Factoryless Goods Producing Firms

Andrew B. Bernard and Teresa C. Fort*

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The global economy is undergoing a series of rapid, connected transformations that are changing the way products are produced and sold. International trade in goods has surged, with the ratio of trade to GDP increasing for almost all country pairs. This increase in trade has been accompanied by the rise of global value networks and the relocation of production activities across national borders. At the same time, there has been renewed interest in the fragmentation of production activities across the boundaries of the firm and its links to the increases in trade and offshoring of production. The different activities of the value chain for a product can be performed by one or more establishments of a single firm, or can involve many different firms. In both cases, the activities can be performed in different locations within and across country borders.

In this paper we consider an extreme form of the fragmentation of production activities where the firm does not conduct manufacturing activities but nonetheless is heavily involved in activities related to the production of goods. Our focus is on firms in the wholesale sector. Traditional wholesalers are primarily, or exclusively, involved in intermediating goods between producers and retailers/consumers. Factoryless goods producing firms (FGPFs), in contrast, design the goods they sell and coordinate the production activities, either at the establishment itself or through the purchase of contract manufacturing services. In other words, FGPFs are manufacturing-like as they perform many of the tasks and activities found in manufacturing firms.

There are many ways to classify the activities or tasks needed to take a product from an initial concept through production until its delivery to the final customer. Pre-production activities can include development of the initial idea or conceptualization, R&D, product design and engineering as well as development of specifications for

*Bernard: Tuck School of Business, CEPR and NBER, 100 Tuck Hall Hanover NH 03755, andrew.b.bernard@tuck.dartmouth.edu. Fort: Tuck School of Business, 100 Tuck Hall, teresa.c.fort@tuck.dartmouth.edu. The research in this paper was conducted while the authors were Special Sworn Status researchers of the US Census Bureau at the Boston Research Data Center and the Center for Economic Studies. Any opinions and conclusions expressed herein are those of the authors and do not necessarily reflect the views of the Census Bureau, the NBER, or any other institution to which the authors are affiliated. All results have been reviewed to ensure that no confidential information is disclosed.

production. Production itself involves transformation and assembly of inputs and coordination of the various production stages. Post-production tasks might cover the determination of prices and quantities, marketing and branding, logistics and the ultimate sale of the good to final customers.

Traditionally, these activities were undertaken by the same firm in one location. Today, firms may perform different parts of each production stage in different domestic and foreign locations. When the activities are separated in space, firms can also decide whether they should outsource them to others. We define a factoryless goods producing firm (FGPF) as a a firm that has no manufacturing establishments in the US, but performs pre-production activities such as design and engineering itself and is involved in production activities, either directly or through purchases of contract manufacturing services (CMS).

FGPFs are present in industries from beer brewing to semiconductors. Perhaps the canonical example of a factoryless goods producer is the British appliance firm, Dyson, best known for its innovative vacuum cleaners. The firm initially designed, engineered and produced vacuum cleaners in Wiltshire, England but subsequently chose to offshore and outsource all the production to Malaysia while leaving several hundred research and other employees in the UK. Dyson's more recent innovations in product lines such as hand dryers and fans have never been produced in the UK or by Dyson itself.

The best-known example of a factoryless goods producer is Apple Inc. Apple designs, engineers, develops, and sells consumer electronics, software and computers. For the vast majority of its products including iPhones, iPads and Macbooks, Apple does none of the production and the actual manufacturing is performed by other firms in China and elsewhere. While Apple is known for its goods and services and closely controls all aspects of a product almost none of Apple's US establishments would be in the manufacturing sector.[1]

The semiconductor industry is well-known to have factoryless goods producers in the form of "fabless" firms.[2] Mindspeed Technologies, a fabless semiconductor manufacturer in Newport Beach, CA "designs, develops and sells semiconductor solutions for communications applications in wireline and wireless network infrastructure equipment." Mindspeed outsources all semiconductor manufacturing to other merchant foundries, such as TSMC, Samsung and others. Mindspeed's establishments would not be in the manufacturing sector.

Dyson and Apple started with production facilities inside the firm in the home country

[1]In December 2013, Apple began producing desktop computers at a US manufacturing facility jointly operated with Flextronics. The specific firms and details given here are based on publicly available information; they may or not be present in the data used in our empirical analyses.

[2]Bayard et al. (2014) document the extent and characteristics of FGPs in the US semi-conductor industry.

and subsequently shed their production lines and outsourced and offshored production. In addition, they retained or expanded other activities including research and development, design, engineering, marketing, and distribution.

These examples raise several important questions about FGPFs, their origins and their relationship to the offshoring of production. Are today's FGPFs more likely to have been involved in manufacturing in the past? Do FGPFs perform a wider range of activities than non-FGPFs? Are they larger firms? Are FGPFs more likely to be importers and do they import a greater share of final sales? We look at import activities of FGPFs and at the importance of manufacturing in the past activities of today's FGPFs.

To date there is very little systematic evidence on the extent of these types of firms.[3] In this paper, we use data from the US Census of Wholesale Trade in 2007 to systematically document features of factoryless goods producing firms in the wholesale sector in the US.[4]

There are several reasons why distinguishing FGPFs from traditional wholesale establishments may be important for economic welfare or policy. First, the mere existence of the FGPFs highlights a new type of production function in the global economy involving extreme fragmentation of tasks. Second, the types of workers, and as result jobs and wages, employed by FGPFs likely differ significantly from those at traditional wholesalers. Third, the relative importance of R&D and innovation is likely more important at FGPFs. These potential differences between FGPFs and traditional wholesalers introduce the possibility of very different wage, employment, and productivity dynamics if factoryless goods production grows as a fraction of aggregate activity.

Our research is related to a broader set of questions that asks how production, innovation, knowledge and productivity are related. One perspective is that without production activities located nearby in the long run a firm cannot continue to generate new ideas, improve product quality, innovate its designs and raise productive efficiency. The counterpoint suggests that the advent of dramatic improvements in telecommunication technology, the rise of the internet, and the reduction of transportation and trade costs have combined to allow firms to separate their activities geographically and potentially locate them outside the firm. This perspective suggests firms will thrive if they can take advantage of comparative advantage and relative cost differences in the performance of the tasks involved in the creation, production, distribution and marketing of a product. Co-location of these tasks may not be necessary and might be more costly.

[3] In a related paper, Bernard and Fort (2013), we focus on FGP establishments in 2002 and 2007. Kamal et al. (2013) discuss data collection efforts to provide new information on FGPs.

[4] There may be substantial numbers of non-wholesale FGPFs in other sectors such as Business Services.

1 Data and Definition

The data employed in this paper are from the 2007 US Census Bureau Census of Wholesale Trade (CW), the Longitudinal Business Database (LBD) for 1992 to 2007, and US Customs trade transactions data on 2007 US imports. To create our definition of a Factoryless Goods Producing Firm we proceed in two steps: first we identify FGP establishments in the wholesale sector and then we aggregate establishment to define FGP firms. We classify establishments in the wholesale sector as Factoryless Goods Producers if they both participate in the pre-production process of design or engineering of the product and are involved in the control of manufacturing through the purchase of contract manufacturing services.[5]

The Economic Censuses collect information at the unit of the establishment. Most firms are single-plant organizations in which establishment and firm definitions are the same. However the smaller number of multi-plant firms account for a disproportionate share of output and employment, and are more likely to produce multiple products.

Definition 1: A *Factoryless Good Producing Firm (FGPF or FGP firm)* is a firm with at least one FGP wholesale establishment and with no manufacturing establishments.

The practical implementation of the definition is complicated by the fact that each wholesale establishment can be in one of three categories: FGP, non-FGP, or Missing.[6] In this paper we only consider firms where all the wholesale establishments can be classified as FGP or non-FGP.

2 Characteristics of FGP firms

We start by describing FGP firms compared to non-FGP firms in the wholesale sector. In Table 1, we consider characteristics of FGP firms in 2007. Only 12 percent of firms are FGPFs and they are found in all industries for which FGP-related data was collected. However, they are disproportionately active in pharmaceuticals and apparel, 24 and 23 percent of firms respectively. These two industries are well-known for having design and product development conducted at a location separate from the production site. As expected, FGP firms are substantially larger than non-FGPFs; they employ twice as many workers, have 2.3 plants in contrast to 1.3 for non-FGPFs

[5]See Bernard and Fort (2013) for details about the survey questions used to identify establishments as FGPs and for information on FGP plants. These survey questions were asked of all establishments in 49 of the 71 six-digit NAICS industries.

[6]Establishments with a Missing designation either were not asked the FGP survey questions or did not answer all the questions.

Table 1: Firm Characteristics, 2007

Panel A	Total Sales	Plants	Wage	Age	
Non-FGP Firms	10,053	1.38	46.8	14.8	
FGP Firms	18,399	2.33	51.5	13.7	
		Employment			
Panel B	Total	Wholesale	Service	Other	MPT
Non-FGP Firms	22.1	14.9	2.0	3.6	1.0
FGP Firms	50.0	24.4	15.3	5.4	3.0

MPT are Management, Professional and Technical service workers. Other includes workers in Retail, Agriculture, Transportation, Warehousing and Utilities, Construction, and Public Administration. Employment figures are counts of employees. Total sales and Wages are in thousands of $s.

and have average sales that are 83 percent larger. This size difference is not surprising if we consider that FGPFs are active in all phases of the production of a product from the design through the decisions about manufacturing to the branding and logistics. FGPFs also pay higher average wages and are younger. The relative youth of FGPFs is surprising given that large firms are typically older firms.

Accordingly, FGPFs are more active across sectors. The typical non-FGP wholesaling firm has 22.1 workers of whom 14.9 are at wholesale establishments. Employment shares in Services, Management/Professional/Technical (MPT) and Other sectors are much smaller. In contrast, the average FGPF has 50.0 workers of whom only half are at wholesale establishments. FGPFs have substantial workers in other industries, 10.7 in other Services sectors, 3.0 MPT and 5.4 in Other. In the remainder of the paper we develop a set of facts around the hypotheses that FGPFs are likely to have made a transition from manufacturing to non-manufacturing and that FGPFs are more likely to have offshored production.

3 FGPFs over time

To begin to understand the origins and evolution of FGPFs over time we use information from the LDB to follow FGPFs and non-FGPFs over time. In 2007 we can define 112,300 firms employing over 2.85 million workers as either FGPFs or non-FGPFs, see Table 2. 13,500 of these firms are FGPFs while 98,800 are non-FGPFs. As noted previously the FGPFs are substantially larger in terms of total employment and wholesale sector employment.

Table 2: FGPFs Over Time

	Firms	Total Employment	Employees Manufacturing	Employees Wholesale
			Panel A: Non-FGP Firms	
1992	40000	1,043,716	1.5 (0.75)	13.8 (0.96)
1997	56500	1,356,654	0.9 (0.72)	13.6 (0.94)
2002	76100	1,701,870	0.4 (0.70)	14.4 (0.93)
2007	98800	2,186,891	0.0	14.9 (0.92)
			Panel B: FGP Firms	
1992	4900	285,650	9.4 (2.96)	17.5 (1.34)
1997	7300	425,244	6.2 (3.09)	20.5 (1.50)
2002	10200	550,673	3.1 (3.17)	21.6 (1.52)
2007	13500	672,443	0.0	24.4 (1.57)

MPT are Management, Professional and Technical service workers. Other includes workers in Retail, Agriculture, Transportation, Warehousing and Utilities, Construction, and Public Administration. Employment figures are counts of employees. Total sales and Wages are in thousands of $s.

We track these firms back into past years in other rows in Table 2. For example, 40.5 percent (40,000) of these non-FGPFs existed in 1992. In contrast only 36.3 percent of the FGPFs existed in 1992 confirming the finding that FGPFs are younger firms. Over time the average wholesale employment at future FGPFs has increased and the relative size compared to future non-FGPFs has risen as well.

More interesting is that future FGPFs have much higher manufacturing employment than future non-FGPFs. Firms present in 1992 show that future FGPFs have 2.96 times as many manufacturing employees and have manufacturing employment shares 2.48 times higher than the average firm in their industry. Future non-FGPFs are 54 percent smaller in terms of average employment and have manufacturing employment shares 19 percent lower.

These results provide some support for the hypothesis that FGPFs include a set of firms that made the transition out of manufacturing.[7] However, it is likely that the current set of FGPFs are a mix of different types of firms including former manufacturing firms, new firms created as FPGFs from their inception and other firms that have made the transition to the design and manufacture of products. More work is needed to understand the evolution of FGPFs over time.

[7] Bernard et al. (2014) document the prevalence and characteristics of these types of switching firms in the Danish manufacturing sector from 1994-2007.

4 FGPFs and imports

While Fort (2014) finds that US firms are much more likely to purchase contract manufacturing services domestically rather than abroad, there is still a strong presumption that production fragmentation also entails offshoring. We examine the import activities of both non-FGP and FGP firms in 2007 in Tables 3 and 4.

Table 3 reports the share of importing firms, the level of imports per firm and the ratio of imports to wholesale sales at the firm in 2007. FGPFs are indeed more likely to be importers than non-FGPFs; one half of FGPFs are importers in contrast to just over one third of non-FGPFs. In addition the level of imports is 40 percent greater at FGPFs. Taken together these findings provide some support for the idea that FGPFs use foreign production sites to manufacture the goods they control. However, looking at the ratio of imports to wholesale sales, we find that FGPFs are importing a much smaller share of sales than non-FGPFs. Non-FGPFs importers have imports equal to 86 percent of their sales, compared to only 38 percent for FGFPs. These results suggest a more complex relationship of factoryless goods producing firms to offshoring.

Table 3: FGPFs and Imports, 2007

	Importer Share	Imports	Imports/Wholesale Sales
Non-FGP Firms	0.354	3566	0.856
FGP Firms	0.499	4998	0.380

Importer share is the fraction of firms that report positive imports. Imports are given in thousands of $. Imports/Wholesale sales is the ratio of imports to sales by wholesale establishments at the firm.

Table 4 shows the top five importing sectors for both non-FGP and FGP firms as well as the share of imports in each of the top sectors. Import sectors for non-FGPFs include Machinery, Electrical equipment as well as Vehicles, Jewelry and Toys. In the latter three sectors, importing wholesale firms are likely to be of the more traditional type providing search and matching services between producers and buyers.

FGPFs are much more concentrated in the top sectors. Almost two-thirds of their imports are in equipment (HS85 and HS84) and apparel and footwear (HS62, HS61, and HS64). Non-FGPFs are spread more evenly with less than half their imports in the top five sectors.

Table 4: Major Import Sectors, 2007

	Non FGP Firms		FGP Firms	
Rank	Sector	Import Share	Sector	Import Share
1	84	0.160	85	0.298
2	85	0.149	84	0.111
3	87	0.063	62	0.085
4	71	0.059	61	0.075
5	95	0.044	64	0.073

The two-digit import (HS) sectors are: (85) Electrical machinery and equipment, (84) Machine and mechanical appliance and computers, (62) Clothing - not knitted, (61) Clothing - knitted, (64) Footwear, (87) Vehicles, (71) Jewelry and precious stones, and (95) Toys.

5 Conclusions

The fragmentation of production across firms and borders raises important questions about the boundaries of the firm and the role of policy. We find that large numbers of workers in the wholesale sector are employed at firms that engage in manufacturing-related activities. Unlike traditional wholesalers, these factoryless goods producing firms are not primarily engaged in intermediation but instead undertake design and engineering of products themselves and exert control over the production process. The potential for increasing fragmentation of production across firms and borders means that FGPFs are likely to play an even larger role in industrialized economies in years to come.

FGPFs are larger, pay higher wages, are active in more industries, and are more likely to be engaged in importing than typical wholesale firms. This paper represents a first step in developing an understanding of factoryless goods producing firms in the US.

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