What Is Manufacturing? Why Does the Definition Matter?

/name redacted/
Section Research Manager

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Summary

Numerous provisions in federal law are intended to support manufacturing in the United States. Almost without exception, these provisions define manufacturing as the process of physically transforming goods. Physical transformation involves what might be thought of as traditional manufacturing activities such as molding, cutting, and assembly. These laws establish a variety of potential benefits, preferences, or penalties based on the country in which physical transformation occurs.

By and large, federal supports targeted specifically at manufacturing rest on two implicit premises that have been rendered questionable as a result of developments in the private sector.

- **Each manufactured product is assumed to have a single country of origin.** The determination of whether a product is American-made is binary; either it was made in the United States or it is an import. This assumption fits uneasily with the global value chains now widely used by manufacturers to combine raw materials, components, services, and intellectual property from multiple countries into a single, finished manufactured good.
- **Physical transformation is assumed to be the means by which manufacturing creates economic benefits.** Under a variety of statutes, the fact that other activities related to making a product are conducted in the United States is not relevant to the determination of whether the product is made in the United States. This is generally the case even if those activities account for a large proportion of the value of the finished good or of the employment related to the good's production. Conversely, a good may be treated as U.S.-made if significant parts are of U.S. origin and if the good was transformed in the United States, even if all research, design, software development, and other nonphysical activities related to its production occurred in other countries.

The physical transformation of manufactured goods increasingly is performed by workers not classified as manufacturing workers. Moreover, it appears that a growing share of workers whose jobs are related to manufacturing are employed in economic sectors not directly involved in physical transformation, including business services, software development, and after-sales service. These changes have made it more difficult to identify workers whose jobs are related to manufacturing. Linkages between nonphysical inputs and factory production may not be evident in government statistics, as the software and services may be produced within the manufacturing firm itself or may be purchased from other firms and may be produced by workers in any number of domestic and foreign locations.

These changes in the structure of manufacturing make it difficult to design government policies that support manufacturing-related value added and employment in the United States. Many federal laws adopted with the goal of supporting manufacturing do not take into account the increasingly blurred lines between manufacturing and other types of economic activity.

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Introduction

Since 1790, when President George Washington told the first session of Congress that the "safety and interest" of a free people "require that they should promote such manufactures as tend to render them independent of others for essential, particularly military supplies,"[1] Congress has taken a special interest in the health of the manufacturing sector. In his *Report on the Subject of Manufactures*, submitted to the House of Representatives the following year, Secretary of the Treasury Alexander Hamilton suggested a variety of measures, including import duties, bounties (subsidies), and patents, intended to strengthen manufacturing in what was then an overwhelmingly agricultural economy.[2] Congress resisted bounties, but it largely accepted Hamilton's recommendations for high import tariffs and strong patent protection.[3]

Defining "manufacturing" and measuring its scope have been challenges from the country's earliest days. When he prepared the first nationwide statistics about manufacturing at the request of the Secretary of the Treasury, Tench Coxe reported the value of manufactured goods produced in 1810 as $127.7 million, but he estimated that including goods "entirely omitted or imperfectly returned" by state and territorial officials would raise the value to $172.8 million—35% more. Additionally, Coxe identified $25.9 million of goods produced in the United States "which are of a doubtful nature in relation to their character as Manufactures." One example was pot ashes. At the time, farmers clearing hardwood forests to plant crops often burned unneeded trees, soaked the ashes in iron pots, and then evaporated the mixture to obtain potash salts to make soap, glass, and textiles. Coxe apparently was unconvinced that this production process was "manufacturing."[4]

The scope and scale of manufacturing have changed considerably in the intervening centuries, but the challenge of defining "manufacturing" has not gone away. If anything, changes in the ways manufactured goods are developed, produced, and sold have made manufacturing more difficult to define and to link to a particular location, and have made it more difficult to identify workers whose jobs are related to manufacturing. Because Congress has written into law a number of preferences for goods deemed to be manufactured in the United States, the economic consequences of these definitional challenges are becoming more significant.

Sources of Value

There are a variety of rationales for special government attention to domestic manufacturing. Historically, Congress has been attentive to the role of manufacturing as a source of employment, especially for workers without higher education. National security considerations may argue for the physical production of a particular product to occur within the United States. Productivity typically rises faster in manufacturing than in other sectors of the economy, making manufacturing an important source of the productivity growth that fuels economic growth.

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[1] *Annals of Congress* 1 (January 8, 1790), p. 969.

[2] "Manufactures. Communicated to the House of Representatives, December 5, 1791," *American State Papers*, vol. 9, pp. 123-144.

[3] Douglas A. Irwin, "The Aftermath of Hamilton's 'Report on Manufactures,'" *Journal of Economic History*, 2004, pp. 800-821.

[4] Information about manufacturing was collected in conjunction with the third census of the United States, taken in 1810. *Tabular Statements of the Several Branches of American Manufactures* (Philadelphia: A. Cornman, 1813), pp. 36-45. The tables were more widely distributed in Tench Coxe, *A Statement of the Arts and Manufactures of the United States of America for the Year 1810* (Philadelphia: A. Cornman, 1814).

The manufacturing sector, as defined by the U.S. government, "comprises establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products," as well as those engaged in "assembling of component parts of manufactured products" for purposes other than construction. Typically, the Census Bureau notes, manufacturing establishments are referred to as plants, factories, or mills.[5]

This definition, however, is of limited usefulness in understanding how manufacturers and workers create economic value. The economic value of a manufactured good, and the employment related to the production of that good, may be derived from a wide variety of specific activities in addition to physical transformation. Two types of nonmanufacturing activities are especially likely to contribute to the value creation and employment in the process of creating manufactured goods and delivering them to end users. One is business services such as research, design, marketing, logistics, and information technology. The other is software development. These nonphysical inputs may be produced within the manufacturing firm itself, or may be purchased from other firms.

Because many manufactured products are unique, understanding of the role of nonmanufactured inputs in manufactured goods has come principally from case studies. These studies seek to disentangle the complex supply chains used to produce many of the final goods that are sold to consumers, firms, and governments.

One such study of Nokia's N95 mobile phone found that the cost of final assembly—that is, the physical manufacture of the product sold to end users—came to only 2% of the final pretax sales price; the value of the physical inputs Nokia purchased to manufacture the phone, such as processors, cameras, and integrated circuits, was estimated to be less than the value of its intellectual property, in-house services, and profit connected with the phone.[6] Another study found the cost of assembling computers and music players to be only 3% to 5% of the selling price.[7] An analysis of an Italian manufacturer's Chinese-made shoes found that design, quality control, logistics, sales, and administration, all of which occurred in Europe, accounted for about half the wholesale cost of the shoes and three-quarters of the value added.[8]

The value of embedded software represents a substantial and growing share of the value of many manufactured products, from pacemakers and washing machines to cars and airplanes. One recent article asserted that "a premium class car now ... runs on 100 [million] lines of software code,"[9] implying that a significant albeit uncertain share of the car's value is created by coders in offices rather than assembly workers on a factory floor. A 2016 consultant study projects that providers

[5] U.S. Census Bureau, "North American Industry Classification System: 2012 NAICS Definition: Sector 31-33—Manufacturing," http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=31&search=2012%20NAICS%20Search.

[6] Jyrki Ali-Yrkkö, Petri Rouvinen, Timo Seppälä, and Pekka Ylä-Anttila, "Who Captures Value in Global Supply Chains: Case Nokia N95 Smartphone," discussion paper 1240, Research Institute of the Finnish Economy, February 2011, http://www.csf.rrojasdatabank.info/WP_196.pdf.

[7] Jason Dedrick, Kenneth L. Kraemer, and Greg Lindon, "Who Profits from Innovation in Global Value Chains? A Study of the iPod and notebook PCs," paper presented to Alfred P. Sloan Foundation Industry Studies Conference, Boston, MA, May 2008.

[8] Kommerskollegium, "Adding value to the European economy," http://www.kommers.se/In-English/Publications/2012/Adding-Value-to-the-European-Economy/. Value added, in this context, is the amount by which the value of a product is increased at each stage of its production. It can be calculated as the revenue from sale of the product, less the cost of raw materials, components, and services used to make the product. A firm's value added includes employee compensation, taxes on production, and profits. In the case of the phone described here, providers of components, software, transportation, marketing and distribution services, and physical assembly, among other parties, each contributed to the value added of the finished good.

[9] John Gapper, "Software is steering auto industry," *Financial Times*, February 19, 2015.

of software and digital services will capture a growing share of the automotive sector's profits as autonomous vehicles come into use.[10]

When a manufacturer incorporates services or software from an external provider into its product, the value added and employment associated with those inputs may not be credited to the manufacturing sector even though the inputs are intrinsic to the manufactured good.[11] The Organisation for Economic Co-operation and Development (OECD), which seeks to harmonize economic data internationally, estimates that services produced in the United States contributed around one-third of the total value added in products sold by the U.S. manufacturing sector in 2011. This share varies considerably among manufacturing industries (**Table 1**).[12] The OECD figures likely understate the role of nonphysical activities in manufacturing production, as the underlying data generally do not capture services and software produced within manufacturing firms rather than purchased.

Table 1. U.S. Services as Share of Value Added in U.S. Manufacturing

2011

Motor vehicles	41.1%
Food & beverages	40.8%
Basic metals	40.8%
Chemicals	33.9%
Fabricated metal products	29.3%
Electrical machinery	27.0%
Electronic & optical equipment	18.9%
All manufacturing	**34.4%**

Source: CRS, from Organisation for Economic Co-operation and Development, Trade in Value Added: Origin of Value Added in Final Demand, https://stats.oecd.org/index.aspx.

Note: "All manufacturing" includes manufacturing industries that do not appear in this table.

Where's the Work?

Under current statistical practices, whether an activity is classified as manufacturing depends largely on where it is conducted. Government statistical agencies track most types of economic activity at the level of the establishment—that is, a single facility or business location—rather than at the level of a firm that may own multiple establishments or an enterprise that may own many firms. As a general rule, if an establishment is "primarily engaged" in transforming or assembling goods, then all output from that establishment is considered output of the manufacturing sector, and all workers (except those employed by outside contractors) are considered manufacturing workers.

[10] Richard Vierecki et al., "Connected car report 2016," *strategy&*, September 28, 2016, http://www.strategyand.pwc.com/reports/connected-car-2016-study.

[11] In such a case, government statistics would treat the software purchased by a manufacturer as a purchased service.

[12] Based on CRS analysis of data from OECD, Trade in Value Added: Origin of Value Added in Final Demand, https://stats.oecd.org/index.aspx.

Thus, if a firm locates its product design employees at a U.S. facility that is primarily engaged in producing goods, those designers will likely be counted as working in a manufacturing establishment, and their work will add to the total value added created in U.S. manufacturing. If, however, the product designers work at a separately located design center, they will probably be considered to work in an industrial design establishment, not a manufacturing establishment. In that case, they will be counted as industrial design workers, and their value added will be attributed to the professional, scientific, and technical services sector, not to the manufacturing sector.[13] The same will be true if the product designers are employed by a separate firm rather than by the firm that owns the manufacturing establishment.

One might identify four separate groups of U.S. workers whose jobs are related to manufacturing:

- Production employees of manufacturing establishments: approximately 8.6 million workers at the end of 2016.
- Nonproduction employees of manufacturing establishments: approximately 3.7 million workers.
- Workers producing manufactured goods but employed by nonmanufacturing establishments: number unknown.
- Workers producing services used in manufacturing but employed by nonmanufacturing establishments: number unknown.

Data related to the first two groups are generally captured by government statistics depicting the manufacturing sector. Data related to the roles of workers in the last two groups are far more tenuous. As one example, establishments in the computer systems design and related services industry employed a total of 1.9 million Americans in 2015. Rough calculations suggest that perhaps 23% of the work hours in this industry, equivalent to 447,000 jobs, might be considered manufacturing work if the workers were employed by manufacturing establishments (**Table 2**).[14]

[13] Manufacturing activities fall within North American Industrial Classification System (NAICS) sectors 31-33, whereas professional, scientific, and technical services of all sorts fall within NAICS sector 54.

[14] Estimate derived by CRS from U.S. Bureau of Economic Analysis (BEA), Input-Output tables, Use of Commodities by Industries Before Redefinitions; BEA, Fixed Assets Accounts table 3.71; and U.S. Bureau of Labor Statistics (BLS), Employment, Hours, and Earnings from Current Employment Survey, NAICS code 5415.

Table 2. Manufacturing Employment Potentially Attributable to the Computer Systems Design and Related Services (CSD) Industry, 2015

Line	Statistic	Output	Employment
A	CSD direct employment in 2015		1,911,400
B	CSD total output in 2015	$462,737,000,000	
C	CSD sales to manufacturers	$16,565,000,000	
D	CSD sales to manufacturers as share of CSD output (C/B)	3.58%	
E	CSD employment attributable manufacturing inputs (D*A)		68,424
F	CSD sales for private nonresidential investment in IP	$236,479,000,000	
G	Total private nonresidential investment in IP	$717,900,000,000	
H	Investment by manufacturers in IP	$278,000,000,000	
I	Manufacturers' investment in IP as share of total (H/G)	38.72%	
J	CSD output possibly attributable to manufacturers' investment in IP (F*I)	$91,574,261,039	
K	CSD sales of IP to manufacturers as share of output (J/B)	19.79%	
L	CSD employment possibly attributable to manufacturers' investment in CSD IP (K*A)		378,260
M	Manufacturing-like employment in CSD (E+L)		446,684

Source: CRS. See note 14.

Note: IP=intellectual property.

Several recent developments make it even more challenging to measure the extent of manufacturing activity and the number of workers employed in manufacturing.

Bundling of Services with Manufactured Goods

Anecdotal evidence suggests that a growing proportion of manufactured goods are sold in conjunction with after-sale services. For example, Boeing Corp., an aircraft manufacturer, recently set a goal of $50 billion of annual revenue from services such as supplying spare parts, modifying and repairing aircraft, training pilots, and monitoring aircraft systems during flights.[15] Many other manufacturers are reshaping themselves to be service providers as well, attracted by the prospect of continuing revenue streams from customers rather than one-time payments.[16]

It is possible that a manufacturer might demand a different price for a good sold as a stand-alone product than for the same good when bundled with a service contract. In such a case, the amount of the product's value to attribute to the manufacturing sector rather than the "other services" sector, which includes machinery and equipment repair and maintenance, may be arbitrary.[17]

[15] Dominic Gates, "Boeing goes outside for new Commercial Airplanes CEO," Seattletimes.com, November 21, 2016.

[16] As an example, United Technologies Corp., which manufactures elevators, aircraft engines, and many other products, reported that "product sales" accounted for 71% of its $56.1 billion of sales in its FY2015, and "service sales" accounted for 29%. Its competitor, General Electric Co., does not make a similar distinction in its financial reports between sales of goods and sales of services. See United Technologies, *2015 Annual Report*, p. 38, and General Electric Co., *Form 10-K for the fiscal year ended December 31, 2015*. It is unclear how either of these companies classifies employees and establishments in its responses to government statistical surveys.

[17] "Other Services (except Public Administration)" fall within NAICS sector 81.

Government data collectors may not be able to capture the value of the good separately from the value of the bundled services, and may not be able to distinguish the workers involved in the original production process from those providing related services.

Factoryless Goods Production/Contract Manufacturing

Factoryless goods producers are firms that design products to be manufactured and own the finished goods but do not engage directly in physical transformation. The transformation or assembly of the goods they sell is done by external suppliers, known as contract manufacturers, in the United States or abroad, although the factoryless goods producer may be closely involved in its contract manufacturers' operations. Examples might include a U.S.-based footwear company that engages other firms to produce the shoes it designs and markets,[18] and a "fabless" semiconductor company that contracts with an unrelated "foundry" to manufacture its chips.[19]

It is impossible to identify factoryless goods producers with certainty; responses to related questions on government surveys are confidential, and companies' annual reports filed with the Securities and Exchange Commission may not provide sufficient detail to determine whether they own manufacturing establishments. However, Alphabet Inc., parent of Google Inc., appears to meet the definition. Alphabet generated more than 90% of its revenue in 2015 from delivering online advertising. However, the company sells computers and telephones to consumers, and designs and oversees production of computer servers used in its data centers. In 2012 a company official referred to Google as "probably ... one of the largest hardware manufacturers in the world." However, according to Alphabet's 2015 annual financial report, "We rely on third parties to manufacture many of our assemblies and finished products," leaving the question of whether Alphabet owns and operates its own manufacturing facilities unanswered. It is unclear whether any Alphabet employees are categorized as manufacturing workers and whether any of the company's sales are registered as manufacturing output.[20]

According to Census Bureau estimates, at least 54,000 nonmanufacturing firms employing 3.4 million workers purchased contract manufacturing services in 2012.[21] Many of the tasks performed by the employees of the purchaser firms may be identical to those performed by employees of manufacturing establishments in management, professional, sales, office, and transportation occupations—45% of workers employed in the U.S. manufacturing sector are engaged in activities other than production.[22] However, as the facilities owned by factoryless

[18] Nike Inc., based in Oregon, reports that "Virtually all of our footwear is manufactured outside of the United States by independent contract manufacturers" at 146 locations, and that its apparel is made in approximately 408 factories in 39 countries. Nike Inc., *2015 Annual Report and Notice of Annual Meeting*, p. 67. The company does not disclose U.S. employment, but according to a press report it had 31,977 U.S. employees in its FY2015. See John Kell, "Majority of Nike's U.S. Employees Are Minorities for the First Time," http://fortune.com/2016/05/12/nike-staff-diversity/, May 12, 2016.

[19] See CRS Report R44544, *U.S. Semiconductor Manufacturing: Industry Trends, Global Competition, Federal Policy*, by (name redacted) and (name redacted)

[20] Cade Metz, "Where in the World Is Google Building Servers?," *Wired*, July 6, 2012; Alphabet Inc., Form 10-K for the fiscal year ended December 31, 2015, pp. 7, 12. 17, 23, and 28.

[21] U.S. Census Bureau, "Enterprise Statistics: 2012 Enterprise Tables," https://www.census.gov/econ/esp/, Table 8. In this survey, which collected data from "enterprises" rather than establishments, each enterprise was assigned to the economic sector with the largest share of the enterprise's payroll (measured in dollars). Most large enterprises would thus be expected to control establishments in more than one economic sector. Some 1.9 million enterprises with a collective $7.7 trillion of sales did not respond to the survey, so the actual number of nonmanufacturing firms purchasing contract manufacturing services may be considerably larger than indicated by the survey.

[22] BLS, Current Population Survey, http://www.bls.gov/cps/tables.htm#annual, Table 17.

goods producers are usually classified as wholesale, retail, or professional, scientific, and technical service establishments rather than manufacturing establishments, it is likely that few if any of their workers are counted as manufacturing workers.

Most contract manufacturing services are provided by establishments in the manufacturing sector, either in the United States or abroad. At the same time, however, more than 20,000 U.S. enterprises whose primary business is not manufacturing reported providing contract manufacturing services in 2012. These enterprises—an "enterprise" may own one or many establishments or firms—collectively employed 1.5 million workers (**Table 3**). The number of those 1.5 million workers who were engaged in manufacturing-related work cannot be determined from published data.[23]

Table 3. Characteristics of U.S. Enterprises Providing Contract Manufacturing

Ranked by number of contract manufacturers

Sector	Number of Contract Manufacturers in Sector	Total Employment of Contract Manufacturers in Sector
Manufacturing	14,683	2,372,674
Professional, scientific, and technical services	5,042	230,648
Wholesale trade	4,699	156,276
Construction	2,244	67,355
Retail trade	2,130	659,501
Accommodation and food services	1,686	73,965
Other	4,332	347,253

Source: U.S. Census Bureau, Enterprise Statistics: 2012 Enterprise Tables, Table 7.

Notes: An enterprise may have establishments in multiple sectors and may control more than one firm.

The definitional questions associated with factoryless goods producers have proven controversial. In 2010, U.S. statistical agencies proposed to categorize factoryless goods producers as manufacturers from 2017.[24] This change would have greatly increased both the number of individuals counted as manufacturing workers and the reported value added of the manufacturing sector.[25] The proposal met with strong objections. In 2014, the Office of Management and Budget ordered the change postponed, citing the poor quality of statistical data about factoryless

[23] U.S. Census Bureau, "Enterprise Statistics: 2012 Enterprise Tables," Table 7.

[24] U.S. Census Bureau, "Economic Classification Policy Committee (ECPC) Recommendation for Classification of Outsourcing in North American Industry Classification System (NAICS) Revisions for 2012," http://www.census.gov/eos/www/naics/fr2010/ECPC_Recommendation_for_Classification_of_Outsourcing.pdf.

[25] The data are difficult to interpret. The Census Bureau assigned enterprises to economic sectors based in establishment-level data about employment. So, for example, an enterprise would likely have been assigned to the retail trade sector if the largest group of its employees worked in retail establishments, even if it owned establishments in other sectors as well, Still, in March 2012 643 enterprises classified as being in the retail trade sector, with a total of 75,470 employees, reported that 100% of their operating revenue and net sales came from providing contract manufacturing services. It is not apparent why such enterprises would have been classified as retail enterprises. For data, see U.S. Census Bureau, "Enterprise Statistics: 2012 Enterprise Tables," Table 7. For definitions, see U.S. Census Bureau, "Definitions for the Enterprise Statistics Program," https://www.census.gov/econ/esp/definitions.html. The Enterprise Statistics Program operated from 1954 to 1992 and again from 2007 to October 2016, when it was again discontinued.

producers.[26] As a result, a significant amount of manufacturing-like work and value added is not attributed to manufacturing in government statistics.

Expansion of Employment Services Firms

Manufacturers make significant use of workers employed by employment services firms in addition to their own employees. According to Bureau of Labor Statistics data, 755,650 people in typical manufacturing production occupations worked for employment services firms in May 2015 (**Table 4**). That number has not changed significantly since 2000, while the number of production and nonsupervisory workers employed by manufacturers has fallen by nearly 4 million.[27]

Table 4. Employees of Employment Services Firms in Production Occupations

May 2015

Occupation	Number of Workers
First-line supervisors of production and operating workers	5,790
Assemblers and fabricators	276,450
Food processing workers	12,120
Metal and plastic workers	92,340
Printing workers	5,910
Textile, apparel, and furnishing workers	7,770
Woodworkers	3,830
Plant and system operators	1,270
Other production occupations	350,170
Total	**755,650**

Source: Bureau of Labor Statistics, Occupational Employment Statistics Query System, data.bls.gov/oes.

It is likely that many nonproduction workers in manufacturing establishments are employed by employment services as well. This includes workers in office, maintenance, and food service occupations. The number of individuals in those categories who work in manufacturing establishments as employees of employment services cannot be ascertained. Nor is it known how much value added by the employment services sector stems from manufacturing-related work.

[26] For background on factoryless manufacturing, see Andrew B. Bernard and Teresa C. Fort, "Factoryless Goods Producing Firms," *American Economic Review: Papers & Proceedings 2015*, vol. 105, no. 5, pp. 518-523. The statistical issues are discussed in Maureen Doherty, "Reflecting Factoryless Goods Production in the U.S. Statistical System," Fariha Kamal, Brent R. Moulton, and Jennifer Ribarsky, "Measuring 'Factoryless' Manufacturing: Evidence from U.S. Surveys," and Kimberly Bayard, David Byrne, and Dominic Smith, "The Scope of U.S. 'Factoryless Manufacturing,'" all in Susan Houseman and Michael Mandel, eds., *Measuring Globalization: Better Trade Statistics for Better Policy*, vol. 2 (Kalamazoo, MI: Upjohn Institute, 2015). Some of the objections to the change are laid out in Robert E. Scott, "What Is Manufacturing and Where Does It Happen?," Economic Policy Institute, July 21, 2014, http://www.epi.org/publication/what-is-manufacturing-and-where-does-it-happen/. The postponement order appeared as Office of Management and Budget, "2017 North American Industry Classification System (NAICS) Revision," *Federal Register*, vol. 79, no. 153, August 8, 2014, p. 46558.

[27] Employment of production and nonsupervisory workers in manufacturing was 12.5 million in May 2000 and 8.7 million in May 2015. Data from BLS, Current Employment Survey, http://www.bls.gov/ces/.

The Meaning of "Made in USA"

The difficulty of defining manufacturing activity and identifying manufacturing work has direct implications for efforts to encourage manufacturing in the United States as a matter of U.S. government policy.

The national identity of manufactured products has been a matter of congressional concern since at least the 1930s. The Tariff Act of 1930, as amended, requires that "every article of foreign origin ... imported in to the United States shall be marked in a conspicuous place as legibly, indelibly, and permanently as the nature of the article ... will permit in such a manner as to indicate to an ultimate purchaser in the United States the English name of the country of origin."[28] Imported goods that are not so marked may be taken out of the country, destroyed, or assessed a penalty equal to 10% of their value.

In regulations implementing the law, U.S. Customs and Border Protection (CBP) defined a good's "country of origin" as "the country of manufacture, production, or growth."[29] However, if further work in another country results in a "substantial transformation" of the good, that country might then be considered the country of origin.[30] More generally, CBP regulations apply a series of tests to be applied, in order, to determine the country of origin. If the country of origin cannot be determined by any of these tests, the country of origin is the last country in which the good underwent production, which is defined to mean "growing, mining, harvesting, fishing, trapping, hunting, manufacturing, processing or assembling a good."[31]

The Tariff Act definition and the regulations implementing rest on two implicit assumptions:

- Each manufactured product is assumed to have a single country of origin. The determination of whether a product is American-made is binary; either it was made in the United States or it is an import. This assumption fits uneasily with the global value chains now widely used by manufacturers to combine components from multiple countries into a single product.
- Physical transformation is assumed to be the means by which manufacturing creates economic benefits. The fact that other activities related to making a product are conducted in the United States may not be relevant to the determination of whether the product is "Made in U.S.A."—even if, as noted above, those activities account for a large proportion of the value of the finished good.

Separately, the Federal Trade Commission (FTC), which has broad general authority to regulate deceptive practices, has asserted authority over claims that products are U.S.-made since 1987. The agency's guidelines assert that "The country in which a product is put together or completed is highly significant to consumers in evaluating where the product is 'made.'"[32] In 2016, it

[28] 19 U.S.C. §1304.

[29] 19 C.F.R. §134.1(b).

[30] Ibid. According to a CBP attorney, "Substantial transformation occurs when an imported article emerges from processing as a new and different article, with a new name, character and use." See Gregory Connor, "Rules of Origin," presentation to 17th Judicial Conference of the United States Court of International Trade, December 3, 2012, http://www.cit.uscourts.gov/Judicial_Conferences/17th_Judicial_Conference/17th_Judicial_Conference_Papers/ConnorPaper.pdf.

[31] 19 C.F.R. §102.11 (d)(3); 19 C.F.R. §102.1(n). These definitions do not apply to apparel and textile products.

[32] Federal Trade Commission, "Enforcement Policy Statement on U.S. Origin Claims," December 1, 1997, https://www.ftc.gov/public-statements/1997/12/enforcement-policy-statement-us-origin-claims.

deferred enforcement action against Bedrock Manufacturing Company, owner of the Shinola Brand, after the company agreed to take a number of corrective actions in response to allegations that it overstates the extent to which some of its products were made in the United States.[33]

FTC policy states that a product claimed to be made in the United States must be "all or virtually all made in the United States," and should "ordinarily be one in which all significant parts and processing that go into the product are of U.S. origin," and should also be one that was "last 'substantially transformed'" in the United States. The commission may base its determination of whether a product is U.S.-made in part on the percentage of total manufacturing costs that are attributable to U.S. costs.[34] The FTC does not consider the value of nonphysical inputs, such as services and software, in determining whether a product may legitimately be said to be U.S.-made.[35]

Manufacturing in Federal Law

Numerous provisions in federal law are intended to support manufacturing in the United States. Many of these provisions create distinctions based on the location at which goods undergo physical transformation. Examples include the following:

Buy American Act

The Buy American Act of 1933,[36] which governs procurement by federal agencies, generally requires that "... only manufactured articles, materials, and supplies that have been manufactured in the United States substantially all from articles, materials, or supplies mined, produced, or manufactured in the United States, shall be purchased for public use," with a number of exceptions. The term "manufacture" is not defined, but courts interpreting the act have generally held that manufacturing involves changes in physical character, and that operations performed after the physical transformation of an item is completed, such as testing and packaging, are not manufacturing. While physical inputs into a manufactured product purchased by the government are subject to the law, service inputs are not.[37]

Federal Transportation Funding—"Buy America"

Federally funded transportation projects are carried out almost entirely by nonfederal public entities such as state and local governments and transit and airport authorities. These entities' expenditures of federal funds are subject to domestic content rules commonly known as "Buy

[33] FTC matter number P074204. See letter from FTC staff attorneys Julia Solomon Ensor and Colin D.A. MacDonald to Lisa Gold, general counsel, Bedrock Manufacturing Company LLD, June 16, 2016, https://www.ftc.gov/enforcement/cases-proceedings/closing-letters/bedrock-manufacturing-company-llc-also-doing-business.

[34] FTC, "Enforcement Policy Statement on U.S. Origin Claims," December 1, 1997.

[35] Some states maintain stricter standards for determining whether an article is made in the United States. California formerly required that all "articles, units, or parts" contained in a product be manufactured in the United States if the product was labeled as made in the United States. A 2015 law relaxed that standard, allowing a product to be labeled "Made in the U.S.A." if the manufacturer shows "that it cannot produce or obtain a certain article, unit, or part" in the United States for reasons other than cost, and that the cost of the foreign article or part is no more than 10% of the finished product's wholesale price. *National Law Review*, "California Relaxes Its 'Made in the U.S.A. Law," September 20, 2015, http://www.natlawreview.com/article/california-relaxes-its-made-usa-law.

[36] 41 U.S.C. §§8301-8305.

[37] For details, see CRS Report R43140, *The Buy American Act—Preferences for "Domestic" Supplies: In Brief*, by (name redacted).

America." Buy America refers to several similar statutes and regulations that apply to federal funds used for highway, public transportation, intercity passenger rail, and aviation projects.[38] (These restrictions should not be confused with the "Buy American" rules applying to procurement directly by federal agencies.)

In general, Buy America requires the use of U.S.-made iron and steel and the domestic production and assembly of other manufactured goods such as buses and commuter rail cars. In certain situations, the statutes permit the Buy America requirements to be waived. The provisions enforced by particular agencies differ. For example, the Federal Highway Administration does not require that manufactured products used in highways and bridges be U.S.-made, except for those predominantly made of iron and steel. Federal Transit Administration (FTA) rules generally require that all "manufactured end products" used in federally funded public transportation projects must be produced in the United States unless a waiver is granted. For transit vehicles to be considered compliant, more than 60% of components, by cost, must be of domestic origin, and final assembly must take place in the United States.[39]

A manufactured product, according to FTA's definition, involves "the application of processes to alter the form or function of materials or elements of the product in a manner adding value and transforming those materials or elements so that they represent a new end product functionally different from that which would result from mere assembly of elements or materials." FTA has granted a general waiver of Buy America requirements for purchases of microprocessors, computers, and software used solely for the purpose of processing or sorting data.[40] The value of U.S. services incorporated into a manufactured product is not included in FTA's determination of whether the product is manufactured in the United States.[41]

Defense Procurement

A large number of laws and regulations require the Department of Defense (DOD) and its contractors to procure U.S.-made products. A provision of law popularly known as the Berry Amendment prohibits the department from purchasing food, clothing, tents, fiber products (including ballistic fibers), and hand and measuring tools "if the item is not grown, reprocessed, reused, or produced in the United States."[42] A separate law prohibits DOD from procuring aircraft, missiles, ships, tanks, automotive items, weapons, and ammunition that contain specialty metals that are "not melted or produced" in the United States.[43] Other laws prohibit the department from purchasing buses and air circuit breakers for naval vessels unless they are "manufactured in the United States or Canada.[44] All such prohibitions are subject to exceptions.

[38] Buy America restrictions date to the passage of the Surface Transportation Assistance Act of 1978 (P.L. 95-599). For additional detail, see CRS Report R44266, *Effects of Buy America on Transportation Infrastructure and U.S. Manufacturing: Policy Options*, by (name redacted) and (name redacted) .

[39] 49 C.F.R. §661.

[40] 49 C.F.R. §661.7, Appendix A.

[41] See, for example, letter from Dana C. Nifosi, Federal Transit Administration (FTA), to Thomas Prendergast, New York Metropolitan Transportation Authority, November 21, 2016, rejecting the authority's request to purchase a fire suppression system because some of its components were manufactured in Finland. The location of design or engineering work on the fire suppression system was not considered in the FTA analysis. https://www.transit.dot.gov/regulations-and-guidance/buy-america/second-avenue-subway-projects-water-mist-fire-suppression.

[42] The original Berry Amendment was enacted in 1941 in P.L. 77-29. The amendment is codified at 10 U.S.C. §2533a(a). Some provisions of the Berry Amendment have been applied to the Transportation Security Administration.

[43] 10 U.S.C. §2533b.

[44] 10 U.S.C. §2534.

In addition, annual bills, like appropriations and authorizations, also contain statutory restrictions. For instance, since FY1996 defense appropriations acts have contained a provision limiting DOD to procuring ball and roller bearings from domestic sources.[45]

In general, DOD uses a two-part test to determine whether a manufactured end product is domestic: the end product itself must be manufactured in the United States, and at least 50% of components, by value, must come from the United States or other qualifying countries.[46] Thus, the value of activities other than physical transformation is generally not considered in determining whether a product is U.S.-made.[47] In some cases, the requirements may not reflect important sources of value. For example, DOD is prohibited from purchasing a supercomputer "unless it is manufactured in the United States," but regulations do not require that the intellectual property used to build supercomputers, such as designs of semiconductors and computer systems, be produced in the United States.[48]

Jones Act

The Merchant Marine Act of 1920, commonly known as the Jones Act, requires that all waterborne shipping between points within the United States be carried by vessels built in the United States.[49] Coast Guard regulations specify that a cargo ship or fishing vessel may be considered to be U.S.-built if "all major components of the hull and superstructure are fabricated in the United States" and if "[t]he vessel is assembled entirely in the United States."[50] The location of other aspects of ship production, such as vessel design and development of information systems, is not relevant in determining whether the vessel is U.S.-made.

Relief of Injury from Imports

The Tariff Act makes it illegal to import articles into the United States if those imports "destroy or substantially injure an industry in the United States" or threaten to do so.[51] The U.S. International Trade Commission (ITC) is responsible for investigating whether imports that allegedly benefit from foreign government subsidies or that are sold below cost (dumped) are causing or threaten to cause material injury to a U.S. industry. The ITC may open an investigation on its own initiative or upon petitions from companies, trade associations, labor unions, or workers. Separately, the U.S. Department of Commerce is responsible for determining whether the imports were traded unfairly. If the protected imports are found both to have been traded unfairly and to threaten or cause material injury, the imports may be subject to higher duties.

[45] The ball bearing provision was first legislated in P.L. 104-61, §8099. The most recent version appears in P.L. 114-113, Consolidated Appropriations Act, 2016, Division C, §8047. Prior to enactment of a domestic content requirement for bearings in 1995, DOD had taken administrative action to require that certain bearings be produced only in the United States or Canada. See U.S. General Accounting Office, *Defense Acquisition: Rationale for Imposing Domestic Source Restrictions* (Washington, DC, 1998), p. 25.

[46] 48 C.F.R. §225.101.

[47] Shipboard anchors for naval vessels are an exception. Anchors more than 4 inches in diameter must be manufactured in the United States, "including cutting, heat treating, quality control, testing, and welding." Hence, two service activities ancillary to manufacturing, quality control and testing, are specifically included within the definition of manufacturing. See 48 C.F.R. §225.7007-1.

[48] 48 C.F.R. §225.7012.1.

[49] 46 U.S.C. §12112.

[50] 46 C.F.R. §67.97.

[51] 19 U.S.C. §1337(a)(1)(A)(i).

The Tariff Act, as amended, provides that in evaluating whether material injury has occurred or may occur, the ITC must consider "the impact of imports of such merchandise on domestic producers of domestic like products, but only in the context of production operations in the United States."[52] This definition severely limits the ITC's ability to consider whether the imports under investigation are contributing to net employment gains or employment losses in the United States. As a hypothetical example, a firm that engages in physical transformation of a product in the United States but employs few U.S. nonproduction workers could conceivably win protection against an import by a firm that does not have a U.S. factory but employs a large number of U.S. nonproduction workers in its manufacturing value chain.

Implications

Labor productivity has been growing far more rapidly in the manufacturing sector than in other parts of the U.S. economy.[53] If future manufacturing output does not increase more rapidly than productivity, fewer employees will be required for manufacturing production.

Although the number of production and nonsupervisory workers in U.S. manufacturing establishments has risen 7% since the most recent trough in early 2010,[54] economists expect that production employment will decline in future years as new production methods, such as additive manufacturing, and more complex machines and information systems, including more flexible robots, displace workers on the factory floor. The U.S. Bureau of Labor Statistics, for example, projects employment declines in many manufacturing production occupations between 2014 and 2024.[55] Similar trends in manufacturing employment are in evidence in many other countries.[56]

As physical production processes become more automated and require fewer production workers, it seems likely that nonphysical inputs into manufactured goods will continue to grow both as a proportion of value added in manufacturing and as a share of employment related to the goods' production. In many cases, the national origins of nonphysical inputs are indistinct. The process of designing a single product, for example, may involve collaboration among workers in multiple countries. The firms concerned may not track the share of the work done in each location, making it difficult to determine the value added to the manufactured good in any single country.

There may be motivations for encouraging domestic production of manufactured goods other than fostering employment and increasing value added. As noted above, for instance, it may be considered important for a good to be transformed within the United States for reasons of national security. But to the extent policymakers are concerned with maximizing domestic employment or domestic value added, it is becoming increasingly challenging to design and enforce effective government policies, as emphasis on the location of physical transformation addresses an aspect of the manufacturing process that is likely to become less important over time.

[52] 19 U.S.C. §1677(7)(B)(i)(III).

[53] Labor productivity, defined as output per work hour, has increased 20% in manufacturing since 2009, but only 7% in the nonfarm business sector as a whole. BLS, "Labor Productivity and Costs," http://www.bls.gov/lpc.

[54] BLS, Current Employment Survey, http://www.bls.gov/ces.

[55] BLS, *Occupational Outlook Handbook*, https://www.bls.gov/ooh/.

[56] CRS Report R42135, *U.S. Manufacturing in International Perspective*, by (name redacted)

Author Contact Information

(name redacted)
Section Research Manager
[redacted]@crs.loc.gov , 7-....