

# 4

## The Scope of U.S. “Factoryless Manufacturing”

Kimberly Bayard  
David Byrne  
*Federal Reserve Board of Governors*

Dominic Smith  
*University of Minnesota*

The “factoryless manufacturing” (FM) business model is employed by a rising share of U.S. firms. Factoryless manufacturers outsource the fabrication of products but maintain control of the production process, own the associated intellectual property, and bear the entrepreneurial risk. FM is an important component in the role of U.S. firms in global manufacturing value chains. Currently, U.S. Census Bureau programs assign establishments engaged in factoryless manufacturing, known as factoryless goods producers (FGPs), to the wholesale trade sector. U.S. statistical agencies are considering classification of FGPs in the manufacturing sector in the future, if collecting data on FM is shown to be feasible.

This chapter estimates the scope of U.S. factoryless manufacturing using three approaches. First, we use financial reports for S&P 500 companies to show that FM is prevalent and increasing in the United States and that FM, once only common in the production of apparel, electronics, toys, and pharmaceuticals, has spread to a broader array of products. Second, we use Economic Census microdata to estimate that manufacturing value-added would have been 5 to 20 percent greater for 2007 if all FGPs were reclassified to manufacturing. Third, using a list of FM semiconductor companies matched to Economic Census microdata, we estimate that value-added would be 20 to 30 percent greater for semiconductor manufacturing, an industry where FM is especially prevalent, if FGPs were included. These results suggest that outsourc-

ing and offshoring of product fabrication by U.S. firms is coupled with significant domestic production management. Thus, identifying FGPs in economic data is important for the study of fragmentation and globalization.

In the next section, “Defining and Measuring Factoryless Manufacturing and Factoryless Goods Producers,” we define factoryless manufacturing (a company concept) and discuss the treatment of factoryless goods producers (an establishment concept) in U.S. economic statistics. In the third section, “The Extent of U.S. Factoryless Goods Production,” we look at the extent of FM using company reports, and we examine the prevalence of FGPs using Economic Census establishment data. The fourth section, “The Structure of Factoryless Manufacturing Firms in the Semiconductor Industry,” presents a close look at the establishment structure of FM firms in the semiconductor industry. Alternative estimates of the size of the manufacturing sector when FGPs are included are found in the fifth section, “U.S. Manufacturing with Factoryless Goods Producers Included,” with a particular focus on semiconductor manufacturing. In Section Six, “Selected Effects of Reclassification and Relevance for Economic Analysis,” we speculate on the effects of reclassifying FGPs for selected economic measures, and we discuss the role that better data on factoryless manufacturing may play in the study of economic issues. Section Seven offers a conclusion.

## **DEFINING AND MEASURING FACTORYLESS MANUFACTURING AND FACTORYLESS GOODS PRODUCERS**

In 1997, the Office of Management and Budget (OMB) introduced the North American Industry Classification System (NAICS), an approach to classifying establishments into industries “according to similarity in the processes used to produce goods or services” (OMB 1998, p.).<sup>1</sup> NAICS defines the manufacturing sector to be the set of establishments “engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products.” Yet NAICS acknowledges that the relevant transformation may happen outside the establishment: “Manufacturing establishments may

process materials or may contract with other establishments to process their materials for them. Both types of establishments are included in manufacturing” (OMB 1998, p. 105)

Since the introduction of NAICS in 1997, the outsourcing of processing materials into products—hereafter, “fabrication” for convenience—has risen dramatically, elevating the importance of consistent treatment of this practice across statistical programs. The Economic Classification Policy Committee (ECPC) of the OMB studied the issue and defined three types of establishments:

- 1) Integrated manufacturers (IMs)
- 2) Manufacturing service providers (MSPs)
- 3) Factoryless goods producers (FGPs)

FGPs have the following characteristics (OMB 2009): They

- own the rights to the intellectual property or design (whether independently developed or otherwise acquired) of the final manufactured product,
- may or may not own the input materials,
- do not own production facilities,
- do not perform transformation activities,
- own the final product produced by MSP partners, and
- sell the final product.

In contrast, IMs and MSPs own production facilities and perform transformation activities, and MSPs do not own the intellectual property or the final product.

In the absence of clear guidance from NAICS, the approach used to classify FGPs has differed across statistical agencies. U.S. Census Bureau practice has been to classify such establishments in the “Wholesale trade” sector.<sup>2</sup> In contrast, the Bureau of Labor Statistics’ (BLS) Producer Price Index (PPI) program collects prices from FGPs for use in some manufacturing PPIs, and the BLS’s Current Employment Statistics (CES) program classifies some reporting FGP establishments in the “Management of companies and enterprises” sector.<sup>3</sup> In 2011, the OMB adopted the ECPC’s proposal to classify FGP establishments in the manufacturing sector “beginning no later than 2017”; however, in August 2014 the OMB backed off from that decision, saying that

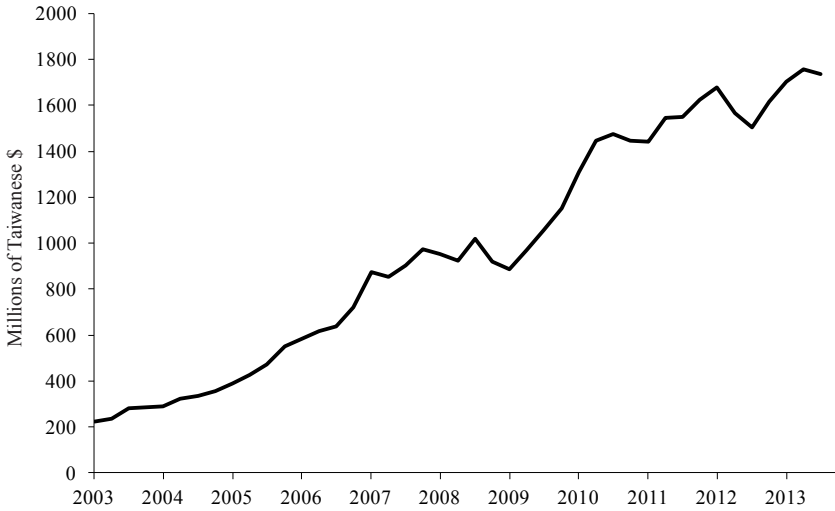
“agencies need an opportunity to perform additional research, testing, and evaluation.” U.S. statistical agencies are currently studying the feasibility of this proposal.<sup>4</sup>

As noted above, the NAICS definition of the manufacturing sector is flexible enough to allow for a manufacturing establishment to be “engaged” in fabrication even if the fabrication takes place at another establishment. But the notion that an establishment can be in manufacturing if no fabrication takes place on-site is somewhat controversial.<sup>5</sup> The BLS’s Business Processes and Business Functions (BPBF) classification system provides a helpful framework for considering the characteristics that distinguish manufacturing establishments from those in other sectors. The manufacturing “operations” business process includes the tasks of producing goods, assembling products, and fabricating components, as well as those of managing production and conducting quality assurance (Brown 2008).<sup>6</sup> In this scheme, FGPs perform the production management and quality assurance portions of manufacturing operations. In addition, other business processes may be performed by the FGPs as well, such as product design and development.<sup>7</sup>

For the purpose of characterizing *companies* (groups of establishments under common ownership), we define the term “factoryless manufacturing” (FM) to be the use of contract manufacturing to produce some or all of the final products sold by a company, provided the company controls the intellectual property or design. We expect that at least one of the establishments of an FM company will be an FGP.

Factoryless manufacturing emerged in the U.S. apparel sector in the 1950s when U.S. companies shifted fabrication to Japan (Gereffi 2002). In the 1970s, FM became common for consumer goods, especially toys (Steiner 1995).<sup>8</sup> The role of contract manufacturing in the production of final goods in electronics has risen dramatically over time as well—in particular, the revenue of major offshore final electronics MSPs has risen markedly over the past 10 years (Figure 4.1).<sup>9</sup> Finally, the use of factoryless manufacturing has surged for semiconductors: The share of semiconductor sales accounted for by FM firms, predominantly U.S. companies, climbed from 3 percent in 1993 to 25 percent in 2012 (Figure 4.2).

**Figure 4.1 Sales of Selected Taiwanese Contract Electronics Manufacturers**



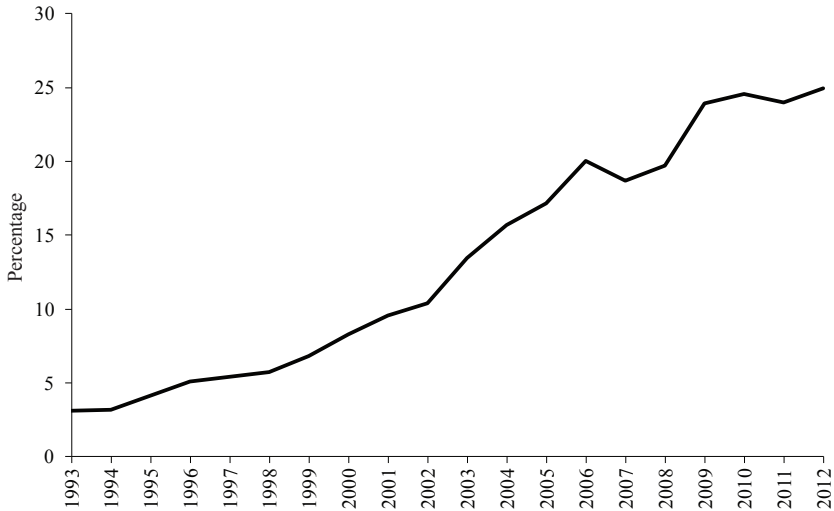
SOURCE: Authors’ calculations based on public financial reports. Companies included are contract electronics firms traded on the Taiwan Stock Exchange: Hon Hai (Foxconn), Quanta, Compal, HTC, Inventec, WNC, and ASUS.

## **THE EXTENT OF U.S. FACTORYLESS GOODS PRODUCTION**

### **Evidence from Company Financial Reports**

In financial reports filed with the Securities and Exchange Commission (SEC), manufacturing companies often indicate that they use factoryless manufacturing for some or all of their production.<sup>10</sup> For example, the 2012 annual report for Nike Inc. notes, “Our principal business activity is the design, development, and worldwide marketing and selling of high quality footwear, apparel, equipment, accessories, and services” and that “virtually all of our footwear is produced by factories we contract with outside of the United States.” Similarly, the 2012 annual report for electronics manufacturer Juniper Networks Inc. states, “Our manufacturing is primarily conducted through contract

**Figure 4.2 Share of Global Industry Shipments for Factoryless Manufacturing of Semiconductors**



SOURCE: Global Semiconductor Alliance.

manufacturers,” and goes on to say that Juniper employees “manage relationships with contract manufacturers, manage our supply chain, and monitor and manage product testing and quality.” These companies report that they outsource some or all of their fabrication activity, but that they manage production and perform product design in-house. Other examples are shown in Table 4.1.

To get a sense of the breadth of factoryless manufacturing by U.S. companies, we searched for evidence of FM activity in the annual reports of all firms in the Standard and Poor’s (S&P) 500 for both 2002 and 2012.<sup>11</sup> Specifically, we reviewed the reports for references to the use of contract manufacturing for fabrication of the companies’ final products.<sup>12</sup> Table 4.2 summarizes the results of our review of the annual reports. For 2012, we find that about half (46 percent) of firms reporting manufacturing of any kind use FM. This is substantially higher than the 31 percent share observed for 2002. About four-fifths of the FM companies use MSPs for only a portion of their output, and approximately one-fifth rely exclusively on MSPs for fabrication.

**Table 4.1 Selected S&P 500 Companies Reporting Factoryless Goods Production, by Primary Product Grouping, 2012**

---

Toys and games
Hasbro Inc.
Mattel Inc.
Apparel
Abercrombie & Fitch Co. <sup>a</sup>
Nike Inc. <sup>a</sup>
Electronics
Advanced Micro Devices Inc. (semiconductors) <sup>a</sup>
Qualcomm Inc. (semiconductors) <sup>a</sup>
Amazon.com Inc. (electronic readers) <sup>a</sup>
Apple Inc. (computing, communications, consumer)
Cisco Systems Inc. (communications) <sup>a</sup>
Pharmaceuticals
Bristol-Myers Squibb Co.
Eli Lilly and Co.
Chemicals excluding pharmaceuticals
Clorox Co.
Colgate-Palmolive Co.
Food, beverage, and tobacco
Campbell Soup Co. (food)
Monster Beverage Corp. (beverage) <sup>a</sup>
Philip Morris International (tobacco)
Paper, plastic, and wood products
Avery Dennison Corp. (paper products)
Newell Rubbermaid Inc. (plastics products)
Electrical equipment
General Electric Co.
Machinery
Applied Materials Inc.
Transportation equipment
Delphi Automotive
Medical supplies excluding pharmaceuticals
Boston Scientific Corp.

---

<sup>a</sup> Company using FGP exclusively—i.e., a company with no integrated manufacturing activity.

SOURCE: Classification based on authors’ analysis of 2012 annual reports filed with the Securities and Exchange Commission.

**Table 4.2 Prevalence of Factoryless Manufacturing among Companies in the S&P 500 Index with Manufacturing Activity**

	2002		2012	
	Count	Share (%)	Count	Share (%)
No factoryless manufacturing	172	70	120	54
Any factoryless manufacturing	74	30	104	46
Exclusively factoryless manufacturing	12	16	21	20
Mixed factoryless and integrated manufacturing	62	84	83	80
	<i>n</i> = 246		<i>n</i> = 224	

SOURCE: Classification based on authors' analysis of annual reports filed with the Securities and Exchange Commission.

As we expected from the evidence reviewed at the end of Section Two, in both 2002 and 2012, factoryless manufacturing was used by a very high share of firms manufacturing toys, apparel, and most electronic products (Table 4.3). For example, in both 2002 and 2012, all companies in the “Toys and games” category of the S&P 500 employed FM practices. Firms in the “Toys and games” sector represented 2 percent of all manufacturing companies in the index in both years. The FM business practice is also quite common among firms producing pharmaceuticals and medicine.

Also of note is the degree to which factoryless manufacturing spread to a broader array of goods from 2002 to 2012. For example, only 9 percent of large cap firms in the “Food, beverage, and tobacco” sector used FM in 2002, but the share had soared to 52 percent by 2012. Several other industries also experienced strong growth in the share of firms using FM over the past decade: Notable gains were recorded for the sectors “Paper, plastic, and wood products,” “Chemicals excluding pharmaceuticals,” “Transportation equipment,” and “Electrical equipment.”

### **Evidence from Economic Census Data**

The Economic Census collects extensive information on U.S. *establishments* every five years, and questions on the 2002 and 2007 Economic Censuses shed light on the prevalence of FGPs. Wholesale trade establishments were asked whether they sold products manufac-



**Table 4.3 S&P 500 Sector Distribution and Share of Companies Using Factoryless Manufacturing (%)**

Sector	Share of companies using factoryless manufacturing <sup>a</sup>		Sector share of total S&P manufacturing	
	2002	2012	2002	2012
Toys and games	100	100	2	2
Apparel	86	100	3	4
Electronic components (including semiconductors)	77	94	9	7
Computers and communications equipment	70	82	11	8
Pharmaceuticals and medicine	48	70	10	9
Food, beverage, and tobacco products	9	52	10	14
Paper, plastic, and wood products	6	45	7	5
Chemicals excluding pharmaceuticals	15	37	8	8
Other final electronics (industrial, defense, aerospace, etc.)	15	37	5	8
Medical excluding pharmaceuticals (including electromedical equipment)	10	23	4	6
Transportation equipment	0	22	7	4
Electrical equipment	0	17	3	3
Machinery	6	17	8	11
Metal, nonmetallic mineral, and petroleum products	6	0	7	8
Unclassified (conglomerates, miscellaneous production)	43	33	6	3

<sup>a</sup> Includes companies employing a mix of factoryless manufacturing and integrated manufacturing.

SOURCE: Authors' classification based on company reports filed with the Securities and Exchange Commission.

tured for them by contract manufacturers and whether they engaged in product design.<sup>13</sup> We consider an affirmative answer to either question to be supporting evidence for classifying the establishment as an FGP, though the questions are not definitive.<sup>14</sup> More than 30 percent of establishments answered “yes” to at least one of these questions in a majority of wholesale industries in 2002 (Tables 4.4 and 4.5).

**Table 4.4 Performance of Product Design/Engineering and Use of Contract Manufacturing Services Share of Merchant Wholesale Establishments, 2002 (%)**

NAICS Code	Industry description	Design/ engineer products sold	Purchase contract manufacturing services	Both	Either
	Durable goods				
4231	Motor vehicles and parts	8	13	3	18
4232	Furniture and home furnishings	25	26	10	41
4233	Lumber and other construction materials	14	20	4	30
4234	Professional and commercial equip. and supplies	19	18	7	30
4235	Metal and mineral	15	26	5	36
4236	Electrical and electronic goods	21	20	7	34
4237	Hardware, plumbing, heating equip. and supplies	15	17	4	28
4238	Machinery, equip. and supplies	19	22	7	34
4239	Miscellaneous durable goods	25	21	10	36
	Nondurable goods				
4241	Paper and paper products	22	25	10	37
4242	Drugs and druggist sundries	22	26	11	37
4243	Apparel, piece goods, and notions	42	35	21	56
4244	Grocery and related	13	14	4	23
4245	Farm product raw material	6	6	1	11
4246	Chemical and allied products	24	24	8	40
4247	Petroleum and petroleum products	3	8	1	10

4248	Beer, wine, distilled alcoholic beverages	5	14	1	18
4249	Miscellaneous nondurable goods	21	17	7	31
	Total, durable and nondurable	18	20	6	32
	Memo:				
	Establishments of FGP semiconductor companies	51	22	18	55
	Firms of FGP semiconductor companies	67	56	48	75

NOTE: Response rate was approximately 50 percent. Special question was on all Census of Wholesale Trade forms in 2002. Establishments reclassified to wholesale trade during census processing did not receive a survey form with this question.

SOURCE: 2002 Census of Wholesale Trade.

**Table 4.5 Performance of Product Design/Engineering and Use of Contract Manufacturing Services Share of Merchant Wholesale Establishments, 2007 (%)**

NAICS Code	Industry description	Purchase			
		Design/ engineer products sold	contract manufacturing services	Both	Either
	Durable goods				
4231	Motor vehicles and parts	6	8	3	11
4233	Lumber and other construction materials	12	16	4	24
4234	Professional and commercial equip. and supplies <sup>a</sup>	23	20	12	31
4235	Metal and mineral	13	23	5	31
4236	Electrical and electronic goods	15	16	7	24
4238	Machinery, equipment, and supplies <sup>a</sup>	15	15	7	23
4239	Miscellaneous durable goods	18	17	8	27
	Nondurable goods				
4241	Paper and paper products	17	16	7	26
4242	Drugs and druggist sundries	22	27	14	35
4243	Apparel, piece goods, and notions	35	29	16	48
4244	Grocery and related	13	12	4	21
4245	Farm product raw material	5	6	1	10
4248	Beer, wine, distilled alcoholic beverages	4	5	2	7
4249	Miscellaneous nondurable goods <sup>a</sup>	17	12	6	23
	Total, durable and nondurable	15	15	7	23

## Memo:

Establishments of FGP semiconductor companies	52	40	35	57
Firms of FGP semiconductor companies	68	42	47	63

NOTE: 2007 response rate was approximately 53 percent for establishments receiving forms. Survey forms for some wholesale trade industries did not include these questions. Statistics are shown for covered six-digit industries within each four-digit industry group. Industry groups marked with an asterisk have omitted industries. Industry groups with no coverage are 4232, 4237, 4246, and 4247. Establishments reclassified to wholesale trade during census processing did not receive a survey form with this question. The "Purchase contract manufacturing services" column combines results for separate questions on domestic and foreign CMS.

SOURCE: 2007 Census of Wholesale Trade.

Prevalence among pharmaceutical and apparel wholesalers is particularly high, as we expected in light of our company report analysis. Interestingly, “Electrical and electronics wholesaling” is not among the industries with the highest prevalence of FGPs. However, when we matched known semiconductor FM companies to census firm records (as discussed in the next section), we found that 75 percent have at least one wholesale establishment reporting design or use of contract manufacturing.<sup>15</sup>

Results for prevalence of contract manufacturing use and product design by industry were similar in 2007 to what they were in 2002; unfortunately, the questions asked were somewhat different in the two years, making it hard to discern trends. Furthermore, in 2007 the questions were not asked of establishments in all industries, as they had been in 2002 (Bernard and Fort 2013).

### **Estimates in Related Work**

Other studies have estimated the scope and scale of factoryless manufacturing using the Economic Census and other data. No survey contains an ideal set of questions for identifying FM, and consequently approaches in studies of FM have varied significantly.

Doherty (Chapter 2 of this volume) focuses on wholesalers who reported their type as “own brand importer-marketer” (OBM), a term that is similar to FGP, but one that only applies to the use of offshore contract manufacturing. In the 2007 Economic Census, 3 percent of wholesale establishments self-identified as OBMs, which is a reasonable lower bound on FGP prevalence. However, because domestic outsourcing is much more common than offshore outsourcing (Fort 2011), FGPs are likely to be substantially more common than OBMs. Kask, Kiernan, and Friedman (2002) note that the OBM share of wholesalers was 3 percent for the 1997 Economic Census as well. In light of other evidence on the rising prevalence of offshore MSPs between 1997 and 2007, the stable share for OBMs is somewhat puzzling.

Jarmin, Krizan, and Tang (2011) look at outsourcing and offshoring using the same Economic Census special questions used in this study, but they employ a different FGP classification rule, which requires that establishments report “resales” as their primary activity in addition to reporting use of contract manufacturing and performance of product

design. Conditioning on resale—the sale of products *bought* and sold without further processing—is problematic in that we expect that FGPs may contract for the service provided by the MSP, rather than purchasing the good itself. Also, as noted above, creating the product design is sufficient to establish ownership of the intellectual property, but not necessary—designs can be purchased or licensed by FGPs. Jarmin, Krizan, and Tang estimate that FGPs account for 1 percent of establishments within the manufacturing and wholesale trade sectors combined.

Bernard and Fort (2013) use a definition of FGP that differs from the ECPC standard in that a wholesale establishment that fabricates products on-site and does not use contract manufacturing can be counted as an FGP. We view reports of fabrication at wholesale trade establishments as evidence of one of two possibilities: 1) misclassification of an IM to wholesale trade, or 2) an FGP establishment with secondary IM activity. Despite the conceptual differences, Bernard and Fort find that the inclusion of FGPs in manufacturing leads to an increase in gross output ranging from 5.2 to 19.4 percent—estimates that are similar to ours. The range in Bernard and Fort depends on the assumptions made about respondents who did not answer the key questions.

Kamal, Moulton, and Ribarsky (Chapter 3 of this volume) examine company-level data from surveys conducted by the Census Bureau and the Bureau of Economic Analysis (BEA) and report results broadly consistent with ours, in that they find that the use of contract manufacturing is common in a wide array of industries and that companies with a mixed FGP/IM approach are far more common than pure FM companies.<sup>16</sup>

## **THE STRUCTURE OF FACTORYLESS MANUFACTURING FIRMS IN THE SEMICONDUCTOR INDUSTRY**

Semiconductor manufacturing is a prominent example of an industry with extensive factoryless manufacturing—in 2012, 25 percent of global semiconductor sales came from FM companies (Figure 4.2).<sup>17</sup> By matching directories of FM firms in the semiconductor industry to Economic Census microdata, we are able to study the establishment structure of FM firms for this industry.<sup>18</sup> In this section, we discuss the results of that matching exercise.

We find that the footprint of semiconductor FM firms in the Economic Census is complex. Single-unit firms account for about 90 percent of the company observations in our data, and of these, only about 30 percent are located in the wholesale trade sector (Table 4.6).<sup>19</sup> This is a surprising result in light of the Census Bureau directive to treat FGPs as wholesalers. However, the classification process depends on a broad review of an establishment's activities. The sole establishment of a single-unit firm would likely be engaged in multiple business processes in addition to production management, such as product, process, and technology development; marketing and sales; strategic management; and any general management "back office" operations that have not been outsourced. If one of these other activities is the primary activity of the establishment, as "determined by its relative share of current production cost and capital investment," the establishment may be classified to an industry outside of "Wholesale trade" (OMB 1998). Still, establishments in the wholesale trade sector account for two-thirds of the value of sales for these firms for 2007 (Table 4.7). About one-half of the 2007 employment for FM semiconductor firms is found in the wholesale trade sector. Among the smaller number of multiunit firms, the majority have units in multiple sectors (Table 4.6).

The establishments of these FM firms are highly concentrated in a few key information technology industries, corroborating our matching process (Table 4.8). Many units are found outside of the whole-

**Table 4.6 Firms by Establishment Structure**

Category	2002	2007
Total	525	525
Single-unit	450	470
Manufacturing	105	100
Wholesale	130	120
Services	220	245
Multi-unit	70	55
3 Sectors	15	10
2 Sectors	25	20
1 Sector	30	20

NOTE: Excludes management establishments. Rounded to nearest 5. Numbers may not sum to totals because of rounding.

SOURCE. Economic Census, 2002 and 2007.



**Table 4.7 Sector Distribution of Semiconductor FM Firm Activity**

Sector	Sales	Employment
	(\$ billions)	(000s)
	2002	
Total	22	55
Wholesale	15	27
Services	2	10
Manufacturing	5	18
	2007	
Total	26	55
Wholesale	19	29
Services	2	12
Manufacturing	5	14

NOTE: Sales and employment rounded to one or two digits. Numbers may not sum to totals because of rounding.

SOURCE: Matched Economic Census and company data, 2002 and 2007. See data appendix.

sale trade sector, but note that while Census Bureau practice is to classify FGPs (establishments) in wholesale trade, establishments of FM companies may have primary activity in other sectors and be properly classified there. Wholesale trade establishments for the FM firms are almost exclusively in “Other electronic parts and equipment wholesalers” (which includes semiconductor wholesalers) and in “Computers, peripherals, and software wholesalers.” The service establishments for these firms are predominantly in “Custom computer programming and systems design services,” in “Physical, engineering, and life sciences R&D services,” and in “Engineering services.” Manufacturing establishments for the FM firms are heavily concentrated in “Semiconductor and related device manufacturing,” with a small but notable share in other electronics manufacturing industries. These manufacturing establishments are an indication that the associated company employs a hybrid FGP/IM approach to production.

Focusing on establishments in the two key wholesale industries, we find that semiconductor FGPs are significantly larger with respect to the value of revenue and the number of employees than non-FGPs within these industries (Table 4.8).<sup>20, 21</sup> The difference in log revenue between FGPs and non-FGPs is 1.5, and the difference in average log

**Table 4.8 Mean Establishment Characteristics by Firm Type and Sector, 2002**

Sector		
Wholesale trade <sup>a</sup>		
	FM firm	Other
Log revenue (\$ 000s)	8.7	7.2
Log employment	2.4	1.8
Log avg. earnings (\$ 000s)	4.4	3.7
Services <sup>b</sup>		
	FM firm	Other
Log revenue (\$ 000s)	7.8	5.8
Log employment	2.9	1.5
Log avg. earnings (\$ 000s)	4.4	3.7
Manufacturing <sup>c</sup>		
	FM firm	Other
Log revenue (\$ 000s)	9.6	7.9
Log employment	4.2	2.8
Log avg. earnings (\$ 000s)	4.1	3.8

<sup>a</sup> Dominant industries (and their NAICS codes) for the wholesale trade sector include “Other electronic parts and equipment” (423690) and “Computers, peripherals, and software” (423430).

<sup>b</sup> Dominant industries (and NAICS codes) for the services sector include “Custom computer programming services” (541511) and “Computer systems design” (541512).

<sup>c</sup> Dominant industries (and NAICS codes) for the manufacturing sector include “Semiconductor and related device manufacturing” (334413) and other industries within “Computer & electronic product manufacturing” (334).

SOURCE: 2002 Matched Economic Census and company data. See data appendix.

employment is 0.6. The average earnings for employees of FM firms is substantially higher as well—the mean of the log earnings distribution is 4.4 for FGPs and 3.7 for non-FGPs. We speculate that FGPs are more likely than conventional wholesalers to employ engineers and other technical professionals with relatively high earnings and are less likely to employ lower-skilled laborers, such as those devoted to managing warehouse inventories.

Establishments of the semiconductor FM firms in the two wholesale industries identified in the previous paragraph and in superscript note <sup>a</sup> of Table 4.8 display a striking tendency to cluster geographically. Approximately two-thirds of wholesale revenue for semiconduc-

tor FGPs comes from plants located in just three metropolitan statistical areas (MSAs), and the top 10 MSAs for FGP activity account for 87 percent of FGP revenue (Table 4.9). In contrast, the other establishments within the two key wholesale trade industries are more geographically diverse. The top three MSAs account for only 26 percent of revenue, and the top 10 MSAs account for only 56 percent. We conjecture that in contrast to wholesalers as conventionally defined—a warehouse or sales office—which are drawn to centers of business activity and transportation hubs, FMs locate FGPs close to other establishments in their industry to benefit from active local markets for specialized labor and other inputs. Silicon Valley for electronics and New York City for apparel are well-known examples (Porter 1998).

The composition of employment in the semiconductor manufacturing industry would be much different with FGPs included in its scope. The mean of the log earnings distribution is 4.4 for FGPs in “Wholesale trade,” noticeably greater than the 3.8 average for log earnings in the “Electronics manufacturing” sector (NAICS 334), excluding semiconductor FGPs.

**Table 4.9 Geographic Concentration of Wholesale Sales, 2002**

FM semiconductor firms		Other firms	
MSA	Sales share	MSA	Sales share
1	43	1	10
2	11	2	8
3	11	3	8
4	6	4	7
5	3	5	6
6	3	6	5
7	3	7	3
8	3	8	3
9	2	9	3
10	2	10	3
Total	87	Total	56

NOTE: MSA rankings generated separately for FM and non-FM companies. “FM” stands for “factoryless manufacturing.” See text for definition.

SOURCE: 2002 Matched Economic Census and company data. See data appendix.

## **U.S. MANUFACTURING WITH FACTORYLESS GOODS PRODUCERS INCLUDED**

### **Total Manufacturing Using Economic Census Special Questions**

As noted in the section beginning on p. 82, the OMB has encouraged economic statistical agencies to assess the feasibility of classifying FGPs in the manufacturing sector. What remains unknown, however, is the effect of this reclassification on the size of the sector. The 2002 and 2007 Economic Censuses of Wholesale Trade both include two questions on contract manufacturing and design that offer an opportunity to assess the difference that classifying FGPs to manufacturing would make. For 2007, we estimate that if one reclassified to manufacturing those establishments answering “yes” to both questions, the value-added for the sector would be greater by \$96 billion, or 4 percent (Table 4.10).<sup>22</sup> Using a more lenient assumption—that an affirmative answer to either question suffices to identify an establishment as an FGP, manufacturing value-added would be greater by \$303 billion, or 13 percent. For 2002, manufacturing would be 3 percent greater using the strict definition, and 14 percent greater using the lenient definition. Unfortunately, response rates for these questions are quite low, and these results implicitly assume nonresponse is a negative answer. We imputed answers for nonrespondents and found manufacturing value-added would have been 5 to 20 percent higher in both years, which we take to be our most plausible estimate.<sup>23</sup>

### **Semiconductor Manufacturing Using Matched FM Company Data**

Next, we narrow our focus to the semiconductor industry, and we use the matched company-establishment data. We count sales of the wholesale establishments of FM firms as manufacturing revenue and estimate that the value of shipments for the semiconductor industry in 2007 would have been \$92 billion—26 percent higher than the \$75 billion reported in the 2007 Economic Census. The share of the (broader) semiconductor industry accounted for by plants of FM firms (including those already in manufacturing) would have been 28 percent.<sup>24</sup>

**Table 4.10 Total Value-Added for Establishments Reporting Either Product Design, Use of Contract Manufacturing, or Both**

Levels (\$ billions)	2002	2007
Baseline		
Either CMS or design	260	303
Both	60	96
Baseline + imputed response		
Either CMS or design	364	413
Both	94	152
Total manufacturing value added	1,888	2,383
Increase to manufacturing (%)		
Baseline		
Either CMS or design	14	13
Both	3	4
Baseline + imputed response		
Either CMS or design	19	17
Both	5	6

NOTE: Selected wholesale trade industries (423690, 423430). Manufacturing value-added from the Census of Manufacturers.

SOURCE: Economic Census, 2002 and 2007.

Interestingly, the FGP share of industry shipments for 2002 is little different from its share for 2007. Consequently, semiconductor industry shipments, including shipments from FGPs, rose 3.7 percent (annual rate) between 2002 and 2007, an increase only slightly greater than the 3.4 percent reported under the current classification system. Meanwhile, the FM portion of the global semiconductor industry ballooned from \$15 billion in 2002 to \$54 billion in 2007 (Figure 4.2). Because U.S. companies account for a very large share of global FM revenue, this could suggest that U.S. FM companies were expanding rapidly during this period, but that the expansion was primarily at offshore establishments. However, such a scenario could be the result of companies keeping earnings overseas for tax avoidance purposes.

## **SELECTED EFFECTS OF RECLASSIFICATION AND RELEVANCE FOR ECONOMIC ANALYSIS**

Because the impact of the NAICS guidance for FGP classification will reflect not only the effect of conceptual differences but also the significant measurement challenges faced by statistical programs in adopting the change, no definitive analysis can be made of its effect on measures of economic activity. Nevertheless, for the sake of discussion we provide a speculative assessment of the effect on some key economic measures.

### **Manufacturing Value-Added**

To begin with, estimates in this chapter and in other work suggest that classification of FGPs to the manufacturing sector will materially increase that sector's value-added. However, it is important to note that the total nominal value-added of the economy should not change, because the increase in manufacturing will be offset by decreases in other sectors. The expansion of the scope of the manufacturing sector beyond establishments engaged in fabrication on-site will introduce an appreciable discontinuity in statistics for the manufacturing sector. That said, the change has the appeal of introducing continuity in the treatment of production management activities and product development. When those tasks are colocated with fabrication, their value-added is counted as manufacturing, and the outsourcing of fabrication arguably should not move their value-added out of that sector. To quote from the OMB decision on the issue, "Goods producers arrange for and bring together all of the factors of production necessary to produce a good. . . . When individual steps in the complete process are outsourced, an establishment should remain classified in the manufacturing sector." That goal will be served by classifying FGPs in the manufacturing sector, but it would be desirable to also report economic statistics that allow for analysis of manufacturing with FGPs excluded.<sup>25</sup>

In addition, classifying FGPs to manufacturing will change the industry composition of the sector because FGPs are not evenly prevalent across wholesale trade industries (Tables 4.4 and 4.5). For example, we expect the change will temper the long decline in U.S. production of

electronics. We consider a provocative example for illustration: Value-added in the “Electronic computer manufacturing” industry (NAICS Industry 334111), as reported by the Census Bureau’s Annual Survey of Manufacturers (ASM), dropped from \$26 billion to \$9 billion between 2008 and 2010, and it fell further, to \$3 billion, in 2011. In addition to the economy-wide effects of the recent recession, such as businesses postponing computer investment, the decline can be partially attributed to a shift in the composition of household computer spending toward tablet computers, especially the iPad, produced by Apple Inc., a company that relies primarily on offshore MSPs for fabrication.

To the extent that offshore iPad fabrication is managed by domestic FGPs, a portion of value-added for this type of product will be counted in the U.S. computer industry under the new classification rules. According to Apple annual reports, Apple’s global iPad revenue surged from \$5 billion to \$20 billion between 2010 and 2011. Assuming Apple’s gross margin share of overall revenue, approximately 40 percent, applies to sales of iPads, and assuming for the sake of argument that half of that margin is value-added at domestic Apple FGPs, under the new NAICS guidance \$6 billion in value-added at these FGPs would be counted in the manufacturing sector and would roughly offset the \$6 billion decline in domestic computer manufacturing reported in the ASM. This somewhat fanciful example illustrates how the new classification approach may have first-order effects and change the narrative for some industries where FM is prevalent.

## **Trade**

It is also worth noting that the new treatment of FGPs has the potential to cause significant changes in the composition of U.S. trade flows, though net trade is in principle unaffected. An FGP that purchases contract manufacturing will record as its own production the product fabricated by the MSP. If the MSP is located abroad and the product is delivered to a foreign market, the sale will be treated as a U.S. export, even though the finished good did not cross the U.S. border. In contrast, if the product is shipped to the U.S. market from the foreign MSP, it will not be treated as a U.S. import, even though the good did cross the U.S. border. In both cases, an import of manufacturing services will be recorded. Thus, the relative importance of services and goods

in total trade may differ under the new system. The new treatment of FGPs has the potential to cause significant changes in the composition of U.S. trade as recorded in the National Income and Product Accounts (NIPAs), though net trade is in principle unaffected.

### **Measurement Effects**

In addition to the conceptual changes mentioned above, we note two ways in which aggregates conceptually unaffected by the change in treatment of FGPs may nevertheless be affected as measured. First, the accuracy of economic statistics whose construction relies on the combination of data generated by different statistical programs, such as industrial production and labor productivity, will be aided by the better alignment of FGP classification practices. Such statistics are at risk of inadvertent mismeasurement if differences with respect to current FGP classification are not taken into account. The added clarity with regard to the treatment of FGPs will serve to reduce the risk of such errors.

Second, measurement of the prices needed to deflate nominal value-added and trade flows for FGPs and MSPs will require significant attention. Byrne, Kovak, and Michaels (2013) study prices for manufacturing services in the semiconductor industry and find that the well-known challenges faced in quality-adjusting product prices also exist for semiconductor manufacturing services. If the composition of trade shifts from goods to services, the relative quality of price measures for services will affect the resulting real balance of trade.<sup>26</sup>

### **Economic Issues**

Deeper understanding of the use of the FM business model may lead to insights into important economic questions. Among these are the following four:

- 1) What is the effect of offshoring on domestic activity—do management and design follow fabrication offshore, or does offshoring enhance that domestic activity through gains from trade?<sup>27</sup>
- 2) What is the impact of this shift in manufacturing approach on manufacturing employment—does the loss of production



worker jobs to offshoring coincide with a gain in domestic knowledge-worker jobs?<sup>28</sup>

- 3) How much of the substantial contribution of information technology (IT) production to productivity growth can be attributed to FGP activity, and how much to fabrication?<sup>29</sup>
- 4) What is the role of FGPs in global “trade in tasks”? Can FGP data lead to more appropriate input-output tables for use in the burgeoning work on decomposing product value into contributions from different economies through value-added trade?<sup>30</sup>

## CONCLUSION

Using company data, we document our premise that factoryless manufacturing is becoming more prevalent and is employed in the production of an increasingly wide variety of goods. With Census Bureau establishment microdata, we find evidence that factoryless goods producers are present in a broad mix of industries in the wholesale trade sector. We present a case study of the semiconductor industry using a data set constructed by matching company data and census establishment data. Here, we find that FGPs are larger in terms of revenue and employment, have higher average earnings, and cluster markedly more than conventional wholesale trade establishments. Finally, we estimate that shifting FGP activity from wholesale trade to manufacturing may increase manufacturing value-added by 5 to 20 percent. In the case of semiconductors, we find that value-added in 2007 would be 26 percent higher if census data were used. We provide examples of anticipated effects on economic statistics from the clarification of the treatment of FGPs and note several areas of economic study that may benefit from the change.

Implementing the OMB guidance on the treatment of FGPs presents substantial challenges for U.S. statistical agencies going forward (Doherty, Chapter 2 of this volume). As was noted earlier, factoryless manufacturing is far from new, and looking backward, there is the daunting task of building a history consistent with the clarified scope of manufacturing, which will be needed to fully exploit the data. How-

ever, bearing in mind the evident size of the FGP phenomenon and the role that better measures of FGPs may play in discussion of pressing economic issues, we consider the clarification of the treatment of factoryless goods producers to be a welcome effort to update the U.S. statistical system.

## Notes

This chapter stems from a paper that was prepared for presentation in 2013 at the “Measuring the Effects of Globalization” conference, organized by the Progressive Policy Institute and the W.E. Upjohn Institute for Employment Research and funded by the Alfred P. Sloan Foundation. We are grateful for the feedback we received from participants at the conference. We also benefited from additional feedback from Maureen Donoghue, Teresa Fort, Susan Houseman, Javier Miranda, John Murphy, Bill Powers, Jennifer Ribarsky, Falan Yinug, and participants in a workshop at the U.S. Census Bureau. The Global Semiconductor Alliance and IHS iSuppli provided data, and we also appreciate their guidance on the semiconductor industry. Remaining errors are our own.

All results have been reviewed by the Census Bureau to ensure that no confidential information is disclosed. References to specific companies are based exclusively on purchased data, public financial reports, and news accounts, not on confidential census information. The views expressed are not the views of the Census Bureau.

Affiliation for Bayard and Byrne is the Federal Reserve Board of Governors. The views expressed should not be attributed to the Board of Governors or other members of the Federal Reserve staff. Affiliation for Smith is the University of Minnesota Department of Economics. Direct correspondence can be addressed to the following: david.m.byrne@frb.gov.

1. An establishment is a company unit, such as a plant, warehouse, or office. The Office of Management and Budget defines it this way: “The establishment . . . is the smallest operating entity for which records provide information on cost of resources . . . employed to produce the units of output. . . . The establishment . . . is generally a single physical location” (OMB 1998).
2. A summary of a recent study of the FGP classification issued by the Economic Classification Policy Committee noted, “To the extent that FGPs can be identified, the Census Bureau statistical programs classify them to wholesale trade” (Murphy 2009). However, this guidance does not apply to apparel. (John Murphy, chair of the ECPC, in discussion with author Byrne, September 2013.)
3. Presentation by the FGP Implementation Planning Group at the Semiconductor Industry Association’s annual meeting, September 11, 2012. The group’s presentation was titled “Redefining Manufacturing in NAICS 2012: The Factoryless Goods Producer (FGP).”

4. For a discussion of the deliberations leading to this decision and the alternatives considered, see Doherty (2013).
5. The *Federal Register* notice from August 17, 2011 (found in *Federal Register* 76[159]: 51240–51243), describes the announced NAICS classification standard for FGP establishments as a clarification, but it also acknowledges that “the inclusion of revenues from FGP activities in manufacturing will effectively change the traditional definition of manufacturing.”
6. Although the Business Processes and Business Functions classification system was not referenced in the FGP classification deliberations, it provides a useful framework for thinking about the nature of factoryless manufacturing. BPBF is based on the concepts developed for the Global Value Chains Initiative and was employed in the BLS’s Mass Layoff Statistics Program, which was discontinued in June 2013 (Sturgeon 2002; Sturgeon and Gereffi 2008).
7. The NAICS manual notes that “almost all manufacturing has some captive research and development or administrative operations, such as accounting, payroll, or management” (OMB 1998).
8. Steiner (1995, 1997) was an early advocate for modifying classification practices to account for FM activity, though the term “factoryless goods producer” had not been coined at the time. Steiner notes that in the 1970s, for a “host of consumer goods,” manufacturing moved offshore but the companies “did the research and development, the production engineering, and were responsible for quality control.”
9. In the electronics sector, the complicated web of component production, design, and management cannot always be simplified to an FGP-MSP relationship. (See Dedrick and Kraemer [2002]; Grunwald and Flamm [1985]; and Sturgeon and Lee [2001].)
10. Under Regulation S-K of the U.S. Securities Act of 1933, annual reports to the SEC on form 10-K are required to include discussion of risks “likely to result in registrant’s liquidity increasing or decreasing in a material way.”
11. Because the S&P 500 is constructed to be representative of the “large cap” segment of the U.S. equities market, these results do not apply to smaller firms. Small and medium-sized firms are an important topic for further study. One potential benefit of decoupling production management from fabrication and the associated fixed costs may be that smaller-scale enterprises are more viable, thus promoting firm creation. That being said, Kamal, Moulton, and Ribarsky (Chapter 3 of this volume) find that two-thirds of firms reporting the use of MSPs or the provision of contract manufacturing are large—they have 250 or more employees.
12. References to contract manufacturing of components of the final product, purchase of “private label” merchandise, licensing of company designs, and provision by the company of contract manufacturing services to others were not treated as evidence of factoryless manufacturing.
13. The survey forms for the Census of Wholesale Trade are included in Appendix 4B.
14. Specifically, the 2002 question asked whether fabrication was “performed for this establishment by another company,” but offshore fabrication by another establish-

ment of the same company would be sufficient to meet the definition of FGP. The 2007 contract manufacturing question is also not a perfect match. With regard to design, to be an FGP, the establishment must own the rights to the design, but it may be independently developed or otherwise acquired.

15. A negative response to both of these questions by an establishment of an FM firm need not be erroneous. For example, a pure sales office for an FM firm would properly be classified in “Wholesale trade.”
16. Kamal, Moulton, and Ribarsky use the Company Organization Survey, conducted by the Census Bureau, and the BEA’s Benchmark Survey of U.S. Direct Investment Abroad as well as its Benchmark Survey of Transactions in Selected Services and Intellectual Property Products with Foreign Persons.
17. For a detailed discussion of FGPs and MSPs in the semiconductor industry, see Byrne, Kovak, and Michaels (2013). To avoid confusion, we do not use the industry-specific term “fabless” for FM firms or the term “foundries” for manufacturing service providers.
18. See Appendix 4A for a description of the sources and matching process.
19. A handful of these single-unit firms have a second establishment in the management sector. These establishments are omitted from the firm structure calculations. Results for the management sector did not meet Census Bureau standards for disclosure.
20. Most firms have no more than one establishment in these wholesale industries, and the results are little changed by treating each establishment separately.
21. Note that our “other” group may contain establishments of FM companies producing products other than semiconductors. We believe this would lead us to understate the differences between our semiconductor FGPs and true wholesale establishments.
22. We focus on value-added for now because of issues involved in double-counting gross output if an FGP purchases contract manufacturing services from a domestic establishment already in the scope of manufacturing. The value-added approach has limitations as well. We calculate value-added in the wholesale sector as sales minus the cost of merchandise and change in inventory. These results will be biased downwards if the reported cost of merchandise reflects the value of product design or of the management of the fabrication process performed at the FGP—for example, if its valuation on import includes the FGP’s value-added.
23. For each question, we predict the probability that each nonresponding establishment would answer “yes” based on observable characteristics. We then add the value-added of the establishment, weighted by the predicted probability, to the manufacturing sector, in addition to the full value-added for the respondents in our baseline estimates. In unreported results, we also use the weighting scheme developed by Fort (2011) to develop predicted probabilities of answering a question conditional on observables. We then multiply value-added for an establishment that answered both questions by the inverse of the predicted probability. This methodology yields estimates that differ by only a few percentage points from the

results reported. Our estimates of the magnitude of the proportional increment to manufacturing gross output are similar as well.

24. Because very little MSP activity for the semiconductor industry was located domestically in 2007, the magnitude of double-counting when using gross output is unlikely to be significant.
25. At the time of this writing, it has not been determined whether such detail will be made available in U.S. economic statistics.
26. On the importance of prices for imported intermediates for productivity measurement, see Houseman et al. (2011).
27. Levinson (2013) notes the relevance for policymakers of the question of whether manufacturing is becoming “hollowed out”—that is, whether a greater share of value-added is taking place offshore.
28. Helper, Krueger, and Wial (2012) note the dwindling role of the manufacturing sector as a source of “high-wage jobs, especially for workers who would otherwise earn the lowest wages.”
29. Byrne, Oliner, and Sichel (2013) note that the contribution from factoryless goods production is an important area for extension of the contribution of IT in productivity.
30. On “trade in tasks,” see Grossman and Rossi-Hansberg (2008). On developments in the measurement of value-added trade, see Ahmad (Chapter 6 of this volume), Timmer et al. (2013), and Yao, Ma, and Pei (Chapter 7 of this volume).



## Appendix 4A

### Data Construction

For the case study of the semiconductor industry, we linked company directory entries to the Census Business Register.<sup>1</sup> The Business Register is a database of U.S. business establishments and companies that serves as a sampling frame for Census Bureau firm and establishment surveys.<sup>2</sup> For each establishment in the Business Register there are identifiers that allow the establishment to be linked to corresponding records in Census Bureau economic surveys. In addition, the Business Register contains a firm identifier for each establishment, which enables us to locate other establishments within the same firm.

To generate our list of census firm identifiers corresponding to FGP companies, we began with a list of 1,579 FGP semiconductor companies created from a directory published by Gartner, a high-tech consultancy, and a directory published by the Global Semiconductor Alliance (GSA), a trade association representing a wide variety of companies involved in semiconductor design and fabrication. Gartner provided a worldwide directory of semiconductor FGP companies active in 2001. The GSA provided a worldwide directory of all semiconductor FGP companies active as of 2012 and a supplemental list of mergers and acquisitions between 2005 and 2012.<sup>3</sup> The supplemental list proved critical because of the high frequency of firm birth and firm death in the industry. We reviewed public records for these companies to amend incomplete records. Eliminating companies that we believed were not operational in either 2002 or 2007 based on a review of public records left us with a list of 1,475 companies (Table 4A.1). The list contains the name, headquarters address, and year of occurrence for major events (establishment, dissolution, merger, acquisition) for each company.

First, for 2002 and 2007, we matched all companies in operation in either

**Table 4A.1 Match Statistics**

Company list	1,475
Matched to business register	1,050
Total Firm IDs	1,125
Matched to 2002 EC establishments	525
Matched to 2007 EC establishments	525
Matched to either 2002 or 2007	750

NOTE: Rounded to nearest 25.

SOURCE: Company data matched to Economic Census (EC) data for 2002 and 2007.

See Appendix 4A.

census year to a three-year window of the Business Register ending in the census year. For this first stage, we only exploit the company name, by finding the name or names in the Business Register that match the greatest number of leading characters for the FGP company name. We then reviewed a randomly selected set of 1,000 of the approximately 40,000 potential matches generated, and we judged whether the entries were a match when considering both full-name information and address variables. This set of matches was used to estimate the importance of all available match-quality variables using a probit. Variables included an indicator of state match, number of leading digits of the zip code in common, company name-spelling distance, address-spelling distance, and whether the establishment operated in a high-tech industry. The estimated index function was then used to rank possible matches for each company on our list from most to least probable. Then we reviewed by hand the matches for each company in descending order until we judged that we had either found a match or there was no match for the company.

Using this name-matching procedure, we located 71 percent of these FGP companies in the Census Business Register files (Table 4.6).<sup>4</sup> Sometimes, however, we could not find in the Economic Census firm identifiers that had appeared in the Business Register. In the end, we were able to locate establishments for about 50 percent of the companies on our list of FGP firms in the Economic Census microdata for 2002 and 2007. Once we link firms from the GSA and Gartner directories to the census data, we identify all establishments connected to those firms and include them in our final data set.

### Appendix Notes

1. For more detail on the matching process, see Smith (2013).
2. See Jarmin and Miranda (2002).
3. Both the GSA and Gartner directories contained companies from around the world. We attempted to find matches for both foreign and domestically headquartered companies because we assumed many of the foreign companies would have a U.S. presence. For the foreign companies we were forced to rely on only name-matching characteristics.
4. It is important to note that our list contains many firms headquartered abroad that may have no U.S. presence.



# Appendix 4B

## Census of Wholesale Trade Forms

Form WH-42103

Page 12

**28** ESTABLISHMENT ACTIVITIES

**A.** Indicate activities that were performed by this establishment or were performed for this establishment by another company during 2002.  
(Mark "X" ALL that apply.)

	This activity was performed by this establishment	This activity was performed for this establishment by another company	This activity was not provided by this establishment
<b>1. Product Development</b>			
a. Product design/engineering . . . . .	0921 <input type="checkbox"/>	0941 <input type="checkbox"/>	0961 <input type="checkbox"/>
b. Materials fabrication/processing/assembly/blending . . . . .	0922 <input type="checkbox"/>	0942 <input type="checkbox"/>	0962 <input type="checkbox"/>
<b>2. Order Fulfillment</b>			
a. Bundling or kitting (combining multiple items into a prepackaged product) . . . . .	0923 <input type="checkbox"/>	0943 <input type="checkbox"/>	0963 <input type="checkbox"/>
b. Pick and pack (taking goods from inventory and packaging them to fill orders) . . . . .	0924 <input type="checkbox"/>	0944 <input type="checkbox"/>	0964 <input type="checkbox"/>
c. Warehousing . . . . .	0925 <input type="checkbox"/>	0945 <input type="checkbox"/>	0965 <input type="checkbox"/>
d. Breaking bulk (reducing large shipments into smaller portions for customers) . . . . .	0926 <input type="checkbox"/>	0946 <input type="checkbox"/>	0966 <input type="checkbox"/>
e. Local delivery (within a city, town, or other local area, including adjoining towns and suburban areas) . . . . .	0927 <input type="checkbox"/>	0947 <input type="checkbox"/>	0967 <input type="checkbox"/>
f. Long distance delivery (beyond local areas and commercial zones) . . . . .	0928 <input type="checkbox"/>	0948 <input type="checkbox"/>	0968 <input type="checkbox"/>
g. Less than truckload . . . . .	0929 <input type="checkbox"/>	0949 <input type="checkbox"/>	0969 <input type="checkbox"/>
<b>3. Other Services</b>			
a. Customs brokerage (providing the services of a licensed customs broker) . . . . .	0930 <input type="checkbox"/>	0950 <input type="checkbox"/>	0970 <input type="checkbox"/>
b. Logistics consulting (providing advice and expertise) . . . . .	0931 <input type="checkbox"/>	0951 <input type="checkbox"/>	0971 <input type="checkbox"/>
c. Processing of returned merchandise . . . . .	0932 <input type="checkbox"/>	0952 <input type="checkbox"/>	0972 <input type="checkbox"/>

**B.** During 2002 did this establishment:

1. Manage inventory owned by this establishment AND held at this location? . . . . .	0936 <input type="checkbox"/> Yes	0937 <input type="checkbox"/> No
2. Manage inventory owned by this establishment BUT held at a customer's location? . . . . .	0956 <input type="checkbox"/> Yes	0957 <input type="checkbox"/> No
3. Manage inventory owned by another company BUT held at this location? . . . . .	0976 <input type="checkbox"/> Yes	0977 <input type="checkbox"/> No
4. Manage inventory owned by another company AND held somewhere other than at this location? . . . . .	0994 <input type="checkbox"/> Yes	0995 <input type="checkbox"/> No

Form WH-4231 1 (1/204/2005)		Page 11														
<b>If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.</b>																
<b>26</b> SPECIAL INQUIRIES - Continued																
<b>C. OTHER ESTABLISHMENT ACTIVITIES</b>																
<b>1.</b> Did this establishment design, engineer, or formulate the manufactured products that it sold, produced, or shipped?																
0318	<input type="checkbox"/>	Yes														
0319	<input type="checkbox"/>	No														
<b>2.</b> Which of the following best describes this establishment's primary activity? (Mark "X" only ONE box.)																
0322	<input type="checkbox"/>	Providing contract manufacturing services for others														
0323	<input type="checkbox"/>	Transforming raw materials or components into new products that this establishment owns or controls														
0324	<input type="checkbox"/>	Reselling goods manufactured by others (with or without minor final assembly)														
0325	<input type="checkbox"/>	Other - Specify <u>7</u>														
0326																
<b>3.</b> Did this establishment purchase contract manufacturing services from other companies or other establishments of your company to process materials or components that this establishment owns or controls?																
0466	<input type="checkbox"/>	Yes, primarily with establishments WITHIN the 50 States and the District of Columbia														
0467	<input type="checkbox"/>	Yes, primarily with establishments OUTSIDE of the 50 States and the District of Columbia														
0468	<input type="checkbox"/>	No														
<b>27-29</b> Not Applicable.																
REMARKS (Please use this space for any explanations that may be essential in understanding your reported data.)																
<b>30</b> CERTIFICATION - This report is substantially accurate and was prepared in accordance with the instructions.																
Is the time period covered by this report a calendar year?																
<input type="checkbox"/> Yes	<input type="checkbox"/> No - Enter time period covered →	<table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <tr> <td style="width: 15%;">FROM</td> <td style="width: 10%;">Month</td> <td style="width: 10%;">Year</td> <td style="width: 10%;">TO</td> <td style="width: 10%;">Month</td> <td style="width: 10%;">Year</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>	FROM	Month	Year	TO	Month	Year								
FROM	Month	Year	TO	Month	Year											
Name of person to contact regarding this report _____ Title _____																
<table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <tr> <td style="width: 15%;">Telephone</td> <td style="width: 10%;">Area code</td> <td style="width: 10%;">Number</td> <td style="width: 10%;">Extension</td> <td style="width: 10%;">Fax</td> <td style="width: 10%;">Area code</td> <td style="width: 10%;">Number</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>			Telephone	Area code	Number	Extension	Fax	Area code	Number							
Telephone	Area code	Number	Extension	Fax	Area code	Number										
Internet e-mail address _____ Date completed _____																
Date completed _____																
<b>Thank you for completing your 2007 ECONOMIC CENSUS form.</b> <b>PLEASE PHOTOCOPY THIS FORM FOR YOUR RECORDS AND RETURN THE ORIGINAL.</b>																

**26** SPECIAL INQUIRIES - Continued

**C. PURCHASE OF CONTRACT MANUFACTURING**

**1.** Did this establishment purchase contract manufacturing services from other companies or foreign plants of your company in 2012?

**Include:**

- Products for which the manufacturing (i.e., transforming or otherwise processing materials or components based on specifications provided by your company) was outsourced to other companies.
- Products for which the manufacturing was performed by your company's foreign plants.

**Exclude:**

- Services for packaging and assembling.
- Purchases of merchandise for resale (sale of products bought and sold without further processing or transformation).

1011  Yes - Go to line 2

1012  No - Go to 26

**2.** Report the costs incurred by the reporting unit for contract manufacturing purchases in 2012. 1013

**3.** Report the value of sales, shipments, receipts, or revenue generated in 2012 from products whose releases were reported as contract manufacturing costs on line 2. 1015

2012		
\$ Bil.	MIL.	Thou.

INFORMATION COPY  
DO NOT USE TO REPORT

**27-29** Not Applicable.

REMARKS (Please use this space for any explanations that may be essential in understanding your reported data.)

**30** CERTIFICATION - This report is substantially accurate and was prepared in accordance with the instructions.

Is the time period covered by this report a calendar year?

Yes  No - Enter time period covered →

FROM	Month	Year	TO	Month	Year

Name of person to contact regarding this report

Title

Telephone   -   -   -

Fax   -   -

E-mail address

Date completed   /   /

Thank you for completing your 2012 ECONOMIC CENSUS form.  
PLEASE PHOTOCOPY THIS FORM FOR YOUR RECORDS AND RETURN THE ORIGINAL.

## References

- Bernard, Andrew B., and Teresa C. Fort. 2013. "Factoryless Goods Producers in the U.S." NBER Working Paper No. 19396. Cambridge, MA: National Bureau of Economic Research.
- Brown, Sharon P. 2008. "Business Processes and Business Functions: A New Way of Looking at Employment." *Monthly Labor Review* 131(12): 51–70.
- Byrne, David M., Brian Kovak, and Ryan Michaels. 2013. "Price and Quality Dispersion in an Offshoring Market: Evidence from Semiconductor Production Services." Finance and Economics Discussion Series Working Paper No. 2013-06. Washington, DC: Board of Governors of the Federal Reserve System.
- Byrne, David M., Stephen D. Oliner, and Daniel E. Sichel. 2013. "Is the Information Technology Revolution Over?" *International Productivity Monitor* 25(Spring): 20–36.
- Dedrick, Jason, and Kenneth L. Kraemer. 2002. *Globalization of the Personal Computer Industry: Trends and Implications*. Irvine, CA: Center for Research on Information Technology and Organizations, University of California, Irvine.
- Fort, Teresa C. 2011. "Breaking Up Is Hard to Do: Why Firms Fragment Production across Locations." Job Market Paper. College Park: University of Maryland, Department of Economics.
- Gereffi, Gary. 2002. "Outsourcing and Changing Patterns of International Competition in the Apparel Commodity Chain." Paper presented at the conference "Responding to Globalization: Societies, Groups, and Individuals," held in Boulder, CO, April 4–7.
- Grossman, Gene M., and Esteban Rossi-Hansberg. 2008. "Trading Tasks: A Simple Theory of Offshoring." *American Economic Review* 98(5): 1978–1997.
- Grunwald, Joseph, and Kenneth Flamm. 1985. *The Global Factory: Foreign Assembly in International Trade*. Washington, DC: Brookings Institution.
- Helper, Susan, Timothy Krueger, and Howard Wial. 2012. *Why Does Manufacturing Matter? Which Manufacturing Matters? A Policy Framework*. Metropolitan Policy Program at Brookings. Washington, DC: Brookings Institution.
- Houseman, Susan, Christopher Kurz, Paul Lengermann, and Benjamin Mandel. 2011. "Offshoring Bias in U.S. Manufacturing." *Journal of Economic Perspectives* 25(2): 111–132.
- Jarmin, Ron S., C. J. Krizan, and John Tang. 2011. "Outsourcing, Offshoring, and Trade: Identifying Foreign Activity across Census Data Products." *Sur-*

- vey of Current Business* 91(2): 121–139.
- Jarmin, Ron S., and Javier Miranda. 2002. “The Longitudinal Business Database.” Center for Economic Studies Discussion Paper No. CES-WP-02-17. Suitland, MD: U.S. Census Bureau, Center for Economic Studies.
- Kask, Christopher, David Kiernan, and Brian Friedman. 2002. “Labor Productivity Growth in Wholesale Trade, 1990–2000.” *Monthly Labor Review* 125(12): 3–14.
- Levinson, Marc. 2013. “*Hollowing Out*” in *U.S. Manufacturing: Analysis and Issues for Congress*. CRS Report for Congress 7-5700. Washington, DC: Congressional Research Service.
- Murphy, John. 2009. *Classification of Units that Outsource Manufacturing Transformation Activities*. Washington, DC: U.S. Census Bureau.
- Office of Management and Budget (OMB). 1998. *North American Industry Classification System: United States, 1997*. Blue Ridge Summit, PA: Bernan Press.
- . 2009. “2007 North American Industry Classification System (NAICS)—Updates for 2012.” *Federal Register* 74(4): 764–768.
- Porter, Michael E. 1998. “Clusters and the New Economics of Competition.” *Harvard Business Review* 76(6): 77–90.
- Smith, Dominic. 2013. “Probabilistic Name and Address Matching.” Working paper. Washington, DC: Federal Reserve Board of Governors.
- Steiner, Robert L. 1995. “Caveat! Some Unrecognized Pitfalls in Census Economic Data and the Input-Output Accounts.” *Review of Industrial Organization* 10(6): 689–710.
- . 1997. “The ‘Own-Brand Marketer’ Debuts in the 1997 Census.” *Review of Industrial Organization* 12(5–6): 809–816.
- Sturgeon, Timothy J. 2002. “Modular Production Networks: A New American Model of Industrial Organization.” *Industrial and Corporate Change* 11(3): 451–496.
- Sturgeon, Timothy J., and Gary Gereffi. 2008. *The Challenge of Global Value Chains: Why Integrative Trade Requires New Thinking and New Data*. Report prepared for Industry Canada. Durham, NC: Duke University, Center on Globalization, Governance, and Competitiveness.
- Sturgeon, Timothy J., and Ji-Ren Lee. 2001. “Industry Co-Evolution and the Rise of a Shared Supply-Base for Electronics Manufacturing.” MIT Working Paper IPC-01-003. Cambridge, MA: Massachusetts Institute of Technology, Industrial Performance Center.
- Timmer, Marcel P., Bart Los, Robert Stehrer, and Gaaitzen J. de Vries. 2013. “Fragmentation, Incomes, and Jobs: An Analysis of European Competitiveness.” *Economic Policy* 28(76): 613–661.

