and Forecasts - 36

An Overview of the Industry 37

The Near and Long Term Forecasts - 40

Appendices 43

Detailed Tables - 44

Table A1: Notable Iron and Steel Industry Companies in Ohio, 2007 45
Table A2: Expansion and Attraction Announcements in Ohio's Iron and Steel Industry, 2004-2006 - - - - - 49
Table A3a: Distribution of Iron and Steel Value-Added in Ohio, 2002 51
Table A3b: Value-Added in the Iron and Steel Industry by Group, 2005- 52
Table A4: Iron and Steel Industry Establishments and Employment, 2005 Means and Percentages 53
Table A5: Iron and Steel Industry Employment and Payroll, 2005 Means and Ratios - - - - - - - - - - - - - - - 54
Table A6: Iron and Steel Industry Establishments and Employment by County, 2005 55
Table A7: Iron and Steel Industry Establishment Trends, Ohio and the U.S.: 1998-2005- - - - - - - - - - - - - 56
Table A8: Iron and Steel Industry Employment Trends, Ohio and the U.S.: 1998-2005 57
Table A9: Raw Steel Production in Ohio and the U.S., 1969-2006 - 58
Table A10: Value-Added by Group in Ohio and the U.S., 1997-2005 59
Table A11: Capital Expenditures by Group in Ohio and the U.S., 1997-2005- 60
Table A12: U.S. Exports and Imports and Apparent Supply of Steel Mill Products, 1969-2006 61
Table A13: Projections of Iron and Steel Industry Employment by Group, Ohio and the U.S.: 2004-2014- - 62

Industry Definition and Examples of Products 63

Glossary - 65

A Primer on Iron and Steel Production Processes 67

Notes - 68

Sources and References Cited 70

EXECUTIVE SUMMARY

- Typically 14% to 17% of the raw steel produced each year in America comes from mills in Ohio.

- Ohio ranked second in the nation in manufacturing products made from purchased steel (NAICS 3312), third in iron, steel and ferroalloys (3311), and second in the combination of the two groups, in terms of dollar value-added according to the latest available data.

- 13 companies on Fortune magazine's U.S.-1,000 or Global-500 lists have iron and steel industry operations in Ohio; three of them – AK Steel, Timken, and Worthington Industries – have their world headquarters here.

- AK Steel is Ohio's largest iron and steel industry employer with over 4,000, followed by ArcelorMittal Steel with 2,500-plus, and Republic Engineered Products with over 2,000; General Motors and Ford are the two largest foundry operators in the state, with over 1,400 and 1,200 people, respectively.

- 234 iron and steel industry establishments in Ohio employed 34,000 people; those figures represent 9.5% of the U.S. industry's establishments and 13.6% of its work force in 2005 – the latest available data.

- The iron, steel and ferroalloys group (3311) was the largest iron and steel industry group in Ohio, with over 17,000 workers in 73 establishments – of which over 15,300 worked in 67 iron and steel mills (331111).

- The greatest concentrations of industry employment in Ohio were in electrometallurgical ferroalloy production (331112 – nearly 70% of the U.S.) and rolled steel shapes (331221 – 28% of the U.S.).

- Ohioans working in the iron and steel industry averaged close to $59,700 in wages during 2005, higher than the national average of $53,300-plus. This is driven by the high wages paid in iron and steel mills (331111) and iron foundries (331511).

- 56.5% of the industry jobs in 2005 were found in Butler, Cuyahoga, Defiance, Stark and Trumbull Counties; adding the jobs in Coshocton, Jefferson, Lake and Lorain raises the proportion to 70.2%.

- 59 counties had at least one industry establishment, with the majority in 10 counties: Columbiana, Cuyahoga, Franklin, Lake, Mahoning, Montgomery, Stark, Summit, Trumbull and Washington.

- 17 companies from 13 foreign nations employ through their subsidiaries and joint ventures about 9,300 people manufacturing steel mill products in Ohio; three of them were on Fortune's Global-500 list. ArcelorMittal and Industrias CH are the largest, combining to employ about 5,100.

- 28 companies announced 34 major industry investments in Ohio during the 2004-2006 period; the projects could total $747 million – with 563 new jobs anticipated – upon completion.

- Overall, the proportion of industry expenditures going into Ohio for manufacturing iron and steel mill products (NAICS 3311 and 3312) averaged 97.3% of the proportion of value-added in Ohio during the 1997-2005 period, indicating the industry's intention to continue production here.

- Beginning in the 1960s, the three most significant developments transforming the U.S. iron and steel industry have been the rise of minimills, the rise of steel imports (i.e., foreign competition), and substitution of alternative materials for iron and steel (most notably by the motor vehicle industry).

- In particular, the rise of imports – both steel mill products as well as other goods incorporating steel – and the substitution of other materials reduced the demand and subsequent production of raw steel in Ohio and the nation beyond the normal variations of the economic cycle.

- Industry employment in Ohio fell from over 52,700 jobs in 1998 to 34,000 in 2005, a net loss of 35.6%; this has been a steeper drop than what has happened across the country.

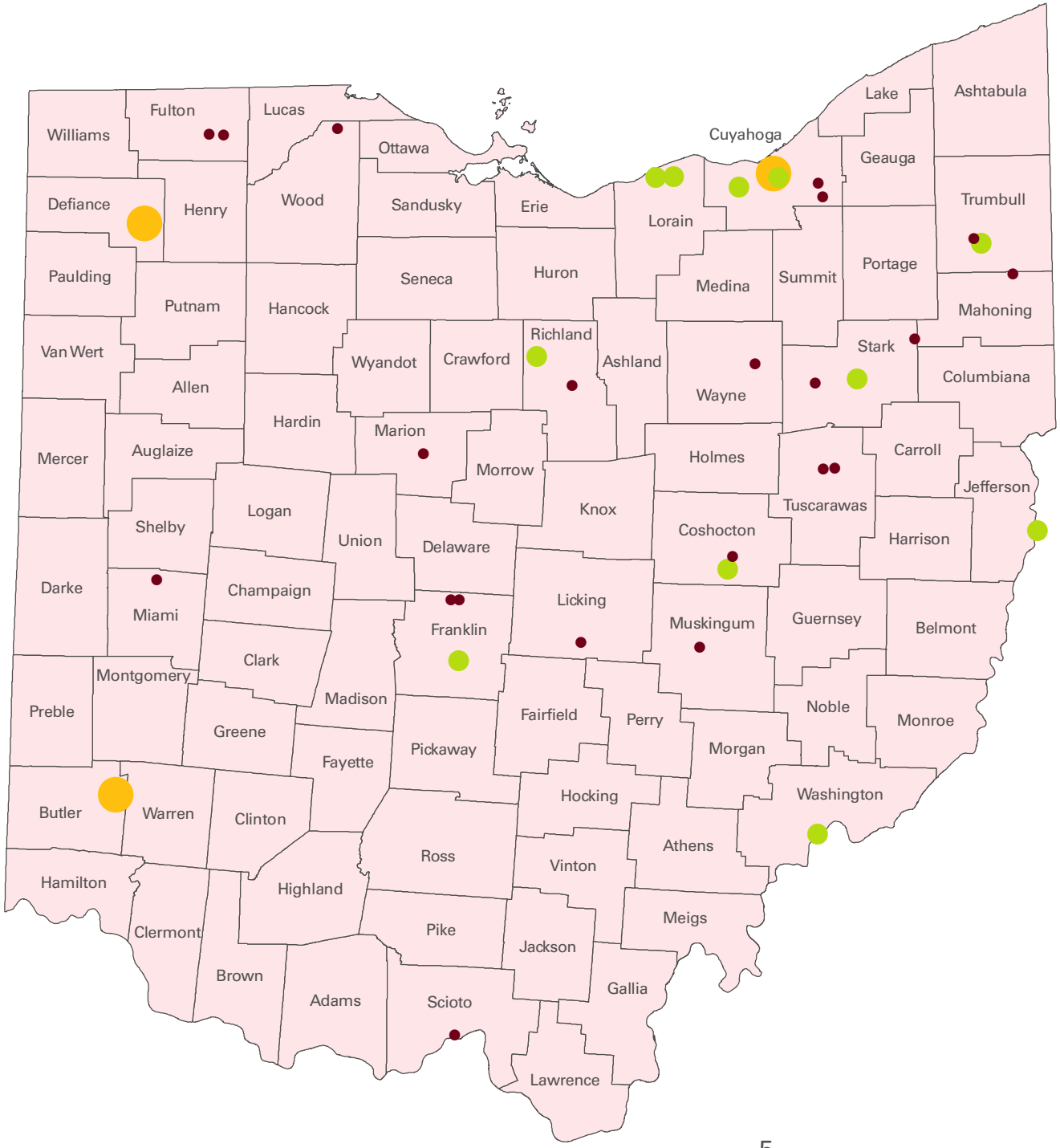
- Steel production in 2007 is expected to be slightly lower than in 2006 due to a softer economy in general, and weaker demand from key markets – in particular construction and motor vehicles; the long-term growth trend for the industry is expected to be slower than average.

- The forecast real growth in output of steel mill products (from 2004 to 2014) is not expected to stem the loss of industry jobs during that time.

DESCRIPTION OF OHIO'S IRON and STEEL INDUSTRY

Ohio Department of Development

Leading and Notable Steel Industry Establishments in Ohio



Key

Steel Establishment Employing:

- 200 - 500
- 501 - 1,500
- 1,501 - 2,470

Ohio County

Source:
Selectory® Business Database
Harris InfoSource, Twinsburg, OH

Prepared by:
Ohio Department of Development
Office of Strategic Research
October 2007

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NOTABLE IRON AND STEEL INDUSTRY MANUFACTURERS

Thirteen companies on Fortune magazine's U.S.-1,000 or Global-500 lists have iron and steel industry establishments in Ohio. Three of them maintain their world headquarters in Ohio: AK Steel, Timken, and Worthington Industries. AK Steel is the largest industry employer in Ohio with over 4,000, followed by ArcelorMittal with 2,500-plus, and Industrias' Republic Engineered Products with over 2,000. Other companies with between 1,000 and 2,000 industry workers in the state include Charter Manufacturing, Ford Motor Co., General Motors (GM), Renco's WCI Steel, Timken, Esmark's Wheeling-Pittsburgh Steel, and Worthington Industries. Ford and GM have the state's largest foundry operations.[1]

The map above shows the locations of the 35 establishments with at least 200 employees. The list below includes the Fortune companies with at least 50 people at a site as well as other companies employing 200 or more people in Ohio and having at least 50 people at a site.[2] It is organized by NAICS code and includes the location city of the site. Iron and steel manufacturing is not the principal business of some companies on the list. However, the sites of such companies are included because the primary NAICS codes of the specific establishments define them as part of the industry.

Industry Group/Company/Subsidiary	Primary NAICS	Location City	Jobs[#] at Site
3311: Iron & Steel Mills & Ferroalloys			
AK Steel Corp.*	331111	Coshocton	584
AK Steel Corp.*	331111	Dover	218
AK Steel Corp.*[1]	331111	Mansfield	389
AK Steel Corp.*[2]	331111	Middletown	2,200
AK Steel Corp.*[3]	331111	West Chester	150
AK Steel Corp.*[1]	331111	Zanesville	218
Allegheny Technologies, Inc.*/Allegheny Ludlum Corp.	331111	Louisville	145
Apollo Advisors, LP/Metals USA, Inc.*/Metals USA Carbon Flat Rolled	331111	Wooster	112
ArcelorMittal Steel Co. NV*/International Steel Group	331111	Warren	135
ArcelorMittal Steel Co. NV*	331111	Cleveland	1,600
Asahi Tec Corp./Metaldyne Corp.	331111	Cleveland	200
BlueScope Steel Ltd.-Cargill, Inc./North Star BlueScope Steel LLC	331111	Delta	330
Charter Manufacturing Co., Inc./Charter Steel – Cleveland, Inc.	331111	Cleveland	992
Industrias CH/Republic Engineered Products[6]	331111	Canton	644
Industrias CH/Republic Engineered Products	331111	Fairlawn	150

Industry Group/Company/Subsidiary	Primary NAICS	Location City	Jobs# at Site
3311: Iron & Steel Mills & Ferroalloys (continued)			
Industrias CH/Republic Engineered Products[7]	331111	Lorain	1,200
Industrias CH/Republic Engineered Products – Central Fabrication[8]	331111	Massillon	215
Nucor Corp.*/Nucor Steel Marion, Inc.[4]	331111	Marion	405
Renco Group, Inc./WCI Steel, Inc.	331111	Warren	1,280
Shiloh Industries, Inc./Liverpool Coil Processing, Inc.	331111	Valley City	101
Timken Co.* - Faircrest and Harrison plants[10]	331111	Canton	n.a.
United States Steel Corp.*/Lorain Pipe Mill	331111	Lorain	550
Wheeling-Pittsburgh Steel Corp.*[1, 11]	331111	Mingo Junction	1,140
Worthington Industries, Inc.*/Dietrich Industries, Inc.	331111	Warren	180
Eramet SA/Marietta Eramet, Inc.	331112	Marietta	550
3312: Steel Products from Purchased Steel			
AK Steel Corp.*/AK Tube LLC	33121	Walbridge	300
ArcelorMittal Steel Co. NV*/Dofasco Tubular Products Corp.[1]	33121	Shelby	666
ArcelorMittal Steel Co. NV*/Marion Dofasco, Inc.[4]	33121	Marion	125
Jackson Tube Service, Inc.[1]	33121	Piqua	313
PTC Alliance Corp./Alliance Tubular Products Co.[14]	33121	Alliance	250
Salzgitter AG/V & M Star LP	33121	Youngstown	430
TI Group plc/TI Group Automotive Systems[13]	33121	Hebron	195
TI Group plc/TI Group Automotive Systems	33121	Washington CH	68
Timken Co.* - Gambrinus plant[10]	33121	Canton	n.a.
Welded Tube of Canada, Inc.	33121	Delta	350
Greer Industries, Inc./Greer Steel Co.	331221	Dover	250
Mitsubishi Corp.*-Sojitz Corp./Coilplus-Ohio, Inc.	331221	Springfield	55
Tata Group/Corus Group*/Thomas Strip Steel Corp.[9]	331221	Warren	500
Wheeling-Pittsburgh Steel Corp.*[1, 11]	331221	Yorkville	n.a.
Worthington Industries, Inc.*[12]	331221	Columbus	400
Worthington Industries, Inc.*	331221	Worthington	250
American Spring Wire Corp.[1]	331222	Cleveland	238

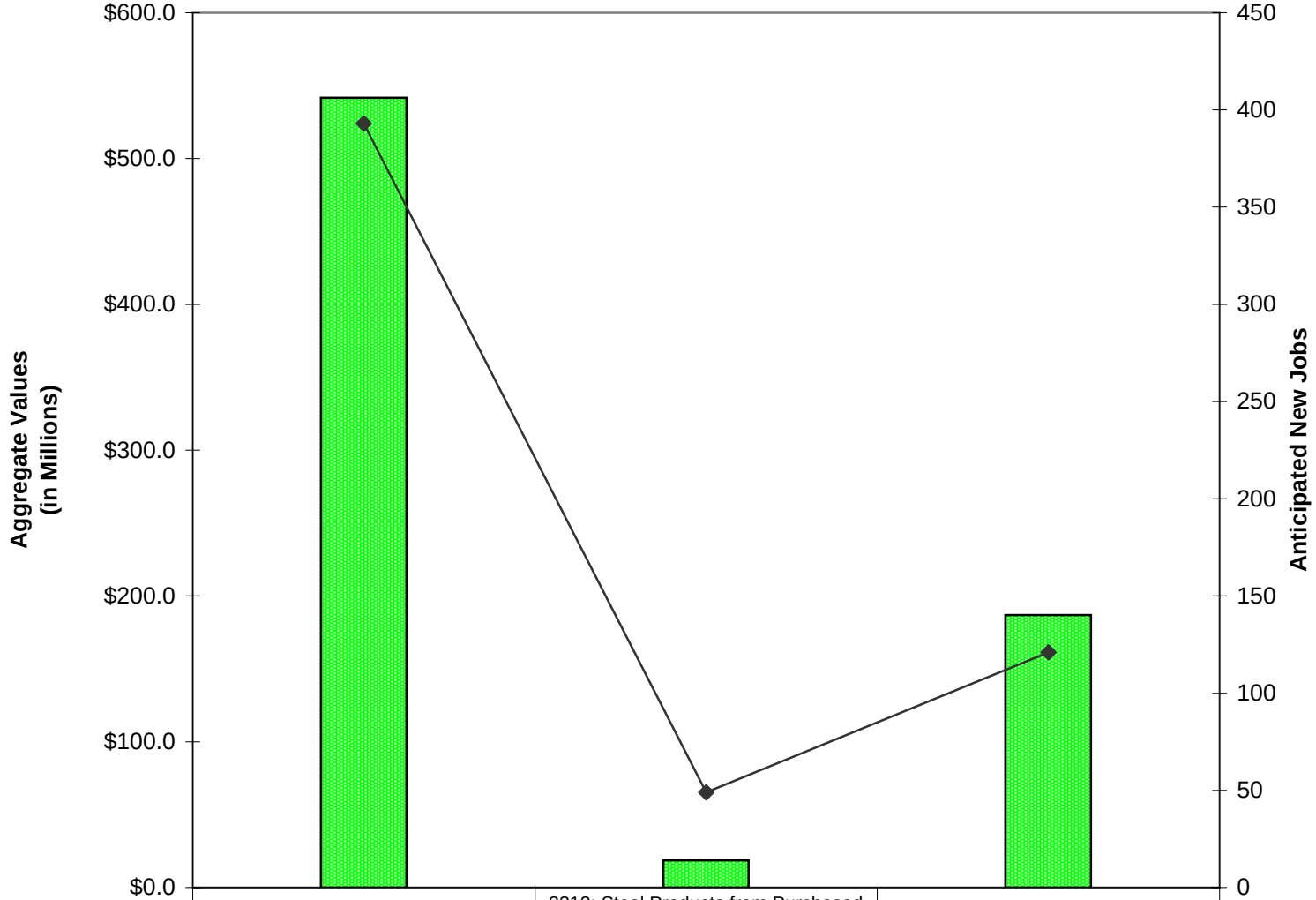
Industry Group/Company/Subsidiary	Primary NAICS	Location City	Jobs# at Site
33151: Ferrous Metal Foundries			
Ford Motor Co.*[5, 13]	331511	Cleveland	1,218
General Motors Corp.*[1]	331511	Defiance	1,454
McWane, Inc.	331511	Coshocton	400
OSCO Industries, Inc.	331511	Jackson	125
OSCO Industries, Inc.	331511	Portsmouth	285
OSCO Industries, Inc.	331511	Portsmouth	67
Quality Castings Co.	331511	Orrville	290
Columbus Steel Castings Co.	331513	Columbus	750
Shiloh Industries, Inc./Medina Blanking, Inc.	331513	Valley City	150
Shiloh Industries, Inc./Medina Blanking, Inc.	331513	Valley City	50
Worthington Industries, Inc.*	331513	Columbus	75
Worthington Industries, Inc.*	331513	Monroe	165

Notes: # - Jobs figures are from Harris (2007) unless otherwise noted; * - A Fortune U.S. 1000 or global 500 company; 1 - Jobs figure from ODOD (2007), usually the Enterprise Zone reports; 2 - Pittsburgh Business Times (2007); 3 - This figure is expected to grow to 300 (Pittsburgh Business Times, 2007); 4 - Jobs figure is from Marion Chamber of Commerce (2007); 5 - Jobs figure is from Ford Motor Co. (2007); 6 - Jobs figure is from Balint (2007); 7 - Jobs figure is from ODOT (2005); 8 - Union jobs only, according to the Canton Repository (2007); 9 - Tata Steel, a subsidiary of the Tata Group, completed acquiring the Corus Group in March, 2007 (Larkin, 2007); 10 - Jobs figure is from Kelley (2005); the Harris (2007) summary figure for Canton is thought to be too low; n.a. - not available; 11 - In March, 2007, the company announced an agreement to merge with Esmark, a steel service center and manufacturer of fabricated metal products (Larkin, 2007); subsequently Giannamore (2007) reports that the roles of the plants will change; therefore, Harris (2007) figures for Martins Ferry, Steubenville, and Yorkville may be too high; 12 - Jobs figure is from Lexis-Nexis (2007); 13 - Closing soon; 14 - Jobs figure is from PR Newswire (2007) and Times-Reporter (2007) combined.

Sources: Balint (2007), Canton Repository (2007), Ford Motor Co. (2007), Fortune (2007), Giannamore (2007), Harris (2007), Kelley (2005), Larkin (2007), Lexis-Nexis (2007), Marion Chamber of Commerce (2007), ODOD (2007), ODOT (2005), Pittsburgh Business Times (2007), PR Newswire (2007), Times-Reporter (2007).

See Table A1

Expansion/Attraction Announcements in Ohio's Iron & Steel Industry
by Group: 2004-2006



	3311: Iron & Steel Mills & Ferroalloys	3312: Steel Products from Purchased Steel	33151: Ferrous Foundries
Aggregate Value of Announced Investments	$541.6	$18.6	$186.8
Anticipated New Jobs	393	49	121

Source: Ohio Dept. of Development

RECENT EXPANSION AND ATTRACTION ANNOUNCEMENTS

Thirty-four major iron and steel industry investments in Ohio were announced by 28 companies during the 2004-2006 period (Office of Strategic Research, 2007). The value of the projects totaled $747.0 million (M), and 563 new jobs were anticipated with the completion of all projects. The largest number of projects – 13, as well as possible new jobs – 316, was announced in 2004. 2004 also saw the largest anticipated investment amount – a $341.1M.[3]

The chart above shows that $541.6M was intended for iron, steel, and ferroalloy products (NAICS 3311) during the 2004-2006 period. This is followed by $186.8M for ferrous foundries (33151), with GM's investments in its Defiance plant comprising about almost 90% of that. The remaining funds – $18.6M – are earmarked for plants making products from purchased steel (3312).

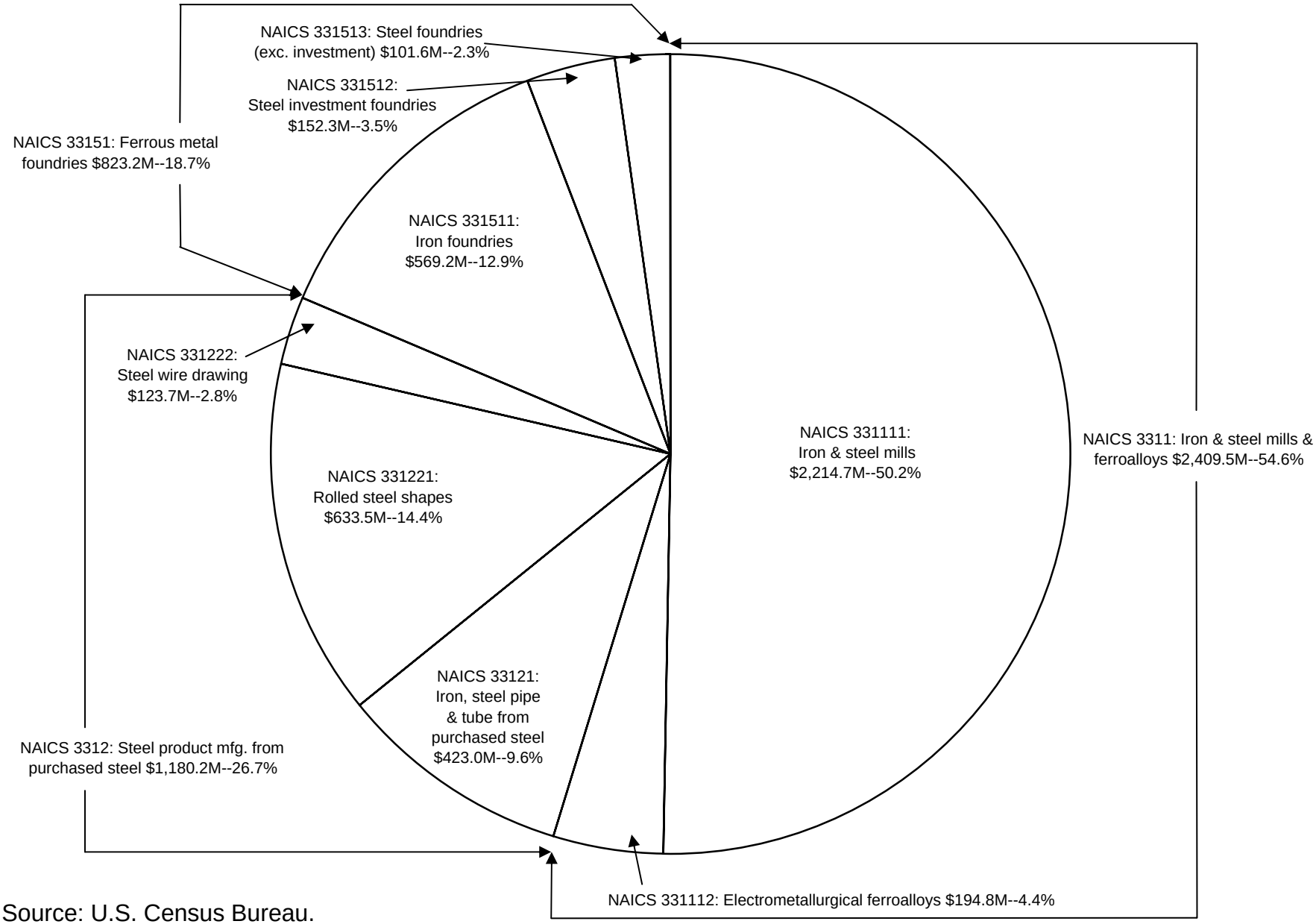
While no one company dominated investment activity, several companies made notably large investments during these years. These include General Motors – $167.9M, Warren Steel Fabricating – $130M, Charter Steel – $102.8M, AK Steel – $73.5, Renco's WCI Steel – $66.0M, ArcelorMittal – $55.2M, and Republic Engineered Products – $54.0M. Other companies investing at least $10.0M include Allegheny Ludlum and Wheeling-Pittsburgh Steel. ArcelorMittal also anticipates adding 190 new jobs when their projects are completed – the largest number by any company.

These counts are derived from a list of major investments compiled by OSR (2007). To be included, a major investment must meet at least one of the following criteria: 20,000 square feet of new space; $1M to be spent for land, building(s), or equipment; or 50 new jobs. Many of the major investments are phased in over a two-to-three year cycle, with production and employee counts phased in after project completion. The data are not comparable with the Census data on capital expenditures.

See Table A2

Value Added in Ohio's Iron & Steel Industry, 2002

Total: $4,412.9 Million--100.0%



Source: U.S. Census Bureau.

THE COMPOSITION OF OHIO'S IRON AND STEEL INDUSTRY: VALUE-ADDED

Value-added data from the 2002 Census of Manufactures and the 2005 Annual Survey of Manufactures provide insight into the composition of iron and steel industry in Ohio and a basis for comparisons with other states and the country as a whole.[4]

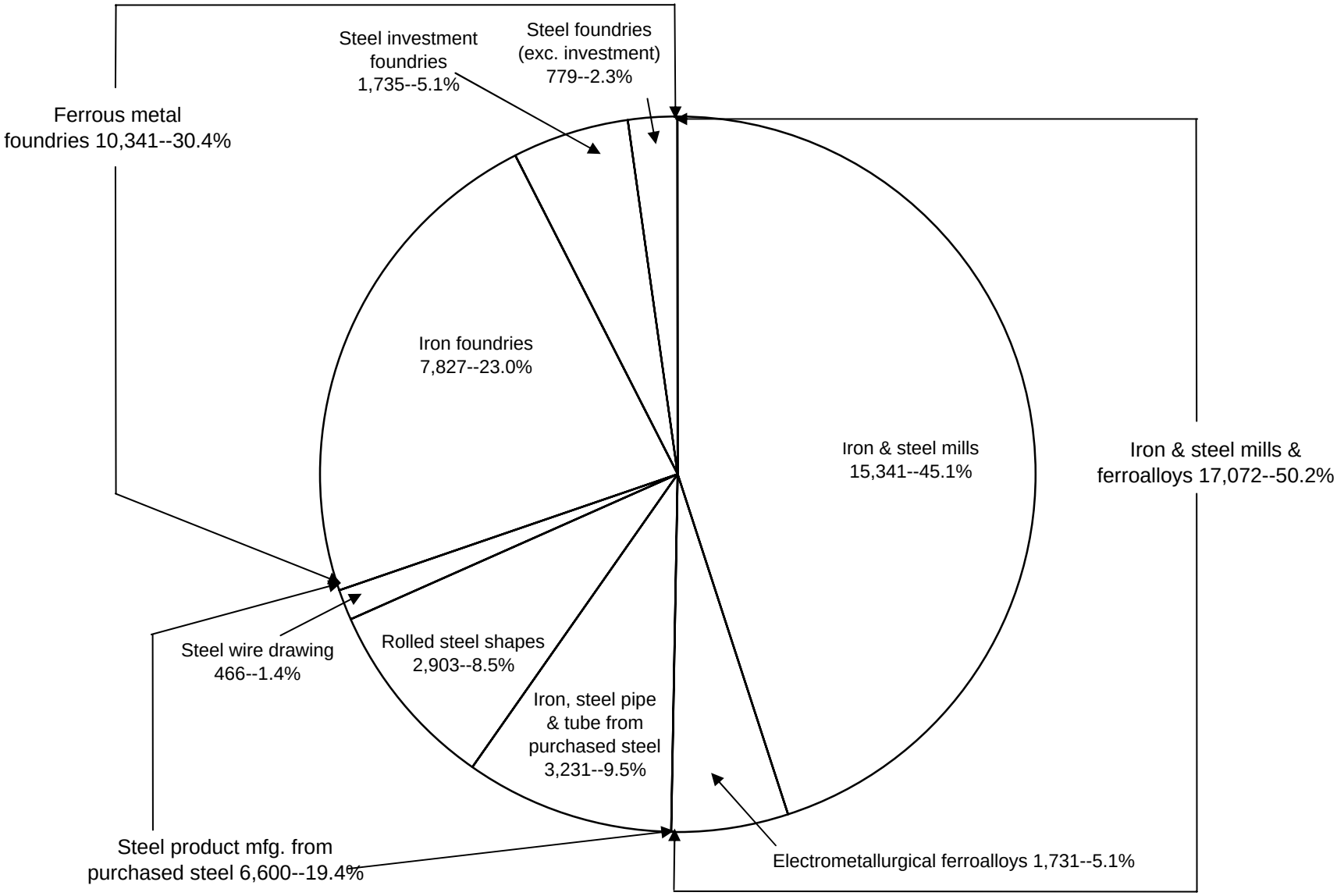
The chart above illustrates the relative distribution of the output by specific industry. One-half of industry production in the state consists of raw steel, as well as semi-finished and finished steel mill products made where the raw steel is produced (NAICS 331111). Steel product manufacturing from purchased steel (3312) comprised 26.7% of output, the largest part of which – 14.4% – was rolled steel shapes (331221 – finished products such as bars, plates, sheets and strips). Foundry operations (33151) comprised the remaining 18.7%, with iron foundries (331511) the largest part of the sub-group. Of all the remaining industries, only iron and steel pipes and tubes manufactured from purchased steel (33121) exceeded 5.0% of total industry output in Ohio (U.S. Bureau of the Census, 2005c).

Value-added data from the Annual Survey of Manufactures show that mills in Ohio contributed almost $4.9 billion (B) worth of iron, steel, and ferroalloys to the economy in 2005. This was 14.8% of the national total, and the third largest among the states. Furthermore, factories in Ohio making products from purchased steel added another $1.3B of goods. The latter figure was 18.1% of the corresponding national total, and the second largest in the country. The combined output of iron and steel mill products – a little less than $6.2B – was 15.4% of the nation, and again was the second largest amount.

See Tables A3a & A3b

Employment in Ohio's Iron and Steel Industry, 2005

Total: 34,013--100.0%



Source: U.S. Census Bureau.

THE COMPOSITION OF OHIO'S IRON AND STEEL INDUSTRY: EMPLOYMENT

234 establishments employed 34,000 people in Ohio's iron and steel industry in 2005. The chart above shows that the industry was dominated by the iron and steel mills and ferroalloys group (NAICS 3311), which had 50.2% of the industry's employment in the state. The 15,300-plus iron and steel workers (331111) at 67 plants were the largest portion of industry employment: 45.1%. The production of metals used in making alloy steel (331112) occupied 1,700-plus people – 5.1% of industry employment at six plants.

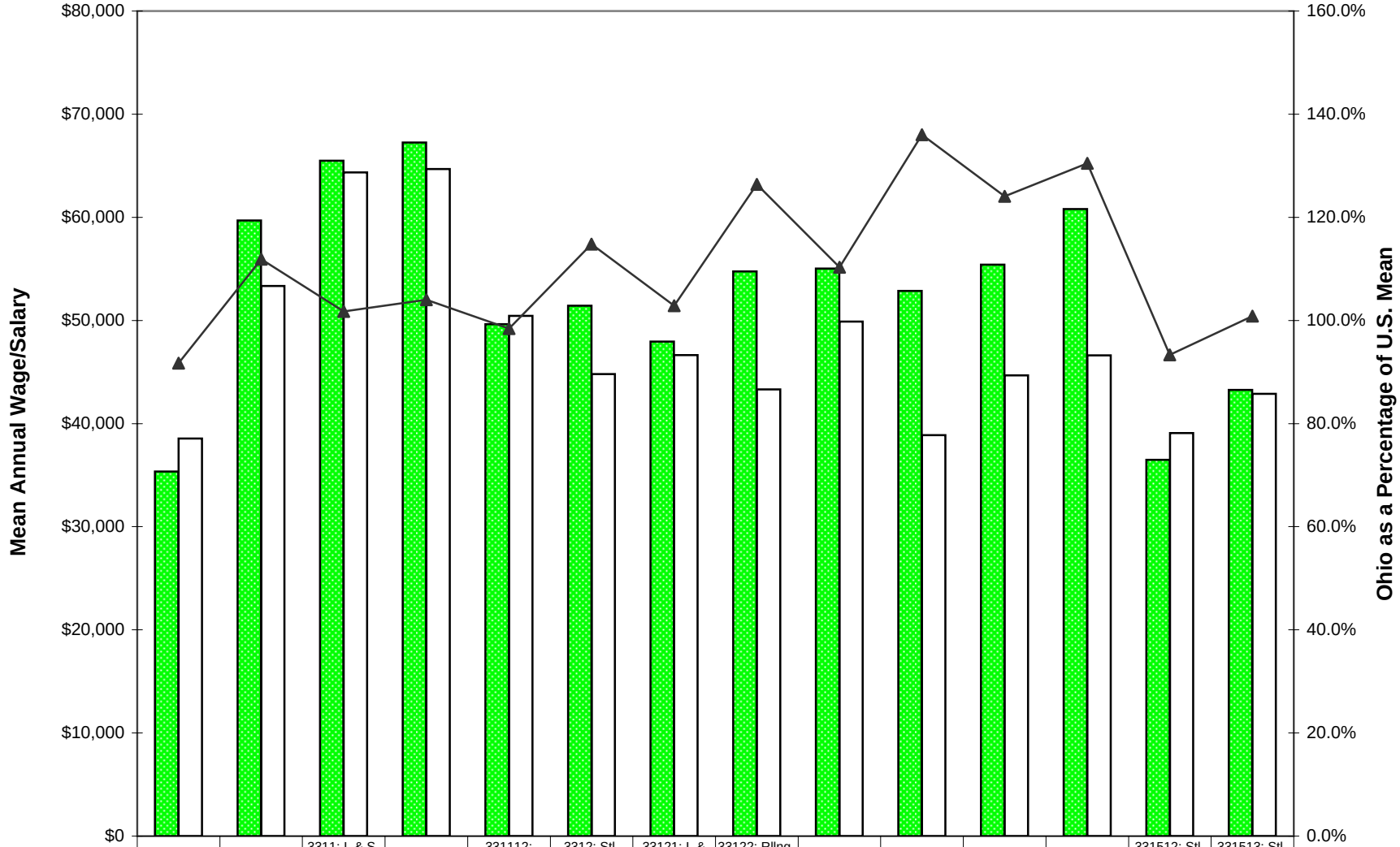
Ferrous metal foundry work (33151) was the second largest segment of the industry with 10,300-plus employees, or 30.4% of the industry total; 7,800-plus – 23.0% – worked in iron foundries (331511). Although there were 62 iron foundries, most of the jobs probably were located at just two: the motor vehicle engine block casting plants of Ford in Cleveland and General Motors in Defiance. Employment in steel foundries (331512 and 331513) amounted to just over 2,500 jobs – 7.4% of industry employment – at 28 plants.

The vast majority of workers making products from purchased steel (3312) were producing either pipes-and-tubes (33121 – 3,200-plus jobs at 28 plants) or rolling steel shapes (331221 – 2,900 jobs at 30 plants). Steel wire drawing (331222) employed less than 500 people at 13 plants. All told, the 6,600 employees in this group held 19.4% of all iron and steel industry jobs.

Comparisons with national figures are also instructive. Appendix table A4 shows that Ohio's portion of all U.S. private non-farm establishments with employees amounted to 3.6%. Similarly, Ohio's portion of all employees at such establishments was 4.1%. The table also shows that 9.5% of the nation's iron and steel industry establishments and 13.6% of its jobs are located in Ohio, indicating the concentration of the industry here. Some specific industries are particularly concentrated in the state. These include making iron and steel pipes and tubes from purchased steel – 12.2% and 15.7% of such plants and jobs in the country; rolled steel shapes – 15.9% and 28.1% of corresponding plants and jobs; and electrometallurgical ferroalloy products – an astounding 24.0% and 69.7% of plants and jobs.

See Table A4

Comparing Ohio and U.S. Industry Wages in 2005



	Ttl. Cvrd. Emplymnt.	Iron & steel industry	3311: I. & S. mills, F-alloys	331111: Iron & steel mills	331112: Elctrmtllrgcl. F-alloy	3312: Stl. Prdcts. frm Prchsd. Stl.	33121: I. & S. pipe & tube	33122: Rllng. & Drwng. Prchsd. Stl.	331221: Rlld. Stl. Shps.	331222: Stl. Wr.Drwng.	33151: Frrs. Mtl. Fndrs.	331511: I. Fndrs.	331512: Stl. Invstmnt Fndrs.	331513: Stl. Fndrs. (Exc. Invstmnt)
Ohio	$35,348	$59,686	$65,476	$67,262	$49,642	$51,423	$47,962	$54,742	$55,042	$52,873	$55,403	$60,808	$36,474	$43,252
U.S.	$38,539	$53,352	$64,353	$64,675	$50,444	$44,792	$46,635	$43,313	$49,901	$38,868	$44,662	$46,607	$39,086	$42,889
Ohio as Percent of U.S.	91.7%	111.9%	101.7%	104.0%	98.4%	114.8%	102.8%	126.4%	110.3%	136.0%	124.0%	130.5%	93.3%	100.8%

Industry

Source: U.S. Census Bureau.

INDUSTRY WAGES

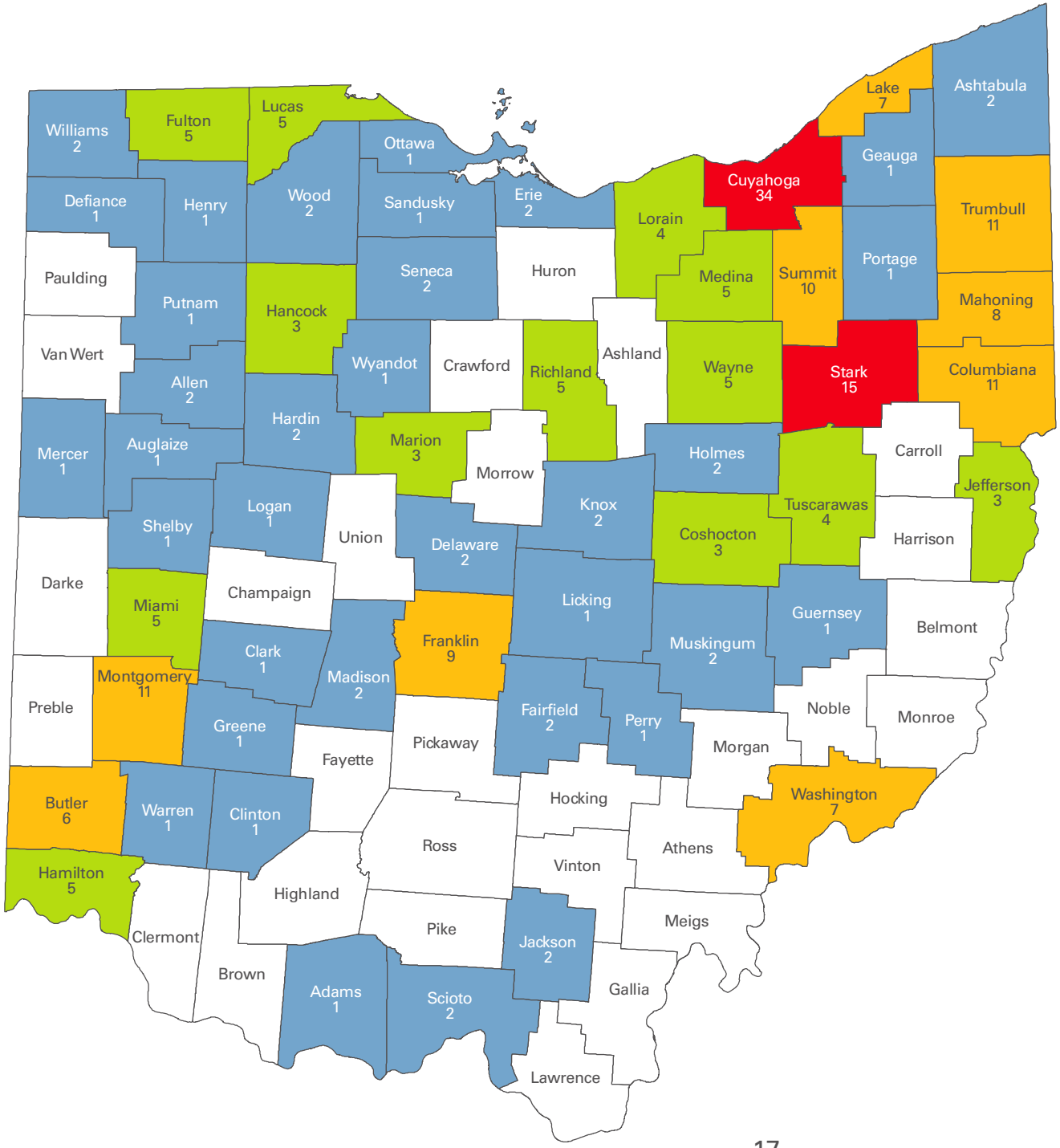
The average annual wage for an Ohio iron and steel industry worker was $59,686 in 2005. This is far greater than the overall average for non-farm employees here – $35,348. Annual averages vary among the specific industries. The highest paying industries were iron and steel mills (331111 – $67,262) and iron foundries (331511 – $60,808). This contrasts with the pay in steel foundries (NAICS 331512-3), which averaged between $36,400 and $43,300. Other industries ranged in pay from a little less than $48,000 to a little over $55,000.

The graph above also shows that average pay in Ohio's iron and steel industry was greater than the national average: $59,686 vs. $53,352. It was much higher in some industries – over 130% of the national averages in steel wire drawing and iron foundries. However, pay was not uniformly higher in every specific industry. The exceptions were steel investment foundries (33152) and electrometallurgical ferroalloys (331112), where pay in Ohio was 93.3% and 98.4% of the corresponding national averages.

See Table A5

Ohio Department of Development

Steel Industry Establishments in Ohio by County 2005



Number of Establishments in County

- 13 - 34
- 6 - 12
- 3 - 5
- 1 - 2
- None

Source:
2005 County Business Patterns
U.S. Census Bureau

Prepared by:
Ohio Department of Development
Office of Strategic Research
October 2007

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THE DISTRIBUTION OF INDUSTRY ESTABLISHMENTS IN OHIO

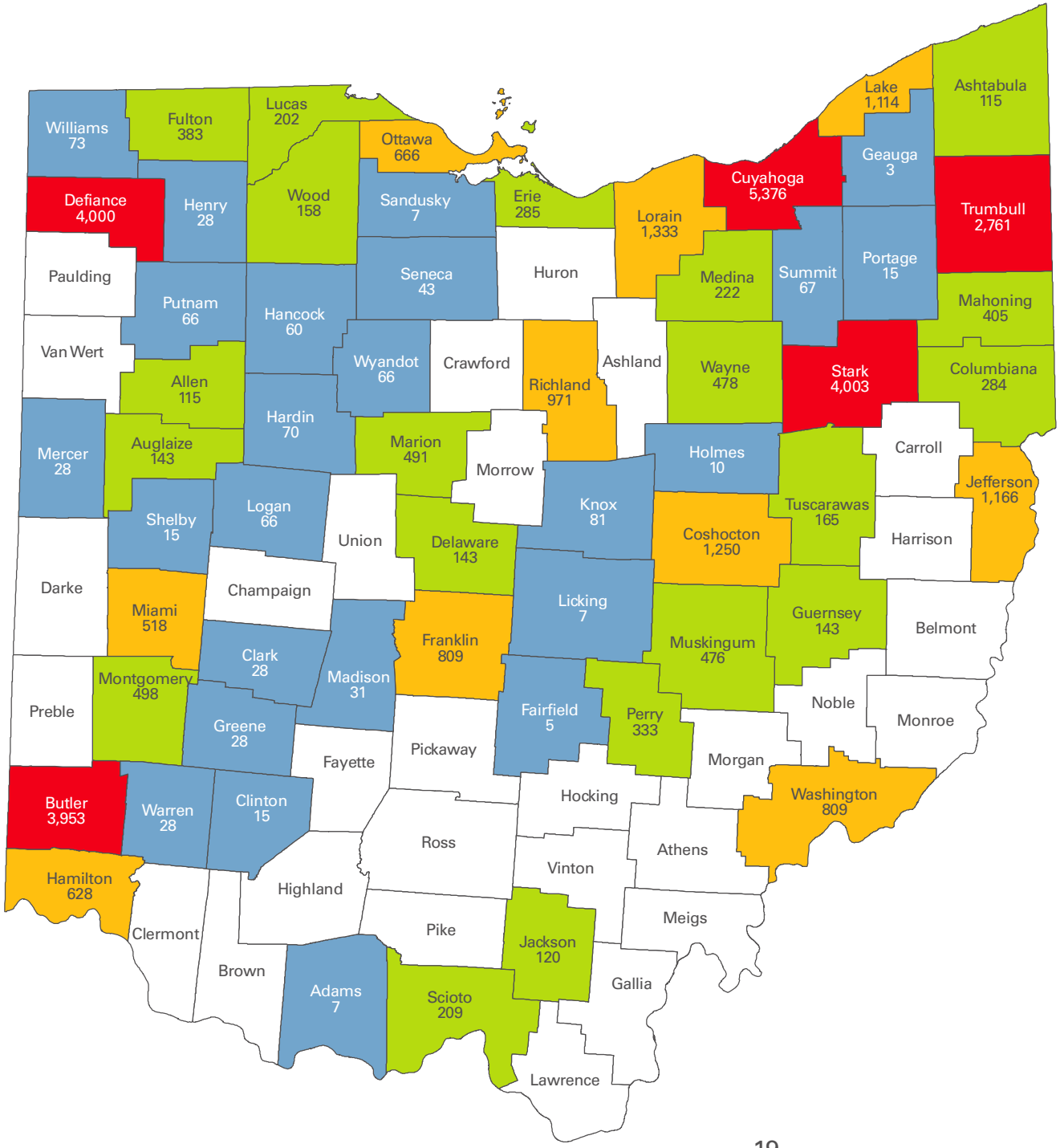
The map above illustrates the distribution of 234 iron and steel industry establishments across Ohio in 2005. Fifty-nine counties have at least one industry establishment. However, the majority were located in 10 counties: Cuyahoga – 34, Stark – 15, Columbiana, Montgomery and Trumbull –11 each, Summit – 10, Franklin – nine, Mahoning – eight, and Lake and Washington – seven each. Eight counties had five or six establishments, and 41 counties had from one to four establishments.

The map above also illustrates the concentration of industry establishments in Northeastern Ohio. In particular, nine counties – Columbiana, Cuyahoga, Lake, Lorain, Mahoning, Stark, Summit, Trumbull, and Wayne – form a contiguous area with 105 establishments, or 44.9% of the industry in Ohio. The other counties with relatively large numbers of establishments – Butler, Franklin, Montgomery, and Washington – are scattered across the state.

See Table A6

Ohio | Department of Development

Steel Industry Employment in Ohio by County 2005



Employment in County

- 2,000 - 5,376
- 500 - 1,999
- 100 - 499
- 1 - 99
- None

Source:
2005 County Business Patterns
U.S. Census Bureau

Prepared by:
Ohio Department of Development
Office of Strategic Research
October 2007

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THE DISTRIBUTION OF INDUSTRY EMPLOYMENT IN OHIO

The map above illustrates the distribution of 34,000 iron and steel industry jobs across Ohio in 2005. Industry employment was more concentrated than the distribution of establishments. Just five counties accounted for 56.4% of the industry jobs: Cuyahoga – well over 5,300, Stark and Defiance – 4,000 each, Butler – between 3,900 and 4,000, and Trumbull – well over 2,700.[5] Four more counties appear to have had between 1,100 and 1,400 jobs each: Coshocton, Jefferson, Lake and Lorain. Six counties had between 500 and 999 jobs, 20 had at least 100 but less than 500, and 24 had less than 100.

The 15,800-plus industry jobs in the same nine contiguous Northeastern Ohio counties – Columbiana, Cuyahoga, Lake, Lorain, Mahoning, Stark, Summit, Trumbull, and Wayne – also comprised about 46.5% of the state total, but there are notable exceptions to the generalization that the concentration of jobs follows the concentration of establishments. Counties with smaller numbers of establishments but larger numbers of jobs include Butler, Coshocton, Defiance, and Jefferson. These counties have large steel making and/or foundry operations. Butler is home to AK Steel. AK and McWane have steel making operations in Coshocton. General Motors has an engine block foundry in Defiance, and Wheeling-Pittsburgh Steel has a primary production facility in Jefferson.

See Table A6

FOREIGN INVESTMENT IN OHIO

Seventeen foreign-based companies have subsidiaries and/or joint ventures in Ohio's iron and steel industry; three are on Fortune's Global 500 list. All of the companies are listed below, along with the countries where the ultimate parent(s) is (are) located, their Ohio subsidiaries, and the total number of employees here.

Foreign Parent(s) / Country & Partner(s)	Ohio Subsidiary(ies)	Jobs
Altana AG / Germany	Eckart America LP	100
ArcelorMittal Steel Co. NV* / Luxembourg-Netherlands	Dofasco, International Steel Group, Mittal, Skyline	2,546
Asahi Tec Corp. / Japan	Metaldyne Corp.	200
BlueScope Steel Ltd.-Cargill, Inc. / Australia-U.S.	North Star BlueScope Steel LLC	330
Eramet SA / France	Marietta Eramet, Inc.	550
Industrias CH, S.A. de C.V. / Mexico	Republic Engineered Products	2,225
Marubeni Corp.-Itochu Corp. / Japan	SOS Leveling Co.	14
Metalurgica Gerdau SA / Brazil	Ameristeel Bright Bar, Inc.	37
Mitsubishi Corp.*-Sojitz Corp. / Japan	Coilplus-Ohio, Inc.	55
N.V. Bekaert SA / Belgium	Bekaert Corp. (f.k.a. Contours)	170
Salzgitter AG / Germany	V & M Star LP	430
Shinagawa Refractories Co., Ltd. / Japan	Shinagawa Advanced Materials	28
Tata Group/Tata Steel/Corus Group* / India	Thomas Strip Steel Corp.	500
Techint Compagnia Tecnica Internazionale SpA / Italy	Tenaris (f.k.a. Maverick Tube Corp.)	100
TI Group PLC / United Kingdom	TI Group Automotive Systems Corp.^	263
Welded Tube of Canada, Inc. / Canada	Welded Tube of Canada, Inc.	350

Notes: *– A Fortune Global 500 company; f.k.a. – formerly known as; ^ - one of the plants is closing soon. Sources: See table A1, Harris (2007), and PRSP (2006).

The foreign parent companies or joint venture partners have headquarters in 13 nations. Six are located in Japan and two in Germany. Australia, Belgium, Brazil, Canada, France, India, Italy, Mexico and the United Kingdom are home to one each. The newly formed ArcelorMittal lists Luxembourg and the Netherlands as its home countries. Altogether, the 17 companies employ approximately 7,900 people – perhaps one-fifth to one-fourth of industry jobs. ArcelorMittal and Industrias CH are the largest employers with over 4,700. Most of the companies are either making steel or making steel products from purchased steel. Eramet is the only ferroalloy producer. None of the subsidiaries appears to run a foundry.

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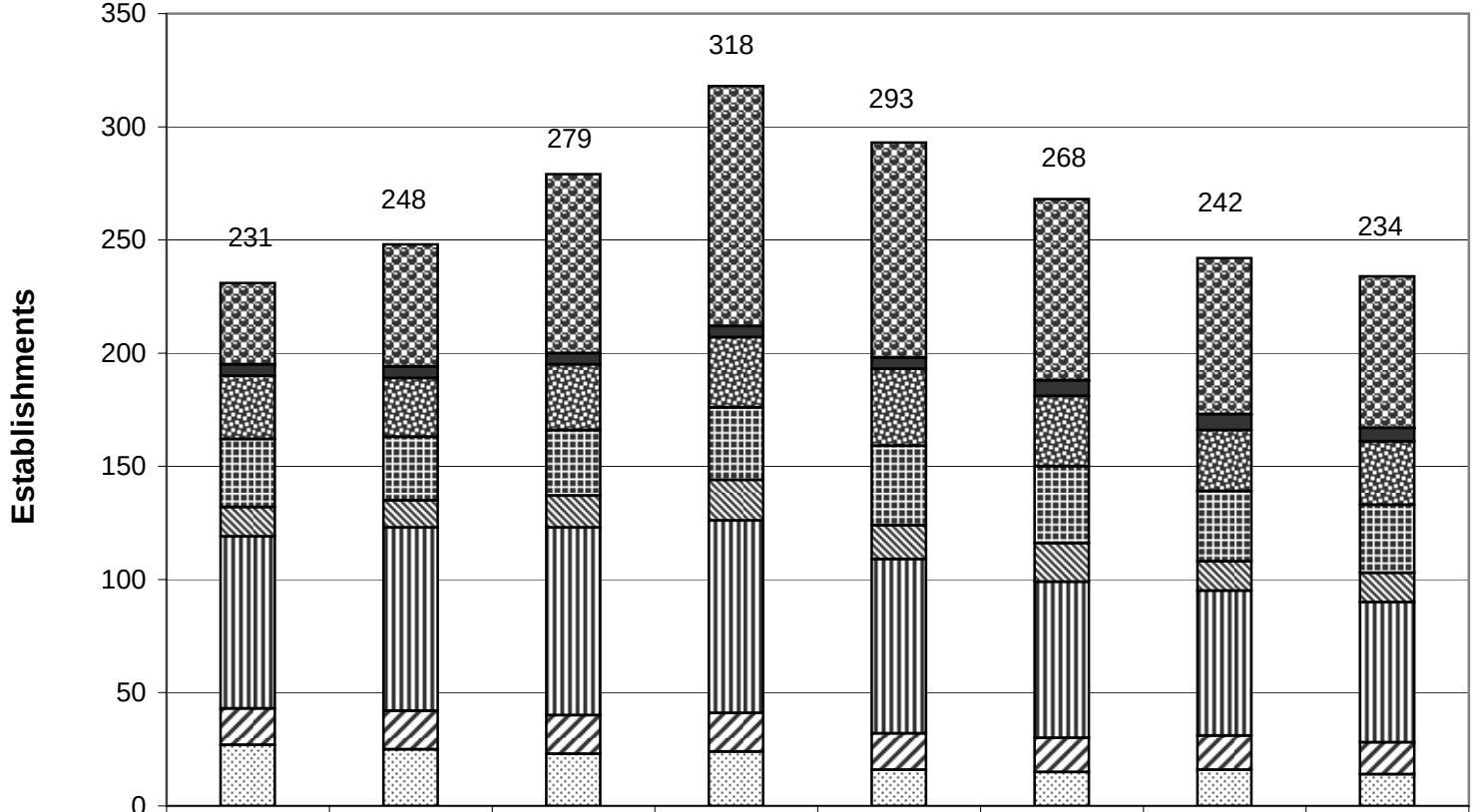
TRENDS

Establishment Trends in Ohio's Iron & Steel Industry: 1998-2005



	1998	1999	2000	2001	2002	2003	2004	2005
331111: Iron & steel mills	36	54	79	106	95	80	69	67
331112: Electrometallurgical ferroalloys	5	5	5	5	5	7	7	6
33121: Iron, steel pipe & tubes	28	26	29	31	34	31	27	28
331221: Rolled steel shapes	30	28	29	32	35	34	31	30
331222: Steel wire drawing	13	12	14	18	15	17	13	13
331511: Iron foundries	76	81	83	85	77	69	64	62
331512: Steel investment foundries	16	17	17	17	16	15	15	14
331513: Steel foundries (exc. investment)	27	25	23	24	16	15	16	14

Source: U.S. Census Bureau.

ESTABLISHMENTS

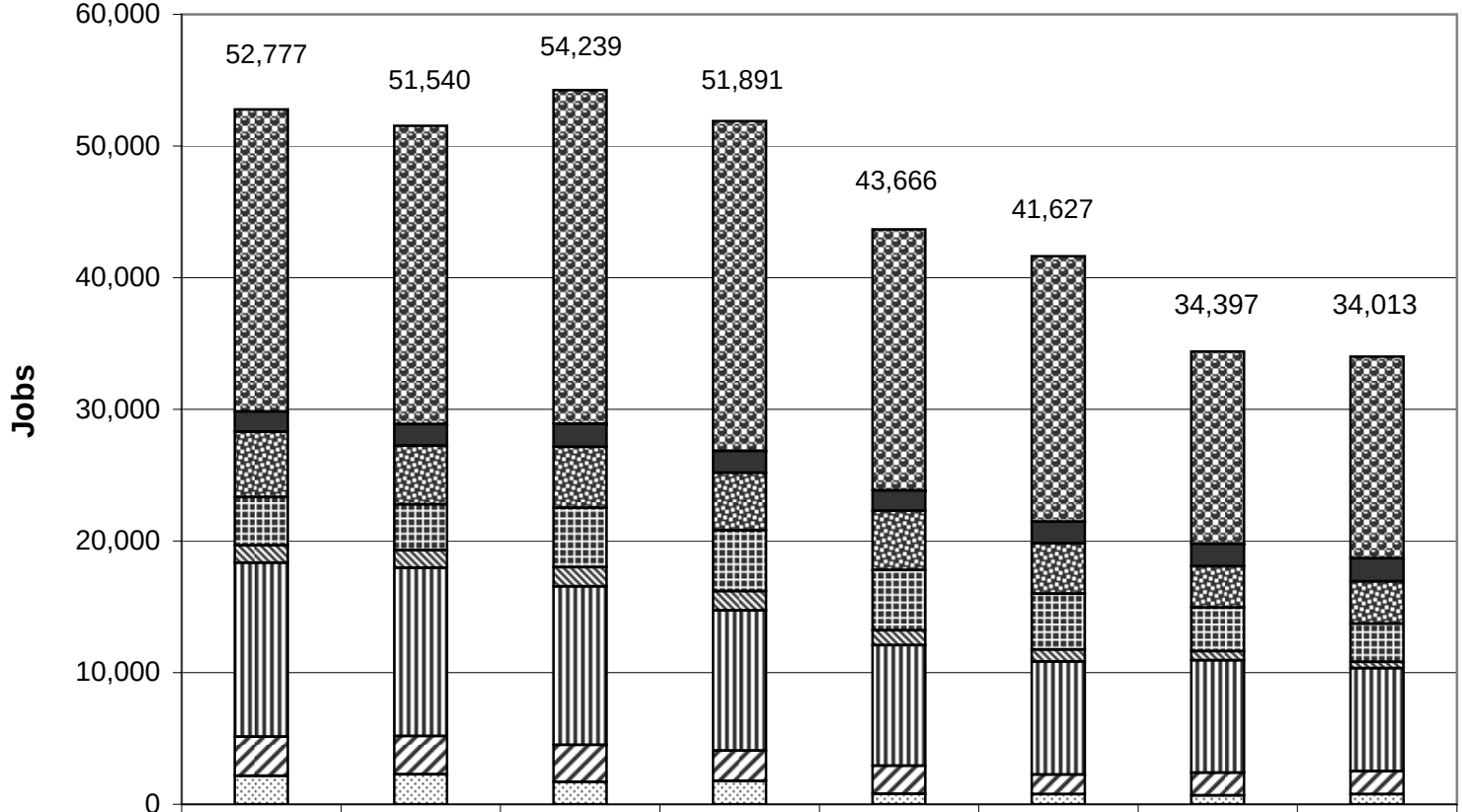
The chart above shows that the number of iron and steel industry establishments in Ohio actually rose from 231 in 1998 to 318 in 2001 before declining to 234 in 2005. This overall pattern of change is the aggregation of different changes in the specific industries. Most notably, the number of iron and steel mills (331111) rose from 36 in 1998 to 106 in 2001 and then dropped to 67 by 2005, with a net increase of 31 establishments. This contrasts with the increase of iron foundries (331511) from 76 in 1998 to 85 in 2001, and the subsequent decline to 62 in 2005 – a net change of -14. The number of steel foundries (excluding investment foundries - 331513) fell by 13. Other industries – electrometallurgical ferroalloys (331112), iron and steel pipes and tubes (33121), rolled steel shapes (331221), steel wire drawing (331222), and steel investment foundries (331512) – fluctuated with little or no net change.

What happened in Ohio was similar to what happened across America. The number of iron and steel mills increased from 1998 to 2001 and decreased until 2005, when it rose. There were more mills in 2005 than in 1998. The number of ferrous foundries (33151) also rose from 1998 to 2001 and decreased thereafter, with a net result of fewer foundries in 2005 than in 1998. The number of plants making products from purchased steel (3312) also rose and fell, but with a smaller net loss – both in absolute and percentage change – than ferrous foundries.

It is also interesting to compare changes in the iron and steel industry with the manufacturing sector in general. The number of iron and steel industry establishments in Ohio rose and fell from 1998 to 2005 with little net change. The changes across the nation as a whole were similar, but slightly more positive for the industry. Meanwhile, the total number of manufacturing establishments steadily declined from 1998 to 2005: by 7.9% in Ohio, and 9.0% throughout the U.S.

See Table A7

Employment Trends in Ohio's Iron & Steel Industry: 1998-2005



	1998	1999	2000	2001	2002	2003	2004	2005
331111: Iron & steel mills	22,948	22,669	25,351	25,061	19,822	20,159	14,610	15,341
331112: Electrometallurgical ferroalloys	1,531	1,637	1,750	1,639	1,531	1,624	1,705	1,731
33121: Iron, steel pipe & tubes	4,961	4,459	4,617	4,368	4,512	3,837	3,139	3,231
331221: Rolled steel shapes	3,676	3,466	4,515	4,631	4,583	4,263	3,306	2,903
331222: Steel wire drawing	1,321	1,338	1,465	1,465	1,139	913	703	466
331511: Iron foundries	13,197	12,791	12,037	10,650	9,154	8,579	8,526	7,827
331512: Steel investment foundries	2,983	2,894	2,805	2,310	2,132	1,488	1,725	1,735
331513: Steel foundries (exc. investment)	2,160	2,286	1,699	1,767	793	764	683	779

Source: U.S. Census Bureau.

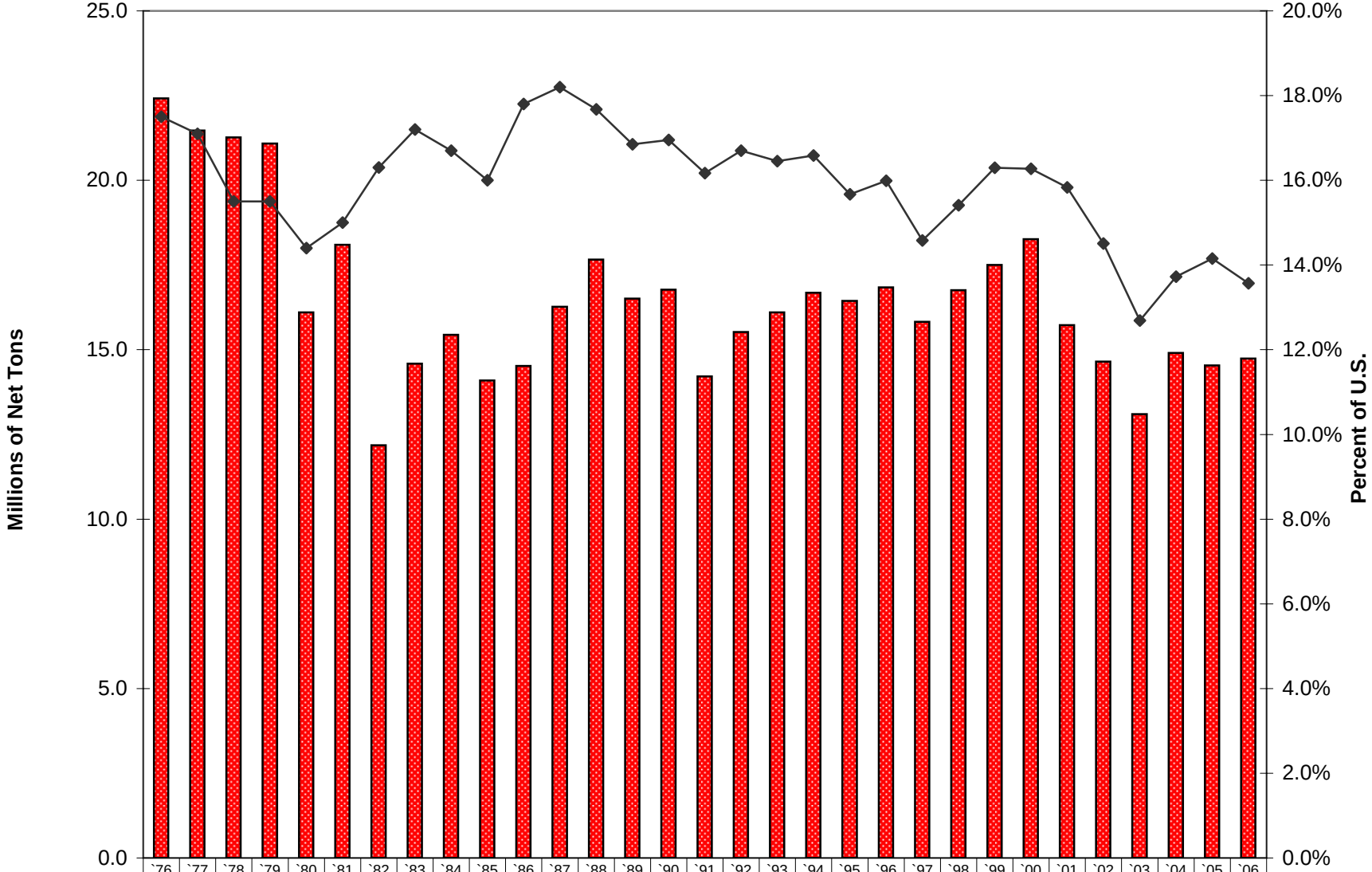
EMPLOYMENT

The chart above shows iron and steel industry employment in Ohio peaking in 2000 and dropping thereafter. The decline appears to have slowed between 2004 and 2005. The net change was a loss exceeding 18,700 jobs. The greatest number of jobs lost occurred in iron and steel mills (NAICS 331111), which declined continuously from over 22,900 to some 15,300 – a drop of one-third. It was followed by a loss of well over 5,300 in ferrous foundries (33151), a 28.9% decline.[6] Other industries with net losses exceeding 1,000 jobs were steel foundries (331512 & 3) and pipe and tube production from purchased steel (33121). Fewer than 1,000 jobs were lost in each of the rolling and drawing industries (33122). While the job losses in these industries were smaller in magnitude, they were often as great or greater on a percentage basis. The only bright spot in employment was electrometallurgical ferroalloys, which gained 200 jobs – an increase of 13.1%. Nevertheless, the iron and steel industry as a whole suffered proportionately greater job losses than the encompassing manufacturing sector – 35.6% vs. 20.3%.

What happened in Ohio was part of what happened across the country. Employment in every individual iron and steel industry was lower in 2005 than it was in 1998. The proportional decline in the industry as a whole was greater than in manufacturing in general – 28.6% vs. 19.3%, and employment fell proportionately greater in foundries than in the other industry groups – 30.6% vs. 26.2% and 29.8%.

See Table A8

Raw Steel Production in Ohio, 1976-2006



	`76	`77	`78	`79	`80	`81	`82	`83	`84	`85	`86	`87	`88	`89	`90	`91	`92	`93	`94	`95	`96	`97	`98	`99	`00	`01	`02	`03	`04	`05	`06
Raw Steel Production	22.4	21.5	21.3	21.1	16.1	18.1	12.2	14.6	15.4	14.1	14.5	16.3	17.7	16.5	16.8	14.2	15.5	16.1	16.7	16.4	16.8	15.8	16.8	17.5	18.3	15.7	14.6	13.1	14.9	14.5	14.7
Percent of U.S.	17.5	17.1	15.5	15.5	14.4	15.0	16.3	17.2	16.7	16.0	17.8	18.2	17.7	16.9	17.0	16.2	16.7	16.5	16.6	15.7	16.0	14.6	15.4	16.3	16.3	15.8	14.5	12.7	13.7	14.2	13.6

Sources: American Iron and Steel Institute, International Iron and Steel Institute, Ohio Steel Industry Advisory Council.

RAW STEEL PRODUCTION

The chart above illustrates the last 31 years of raw steel production in Ohio, and with it, the changes and continuities that characterize the industry. One of these is the highly cyclical nature of the industry. Years associated with recessions – 1980, 1982, 1991, and 2001 – show notably lower levels of production when compared with the preceding years and (usually) the following years. Declines in other years, though, may reflect significant changes at individual facilities in the state; for example, a strike at WHX in 1997 or LTV's bankruptcy in 2002 and 2003. Raw steel production rose in the years following the resolution of the problems.

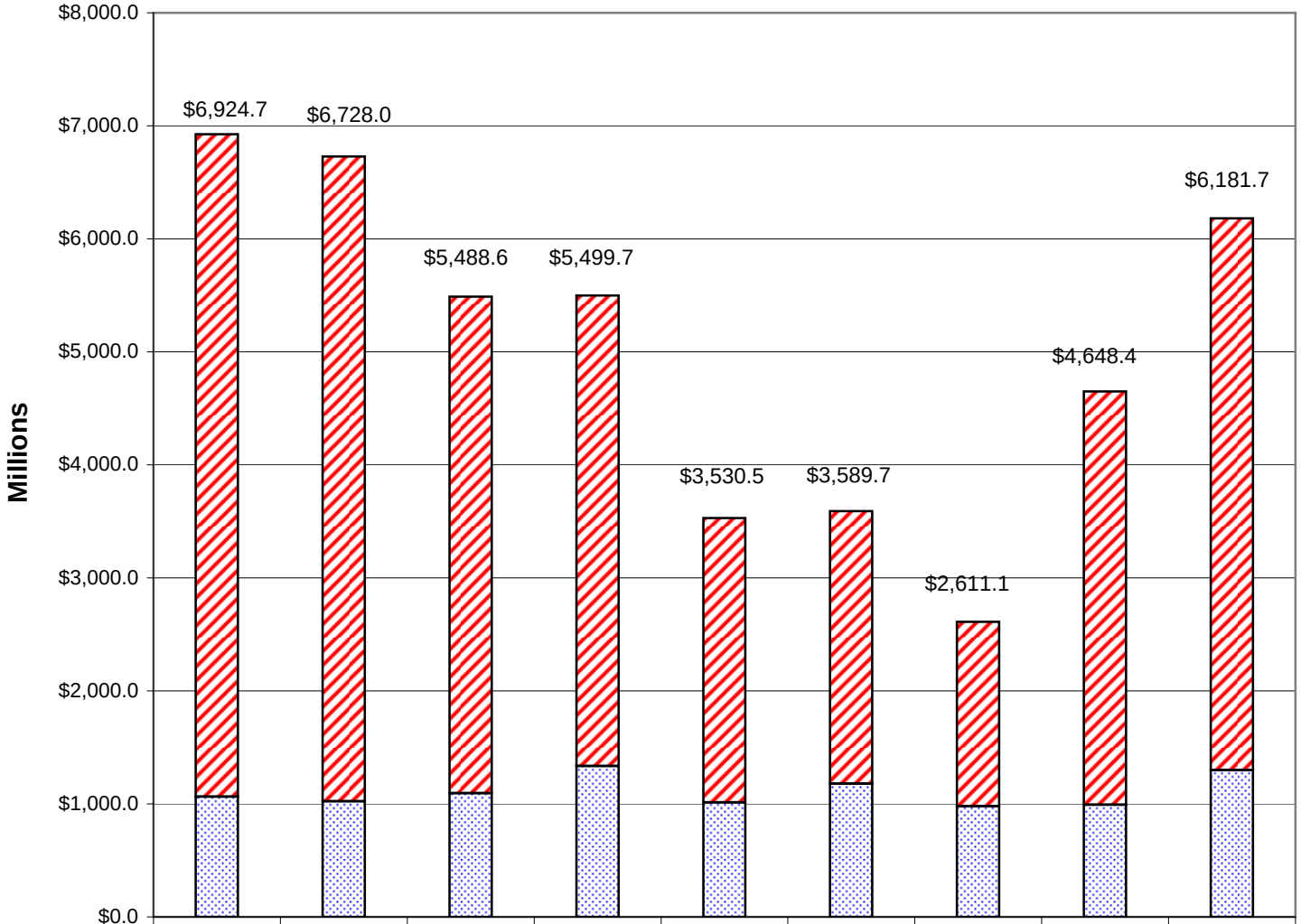
Another change evident above is not cyclical. Raw steel production in Ohio exceeded 20 million tons (MT) every year before 1980. (Additional data in table A9 extend back to 1969, and show 1975 to be – just barely – an exception to the preceding statement.) By contrast, production in Ohio has never been above 20MT after 1979. With the exceptions of 1982 and 2003 for reasons previously cited, production here has fluctuated between 14.1MT and 18.3MT from 1980 through 2006. This generally lower level of output is consistent with a structural change in the U.S. economy noted by industry analysts: less consumption of iron and steel. (See the Overview of the Industry for further details.)

Steel production in Ohio typically ranges from 14% to 17% of the national total despite the sometimes dramatic ups and downs in tonnage, although it has dipped below that range in three of the last four years.

Bearing these facts in mind, the data show no definitive long-term trend away from production in Ohio. However, it appears that the proportion of U.S. steel production outside of Ohio has grown.

See Table A9

Value-Added by Group in Ohio, 1997-2005



	1997	1998	1999	2000	2001	2002	2003	2004	2005
3311: Iron & Steel Mills & Ferroalloys	$5,861.7	$5,705.4	$4,393.5	$4,165.5	$2,517.7	$2,409.5	$1,631.3	$3,656.2	$4,883.3
3312: Products from Purchased Steel	$1,063.0	$1,022.6	$1,095.1	$1,334.1	$1,012.8	$1,180.2	$979.8	$992.2	$1,298.3

Source: U.S. Census Bureau.

VALUE ADDED – A BROADER MEASURE OF ECONOMIC OUTPUT

Value-added data are a broader measure of industrial activity than raw steel production alone because the former include iron and steel mill products, whether made at the mill or from purchased steel (NAICS 3311 and 3312, respectively.) (The Annual Survey of Manufactures does not publish annual figures for subgroups, including ferrous metal foundries – 33151.) The chart above shows an unmistakable decline in the value-added of iron, steel, and ferroalloy output (3311) in Ohio from 1997 through 2003, and increasing output in 2004 and 2005. These changes incorporate the consequences of LTV's bankruptcy as well as the recession. They also reflect resumption of some operations by its successor, the International Steel Group (now part of ArcelorMittal) and the subsequent economic expansion.

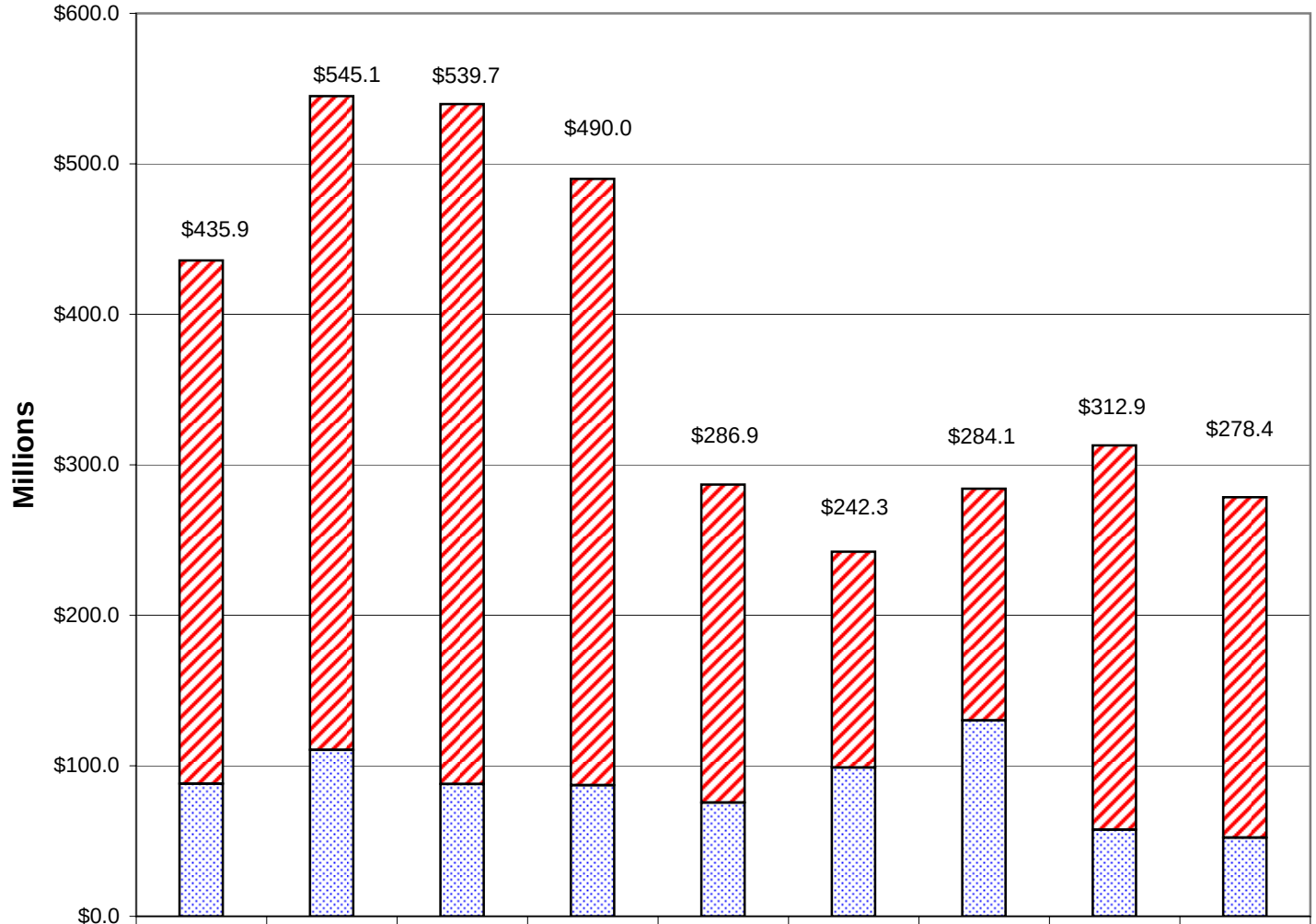
This is a stark contrast to the value-added in manufacturing products made from purchased steel (3312), which fluctuated, but finished higher in 2005 than in 1997. (Because value-added figures are not adjusted for inflation, the net change in real output is unknown.)

What happened in Ohio during this time was more or less what was happening throughout the American iron and steel industry. Data in appendix table A10 show drops of 42.0% iron, steel and ferroalloy production and 16.0% in products made from purchased steel during the 1997-2001 period. The subsequent recovery saw increases of 123.3% and 26.5%, respectively, in value-added by 2005. (Again, no adjustment for inflation has been made.)

Throughout these ups and downs, the percentage of products-made-from-purchased-steel in Ohio fluctuated around 17.5% of the national total. This contrasts with the percentage of iron, steel and ferroalloy products made in Ohio. That percentage fell from 23.0% in 1997 to 9.3% in 2003, and rose to 14.8% by 2005. Whether it will continue to rise remains to be seen, but for now, plants in Ohio play a smaller role in the iron and steel industry than they did in the past.

See Table A10

Capital Expenditures by Group in Ohio, 1997-2005



	1997	1998	1999	2000	2001	2002	2003	2004	2005
3311: Iron & Steel Mills & Ferroalloys	$347.8	$434.6	$451.9	$402.9	$211.4	$143.4	$154.1	$255.5	$226.2
3312: Products from Purchased Steel	$88.1	$110.5	$87.8	$87.2	$75.5	$98.8	$130.1	$57.4	$52.2

Source: U.S. Census Bureau.

CAPITAL EXPENDITURES BY GROUP

Capital expenditures are funds spent for buildings and equipment used in manufacturing. The chart above shows capital expenditures in Ohio first rising from $435.9 million (M) in 1997 to roughly $540M in 1998 and 1999 before dropping to around $280M in 2001, 2003, and 2005. They were notably lower in 2002 and higher in 2004. However, even in a capital-intensive industry noted for episodic expenditures, the level of spending appears significantly lower after 2000 than before 2001.

The chart above also shows that the vast majority of expenditures went for iron, steel, and ferroalloy production (NAICS 3311) – and that is where most of the reduction in expenditures has occurred. Capital expenditures in the group averaged $409.3M per year for 1997-2000 and $198.1M for 2001-2005 – a little less than one-half. This is a marked contrast with the recent history of steel products made from purchased steel (NAICS 3312); annual capital expenditures for the latter averaged $93.4M and $82.8M for the corresponding periods.

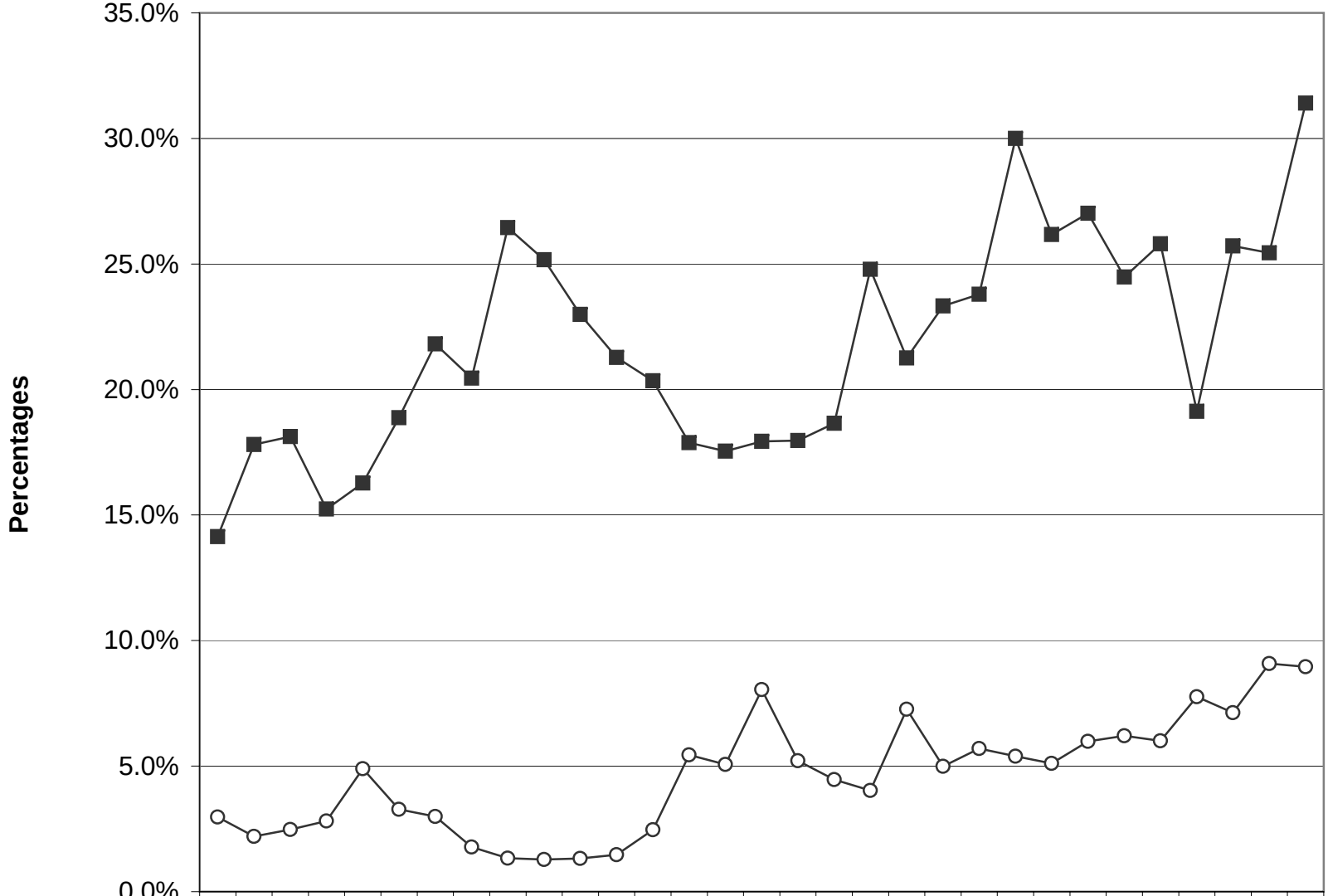
Data for the U.S. in appendix table A11 tell a similar story: between the two groups, the majority of capital expenditures are made for iron, steel, and ferroalloy production; average annual expenditures for that group in 2001-2005 were about one-half of what they were in 1997-2000, while average annual expenditures in products made from purchased steel fell considerably less from the earlier period to the later. Yet the pattern of change in the national data could also be interpreted as evidence for a decline and partial recovery in capital expenditures for iron, steel, and ferroalloys, while expenditures for the products-from-purchased-steel group have fallen continuously, except for some interruptions.

Capital expenditures in Ohio by companies have varied by industry group in another way. Those for iron, steel, and ferroalloys have been, on average, slightly less than proportional to the value-added originating here: 15.8% vs. 16.9%, respectively, of national totals. Those for products-made-from-purchased-steel have been slightly more than proportional to the value-added here, averaging 19.6% vs. 17.5% of the national totals. Overall, the proportion of industry expenditures going into Ohio averaged 97.3% of the proportion of value-added here (see tables A9 and A10). Given the year-to-year variability of value-add and capital expenditures, it seems fair to say that the industry *intends* to continue production in Ohio, even though output falls.

As with value-added, annual capital expenditure data for the ferrous metal foundries subgroup (NAICS 33151) are not available from the Annual Survey.

See Tables A10 & A11

Imports and Exports of Steel Mill Products: 1976-2006



	`76	`77	`78	`79	`80	`81	`82	`83	`84	`85	`86	`87	`88	`89	`90	`91	`92	`93	`94	`95	`96	`97	`98	`99	`00	`01	`02	`03	`04	`05	`06
Exports as Percent of Total Shipments	3.0	2.2	2.5	2.8	4.9	3.3	3.0	1.8	1.3	1.3	1.3	1.5	2.5	5.4	5.1	8.0	5.2	4.5	4.0	7.3	5.0	5.7	5.4	5.1	6.0	6.2	6.0	7.8	7.1	9.1	9.0
Imports as Percent of Apparent Supply	14.1	17.8	18.1	15.2	16.3	18.9	21.8	20.5	26.4	25.2	23.0	21.3	20.3	17.9	17.5	17.9	18.0	18.7	24.8	21.3	23.3	23.8	30.0	26.2	27.0	24.5	25.8	19.1	25.7	25.4	31.4

Sources: American Iron & Steel Institute, Larkin

EXPORTS AND IMPORTS OF STEEL MILL PRODUCTS

The graph above illustrates two distinct-but-related phenomena: the variable-but-generally-greater importance of exports for steel producers and the variable-but-generally-greater importance of imports for consumers of steel mill products (apparent supply is equivalent to consumption). Exports have been relatively more important for steel manufacturers since 1989, when they first rose above 5% of total shipments. Although exports fell below 5% in 1993 and 1994, they have become increasingly important since 1996, rising to 9.1% in 2005. Data in table A12 show that exports have grown from 929,000 tons in 1986 to 9,728,000 tons in 2006. (Data also extend back to 1969.) Analysts cite a number of factors in explaining these changes. The generally weaker value of the dollar in recent years – especially compared with the mid-1980s – makes U.S. steel mill products relatively more affordable. Some also note the rapid and sizable economic growth of China as a locus of increased demand (Larkin, 2007). The growth of exports also may have been facilitated by the reduction of trade barriers.

The graph above shows that imports play a highly variable but comparatively more significant role in meeting the demand for steel mill products in America, ranging from 14.1% of the apparent supply in 1976 to a record 31.4% in 2006.[7] Imports began taking a larger share of the American market in the 1960s initially because foreign producers had more efficient equipment and lower labor costs. Over the years, though, analysts have cited a number of additional factors to explain why imports play a relatively large role in domestic consumption. These included low transportation costs and the higher prices in America (Matthews, 2007b), subsidies provided by the governments of foreign steel makers, the relative openness of the American market, and the high value of the dollar, which made imports relatively inexpensive (Larkin, 2003). However, the value of the dollar does not explain the greater role of imports beginning in the mid-1990s. Instead, Larkin (2007: 19) notes that some domestic steel makers had reduced their primary production capacity so much that they had to import semi-finished products in order to meet the demand for finished products.

U.S.-based steel companies were not idle as foreign producers gained market share. They sought and received tariffs to counter what they claimed were unfair trade practices. At the same time, though, foreign producers and domestic steel consumers argued their cases in response. Thus the federal government has granted tariff requests and subsequently granted exemptions from those tariffs. In addition, at least one international organization has ruled an American steel tariff unjustified. Therefore, it seems that U.S.-based steel companies cannot rely on tariffs alone to deal with foreign competition. Even market forces – the relatively lower value of the dollar and high demand from China – have not consistently reduced imports. Foreign competition remains significant for domestic producers (Larkin, 2003, 2007).

Regardless of the reason why, domestic consumers of steel like imports because inexpensive steel helps them compete at home and abroad. Imports have become an integral part of steel supplies, and their elimination would cause problems

for steel consumers because domestic steel makers usually lack the capacity to replace imports. Put differently, the consumption of steel mill products has been greater than domestic capacity in nine of the 11 latest years for which data are available (1996-2006). During these same 11 years, imports ranged from 19.1% to 31.4% of apparent supply (which is equivalent to consumption), averaging 25.8% (Larkin, 2007: 1).

See Table A12

OVERVIEW and FORECASTS

AN OVERVIEW OF THE INDUSTRY

U.S. steel production in 2006 was 5.7% higher than in 2005, but remained below the pre-recession peak of 2000 and the post-recession peak of 2004. Capacity utilization rates in 2006 were a fairly typical 87.9% – better than 2005, but below the recent peak of 2004. The 2006 figures reflect improvements in shipments to two key markets in particular – construction and motor vehicles – as well as most other steel consumers (Larkin, 2007).

The variations during the last few years illustrate the cyclical character of the industry and its sensitivity to changes in demand from key markets as well as the overall strength or weakness of the economy. The key markets for the industry are service/distribution centers[8] – 21.8% of all shipments in 2006, construction – 16.2%, motor vehicles – 12.9%, converting and processing – 7.9%, exports – 2.8%, containers – 2.3%, oil and gas – 2.3%, appliances – 1.6%, machinery – 1.3%, and electrical equipment – 1.1%. All other uses account for the remaining 29.8% of shipments (Larkin, 2007: 2).

Overall, the iron and steel industry tends to experience the most growth in demand late in the business cycle, due to the relatively greater impact of capital goods demand. (The demand for capital goods such as non-residential construction occurs late in the business cycle, and minimills dominate the market for steel used in construction.) Primary producers, though, are more closely tied to consumer durables – particularly cars and light trucks – than are minimills, and consequently are more of an early-cycle industry (Larkin, 2007: 22).

Beyond the business cycle, though, the iron and steel industry of today differs from that of years ago. Iron and steel production was a vertically integrated process dominated by large companies for much of the 20th century. The companies owned the materials and equipment used at each step of the process. These included the mines for iron ores, coal, and flux production, the coke ovens, blast furnaces and breakdown mills, and the service/distribution centers for steel slitting and sales to end users.

Today, the industry plays a smaller role in the economy, as evidenced by the reductions in raw steel production (see table A8), and only U.S. Steel comes close to being integrated since all of the remaining companies have divested significant portions of their assets.[7] Three factors are thought to largely explain this change: the rise of imports, the rise of minimills, and reduced demand for steel – most notably by the motor vehicle industry (Larkin, 2007: 18). The role of imports was discussed in the preceding section. How the latter two changed the industry is briefly described below.

Minimills make steel by recycling ferrous scrap in electric arc furnaces. (They may substitute directly reduced iron when scrap prices are high.) Doing so means that they avoid the costs associated with blast furnaces, coke ovens and equipment to handle raw materials. Consequently, their capital costs are much lower than primary producers – about $500 per

net ton of capacity vs. $2,000. This, combined with a leaner management structure, and more flexible, less costly labor arrangements, allows minimills to undercut the prices primary producers would charge for the same products. Minimills were initially limited to lower-quality commodity products. However, as their quality improved, they took progressively larger shares of the overall market from primary producers, forcing the latter to abandon markets for specific steel products. Minimills accounted for 8.4% of raw steel production in 1960; in 2006, they accounted for 57% (Larkin, 2007).

Changes in the motor vehicle industry exemplify the reduced demand for iron and steel products. Motor vehicle production directly and indirectly comprises about 25% of the market for iron and steel products. Two interrelated factors help explain its reduced demand: (1) the increase in imported motor vehicles displaced sales of U.S.-brand vehicles, and imported vehicles did not use domestically made iron and steel; and (2) the efforts of companies to improve fuel efficiency. The easiest way to improve fuel efficiency has been to reduce vehicle weight. To that end, motor vehicle manufacturers made vehicles smaller, and replaced some iron and steel components with ones made from aluminum, plastics, or even ceramics.[10] The shift of consumer preferences toward light trucks mitigated the losses of iron and steel makers because trucks use more steel (Larkin, 2005), but a shift away from light trucks (due to high fuel prices) would again dampen the demand for iron and steel.

The challenges of reduced demand for iron and steel products, as well as competition from imports, minimills, and manufacturers of alternative materials, elicited a number of responses from primary producers. Steel makers developed lighter and stronger products to compete with alternative materials, and near net shape casting reduced the need for machining parts. (See the Glossary and the Primer on Iron and Steel Production Processes in the Appendix.) Consequently, iron and steel makers regained some of the business lost to manufacturers of alternative materials. However, not all technological innovations have been unmixed blessings for primary producers. For example, advances such as thin slab- and strip-casting probably benefited minimills even more than primary producers. These innovations eliminated the need for high-cost reducing stands, thereby lowering the capital needed to compete in markets for higher quality goods such as pipes, plates, strips and sheets. Such items had been the domain of primary producers. Despite the gains of minimills in these markets, primary producers remain the source for the highest-grade goods (Larkin, 1994, 1995, 2005).

While technological advances reduced costs by improving operational efficiency, primary producers also reduced fixed costs by divesting at least some assets such as mines, coke ovens, or distribution/service centers.[11] A few companies went so far as to largely abandon primary production and concentrate on the production of specialty steels. However, implementation of this strategy has met with some unanticipated consequences. As demand increased, some companies found themselves short of capacity to produce slabs, and were thus compelled to buy them to make finished products. Some companies also were vulnerable to the sharp rise in material costs since 2001. These experiences led some companies to reverse course, pursuing vertical integration as a way of controlling costs (Larkin, 2007). Two companies with

operations in Ohio illustrate this trend. ArcelorMittal has decided to buy-out other owners (among them Cleveland-Cliffs) of Canada's Wabush Mines (Wire Report, 2007), and Wheeling Pittsburgh has formed a joint venture with a Brazilian iron ore producer and a Ukrainian steelmaker (Matthews, 2007a). Similarly, at least one minimill company formed a joint venture with mining company to secure a supply of directly reduced iron, and another one purchased a scrap dealer. Both actions were taken to control the costs of their raw materials (Larkin, 2007).

2001 also marked the last major downturn in the industry, with several primary producers forced into bankruptcy. Some had been in bankruptcy before, but this time they did not emerge. Instead, some of their assets were purchased as part of the liquidation process. This became feasible and attractive when the Pension Benefit Guaranty Corp. (PBGC) assumed the pension plans and health care benefits of the liquidating companies.[12] Such asset purchases by surviving companies are part of the international consolidation of the industry. One example from Ohio illustrates these changes. W.L. Ross formed the International Steel Group (ISG) by purchasing assets of LTV, Bethlehem and Weirton. ISG's management structure resembled that of a minimill, and it produced 90% of what LTV did with only one-fourth of the production workers. ISG's merger with Ispat International NV formed Mittal NV. In turn, the merger of Arcelor with Mittal creates the world's largest steel company (Larkin, 2005, 2007).[13]

The responses of primary producers to the challenges described above have at their core an effort to reduce costs to remain competitive. Although the efforts have not always been successful – primary producers have closed facilities and reduced the number of employees – they continue with this quest. Currently they are reducing costs by moving to defined-contribution retirement plans and away from defined-benefit plans. Other measures taken to control costs include reducing the size of the work force – including fewer levels of management, and changing work classifications to permit greater flexibility in what people do (Larkin, 2007: 12).

Mergers also have been a way to deal with the increased competition in the steel industry. In 2001, eight companies still accounted for some 50% of raw steel shipments: by 2006, four companies accounted for 43.7% of shipments. Those four included two minimills – Nucor and Steel Dynamics – and two primary producers – AK Steel and U.S. Steel (Larkin, 2007: 11).

THE NEAR- AND LONG-TERM FORECASTS

Through June 16, 2007, national steel production totaled 48.0 million tons, compared with 51.7 million tons during the same period in 2006. This decline of 7.2% reflects the much slower growth of the economy in general as well as the weakness in three key markets. Motor vehicle production through May, 2007, was 5.2% lower than the same period of 2006, and shipments to construction and distribution centers through April, 2007, declined by 1.1% and 7.3% respectively, compared with the first four months of 2006. However, the weakness seen in key markets during the first half of 2007 is expected to ease in the second half. For these reasons, Larkin (2007: 1-2) predicts that total steel shipments for the year will be only 1%-to-2% below that of 2006. This also implies that total year production may be slightly lower as well.

Beyond the variations of the business cycle, some of the recent trends discussed in preceding sections are expected to continue for the foreseeable future. Perhaps the most notable is industry consolidation. Despite the mergers of recent years, the industry can still be described here and abroad as fragmented, and the conditions making mergers possible and advantageous still exist. These include low borrowing costs, high stock prices, large amounts of cash, continuing competition, and the high cost of raw materials and ferrous scrap. Companies created by mergers or supplemented by acquisitions may have more control over raw materials, or may be able to obtain more favorable terms when purchasing them (Larkin, 2007: 5; Matthews, 2007c). It is also possible that foreign-based companies will own about 40% of domestic capacity by the end of 2007, and it could continue growing (Larkin, 2007: 16; Matthews, 2007b).

A graph shown earlier in this report illustrated how imports varied over the years in meeting demand in the American steel market. Such variation seems a testament to the difficulty of forecasting, and arguments can be made for changes either way. Larkin (2007: 3, 17) thinks that steel imports in 2007 (and perhaps beyond) are likely to decline from the record level of 2006 for a number of reasons: prices for domestically made products – and the value of the dollar – are expected to drop; the consolidation of the domestic industry has resulted in considerable cost reduction, and it is far more competitive vis-à-vis foreign rivals; and the increased costs of raw materials and transportation have reduced the cost advantages of foreign steel makers. Matthews (2007b) goes further, noting that these are reasons for foreign-based companies to set up operations here, either by themselves, or in joint ventures with domestic companies. Larkin (2005) also speculates that the international nature of the mergers could mitigate trade disputes; if a foreign-based company experiences a weak home market, would it aggressively ship products to America when such shipments would hurt its American operations?

On the other hand, lower prices in China, whose currency is still more or less pegged to the value of the dollar, could keep import levels high. The emergence of China as a net exporter of steel could lead to a global steel glut, but it is highly unlikely that any nation, including the U.S., will allow Chinese producers to flood its market. “While the United States has the least amount of import restrictions of any nation, US [sic] producers have, from time to time, had the US government im-

pose restraints on imports in the form of quotas, tariffs, and voluntary restraint agreements. We [i.e., Standard & Poor's] believe that any attempt by China to swamp the US market with surplus steel would be met with demands for protectionist measures and the filing of antidumping suits" (Larkin, 2007: 17).

Other factors previously mentioned will continue to affect the industry over the long term. It is possible that producers of alternative materials – particularly aluminum – will make further inroads into the markets of steel producers in the long term. It is unlikely, though, that they will further displace iron and steel in motor vehicles in the near term for two reasons: all of the easy substitutions have been made, and steel is easier to recycle than are automotive plastics (Larkin, 2005).

Technological improvements continue to be made. For example, WCI is installing a walking beam furnace, which is expected to reduce energy costs and facilitate custom production. It also is working to use fuel oil and natural gas as alternatives to coke, as well as considering pulverized coal injection; both could reduce expenses (Vinarsky, 2007).

Larking (2005) believes that some technological improvements may benefit minimills more than primary producers, allowing the former to make further gains in the sheet market. However, future gains of market share by minimills may be limited by the high price of scrap. As this is written, there is only one minimill under construction, and there are no plans to build more in the immediate future. High scrap prices affect primary producers to a lesser degree because they typically use a 3-to-1 ratio of pig iron to scrap in steel production (Larkin, 2007: 10). However, the longer-term outlook for primary producers is more problematic because they may not be able to count on high prices – whether of scrap, raw steel, or finished products – to stay in business (Larkin, 2005).

These long term challenges may be why Berman (2005) forecasts average annual rates of growth for the two iron and steel groups that are slower than for the U.S. economy as a whole: 1.6% each for iron, steel, and ferroalloy production (NAICS 3311) and products made from purchased steel (3312), vs. 3.6% for the decade of 2004-2014. If these forecasts for the two groups come to pass, they would be an improvement from the preceding decade (1994-2004) when the output of both was lower in 2004 than in 1994. (The U.S. economy grew at an average annual rate of 3.2% during the decade.) Nevertheless, the iron and steel industry is expected to play a relatively smaller role in the economy than in the past.

Unfortunately, the improved forecasts for the industry groups are not expected to translate into more industry jobs. Berman (2005) predicts employment in iron and steel mills and ferroalloys will fall from the 95,400 of 2004 to 80,300 in 2014 – a 15.8% drop, and employment in products made from purchased steel will decline by 5,800 to 55,000, or 9.5%, during the same time. The Ohio Dept. of Job and Family Services' Bureau of Labor Market Information (ODJFS-BLMI, 2007) predicts proportionally similar declines for the same time period. Employment in iron and steel mills and ferroalloys is forecast to fall from 13,600 to 11,100 – or 18.4%, and employment in products made from purchased steel expected to decline by 1,300 to 8,100 – about 13.8%.

The use of the Internet to link manufacturers, distributors and suppliers has grown, but a number of specific ventures have failed. Ultimately, though, Internet usage is expected to do a number of things for buyers and sellers: provide more information, match production and order flows, and reduce expenses. Consequently, the role of establishments that just warehouse metal will be reduced, but those that offer further processing will remain (Larkin, 2007: 22).

See Table A13

APPENDICES

DETAILED TABLES

Table A1: Notable Iron and Steel Industry Companies in Ohio, 2007

Parent/Company/Division	Primary NAICS	City	Jobs# Total	Jobs# at Site
AK Steel Holding Corp.*			4,059	
AK Steel Corp.	331111	Coshocton		584
AK Steel Corp.	331111	Dover		218
AK Steel Corp.[1]	331111	Mansfield		389
AK Steel Corp.[2]	331111	Middletown		2,200
AK Steel Holding Corp.[3]	331111	West Chester		150
AK Steel Corp.[1]	331111	Zanesville		218
AK Steel Corp./AK Tube LLC	33121	Walbridge		300
Allegheny Technologies, Inc.*/Allegheny Ludlum Corp.	331111	Louisville		145
American Spring Wire Corp.[1]	331222	Cleveland		238
Apollo Advisors, LP/Metals USA, Inc.*/Metals USA Carbon Flat Rolled	331111	Wooster		112
ArcelorMittal Steel Co. NV*			2,546	
Mittal Steel USA, Inc./International Steel Group	331111	Warren		135
Mittal Steel USA-Warren, Inc.	331111	Cleveland		1,600
Dofasco Tubular Products Corp.[1]	33121	Shelby		666
Marion Dofasco, Inc.[4]	33121	Marion		125
Skyline Steel Corp.	331221	Belpre		20
Asahi Tec Corp./Metaldyne Corp.	331111	Cleveland		200
BlueScope Steel Ltd.-Cargill, Inc./North Star BlueScope Steel LLC	331111	Delta		330
Charter Manufacturing Co., Inc.			1,012	
Charter Steel - Cleveland, Inc.	331111	Cleveland		992
Charter Manufacturing Co., Inc.[1]	331111	Rising Sun		20
Columbus Steel Castings Co.	331513	Columbus		750
Eramet SA/Marietta Eramet, Inc.	331112	Marietta		550
Ford Motor Co.*[5, 13]	331511	Cleveland		1,218
General Motors Corp.*[1]	331511	Defiance		1,454
Greer Industries, Inc./Greer Steel Co.	331221	Dover		250
Industrias CH, SA de CV/Grupo Simec			2,225	
Republic Engineered Products	331111	Fairlawn		150
Republic Engineered Products[6]	331111	Canton		644

Table A1: Notable Iron and Steel Industry Companies in Ohio, 2007

Parent/Company/Division	Primary NAICS	City	Jobs# Total	Jobs# at Site
Industrias CH (continued)				
Republic Engineered Products[7]	331111	Lorain		1,200
Republic Engineered Products - Central Machine/Fabrication[8]	331111	Massillon		215
Republic Engineered Products - Cold Finished Plant	331221	Massillon		16
Jackson Tube Service, Inc.[1]	33121	Piqua		313
McWane, Inc.	331511	Coshocton		400
Mitsubishi Corp.*-Sojitz Corp./Coilplus-Ohio, Inc.	331221	Springfield		55
Nucor Corp.*/Nucor Steel Marion, Inc.[4]	331111	Marion		405
OSCO Industries, Inc.			477	
OSCO Industries, Inc.	331511	Portsmouth		285
OSCO Industries, Inc.	331511	Jackson		125
OSCO Industries, Inc.	331511	Portsmouth		67
PTC Alliance Corp.			273	
PTC Alliance Corp.	33121	Salem		23
Alliance Tubular Products Co.[14]	33121	Alliance		250
Quality Castings Co.	331511	Orrville		290
Renco Group, Inc./WCI Steel, Inc.	331111	Warren		1,280
Ryerson, Inc.*/Ryerson, Tull Corp./J & F Steel Corp.	331221	Middletown		26
Salzgitter AG/V & M Star LP	33121	Youngstown		430
Shiloh Industries, Inc.			301	
Liverpool Coil Processing, Inc.	331111	Valley City		101
Medina Blanking, Inc.	331513	Valley City		150
Medina Blanking, Inc.	331513	Valley City		50
Tata Group/Tata Steel/Corus Group*/Thomas Strip Steel Corp.[9]	331221	Warren		500
TI Group plc			263	
TI Group Automotive Systems[13]	33121	Hebron		195
TI Group Automotive Systems	33121	Washington Court House		68
Timken Co.*[10]			1,700	
Timken Co. (Faircrest)	331111	Canton		n.a.
Timken Co. (Gambrinus)	33121	Canton		n.a.

Table A1: Notable Iron and Steel Industry Companies in Ohio, 2007

Parent/Company/Division	Primary NAICS	City	Jobs# Total	Jobs# at Site
Timken Co.* (continued)				
Timken Co. (Harrison)	331111	Canton		n.a.
Timken Co.	n.a.	Eaton		n.a.
Timken Co.[1]	331111	Wauseon		41
United States Steel Corp.*/Lorain Pipe Mill	331111	Lorain		550
Welded Tube of Canada, Inc.	33121	Delta		350
Wheeling-Pittsburgh Steel Corp.*[1, 11]			1,854	
Wheeling-Pittsburgh Steel Corp.	331111	Martins Ferry		n.a.
Wheeling-Pittsburgh Steel Corp.[1]	331111	Mingo Junction		1,140
Wheeling-Pittsburgh Steel Corp.	331111	Steubenville		n.a.
Wheeling-Pittsburgh Steel Corp.	331221	Yorkville		n.a.
Worthington Industries, Inc.*			1,080	
Dietrich Industries, Inc.	331111	Warren		180
Worthington Industries, Inc.[12]	331221	Columbus		400
Worthington Industries, Inc.	331221	Columbus		10
Worthington Industries, Inc.	331221	Worthington		250
Worthington Industries, Inc.	331513	Columbus		75
Worthington Industries, Inc.	331513	Monroe		165

Notes: # - Jobs figures are from Harris (2007) unless otherwise noted; * - A Fortune U.S. 1000 or global 500 company; 1 - Jobs figure from ODOD (2007), usually the Enterprise Zone reports; 2 - Pittsburgh Business Times (2007); 3 - This figure is expected to grow to 300 Pittsburgh Business Times (2007); 4 - Jobs figure is from Marion Chamber of Commerce (2007); 5 - Jobs figure is from Ford Motor Co. (2007); 6 - Jobs figure is from Balint (2007); 7 - Jobs figure is from ODOT (2005); 8 - Union jobs only, according to the Canton Repository (2007); 9 - Tata Steel, a subsidiary of the Tata Group, completed acquiring the Corus Group in March, 2007 (Larkin, 2007: 5); 10 - Jobs figure is from Kelley (2005); the Harris (2007) figure for Eaton and the summary figure for Canton are thought to be too low; n.a. - not available; 11 - In March, 2007, the company announced an agreement to merge with Esmark, a steel service center and manufacturer of fabricated metal products (Larkin, 2007); subsequently Giannamore (2007) reports that the roles of the plants will change; therefore, Harris (2007) figures for Martins Ferry, Steubenville, and Yorkville may be too high; 12 - Jobs figure is from Lexis-Nexis (2007); 13 - Closing soon; 14 - Jobs figure is from

Table A1: Notable Iron and Steel Industry Companies in Ohio, 2007

Parent/Company/Division	Primary NAICS	City	Jobs# Total	Jobs# at Site

Times-Reporter (2007) and PR Newswire (2007) combined, and is approximate.

Sources: Balint (2007), Canton Repository (2007), Ford Motor Co. (2007), Fortune (2007), Giannamore (2007), Harris (2007), Kelley (2005), Larkin (2007), Lexis-Nexis (2007), Marion Chamber of Commerce (2007), ODOD (2007), ODOT (2005), Pittsburgh Business Times (2007), PR Newswire (2007), Times-Reporter (2007).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 800-848-1300, or 614-466-2116 (DL, 10/07).

Table A2: Expansion and Attraction Announcements in Ohio's Iron and Steel Industry, 2004-2006

Year	Company	City or Township	NAICS Code	Product	New or Expanded	Total Invested	Jobs	Space (Sq. Ft.)
2004	AK Steel Corp.	Middletown	331111	Steel	Expanded	$65,000,000		
2004	Ambassador Steel	Marion	33121	Steel pipe	New	$1,200,000	16	27,000
2004	ArcelorMittal Steel Co. NV/International Steel Group	Cleveland	331111	Steel	Expanded	$10,000,000	140	
2004	ArcelorMittal Steel Co. NV/International Steel Group	Cuyahoga Heights	331111	Galvanized steel	Expanded	$40,000,000	50	
2004	CANDO	Marion	331511	Steel foundry	New	$4,000,000	75	
2004	Charter Steel	Cuyahoga Heights	331111	Steel rods/wire	Expanded	$90,000,000		
2004	Columbus Steel Castings Co.	Columbus	331511	Steel castings	Expanded	$4,800,000	25	
2004	General Motors Corp.	Defiance	331511	Iron castings	Expanded	$58,400,000		
2004	Industrias CH, SA de CV/Republic Engineered Products	Canton	331111	Steel	Expanded	$54,000,000		
2004	New Dimension Metals Corp.	Moraine	331111	Steel	Expanded	$1,200,000		
2004	Parker Hannifin Corp.	Columbus	33121	Steel tubes	Expanded	$1,500,000		12,000
2004	Salzgitter AG/V & M Star LP	Youngstown	331111	Steel	Expanded	$5,000,000		
2004	Steel Technologies, Inc.	Ottawa	331111	Steel processing	Expanded	$6,000,000	10	70,000
2004 Subtotals*:						$341,100,000	316	109,000
2005	Allegheny Technologies, Inc./Allegheny Ludlum Corp.	Louisville	331111	Stainless steel coils	Expanded	$24,000,000		
2005	Charter Steel	Perry Twp.	331111	Steel products	Expanded	$12,800,000	16	72,000
2005	Ferrolux Metals Co.	Macedonia	331221	Cold rolled steel	New	$3,600,000	23	
2005	Liberty Casting Co.	Delaware	331513	Iron castings	Expanded	$1,300,000	20	
2005	McDonald Steel Corp.	McDonald	331111	Steel	Expanded	$7,000,000	25	
2005	PTC Alliance Corp.	Massillon	331111	Steel tubing	New	$2,000,000	30	
2005	Warren Fabricating Steel	Hubbard Twp.	331111	Plate steel	New	$130,000,000	100	150,000
2005	Wheeling-Pittsburgh Steel Corp.	Steubenville	331111	Steel	Expanded	$14,500,000		
2005	Xtek, Inc.	Sharonville	331513	Steel parts	Expanded	$1,000,000		29,000
2005	Youngstown Pipe & Supply	Youngstown	331111	Pipe products	New	$1,080,000	18	
2005 Subtotals:						$197,280,000	232	251,000
2006	AK Steel Corp.	Walbridge	33121	Steel tubing	Expanded	$8,500,000		
2006	Columbus Steel Castings Co.	Columbus	331513	Steel castings	Expanded	$1,800,000		
2006	General Motors Corp.	Defiance	331511	Engine blocks	Expanded	$109,500,000		
2006	Liberty Steel Products	Jackson Twp.	331111	Steel products	Expanded	$5,000,000		50,000
2006	N.V. Bekaert SA/Bekaert Corp.	Orrville	331111	Steel tire cord	Expanded	$4,558,000		35,100
2006	OSCO Industries, Inc.	Jackson	331511	Foundry	Expanded	$3,000,000	1	
2006	OSCO Industries, Inc.	Portsmouth	331511	Foundry	Expanded	$3,000,000		
2006	Pro-Tec Coating Co.	Leipsic	331111	Steel galvanizing	Expanded	$2,000,000	4	
2006	Renco Group, Inc./WCI Steel, Inc.	Warren	331111	Steel	Expanded	$66,000,000		
2006	Slob & Sons Pipe Casing	Marion	33121	Steel pipe	New	$3,800,000	10	31,500

Table A2: Expansion and Attraction Announcements in Ohio's Iron and Steel Industry, 2004-2006

Year	Company	City or Township	NAICS Code	Product	New or Expanded	Total Invested	Jobs	Space (Sq. Ft.)
2006	Youngstown Tube Co., Inc.	Youngstown	331111	Steel sprinkler pipe	Expanded	$1,500,000		20,000
2006 Subtotals:						$208,658,000	15	136,600
Grand Totals 2004-2006:						$747,038,000	563	496,600

Note: * - Excludes three coke oven operation announcements valued at $504,000,000 with 199 new jobs. Coke ovens are excluded from the iron and steel industry if they are not part of the iron smelting complex.

Source: Office of Strategic Research (2007).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 800/848-1300, or 614/466-2116 (DL, 7/07).

Table A3a: Distribution of Iron and Steel Value-Added in Ohio, 2002

NAICS Code	Industries	Value Added (in millions)	Percent Distri-bution
	Iron & steel industry	$4,412.9	100.0%
3311	Iron & steel mills & ferroalloys	$2,409.5	54.6%
331111	Iron & steel mills	$2,214.7	50.2%
331112	Electrometallurgical ferroalloy products	$194.8	4.4%
3312	Steel product mfg. from purchased steel	$1,180.2	26.7%
33121	Iron, steel pipe & tube mfg. from purchased steel	$423.0	9.6%
33122	Rolling & drawing of purchased steel	$757.2	17.2%
331221	Rolled steel shapes	$633.5	14.4%
331222	Steel wire drawing	$123.7	2.8%
33151	Ferrous metal foundries	$823.2	18.7%
331511	Iron foundries	$569.2	12.9%
331512	Steel investment foundries	$152.3	3.5%
331513	Steel foundries (exc. investment)	$101.6	2.3%

Abbreviations: exc. - except; mfg. - manufacturing.

Source: U.S. Bureau of the Census (2005c).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Phone 614/466-2116 (DL, 8/05).

Table A3b: Value-Added in the Iron and Steel Industry by Group, 2005 (in millions)

Area	Subtotal	Industry Group* 3311	3312
U.S.	$40,116.6	$32,932.8	$7,183.8
Alabama	$1,727.9	$1,727.9	$0.0
Alaska	$0.0	$0.0	$0.0
Arizona	$0.0	$0.0	$0.0
Arkansas	$1,598.0	$1,372.3	$225.7
California	$1,315.5	$1,076.1	$239.3
Colorado	$0.0	$0.0	$0.0
Connecticut	$86.5	$0.0	$86.5
Delaware	$0.0	$0.0	$0.0
District of Columbia	$0.0	$0.0	$0.0
Florida	$0.0	$0.0	$0.0
Georgia	$0.0	$0.0	$0.0
Hawaii	$0.0	$0.0	$0.0
Idaho	$0.0	$0.0	$0.0
Illinois	$3,500.4	$3,125.4	$375.0
Indiana	$5,701.4	$5,298.6	$402.8
Iowa	$0.0	$0.0	$0.0
Kansas	$0.0	$0.0	$0.0
Kentucky	$940.5	$940.5	$0.0
Louisiana	$0.0	$0.0	$0.0
Maine	$0.0	$0.0	$0.0
Maryland	D	D	$0.0
Massachusetts	$0.0	$0.0	$0.0
Michigan	$933.2	$688.2	$244.9
Minnesota	$0.0	$0.0	$0.0
Mississippi	$0.0	$0.0	$0.0
Missouri	$206.0	$0.0	$206.0
Montana	$0.0	$0.0	$0.0
Nebraska	$0.0	$0.0	$0.0
Nevada	$0.0	$0.0	$0.0
New Hampshire	$0.0	$0.0	$0.0
New Jersey	$164.6	$0.0	$164.6
New Mexico	$0.0	$0.0	$0.0
New York	$529.7	$529.7	$0.0
North Carolina	$0.0	$0.0	$0.0
North Dakota	$0.0	$0.0	$0.0
Ohio	$6,181.7	$4,883.3	$1,298.3
Oklahoma	$202.8	$0.0	$202.8
Oregon	D	D	$0.0
Pennsylvania	$7,833.0	$6,137.1	$1,695.9
Rhode Island	$0.0	$0.0	$0.0
South Carolina	D	D	$136.1
South Dakota	$0.0	$0.0	$0.0
Tennessee	$265.7	$0.0	$265.7
Texas	$1,622.1	$1,337.5	$284.6
Utah	$0.0	$0.0	$0.0
Vermont	$0.0	$0.0	$0.0
Virginia	$306.9	$306.9	$0.0
Washington	$0.0	$0.0	$0.0
West Virginia	$186.4	$186.4	$0.0
Wisconsin	$177.2	$0.0	$177.2
Wyoming	$0.0	$0.0	$0.0

Notes: D - Suppressed to maintain confidentiality. $0.0. - may only indicate that the state and industry combination was too small to be covered by the survey. * - No data available for ferrous metal foundries (NAICS 33151).

Source: U.S. Bureau of the Census (2006a).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 7/07).

Table A4: Iron and Steel Industry Establishments and Employment, 2005 Means and Percentages

NAICS Code	Industries	Ohio: Number of Establishments	Ohio: Number of Employees	Ohio: Mean per Establishment	U.S.: Number of Establishments	U.S.: Number of Employees	U.S.: Mean per Establishment	Ohio as a Percentage of U.S.: Establishments	Ohio as a Percentage of U.S.: Employment
	Total Covered Employment	270,968	4,762,618	17.6	7,499,702	116,317,003	15.5	3.6%	4.1%
	Iron & steel industry	234	34,013	145.4	2,468	249,853	101.2	9.5%	13.6%
3311	Iron & steel mills & ferroalloys	73	17,072	233.9	839	109,957	131.1	8.7%	15.5%
331111	Iron & steel mills	67	15,341	229.0	814	107,474	132.0	8.2%	14.3%
331112	Electrometallurgical ferroalloy products	6	1,731	288.5	25	2,483	99.3	24.0%	69.7%
3312	Steel product mfg. from purchased steel	71	6,600	93.0	716	46,193	64.5	9.9%	14.3%
33121	Iron, steel pipe & tube mfg. from purchased steel	28	3,231	115.4	229	20,571	89.8	12.2%	15.7%
33122	Rolling & drawing of purchased steel	43	3,369	78.3	487	25,622	52.6	8.8%	13.1%
331221	Rolled steel shapes	30	2,903	96.8	189	10,322	54.6	15.9%	28.1%
331222	Steel wire drawing	13	466	35.8	298	15,300	51.3	4.4%	3.0%
33151	Ferrous metal foundries	90	10,341	114.9	913	93,703	102.6	9.9%	11.0%
331511	Iron foundries	62	7,827	126.2	572	60,892	106.5	10.8%	12.9%
331512	Steel investment foundries	14	1,735	123.9	128	15,847	123.8	10.9%	10.9%
331513	Steel foundries (exc. investment)	14	779	55.6	213	16,964	79.6	6.6%	4.6%

Abbreviations: exc. - except; mfg. - manufacturing.

Source: U.S. Bureau of the Census (2007).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Phone 614/466-2116 (DL, 7/07).

Table A5: Iron and Steel Industry Employment and Payroll, 2005 Means and Ratios

NAICS Code	Industries	Ohio Number of Employees	Ohio Annual Payroll ($millions)	Ohio Mean per Employee	U.S. Number of Employees	U.S. Annual Payroll ($millions)	U.S. Mean per Employee	Ratio: Ohio to U.S. Means
	Total Covered Employment	4,762,618	$168,350.5	$35,348	116,317,003	$4,482,722.5	$38,539	91.7%
	Iron & steel industry	34,013	$2,030.1	$59,686	249,853	$13,330.1	$53,352	111.9%
3311	Iron & steel mills & ferroalloys	17,072	$1,117.8	$65,476	109,957	$7,076.1	$64,353	101.7%
331111	Iron & steel mills	15,341	$1,031.9	$67,262	107,474	$6,950.8	$64,675	104.0%
331112	Electrometallurgical ferroalloy products	1,731	$85.9	$49,642	2,483	$125.3	$50,444	98.4%
3312	Steel product mfg. from purchased steel	6,600	$339.4	$51,423	46,193	$2,069.1	$44,792	114.8%
33121	Iron, steel pipe & tube mfg. from purchased steel	3,231	$155.0	$47,962	20,571	$959.3	$46,635	102.8%
33122	Rolling & drawing of purchased steel	3,369	$184.4	$54,742	25,622	$1,109.8	$43,313	126.4%
331221	Rolled steel shapes	2,903	$159.8	$55,042	10,322	$515.1	$49,901	110.3%
331222	Steel wire drawing	466	$24.6	$52,873	15,300	$594.7	$38,868	136.0%
33151	Ferrous metal foundries	10,341	$572.9	$55,403	93,703	$4,185.0	$44,662	124.0%
331511	Iron foundries	7,827	$475.9	$60,808	60,892	$2,838.0	$46,607	130.5%
331512	Steel investment foundries	1,735	$63.3	$36,474	15,847	$619.4	$39,086	93.3%
331513	Steel foundries (exc. investment)	779	$33.7	$43,252	16,964	$727.6	$42,889	100.8%

Abbreviations: exc. - except; mfg. - manufacturing.

Source: U.S. Bureau of the Census (2007).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Phone 614/466-2116 (DL, 7/07).

Table A6: Iron and Steel Industry Establishments and Employment by County, 2005

Area Name	Establishments	Employees	Area Name	Establishments	Employees	Area Name	Establishments	Employees
Ohio	234	34,013	Greene*	1	28	Morrow	0	0
			Guernsey*	1	143	Muskingum*	2	476
Adams*	1	7	Hamilton*	5	628	Noble	0	0
Allen*	2	115	Hancock*	3	60	Ottawa*	1	666
Ashland	0	0	Hardin*	2	70	Paulding	0	0
Ashtabula*	2	115	Harrison	0	0	Perry*	1	333
Athens	0	0	Henry*	1	28	Pickaway	0	0
Auglaize*	1	143	Highland	0	0	Pike	0	0
Belmont	0	0	Hocking	0	0	Portage*	1	15
Brown	0	0	Holmes*	2	10	Preble	0	0
Butler*	6	3,953	Huron	0	0	Putnam*	1	66
Carroll	0	0	Jackson*	2	120	Richland*	5	971
Champaign	0	0	Jefferson*	3	1,166	Ross	0	0
Clark*	1	28	Knox*	2	81	Sandusky*	1	7
Clermont	0	0	Lake*	7	1,114	Scioto*	2	209
Clinton*	1	15	Lawrence	0	0	Seneca*	2	43
Columbiana*	11	284	Licking*	1	7	Shelby*	1	15
Coshocton*	3	1,250	Logan*	1	66	Stark*	15	4,003
Crawford	0	0	Lorain*	4	1,333	Summit*	10	67
Cuyahoga*	34	5,376	Lucas*	5	202	Trumbull*	11	2,761
Darke	0	0	Madison*	2	31	Tuscarawas*	4	165
Defiance	1	4,000	Mahoning*	8	405	Union	0	0
Delaware*	2	143	Marion*	3	491	Van Wert	0	0
Erie*	2	285	Medina*	5	222	Vinton	0	0
Fairfield*	2	5	Meigs	0	0	Warren*	1	28
Fayette	0	0	Mercer*	1	28	Washington*	7	809
Franklin*	9	809	Miami*	5	518	Wayne*	5	478
Fulton*	5	383	Monroe	0	0	Williams*	2	73
Gallia	0	0	Montgomery*	11	498	Wood*	2	158
Geauga*	1	3	Morgan	0	0	Wyandot*	1	66

Note: * - Employment figure is, or contains, an estimate - which is why the county employment figures sum to 35,572 and not the state total of 34,013. That, in turn, means that the estimates tend to be a little high.

Sources: Harris (2005), U.S. Bureau of the Census (2007).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Phone 614/466-2116 (DL, 7/07).

Table A7: Iron and Steel Industry Establishment Trends, Ohio and the U.S.: 1998-2005

NAICS Code	Shorter Industry Title	1998	1999	2000	2001	2002	2003	2004	2005	Changes: 1998-2005 Number	Percent
Ohio	Total	270,343	270,766	270,509	269,944	271,181	270,255	271,733	270,968	625	0.2%
31-33	Manufacturing	18,052	17,930	17,704	17,597	17,189	17,082	16,887	16,617	-1,435	-7.9%
3311-2-51	Iron & steel industry	231	248	279	318	293	268	242	234	3	1.3%
3311	Iron & steel mills & ferroalloys	41	59	84	111	100	87	76	73	32	78.0%
331111	Iron & steel mills	36	54	79	106	95	80	69	67	31	86.1%
331112	Electrometallurgical ferroalloys	5	5	5	5	5	7	7	6	1	20.0%
3312	Steel products from purchased steel	71	66	72	81	84	82	71	71	0	0.0%
33121	Iron, steel pipe & tubes	28	26	29	31	34	31	27	28	0	0.0%
33122	Rolling & drawing	43	40	43	50	50	51	44	43	0	0.0%
331221	Rolled steel shapes	30	28	29	32	35	34	31	30	0	0.0%
331222	Steel wire drawing	13	12	14	18	15	17	13	13	0	0.0%
33151	Ferrous metal foundries	119	123	123	126	109	99	95	90	-29	-24.4%
331511	Iron foundries	76	81	83	85	77	69	64	62	-14	-18.4%
331512	Steel investment foundries	16	17	17	17	16	15	15	14	-2	-12.5%
331513	Steel foundries (exc. investment)	27	25	23	24	16	15	16	14	-13	-48.1%
U.S.	Total	6,941,822	7,008,444	7,070,048	7,095,302	7,200,770	7,254,745	7,387,724	7,499,702	557,880	8.0%
31-33	Manufacturing	366,249	360,244	354,498	352,619	344,341	341,849	339,083	333,460	-32,789	-9.0%
3311-2-51	Iron & steel industry	2,321	2,726	3,134	3,525	3,205	2,708	2,473	2,468	147	6.3%
3311	Iron & steel mills & ferroalloys	410	702	1,003	1,374	1,259	876	799	839	429	104.6%
331111	Iron & steel mills	381	672	970	1,345	1,242	853	769	814	433	113.6%
331112	Electrometallurgical ferroalloys	29	30	33	29	17	23	30	25	-4	-13.8%
3312	Steel products from purchased steel	762	824	933	939	870	828	734	716	-46	-6.0%
33121	Iron, steel pipe & tubes	252	265	290	281	281	221	205	229	-23	-9.1%
33122	Rolling & drawing	510	559	643	658	589	607	529	487	-23	-4.5%
331221	Rolled steel shapes	213	242	286	295	230	226	181	189	-24	-11.3%
331222	Steel wire drawing	297	317	357	363	359	381	348	298	1	0.3%
33151	Ferrous metal foundries	1,149	1,200	1,198	1,212	1,076	1,004	940	913	-236	-20.5%
331511	Iron foundries	683	731	739	747	655	623	584	572	-111	-16.3%
331512	Steel investment foundries	162	159	160	156	143	147	135	128	-34	-21.0%
331513	Steel foundries (exc. investment)	304	310	299	309	278	234	221	213	-91	-29.9%

Sources: U.S. Census Bureau (2000-2002, 2003b, 2004, 2005b, 2006b, 2007).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Phone 614/466-2116 (DL, 7/07).

Table A8: Iron and Steel Industry Employment Trends, Ohio and the U.S.: 1998-2005

NAICS Code	Shorter Industry Title	1998	1999	2000	2001	2002	2003	2004	2005	Changes: 1998-2005 Number	Percent
Ohio	Total	4,806,046	4,867,368	5,001,980	4,932,943	4,743,151	4,770,283	4,762,205	4,762,618	-43,428	-0.9%
31-33	Manufacturing	994,788	982,853	988,612	936,161	829,456	838,725	814,662	792,783	-202,005	-20.3%
3311-2-51	Iron & steel industry	52,777	51,540	54,239	51,891	43,666	41,627	34,397	34,013	-18,764	-35.6%
3311	Iron & steel mills & ferroalloys	24,479	24,306	27,101	26,700	21,353	21,783	16,315	17,072	-7,407	-30.3%
331111	Iron & steel mills	22,948	22,669	25,351	25,061	19,822	20,159	14,610	15,341	-7,607	-33.1%
331112	Electrometallurgical ferroalloys	1,531	1,637	1,750	1,639	1,531	1,624	1,705	1,731	200	13.1%
3312	Steel products from purchased steel	9,958	9,263	10,597	10,464	10,234	9,013	7,148	6,600	-3,358	-33.7%
33121	Iron, steel pipe & tubes	4,961	4,459	4,617	4,368	4,512	3,837	3,139	3,231	-1,730	-34.9%
33122	Rolling & drawing	4,997	4,804	5,980	6,096	5,722	5,176	4,009	3,369	-1,628	-32.6%
331221	Rolled steel shapes	3,676	3,466	4,515	4,631	4,583	4,263	3,306	2,903	-773	-21.0%
331222	Steel wire drawing	1,321	1,338	1,465	1,465	1,139	913	703	466	-855	-64.7%
33151	Ferrous metal foundries	18,340	17,971	16,541	14,727	12,079	10,831	10,934	10,341	-7,999	-43.6%
331511	Iron foundries	13,197	12,791	12,037	10,650	9,154	8,579	8,526	7,827	-5,370	-40.7%
331512	Steel investment foundries	2,983	2,894	2,805	2,310	2,132	1,488	1,725	1,735	-1,248	-41.8%
331513	Steel foundries (exc. investment)	2,160	2,286	1,699	1,767	793	764	683	779	-1,381	-63.9%
U.S.	Total	108,117,731	110,705,661	114,064,976	115,061,184	112,400,654	113,398,043	115,074,924	116,317,003	8,199,272	7.6%
31-33	Manufacturing	16,945,834	16,659,930	16,473,994	15,950,424	14,393,609	14,132,020	13,821,976	13,667,337	-3,278,497	-19.3%
3311-2-51	Iron & steel industry	349,739	338,509	343,299	330,496	287,205	270,090	250,690	249,853	-99,886	-28.6%
3311	Iron & steel mills & ferroalloys	148,969	144,194	149,128	148,381	126,969	125,871	114,097	109,957	-39,012	-26.2%
331111	Iron & steel mills	145,386	140,417	145,232	144,938	124,703	123,543	111,709	107,474	-37,912	-26.1%
331112	Electrometallurgical ferroalloys	3,583	3,777	3,896	3,443	2,266	2,328	2,388	2,483	-1,100	-30.7%
3312	Steel products from purchased steel	65,827	64,799	68,030	65,597	58,699	52,401	47,183	46,193	-19,634	-29.8%
33121	Iron, steel pipe & tubes	27,759	26,759	27,681	27,490	25,191	20,181	19,182	20,571	-7,188	-25.9%
33122	Rolling & drawing	38,068	38,040	40,349	38,107	33,508	32,220	28,001	25,622	-12,446	-32.7%
331221	Rolled steel shapes	14,169	13,268	15,521	14,349	13,962	13,079	10,786	10,322	-3,847	-27.2%
331222	Steel wire drawing	23,899	24,772	24,828	23,758	19,546	19,141	17,215	15,300	-8,599	-36.0%
33151	Ferrous metal foundries	134,943	129,516	126,141	116,518	101,537	91,818	89,410	93,703	-41,240	-30.6%
331511	Iron foundries	85,684	83,760	82,106	75,053	66,380	62,382	59,511	60,892	-24,792	-28.9%
331512	Steel investment foundries	24,251	22,315	21,166	20,260	17,252	15,036	14,794	15,847	-8,404	-34.7%
331513	Steel foundries (exc. investment)	25,008	23,441	22,869	21,205	17,905	14,400	15,105	16,964	-8,044	-32.2%

Sources: U.S. Census Bureau (2000-2002, 2003b, 2004, 2005b, 2006b, 2007).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Phone 614/466-2116 (DL, 7/07).

Table A9: Raw Steel Production in Ohio and the U.S., 1969-2006 (in thousands if net tons, except ranks and percentages)

	Ohio		U.S.					Ohio		U.S.			
Year	Raw Steel Output	Percent Change from Prior Period	Raw Steel Output	Percent Change from Prior Period	Ohio as Percent of U.S. Output	Ohio's Rank in U.S.	Year	Raw Steel Output	Percent Change from Prior Period	Raw Steel Output	Percent Change from Prior Period	Ohio as Percent of U.S. Output	Ohio's Rank in U.S.
1969	24,202	n.a.	141,262	n.a.	17.1%	2	1989	16,506	-6.5%	97,943	-2.0%	16.9%	2
1970	21,684	-10.4%	131,514	-6.9%	16.5%	2	1990	16,769	1.6%	98,906	1.0%	17.0%	2
1971	20,064	-7.5%	120,443	-8.4%	16.7%	2	1991	14,210	-15.3%	87,896	-11.1%	16.2%	2
1972	23,851	18.9%	133,241	10.6%	17.9%	2	1992	15,524	9.2%	92,949	5.7%	16.7%	2
1973	26,510	11.1%	150,799	13.2%	17.6%	2	1993	16,101	3.7%	97,877	5.3%	16.5%	2
1974	25,251	-4.7%	145,720	-3.4%	17.3%	2	1994	16,683	3.6%	100,579	2.8%	16.6%	2
1975	19,620	-22.3%	116,642	-20.0%	16.8%	3	1995	16,444	-1.4%	104,930	4.3%	15.7%	2
1976	22,419	14.3%	128,000	9.7%	17.5%	2	1996	16,837	2.4%	105,309	0.4%	16.0%	2
1977	21,466	-4.3%	125,333	-2.1%	17.1%	3	1997	15,827	-6.0%	108,561	3.1%	14.6%	2
1978	21,268	-0.9%	137,031	9.3%	15.5%	3	1998	16,758	5.9%	108,752	0.2%	15.4%	2
1979	21,082	-0.9%	136,341	-0.5%	15.5%	3	1999	17,499	4.4%	107,395	-1.2%	16.3%	2
1980	16,100	-23.6%	111,835	-18.0%	14.4%	3	2000	18,263	4.4%	112,242	4.5%	16.3%	2
1981	18,096	12.4%	120,828	8.0%	15.0%	3	2001	15,726	-13.9%	99,321	-11.5%	15.8%	2
1982	12,181	-32.7%	74,577	-38.3%	16.3%	2	2002	14,646	-6.9%	100,958	1.6%	14.5%	2
1983	14,586	19.7%	84,615	13.5%	17.2%	2	2003	13,100	-10.6%	103,261	2.3%	12.7%	2
1984	15,438	5.8%	92,528	9.4%	16.7%	2	2004*	14,907	13.8%	108,601	5.2%	13.7%	n.a.
1985	14,094	-8.7%	88,259	-4.6%	16.0%	2	2005*	14,539	-2.5%	102,752	-5.4%	14.2%	n.a.
1986	14,522	3.0%	81,606	-7.5%	17.8%	2	2006*	14,741	1.4%	108,620	5.7%	13.6%	n.a.
1987	16,267	12.0%	89,151	9.2%	18.2%	2	2006: 1st qtr.*	3,822	n.a.	27,193	n.a.	14.1%	n.a.
1988	17,662	8.6%	99,924	12.1%	17.7%	2	2007: 1st qtr.*	3,406	-10.9%	25,908	-4.7%	13.1%	n.a.

Notes: * - Ohio data from Ohio Steel Council, U.S. data from International Iron and Steel Institute (2007); n.a. - not available.

Sources: American Iron and Steel Institute (1970-2004), International Iron and Steel Institute (2007), Ohio Steel Council (2007).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 9/07).

Table A10: Value-Added by Group in Ohio and the U.S., 1997-2005
(in millions of current dollars, except percentages)

	Ohio Industry Group			U.S. Industry Group			Ohio as a Percent of U.S.		
Year	Subtotal	3311	3312	Subtotal	3311	3312	Subtotal	3311	3312
1997	$6,924.7	$5,861.7	$1,063.0	$32,194.4	$25,432.0	$6,762.4	21.5%	23.0%	15.7%
1998	$6,728.0	$5,705.4	$1,022.6	$30,989.0	$24,416.1	$6,572.9	21.7%	23.4%	15.6%
1999	$5,488.6	$4,393.5	$1,095.1	$28,277.4	$21,859.9	$6,417.5	19.4%	20.1%	17.1%
2000	$5,499.7	$4,165.5	$1,334.1	$27,308.6	$20,629.1	$6,679.5	20.1%	20.2%	20.0%
2001	$3,530.5	$2,517.7	$1,012.8	$20,426.6	$14,748.7	$5,677.9	17.3%	17.1%	17.8%
2002	$3,589.7	$2,409.5	$1,180.2	$24,251.6	$18,533.4	$5,718.2	14.8%	13.0%	20.6%
2003	$2,611.1	$1,631.3	$979.8	$22,648.3	$17,600.3	$5,047.9	11.5%	9.3%	19.4%
2004	$4,648.4	$3,656.2	$992.2	$39,210.5	$32,330.7	$6,879.8	11.9%	11.3%	14.4%
2005	$6,181.7	$4,883.3	$1,298.3	$40,116.6	$32,932.8	$7,183.8	15.4%	14.8%	18.1%
Average 1997-2005							17.0%	16.9%	17.5%

Note: 3311 - Iron and steel mills and ferroalloys; 3312 - Steel product manufacturing from purchased steel.

Source: U.S. Bureau of the Census (2003a, 2005a, 2006a).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 7/07).

Table A11: Capital Expenditures by Group in Ohio and the U.S., 1997-2005
(in millions of current dollars, except percentages)

	Ohio Industry Group			U.S. Industry Group			Ohio as a Percent of U.S.		
Year	Subtotal	3311	3312	Subtotal	3311	3312	Subtotal	3311	3312
1997	$435.9	$347.8	$88.1	$3,207.3	$2,673.7	$533.5	13.6%	13.0%	16.5%
1998	$545.1	$434.6	$110.5	$3,149.5	$2,632.2	$517.3	17.3%	16.5%	21.4%
1999	$539.7	$451.9	$87.8	$2,705.6	$2,265.5	$440.1	19.9%	19.9%	19.9%
2000	$490.0	$402.9	$87.2	$2,572.7	$2,104.0	$468.7	19.0%	19.1%	18.6%
2001	$286.9	$211.4	$75.5	$1,778.1	$1,365.0	$413.1	16.1%	15.5%	18.3%
2002	$242.3	$143.4	$98.8	$1,743.3	$1,332.5	$410.7	13.9%	10.8%	24.1%
2003	$284.1	$154.1	$130.1	$1,359.6	$937.9	$421.8	20.9%	16.4%	30.8%
2004	$312.9	$255.5	$57.4	$1,938.3	$1,489.9	$448.4	16.1%	17.1%	12.8%
2005	$278.4	$226.2	$52.2	$2,162.9	$1,802.5	$360.4	12.9%	12.6%	14.5%
Average 1997-2005							16.6%	15.8%	19.6%

Note: 3311 - Iron and steel mills and ferroalloys; 3312 - Steel product manufacturing from purchased steel.

Source: U.S. Bureau of the Census (2003a, 2005a, 2006a).

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Table A12: U.S. Exports, Imports and Apparent Supply of Steel Mill Products, 1969-2006
(in thousands of net tons, except percentages)

Year	Exports	Imports	Balance of Trade	Total Net Shipments	Exports as Percent of Total Net Shipments	Apparent Supply	Imports as Percent of Apparent Supply	Year	Exports	Imports	Balance of Trade	Total Net Shipments	Exports as Percent of Total Net Shipments	Apparent Supply	Imports as Percent of Apparent Supply
1969	5,229	14,034	-8,805	93,877	5.6%	102,682	13.7%	1988	2,069	20,891	-18,822	83,840	2.5%	102,662	20.3%
1970	7,062	13,364	-6,302	90,798	7.8%	97,100	13.8%	1989	4,578	17,321	-12,743	84,100	5.4%	96,843	17.9%
1971	2,827	18,304	-15,477	87,038	3.2%	102,515	17.9%	1990	4,303	17,169	-12,866	84,981	5.1%	97,847	17.5%
1972	2,873	17,681	-14,808	91,805	3.1%	106,613	16.6%	1991	6,346	15,845	-9,499	78,846	8.0%	88,345	17.9%
1973	4,052	15,150	-11,098	111,430	3.6%	122,528	12.4%	1992	4,288	17,075	-12,787	82,241	5.2%	95,028	18.0%
1974	5,833	15,970	-10,137	109,472	5.3%	119,609	13.4%	1993	3,968	19,501	-15,533	89,022	4.5%	104,555	18.7%
1975	2,953	12,012	-9,059	79,957	3.7%	89,016	13.5%	1994	3,826	30,066	-26,240	95,084	4.0%	121,324	24.8%
1976	2,654	14,285	-11,631	89,447	3.0%	101,078	14.1%	1995	7,080	24,409	-17,329	97,494	7.3%	114,823	21.3%
1977	2,003	19,307	-17,304	91,147	2.2%	108,451	17.8%	1996	5,031	29,164	-24,133	100,878	5.0%	125,011	23.3%
1978	2,422	21,135	-18,713	97,935	2.5%	116,648	18.1%	1997	6,036	31,157	-25,121	105,858	5.7%	130,979	23.8%
1979	2,818	17,518	-14,700	100,262	2.8%	114,962	15.2%	1998	5,520	41,520	-36,000	102,420	5.4%	138,420	30.0%
1980	4,101	15,495	-11,394	83,853	4.9%	95,247	16.3%	1999	5,426	35,731	-30,305	106,201	5.1%	136,506	26.2%
1981	2,904	19,898	-16,994	88,450	3.3%	105,444	18.9%	2000	6,529	37,957	-31,427	109,050	6.0%	140,477	27.0%
1982	1,842	16,663	-14,821	61,567	3.0%	76,388	21.8%	2001	6,144	30,080	-23,936	98,940	6.2%	122,876	24.5%
1983	1,199	17,070	-15,871	67,584	1.8%	83,455	20.5%	2002	6,009	32,686	-26,677	100,000	6.0%	126,677	25.8%
1984	980	26,163	-25,183	73,739	1.3%	98,922	26.4%	2003	8,220	23,125	-14,906	105,974	7.8%	120,880	19.1%
1985	932	24,256	-23,324	73,043	1.3%	96,367	25.2%	2004	7,933	35,808	-27,875	111,384	7.1%	139,259	25.7%
1986	929	20,692	-19,763	70,263	1.3%	90,026	23.0%	2005	9,393	32,109	-22,715	103,474	9.1%	126,189	25.4%
1987	1,129	20,414	-19,285	76,654	1.5%	95,939	21.3%	2006	9,728	45,272	-35,545	108,609	9.0%	144,154	31.4%

Notes: Balance of Trade = Exports - Imports; Apparent supply (equivalent to domestic consumption) = Total net shipments - Exports + Imports.

Sources: American Iron and Steel Institute (1974, 1978, 1982, 1989, 1992, 1996, 1998); Larkin (2007).

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Table A13: Projections of Iron and Steel Employment by Group*, Ohio and the U.S.: 2004-2014

NAICS Code	Shorter Industry Title	Jobs: Actual 2004	Jobs: Projected 2014	Changes: 2004-2014 Number	Changes: 2004-2014 Percent
Ohio	Total	5,822,100	6,247,900	425,800	7.3%
31-33	Manufacturing	824,000	746,300	-77,700	-9.4%
3311-2	Iron & Steel Subtotal	23,000	19,200	-3,800	-16.5%
3311	Iron & Steel Mills & Ferroalloys	13,600	11,100	-2,500	-18.4%
3312	Steel Products from Purchased Steel	9,400	8,100	-1,300	-13.8%
3315	Foundries*	17,900	14,200	-3,700	-20.7%
U.S.	Total	145,612,300	164,539,800	18,927,500	13.0%
31-33	Manufacturing	14,329,600	13,553,300	-776,300	-5.4%
3311-2	Iron & Steel Subtotal	156,200	135,300	-20,900	-13.4%
3311	Iron & Steel Mills & Ferroalloys	95,400	80,300	-15,100	-15.8%
3312	Steel Products from Purchased Steel	60,800	55,000	-5,800	-9.5%
3315	Foundries*	165,400	127,800	-37,600	-22.7%

Note: * - Projections have not been made for ferrous metal foundries (NAICS 33151). Consequently, projections for iron and steel industry totals are not possible. However, ferrous metal foundries are about 56% of all foundry jobs (U.S. Bureau of the Census, 2007). Therefore, it seems probable that employment in ferrous metal foundries also will decline.

Sources: Berman (2005), ODJFS-BLMI (2006), U.S. Bureau of the Census (2007).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 7/07).

Industry Definition and Examples of Products

Beginning in 1997, the nation's industry statistics have been collected under the North American Industry Classification System (NAICS) (Office of Management and Budget, 2002). Establishments producing goods or services sufficiently alike are classified in the same *industry*, and assigned a six-digit code number. Closely related industries form an *industry group*. The first four digits of the industry code indicate the group to which the industries belong. In this report the iron and steel industry is defined as the combination of two groups and a subgroup: *iron and steel mill and ferroalloy manufacturing* (NAICS 3311), *steel product manufacturing from purchased steel* (3312), and *ferrous metal foundries* (33151). (A five-digit code defines a *subgroup* when it subsumes more than one six-digit code; otherwise, it defines an industry.) Definitions and examples of specific industry products follow.

3311	Iron & Steel Mills & Ferroalloys.
33111	Iron & Steel Mills & Ferroalloys.
331111	Iron & Steel Mills. Activities include the direct reduction of iron ore, producing pig iron, and/or converting pig iron into steel. Steel products such as bars, pipes, plates, rods, sheets, strips, tubes, and wire are included if they are made at the same establishment where the steel is produced are included. Likewise, coke ovens may be included if they are part of the same establishment; otherwise, they are classified elsewhere.
331112	Electrometallurgical Ferroalloy Products. Activities include the production of elements added to molten steel to alter or improve the characteristics of steel. (See alloy steels in the glossary.) Non-ferrous alloy manufacturing is classified elsewhere. Electrometallurgical refers to either the application of electric current for electrolytic deposition or the use of electric current as a source of heat in smelting or refining metals. The actual production of electrometallurgical steel is classified in 331111.
3312	Steel Products from Purchased Steel. Products in this group are not made at the same establishment where the raw iron or steel is produced.
33121	Iron & Steel Pipes & Tubes from Purchased Steel. Examples include welded, riveted, and seamless pipes and tubes.
33122	Rolling & Drawing Purchased Steel.
331221	Rolled Steel Shapes. Activities include rolling and drawing shapes such as plates, sheets, strips, rods and bars from purchased steel. Drawing wire is classified in 331222.
331222	Steel Wire Drawing. Establishments in this industry draw wire from purchased steel. Making wire products such as nails, spikes, and paper clips from purchased steel is classified in fabricated metal products (332).
33151	Ferrous Metal Foundries. Establishments in this sub-group pour molten iron and steel (that they purchased) into molds of a desired shape to make castings. They may also perform further operations such as cleaning and deburring, but activities such as threading or machining that transform castings into more-finished pro-

ducts would lead to classification outside of the industry. Foundry operations at the same establishment where the iron or steel is first made – i.e., with iron and steel not purchased – are classified in 331111.

331511 Iron Foundries. Establishments in this industry melt and pour into molds the pig iron or iron alloys that they have purchased. Examples of products include manhole covers, cast-iron pipes, and cast-iron skillets.

331512 Steel Investment Foundries. Investment foundries create seamless molds by covering a wax shape with refractory slurry. The wax is melted and drained after the slurry hardens. Highly detailed and consistent castings may be made from such molds.

331513 Steel Foundries (exc. Investment). Non-investment castings of purchased steel.

Glossary

Iron and steel terms, presented in approximate order of the primary production process:

Iron ore – rocks or deposits of iron (Fe) compounds. Hematite (Fe_2O_3) is an example.

Directly reduced iron (DRI) – iron ore reduced to the solid metallic state by heating it without melting it. Natural gas usually is the refining agent. 90% to 95% iron, it is a substitute for scrap, used when scrap prices are high. Iron carbide (Fe_3C) and hot briquetted iron are other examples of scrap substitutes.

Coke – derived by baking coal (petroleum-related material may also be used), it is primarily carbon (C); however, other matter and minerals may still be present. Coke supplies the carbon monoxide (CO) to reduce iron ore in a blast furnace and is a heat source for melting the iron. Coke burns hotter than coal.

Fluxes – substances used to promote the reduction of metals. Examples include, but are not limited to, limestone (primarily calcium carbonate ($CaCO_3$), secondarily magnesium carbonate ($MgCO_3$)), dolomite ($CaMg(CO_3)$), lime (an oxide of calcium) and fluorite (CaF_2).

Blast furnace – a furnace operating at $3{,}000^0$F (or higher) for reducing iron ore to pig iron. Air blasted through the fuel increases the combustion rate.

Pig iron – an iron-based product with a carbon content greater than 1.7% but less than 5%.

Slag – a non-metallic product resulting from the interaction of fluxes and impurities in the smelting and refining of metals. Slag is separated from molten steel and solidified outside the mill. It may eventually be recycled into things such as concrete building blocks.

Basic oxygen process (BOP) – making steel from molten pig iron and scrap with fluxes and oxygen (O_2) that is 99% pure to reduce carbon, phosphorus (P) and Sulfur (S) to specified levels without introducing nitrogen (N_2) or hydrogen (H_2).

Electric arc (EA) furnace – a furnace wherein materials are melted by passing an electric current through them, permitting the close control and addition of alloying elements.

Steel – an iron-based product with a carbon content of 1.7% or less.

Carbon steel – the world's most common steel; its properties depend on the specific carbon content and microstructure. Steel with carbon content greater than .5% is considered high-carbon steel.

Alloy steels – steels with elements added to alter or improve their properties. Examples include chromium (Cr – at least 10%) and nickel (Ni) to produce stainless steel (which resists corrosion), and silicon (Si) to reduce energy loss in electrical steel. Other important elements used in alloy steel and high-strength-low-alloy steels are molybdenum (Mo), niobium (Nb), tungsten (W) and vanadium (V) for luster, strength, toughness, wear and/or corrosion resistance.

Raw steel – molten steel before it has been shaped or rolled, including the primary production of steel from iron ore with the BOP and steel produced by recycling in EA furnaces.

Net ton – 2000 pounds; a long ton is a metric ton (1,000 kg.), or about 2,204.6 pounds.
Semi-finished steel – the unrolled basic shapes of billets, blooms and slabs.
- **Billet** – a square or rectangular shape.
- **Bloom** – a square or rectangular shape larger than a billet.
- **Slab** – usually 8-to-10 inches thick, and wider than a bloom. An intermediate slab may be 4-to-6 inches thick, while a thin slab may be 1.5-to-2 inches thick.

Rolling – reducing or changing the cross-sectional area of a work-piece by the compressive forces of rotating rolls. The process is similar to squeezing clothes through the wringers of an old fashion washing machine.
- **Flat rolled** – processed on rolls with smooth faces, as opposed to grooved or cut faces used for structural or shaped products. Common products include sheets, strips and plates.
- **Cold rolled** – processed without first reheating the steel. Cold rolling produces a smooth surface and makes the piece easier to machine.
- **Hot rolled** – processed after it has been reheated.

Finished steel products include, but are not limited to:
- **Bars** – shaped and rolled into various forms from billets, one of the industry's highest volume class of products.
- **Structural shapes** – one example is an I-beam rolled and shaped from a bloom.
- **Sheets** – flat rolled from slabs, wider than 12 inches, far and away the single largest class of products (by volume) of the industry.
- **Strips** – flat rolled from slabs, less than 12 inches wide, but with a more precise control of thickness.
- **Plates** – flat rolled from slabs, thicker and heavier than sheets, a higher-volume class of products, primarily used in the construction and heavy machinery industries.

Near net shape casting – casting iron or steel in a thin and intricate-but-strong form that eliminates or reduces machining requirements before use or installation of the product.
Annealing* – heating and cooling steel to improve formability and surface durability.
Pickling* – removing oxide or mill scale from the surface by immersion in an acidic or alkaline solution in preparation for further processing.
Galvanizing* – coating steel with a layer of zinc (Z) for corrosion resistance.
Slitting* – passing a sheet or strip of steel through rotary knives as part of further processing; often performed at steel service/distribution centers.

* - These activities are not classified under NAICS codes 3311, 3312, or 33151.

A Primer on Iron and Steel Production Processes

There are two basic types of steel mills: primary producers and minimills. Producing pig iron is the first step of the primary steel making process. Iron ore pellets, limestone and coke are loaded into a blast furnace. The heat melts the ore and the limestone. Two general chemical reactions occur: the carbon from the coke removes the oxygen from the ore, and the limestone removes some impurities. (The result of the latter is called slag, and is removed from the blast furnace.[14]) The molten pig iron is transferred to a basic oxygen process (BOP) furnace where contaminants such as phosphorus and sulfur are removed, and carbon, manganese and silicon are either removed or reduced to specified levels. Ferrous scrap, directly reduced iron (DRI), and fluxes may be combined with molten pig iron in this stage of steel making. The defining characteristic of steel is that its carbon content is no greater than 1.7%. Annual production capacities of primary producers typically range from two to four million net tons (Gnidovec, 2003; Larkin, 1994, 1995, 2005; Miller, 1984).

By contrast, minimills neither produce pig iron nor use it as a raw material. They melt ferrous scrap (and, occasionally, DRI) with fluxes in electric arc (EA) furnaces.[15] The capacity of one minimill typically ranges from 150,000 to 400,000 tons per year. (The capacity of a minimill company, though, may be tens of millions of tons.) Historically, primary producers located near their raw material. Minimills locate near their clients because ferrous scrap is ubiquitous (Larkin, 1994, 1995, 2007; Miller, 1984). EA furnaces also are used by both primary producers and minimills to control the addition of various elements when creating alloy steels (Parker, 1984). The elements add desired characteristics such as luster, strength, toughness, wear- and/or corrosion-resistance.

The technology of iron and steel production has changed over the decades. By 1992, BOP furnaces completely replaced the less efficient open-hearths for primary steel production, and the majority of all raw steel production in America now comes from minimills (American Iron and Steel Institute, 1970-2004; Larkin, 2007: 19). The practice of pouring molten iron or steel into ingots for cooling – and then sending the ingots to a breakdown mill for reheating and further processing – has almost disappeared. Nowadays, almost all raw steel is continually cast; i.e., it is poured into a water-cooled mold, and then drawn down through a series of rolls and water sprays, yielding slabs, billets and blooms in a single step. This saves time, energy and money, and creates a better product. Rolling mill machinery is used to further work such semi-finished steel into finished products: slabs are processed into plates, sheets and strips; billets into bars, rods, and tube rounds; and blooms into structural shapes and rails (Larkin, 1994, 1995, 2007; Miller, 1984). Starting in the late 1980s, a related development allowed molten steel to be squeezed to initial thicknesses of 1.5 to 2.0 inches. This thin slab- and strip-casting technology eliminated the intermediate step of reducing stands working on conventional 8- to 10-inch slabs (Larkin, 2007: 9-10), again saving time, energy and money.

NOTES:

1 Other motor vehicle companies may have foundry operations in the state, but the final product of their establishments is an engine. Such establishments are classified in NAICS 336312 if they make gasoline engines or 333618 if they make diesel engines. Classifying establishments with foundries based on their end products – i.e., castings that are subject to further manufacturing technologies *at the same plant* after emerging from the foundries – underestimates the importance of foundry operations in the economy.

2 Ryerson's J & F Steel is counted among the 13 Fortune companies and included in table A1, but is omitted from the text list by this criterion. Similar establishments from other companies are listed only in table A1.

3 The figures for 2004 exclude three announced coke oven projects valued at $504 million with 199 more possible jobs. Coke ovens are excluded from the iron and steel industry if they are not part of the iron smelting complex (OMB, 2002).

4 Value-added is approximately equal to the value of shipments minus the cost of materials and labor. Although value-added still includes the costs of services purchased by the establishment, it is closer to the industry's net contribution to the economy than the value of shipments.

5 Almost all of the employment figures for the counties with industry establishments should be regarded as more or less rough estimates because the U.S. Bureau of the Census (2007) does not disclose precise figures if doing so would violate the confidentiality of respondents. The Bureau merely provides range(s) encompassing the jobs figure(s) for the establishment(s) in the county under such circumstances. The figures in the text and table A6 are the result, at least in part, of an estimation technique thought to be fairly accurate on average, except when data from Harris (2005) could reasonably be incorporated. It should also be noted that the Defiance figure is now 1,454.

6 Undoubtedly LTV's bankruptcy played a significant role in the industry's job losses in Ohio as well as across the nation. Employment reductions at General Motors' casting plant were part of the net loss in iron foundries.

7 To some degree, the relative importance of imports reflects the relative importance of exports because of the mathematical relationship between the two. Apparent supply is calculated by subtracting exports from total shipments and then adding imports. Consequently, as exports increase, imports will, *ceteris paribus*, become a larger portion of apparent supply.

8 Service/distribution centers are predominantly wholesale and warehouse operations that slit and sell steel mill products to a variety of customers (Office of Management and Budget, 2002).

9 For that reason, it is no longer entirely accurate to refer to the companies as integrated; “primary producers” is probably a more accurate description because their product is steel smelted from iron ore.

10 The choice between iron, steel, aluminum, plastics or ceramics turns on the consideration of many factors: costs (of the material, the tooling, and the labor to make the product), weight, aerodynamic qualities, production speed, surface finish and paintability, ease of recycling, operating temperature, and corrosion resistance. The advantages of iron and steel are ease of recycling, the ability to operate in high temperature environments, surface finish, and paintability. Steel can be made corrosion resistant, but it becomes more expensive (Larkin, 2005).

11 Larkin (2005) states that companies divesting their coke ovens did so because they were unwilling to make the financial investments to meet the 1990 Clean Air Act Amendment requirements.

12 In the past, companies such as LTV and Wheeling-Pittsburgh Steel that entered bankruptcy were not acquired by other steel companies because they retained their liabilities for pension and health care benefits (Larkin, 2005).

13 Mittal was required by the Justice Department to sell its Sparrows Point facility before final approval of its merger with Arcelor. This means that antitrust concerns will limit the consolidation of the industry. Esmark, the company which bought Wheeling-Pittsburgh Steel, bought the facility. Sparrows Point will supply slabs to Wheeling-Pittsburgh for further processing (Matthews, 2007a).

14 Slag is mostly lime, silica, and alumina. While it is a byproduct of smelting and refining metals, it becomes an ingredient for other things – mostly road bases and concrete products for road surfaces. It is also spun into mineral wool for insulation, and used in sandblasting, railroad ballast, highway fill, and filters at sewage treatment plants (Gnidovec, 2003).

15 Slag is also produced in BOP and EA furnaces. Again, it is a byproduct of flux use (Gnidovec, 2003).

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