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Firm-level relationships disaggregated by skills and suppliers"

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Abstract

Previous studies have established that offshoring firms employ more non-production workers. By using micro-data on Japanese firms, this paper disaggregates non-production workers. The share of *skilled* non-production workers tends to be high in offshoring firms but that of *unskilled* non-production workers is not. The share of non-production workers for the management of overseas activities tends to be high in FDI firms and in firms outsourcing to foreign suppliers, but not in Japanese firms outsourcing to offshore suppliers owned by other Japanese firms. These findings suggest that offshoring has different impacts on employment depending on suppliers and the worker's skill.

Keywords: offshoring; outsourcing; non-production workers; skill; firm-level data
JEL classifications: D23; F23; L24

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1. Introduction

In recent years, firms are actively sourcing from suppliers across national borders. Motivated by these new developments in the real world, the impact of offshoring on the skill composition of firms has been extensively investigated in international economics. Previous literature since Feenstra and Hanson (1996) has established that offshoring firms tend to employ high share of non-production workers.[1] However, not all non-production workers are highly skilled. Non-production activities are heterogeneous, ranging from strategic corporate decision to clerical works.[2] Feenstra (2010) points out that the employment share of non-production workers relative to production workers in the U.S. had risen in the 1980s but turned to decline in the 1990s while offshoring expanded from production to back-office jobs. Consequently, the distinction of skilled vs. unskilled non-production workers is increasingly more critical in examining the relation with offshoring.[3]

Furthermore, while previous international trade research has focused on the gap between skilled vs. unskilled workers (measured by non-production vs. production workers), overseas business activities such as "FDI or international outsourcing…require different types of skills" (Matsuyama 2007, p.253). For example, firms need to hire workers with communication skills in foreign languages or detailed knowledge on foreign regulations when they enter into cross-border operations. Even in English-speaking U.K., Kneller and Pisu (2007) report that 36.5% of firms cite language barriers and 42.2% of them refer to "legal, financial, and tax regulations and standards overseas" as barriers to exporting. Antràs, Garicano, and

[1] Empirical evidence has accumulated for many countries outside of U.S. as well, including Geishecker (2006) for Germany. High share of non-production workers has also been found in firms engaged in other modes of globalization, such as exporting (e.g. Bernard and Jensen, 1997).
[2] The same problem persists even if we use data on white-collar/blue-collar, or manual/non-manual workers. Another popular classification is based on workers' educational attainments, but only academic achievement is considered. Winchester, Greenaway, and Reed (2006) redefine skilled workers based on cluster technique to respond to the problem of these traditional classifications.
[3] Maurin et al. (2002) is a rare example empirically distinguishing skilled and unskilled non-production workers at the firm level, but they analyze exporters, not offshoring firms.

Rossi-Hansberg (2008) show that more middle managers are required for offshoring to countries with higher communication costs, with empirical evidence from aggregated country-level FDI data. In examining the relation between offshoring and employment composition, we need to distinguish non-production workers who have special skills for and are devoted to overseas business activities.

By exploiting the unique firm-level data on offshoring by Japanese manufacturers, this paper examines the following two issues. First, this paper disaggregates non-production workers into (i) skilled non-production workers, (ii) unskilled non-production workers, and (iii) non-production workers with skills specially required for globalization (workers for the management of overseas activities), and investigates how the relation with offshoring differs across these three groups of non-production workers. Workers in the last category are supposed to be required only in globalized firms and possess special skills, such as communication skills in foreign languages or knowledge on foreign markets. Second, this paper focuses on these non-production workers with special skills, and investigates how their employment varies depending on the types of suppliers in offshoring: FDI intra-firm offshoring, outsourcing to foreign suppliers, and outsourcing to suppliers owned by other Japanese firms. The investigation of Japanese firms provides us with a rare opportunity to test the impact of language barriers, since the Japanese language is nearly always used in transactions between Japanese firms but seldom used in transactions with foreign firms. As language barriers occupy non-negligible share in trade cost, our analysis sheds light on other coordination costs caused by differences in legal systems or in business practices.[4] By linking our unique offshoring data with official corporate statistics at the firm level, we control for various firm-characteristics, such as firm size,

[4] For empirical evidence for impacts of languages on trade cost, see Melitz (2008), for example.

capital intensity, R&D intensity, export, and the ownership structure of the offshoring firms. Unobservable time-invariant firm-specific effects are also controlled for in panel regressions.

The rest of the paper is organized as follows. Section 2 describes our survey on offshoring and report summary statistics. Section 3 presents the firm-level regressions of employment shares on offshoring, and discusses the differences between skilled and unskilled non-production workers. Section 4 reports how firm-level regression results differ depending on offshore suppliers. Section 5 adds concluding remarks.

2. Description of the data

2.1. Description of the survey

This paper derives firm-level data from a unique offshoring survey linked with official mandatory corporate statistics. The questionnaire was sent to 14,062 firms in Japan, of which 39% returned their answer sheets.[5] As the population of firms for this survey is chosen as the same as those used for the previous wave of the annual legal mandatory survey, these firms coincide virtually all large- or medium-sized firms in all manufacturing industries, and thus should be regarded as reasonably reliable in deriving implications to the whole manufacturing.[6] While this survey was conducted only once at 2006, the retrospective question on the firm's offshoring experience five years ago is included to alleviate the limitation of a one-shot survey.

The "offshoring," or offshore sourcing, is defined by contracting-out to other firms[7] located overseas based on explicit contracts specifying specifications or other dimensions of the offshored tasks. Purchases of standardized commodities at marketplace are not counted as

[5] The survey was conducted by Japan's Research Institute of Economy, Trade and Industry (RIETI) for our research project. For details of the survey, see Ito et al. (2007).
[6] The questionnaire was sent to all firms surveyed by *The Basic Survey of Business Structure and Activities* (*Kigyo Katsudo Kihon Chosa*, in Japanese), which covers all firms with 50 or more employees and capitalized at no less than 30 million yen.
[7] Imports from branch offices/factories are not included as they are not independent legal entities.

offshoring in this survey. We choose this restrictive definition to focus on costs of coordination and management. Offshoring of both production and service tasks are covered. Our survey also collects data on domestic sourcing explicitly distinguished from offshore sourcing; i.e. sourcing of specialized inputs (goods or services) from suppliers located within Japan.

As the most unique and informative contribution, the survey distinguishes the following three types of suppliers in offshoring:

(A) offshore subsidiaries owned by the offshoring firm,

(B) offshore subsidiaries owned by other Japanese multinational firms ("Japanese suppliers" for short, hereinafter), and

(C) foreign suppliers.

"Subsidiary" is defined by the majority ownership. While 10% threshold is often used in FDI studies, the majority ownership is practically central and conceptually critical in discussing a controlling stake.[8] The last category (C) includes not only local firms but also subsidiaries owned by multinationals headquartered in countries other than Japan, typically in U.S. or E.U.

The offshoring in the first category (A) is intra-firm offshoring within a multinational corporation, while the other two categories correspond to offshore outsourcing across the firm boundary. Although they are often used interchangeably, we distinguish "offshoring" and "outsourcing." Offshoring refers to cross-border sourcing (intra-firm or arm's-length), while outsourcing is sourcing across firm boundary (offshore or domestic).

While the intra-firm trade share has been often used to analyze the offshore outsourcing vs. integration decision (e.g. Nunn and Trefler, 2008), this binary measure ignores coordination costs associated with different languages or business practices in arm's-length outsourcing

[8] As a support for the focus on majority-owned FDI, Nunn and Trefler (2008) confirm that "for a very large proportion of ownership positions in the BEA data, once the position is more than 10%, it is also more than 50%" (p.21).

transactions. As far as the authors know, this paper is the first attempt at distinguishing three types of suppliers in offshoring.

As in offshore sourcing, suppliers located in Japan are not necessarily independent suppliers, but can include subsidiaries. Unfortunately, the survey cannot distinguish domestic supplier types as in offshoring. This paper controls for the firm's domestic sourcing status (whether or not the firm is involved in domestic sourcing) in regressions.

The investigation of Japanese offshoring is suitable for our research purpose. Communications between Japanese people are almost certainly in Japanese language, but those with non-Japanese people are extremely unlikely to be in Japanese.[9] Such a sharp contrast is implausible for other languages used in major economies in the world, since all other languages used in major economies, such as English, French, Spanish, or Chinese, are used actively also abroad and/or multiple languages are used in the home country. While it is practically impossible to identify the actual language used in contracting and monitoring, this paper assumes that firms headquartered in Japan ("Japanese firms") and the suppliers, even if they operate overseas, owned by Japanese firms with majority ownerships ("Japanese suppliers") use the Japanese language. As top management positions in FDI subsidiaries owned by Japanese firms are predominantly occupied by people with Japanese nationality dispatched from parent companies, this assumption is reasonable.[10]

2.2. Descriptive statistics

[9] This uniqueness of the Japanese language is confirmed in Ethnologue Database (Lewis, 2009), which catalogues languages around the world. Within Japan, second-language speakers are less than one-percent of the total population. Besides, people using the Japanese language are extremely few outside of Japan. .

[10] In more than 90% of Japanese offshore affiliates, people with Japanese nationality occupy the president position at 2006, according to a survey by Japan Institute for Labor Policy and Training.

Before investigating the regression results in the next section, it will be useful to briefly summarize descriptive statistics from our survey.

Table 1 reports how many firms are active in offshoring and choose different categories of suppliers in offshoring at the more recent year in our sample 2006.[11] Offshoring firms are disaggregated based on the supplier types: *I* (firms engaged in intra-firm sourcing from own FDI subsidiaries), *F* (firms offshoring to foreign suppliers), and *J* (firms offshoring to Japanese suppliers). The categories are mutually exclusive. For example, *F*J* denotes firms offshoring from foreign and Japanese suppliers but not from FDI subsidiaries. As far as the authors, this is the first firm-level report on offshoring disaggregated by these three different types of suppliers. Several points are worth noting in this table.

First of all, merely around one out of five firms in our sample are active in offshore sourcing. This participation rate may sound extremely low in a sample of offshoring of both production and service tasks by large- or medium-sized firms in a developed country, but is consistent with high fixed entry costs for offshoring as has been formalized in theoretical models (e.g. Antràs and Helpman, 2004).[12]

Substantially more firms are active in domestic sourcing. This difference in participation rates should reflect different entry barriers into offshore vs. domestic sourcing. Almost all the offshoring firms are also active in domestic sourcing (19% out of 21%). Very few firms (1%) are sourcing offshore totally bypassing domestic sources.

Turing to the lower panel (1-2) of Table 1, intra-firm FDI sourcing (*I*) and outsourcing to foreign suppliers (*F*) are the two major modes in offshoring. This suggests that internalization gains and low costs should dictate the motivations of offshoring for Japanese firms. Relatively

[11] Comparable figures at 2001 are available upon request.
[12] Tomiura (2007) reports that only 3% of the manufacturing firms are outsourcing production offshore at 1998 in Japan among 118,300 surveyed firms, of which nearly 80% are with less than 50 workers.

limited firms choose suppliers owned by other Japanese multinationals. This figure clearly contradicts with the presumption that Japanese firms are offshoring each other within traditional Japanese inter-firm networks.

The same table provides us with detailed information by distinguishing overlaps in sourcing modes. Among various offshoring modes of Japanese firms, the most frequently chosen are intra-firm FDI sourcing and/or offshore outsourcing to foreign suppliers combined with domestic sourcing (*I*, *F*, and *I***F* in the row titled "Offshore & Domestic"). Although many combinations are theoretically possible, the percentages in Table 1 show that all other modes are actually chosen by less than three percent of firms.

3. Empirical findings on skilled- vs. unskilled non-production workers

3.1. Empirical specifications

Before comparing skilled vs. unskilled non-production workers, this paper first estimates the following regression linking non-production workers with the firm's offshoring status:

$$\frac{L_{jt}^{NP}}{L_{jt}} = \alpha_1 + \beta_1 \cdot OFF_{jt} + \mu_{1j} + \varepsilon_{1jt}. \qquad (1)$$

The firm is identified by the suffix *j* in (1). The dependent variable L^{NP}/L is the percentage of non-production workers in total employment.[13] *OFF* is the dummy variable for offshoring. The estimated coefficient on the offshoring dummy β is the offshoring premium, while the constant term α corresponds to the share of non-production employment in the average non-offshoring firms. Since offshoring data are available at the two years *t* = 2001 and 2006, we estimate (1) in a panel format to control for time-invariant firm-specific effects μ. As a robustness check, we

[13] This paper defines "non-production workers" by the employees in corporate function sections (*honsha-kinou bumon*, in Japanese), who are not directly involved in manufacturing or commerce. Although some employees in production plants, such as managers, are non-production workers, no such data are available in Japanese corporate or industrial statistics. .

will also reports results from cross-section regressions for each year in Appendix. The idiosyncratic disturbance term is denoted by ε. We should not interpret (1) as indicating the direction of causality. This regression is intended to confirm the stylized fact before our main investigation.

Next, we disaggregate non-production workers by their skills:

$$\frac{L_s^{NP}}{L} = \alpha_2 + \beta_2 \cdot OFF + \gamma_2 \cdot Z + \mu_2 + \varepsilon_2 . \qquad (2)$$

The firm and year subscripts *jt* are omitted. The skill of non-production workers is distinguished by *s*: *s* = *S* (skilled), *U* (unskilled), and *O* (overseas management skill). The sum over these three categories coincides with the total number of non-production workers L^{NP}. The skilled non-production workers L_s is the number of workers engaged in the following high-skill corporate activities: corporate research and planning (*kikaku-chosa*, in Japanese), corporate R&D, and corporate information processing. On the other hand, L_o denotes the number of workers for the management of overseas business activities (*kokusai jigyo*, in Japanese), who are supposed to be required only in firms active in overseas activities, such as exporting, FDI, or offshoring.[14] As Matsuyama (2007) pointed out in his construction of theoretical model of exporting, we need to distinguish special skills required only for overseas activities, in addition to the distinction between skilled vs. unskilled workers. In analyzing entry costs for exporting, Roberts and Tybout (1997) cite knowledge on "transportation, customs and shipping services, as well as information on prices, potential buyers, and product standards or requirements in other countries" (p.550). All tasks listed above involve special skills, not normally required in domestic operations. L_u is the number of other miscellaneous non-production workers, such as workers involved in general administration, personnel administration, accounting, or other

[14] As we disaggregate employees in corporate function sections, this second category exclude employees dispatched to overseas subsidiaries/plants.

clerical tasks. It is inevitably true that some of the workers in this last miscellaneous category are highly skilled (e.g. accountants), just as production workers, repeatedly used in the previous literature, include not only unskilled workers but also skilled workers (e.g. workers handling advanced machines).[15] Since detailed data on occupations/tasks are unavailable in normal corporate statistics, our disaggregation should be evaluated as an improvement. In our sample, 5.3% of total workers are skilled non-production workers and 8.5% are unskilled non-production workers, while 0.28% are managing overseas activities at 2006.

Other variables, summarized by Z in (2), are given based on standard definitions as follows. First, we include basic firm characteristics, which are supposed to be correlated with the firm's skill level: firm size, capital-labor ratio, and R&D intensity. Large-sized, capital-intensive, or R&D-intensive firms are likely to employ high-skill workers. The firm size is measured in sales. The capital-labor ratio is defined by the book value of machine and equipment divided by the total number of all workers.[16] The R&D intensity is the percentage of R&D expenditure relative to sales. These three continuous variables are in logarithms.[17]

Next, we control for the firm's export activities. Exporting firms, even if they are not involved in offshoring, are likely to hire skilled workers, and workers with overseas management skills. *Export* is the dummy variable identifying a direct exporter.

The last two variables are on the ownership of the offshoring firm. *Foreign Share* measures the share owned by foreign stockholders (residents outside of Japan), while *Parent Share* measures the share owned by the parent firm (Japanese or foreign combined). A firm owned more by its parent company may allocate fewer workers to the management of overseas

[15] Maurin et al. (2002) define skilled non-production workers by the sum of engineers and technicians in their analysis of exporting firms.
[16] The value of tangible fixed assets is often used to construct the capital-labor ratio, but our measure is superior in excluding volatile fluctuations in values of land and plant construction.
[17] Negligible 10^{-8} is added before taking logarithm to include firms with R&D or capital not available or reported as zero.

activities if the parent company handles the management of overseas activities, including the management of overseas grandchildren companies. A firm owned more by foreign owners may allocate more workers to overseas management for cross-border coordination with stockholders.

The firm-level data for these variables are derived from annual official statistics. This paper also controls for the effects of domestic sourcing by introducing the dummy (*Domestic Sourcing*) taking the value one when the firm is sourcing from a supplier located within Japan. We add dummies for 24 industries to control for industry-specific effects.

3.2. Estimation results

Table 2 reports the offshoring premium in employment share, based on the specification (1). Robust standard errors are in parentheses. All the firms, of which the offshoring data both at 2001 and 2006 are available, are included in random-effect generalized least-squares estimations.[18] In the regressions, we concentrate on the firms in the balanced panel to control for time-invariant firm-specific effects. The offshoring dummy is statistically significant at any conventional significance level in all cases. Noteworthy points are as follows.

First, the column (1) confirms that offshoring firms on average hire significantly more non-production workers in total employment, compared with non-offshoring firms. This result is clearly a confirmation of the stylized fact. The gap between offshoring vs. non-offshoring firms is as sizable as around ten percent (1.48/14.2).

Next, the columns (2)-(4) present the regression results with disaggregated non-production workers. The average share of skilled non-production workers in offshoring firms relative to non-offshoring firms is significantly higher but that of unskilled non-production

[18] Since less than six percent of the surveyed firms switched from non-offshoring to offshoring or vice versa, it is practically difficult to precisely estimate the effect of offshoring in a fixed-effect model. We check the robustness of the results from the random-effect model by estimating cross-section regressions separately for each year.

workers is found rather slightly lower. We have also found that offshoring firms on average allocate significantly more workers to the management of overseas business activities, compared with non-offshoring firms. These findings are impressive but are merely primitive comparisons of the mean values without any control of relevant factors.

To check the impressions from the previous table, Table 3 reports the regression results with firm characteristics and 24 industry dummies, as specified in (2). The comparison between the columns (1) and (2) demonstrate that offshoring firms tend to employ significantly more *skilled* non-production worker, not *unskilled* non-production workers, even after controlling for firm- and industry-factors. The negative coefficient estimate for the unskilled workers previously reported in Table 2 turns to be slightly positive and insignificant in this table. Table A1 in Appendix confirms the robustness of these random-effect panel regression results by cross-section OLS regressions of each year. Non-production workers employed more in offshoring firms are skilled non-production workers, not unskilled non-production workers.

This finding is in line with the previous result on exporters-vs.-non-exporters in France by Maurin et al. (2002). As far as the authors know, this is the first firm-level evidence for offshoring.[19] Treating all production workers as unskilled and all non-production workers as skilled is an oversimplification. Although we cannot identify in our firm-level data, the share of skilled production workers may also be higher in offshoring firms. The simple dichotomy of production workers vs. non-production workers is no longer suitable for characterizing offshoring firms. As Feenstra (2010) pointed out, it is critical to distinguish skilled from unskilled workers in non-production workers, as the range of offshored tasks appears to have expanded from production to unskilled non-production activities, such as replacing in-house

[19] Morrison Paul and Yasar (2009) report that higher share of subcontracted inputs is related with higher share of administrative and technical workers in the case of Turkish apparel plants, but they do not distinguish offshore outsourcing.

paper works by electronic data entry overseas. Our finding should be regarded as an important first report on this point.

Next, the column (3) shows that the share of workers for the management of overseas activities is significantly higher in offshoring firms than in non-offshoring firms, even after we control for firm-specific and industry-specific factors. The estimated coefficient on the offshoring dummy (0.30) indicates that the offshoring premium is large, as non-offshoring firms allocate very limited workers to this function (the overall mean is 0.28% as reported in the previous section). Non-offshoring firms may be involved in other cross-border activities, such as exporting, but the relation with offshoring is thus substantial. This finding suggests that contracting with and monitoring performance of suppliers overseas require special skills or incur non-negligible management overloads.

Several interesting regularities are also found for other variables in Table 3. First, as evident from the contrast between the columns (1) and (2), firms engaged in domestic sourcing tend to employ significantly more skilled non-production workers, but the share of unskilled non-production workers is not significantly different from that in non-offshoring firms, as we found for offshore sourcing firms. This suggests that sourcing not only across borders but also within the home country is significantly related with the employment shift toward skilled workers within non-production workers. The share of workers for overseas management is *not* related with domestic sourcing, as expected.

Second, exporting requires substantially more workers for overseas management possibly to overcome entry costs for foreign markets, as shown in the column (3). This implies that the overseas management section is responsible not only for offshoring but also for exporting. Table 3 also shows that exporting firms on average employ significantly fewer unskilled non-production workers in total employment, though the relation with skilled non-production is

positive but statistically insignificant. This result is consistent with previous finding of higher ratio of skilled/unskilled workers in exporters. This paper finds that this relation holds even within non-production workers. Exporting is supposed to require advanced production technology or more active R&D to compete in the world market, but we control for R&D intensity and capital intensity at the firm level in our regressions and concentrate on variations within non-production workers.

Third, firms spending more on R&D tend to employ significantly more skilled non-production workers. As workers engaged in R&D are obviously highly skilled, this result is as expected.[20] Several previous studies have also confirmed the critical role of R&D in this context. For example, Kastl et al. (2008) report that R&D intensity is positively related with the number of managers in Italian manufacturing firms. Higher R&D intensity is also positively related with the employment share of overseas management, possibly because innovative firms, even if they are not currently active in offshoring or exporting, are likely to be active in gathering technology information overseas. No significant relation is detected for capital－labor ratio in our case.

Firm size is negatively related with the share of unskilled non-production workers. This indicates strong economies of scale in administrative activities, as the share of these workers declines with firm size.

Finally, firms owned more by their parent companies tend to allocate significantly fewer workers for overseas management. This suggests that parent companies are likely to manage overseas business activities not only of their direct subsidiaries but also of their grandchildren companies abroad. On the other hand, firms owned more by foreign stockholders on average employ more skilled non-production workers. As these firms are affiliates of multinational

[20] One must note that our definition of skilled non-production workers do not necessarily include all workers engaged in R&D, such as technicians at production plants and researchers at laboratories.

corporations, this result is consistent with the established finding of high skills in multinationals.

In sum, this paper first confirms that offshoring firms tend to have higher share of non-production workers in total employment. However, once non-production workers are disaggregated, the relation with offshoring remains positively significant for skilled non-production workers, but insignificant for unskilled non-production workers. This suggests the possibility that unskilled workers, including production and non-production workers, are exposed to intensified international competition through offshore sourcing. This paper also finds a significantly positive relation with offshoring for workers engaged in overseas management. This latter finding indicates that firms are required to possess special skills for offshoring.

4. Empirical findings on different types of offshore suppliers

4.1. Empirical specifications

While the previous section found that offshoring firms tend to allocate significantly more workers to the management of overseas activities, the management load associated with offshoring is likely to vary depending on the offshore suppliers due to differences in languages and in business practices. To shed light on management overload often referred to in formalizing firm's globalization choice, we focus on workers specially required for overseas operations.[21] This section disaggregates offshore suppliers into the following three types: own offshore FDI subsidiaries (*I*), suppliers located offshore but owned by Japanese multinationals (*J*), and foreign suppliers (*F*), and estimates their relation with the share of workers for overseas management by the following specification:

$$\frac{L_O^{NP}}{L} = \alpha_3 + \beta_3 \cdot Supplier + \gamma_3 \cdot Z + \mu_3 + \varepsilon_3 . \qquad (3)$$

[21] We have confirmed that the share of other non-production workers, skilled or unskilled, rarely varies systematically with supplier types in offshoring.

Supplier is a vector of all possible combinations of the three offshore supplier dummies interacted with the domestic sourcing dummy (*D*)[22], which is listed as {*I, F, J, I*F, F*J, I*J, I*F*J, I*D, F*D, J*D, I*F*D, F*J*D, I*J*D,* and *I*F*J*D*}. As these are disjoint, only one of them takes the value one for any offshoring firm. The dependent variable in (3) is the employment percentage of workers for overseas management.[23] All other firm characteristics *Z* used in the previous regression (2) are kept included to facilitate comparisons. To clarify the effect of *I* (FDI sourcing), we add *FDI*, which is defined by the overseas capital stock relative to the firm size (sales), in *Z* to control for the effects of another important globalization mode: FDI (FDI not necessarily with sourcing, typically horizontal FDI).[24]

4.2. Estimation results

Table 4 presents the regression results with disaggregated supplier types.[25] The column (1) is without and (2) is with firm characteristics and industry dummies. The only offshoring dummy variables statistically significant in both columns are *F, I*F*J, I*D, F*D,* and *I*F*D*. All are positively related with the share of overseas management. Among these five cases, *I*F*J* is the only one involving offshore sourcing to Japanese suppliers (*J*), but the high employment share of overseas management in the *I*F*J* firms is rather natural because all their sourcing is exclusively across borders (not involved in domestic sourcing at all). Aside from these exceptional firms, all other four cases are active in *F* and/or *I* with or without domestic sourcing, but not offshoring to Japanese suppliers at all. Furthermore, as reported in Table 1, *I*D, F*D,* and *I*F*D* are the top three most popular sourcing modes among Japanese

[22] We must note again that our survey cannot distinguish intra-firm sourcing from outsourcing within domestic sourcing.
[23] Our principal findings are qualitatively unaffected even if the multinomial logit model of the firm's sourcing mode choice (combinations on the left-hand side) is instead estimated.
[24] When a firm exports goods/services to but imports nothing from FDI subsidiaries, however, the firm is involved in vertical FDI but not in offshoring.
[25] In our sample, no firm happens to choose *F*J*.

offshoring. Table A2 in Appendix confirms these random-effect panel results by cross-section regressions of each year, showing that significant in both years are limited to *I*D*, *F*D*, and *I*F*D* among various possible combinations of offshoring modes.

Consequently, our regression results indicate that management overloads tend to be especially heavy when offshoring firms operate their own FDI subsidiaries or when offshore suppliers are (non-Japanese) foreign firms. Even if they are involved in offshoring, Japanese firms need not to allocate significantly more workers to the section for overseas management when they are offshoring to suppliers located abroad but owned by Japanese multinationals. This difference in the employment share of overseas management is likely to be at least partly due to differences in language and/or in business practices. In offshoring to Japanese suppliers, Japanese firms can communicate in the common mother tongue and share Japanese business practices. They can also sometimes even negotiate with Japanese parent companies within the home country and can economize costly cross-border communications with offshore suppliers.

Firms involved in intra-firm sourcing allocate more workers to overseas management because owing and operating overseas subsidiaries require special skills and heavy management burden, as has been often formalized by higher entry costs for FDI compared with exporting or outsourcing (e.g. Antràs and Helpman, 2004). Our definition of L_o does not include expatriate employees dispatched to overseas subsidiaries, but this underestimation rather strengthens our result. While the coefficient on *I* is estimated to be weakly negative, *FDI* is strongly positive. This indicates that multinationals active in horizontal FDI tend to have significantly larger overseas management section, even if they are not involved in offshoring.

Our finding of different relations with offshoring to Japanese suppliers is also in line with previous research on international trade. Acumulated studies since Rauch (1999) have investigated impacts of social networks such as immigrant networks through languages, legal

system origin, ethnic background, though offshoring has not been considered. As a related empirical study, Kneller and Pisu (2007) finds in U.K. firms that "the most common export impediments are those associated with 'Identifying who to make contact with in the first instance', and 'The marketing costs associated with doing business in an overseas market" (p.11). Although they examine exporting, firms should face similar barriers in offshoring, but these impediments are likely to be at least partly mitigated by common languages and shared business practices.

5. Concluding remarks

This paper has empirically investigated how the relation between offshoring and non-production workers changes when we distinguish skilled and unskilled non-production workers and when we distinguish different types of offshore suppliers. By disaggregating non-production workers, this paper has found that the share of skilled non-production workers is significantly high in offshoring firms but that of unskilled non-production workers is not. This suggests that offshoring is related with employment shift toward high skills within non-production workers. This paper has also found that the employment share of workers for overseas management is significantly high in FDI firms and firms engaged in outsourcing to foreign suppliers, but not in Japanese firms offshoring to Japanese suppliers. This indicates that management overloads tend to be heavier in FDI firms, but likely to be at least partly alleviated by shared business practices. These findings are largely robust even after various firm-characteristics are controlled for.

While this paper has found previously unexplored employment relationships with offshoring, there remain several important extensions. For example, our survey contains no quantitative information on how much each firm is offshoring and on how much each subsidiary is owned. As another extension, data from some other countries, such as France, will enable us

to analyze language effects varying across offshoring destinations by isolating French-speaking foreign countries. These additional data will certainly enrich the research of this topic, if gathered by future independent surveys.

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Table 1 Percentages of firms

(1-1) Sourcing modes

Domestic (*D*) Only	Offshore & Domestic (*D*)	Offshore Only	Not involved	Total
43.21	19.41	1.14	36.24	100

(1-2) Disaggregating suppliers in offshore sourcing

Offshore suppliers / Sourcing mode	*I*	*F*	*J*	*I*F*	*F*J*	*I*J*	*I*F*J*	Total
Offshore & Domestic (*D*)	5.14	6.59	1.78	3.03	1.13	0.53	1.21	19.41
Offshore only	0.43	0.41	0.10	0.16	0	0.02	0.02	1.14

Notes: Percentages are in the number of all firms at 2006. Categories are mutually exclusive. Offshore sourcing is disaggregated by suppliers: *I* (intra-firm offshore sourcing from FDI subsidiaries), *F* (offshore outsourcing to foreign suppliers), and *J* (offshore outsourcing to suppliers located overseas but owned by other Japanese firms).

Table 2 Offshoring premium

	(1) L^{NP}/L	(2) L_S^{NP}/L	(3) L_U^{NP}/L	(4) L_O^{NP}/L
Offshoring premium	1.4827	1.5311	–0.5313	0.4471
	(0.3868)	(0.2787)	(0.2431)	(0.0433)
Non-offshoring	14.2104	5.1915	8.8498	0.1758
firms	(0.1721)	(0.1190)	(0.1160)	(0.0117)
Wald χ^2	7985.52	2343.67	6854.80	420.91

Notes: The dependent variable of the regression is shown in the top row (%). "Offshoring premium" is the estimated coefficient on the offshoring dummy. Shown in the row "Non-offshoring firms" is the estimated constant term. Balanced-panel random-effect GLS estimation results are shown. Robust standard errors are in parentheses. 3,992 firms are covered.

Table 3 Disaggregating non-production workers with firm characteristics controls

	(1) L_S^{NP}/L	(2) L_U^{NP}/L	(3) L_O^{NP}/L
Offshore sourcing	0.7594	0.1262	0.3020
	(0.2897)	(0.2626)	(0.0473)
Domestic sourcing	0.6000	–0.2484	0.0504
	(0.2063)	(0.2329)	(0.0232)
Export	0.1073	–0.4471	0.1372
	(0.1165)	(0.1563)	(0.0182)
Firm Size	–0.0441	–0.4305	0.0195
	(0.0945)	(0.0862)	(0.0105)
Capital-Labor ratio	–0.0589	–0.0007	–0.0071
	(0.0372)	(0.0301)	(0.0044)
R&D intensity	0.1425	–0.0247	0.0084
	(0.0128)	(0.0136)	(0.0020)
Foreign Share	3.6070	0.7561	0.5263
	(1.6652)	(1.0773)	(0.3037)
Parent Share	–0.0843	0.0553	–0.1346
	(0.1987)	(0.2223)	(0.0226)
Wald χ^2	39675.61	7994.22	663.56

Notes: The dependent variable of the regression is shown in the top row (%). Balanced-panel random-effect GLS estimation results are shown. Robust standard errors are in parentheses. Industry dummies are included and 3,992 firms are covered in all cases.

Table 4 Disaggregating offshore suppliers

	(1)	(2)
I	–0.0073 (0.0558)	–0.1513 (0.0618)*
F	0.5104 (0.1952)**	0.3813 (0.1859)*
J	0.1357 (0.2084)	0.1394 (0.2275)
*I*F*	0.0613 (0.2626)	–0.1159 (0.2115)
*I*J*	0.1031 (0.1726)	–0.0256 (0.1257)
*I*F*J*	1.8849 (0.2999)**	1.0768 (0.3922)**
*I*D*	0.5870 (0.0791)**	0.3136 (0.0839)**
*F*D*	0.4684 (0.0921)**	0.3271 (0.0905)**
*J*D*	0.0092 (0.0570)	–0.0513 (0.0579)
*I*F*D*	0.7679 (0.0950)**	0.4785 (0.0985)**
*F*J*D*	0.3870 (0.1547)**	0.2353 (0.1519)
*I*J*D*	0.4622 (0.1933)**	0.1744 (0.1895)
*I*F*J*D*	0.4917 (0.1102)**	0.1254 (0.1147)
D	0.0873 (0.0222)**	0.0390 (0.0227)
Export	-------	0.1241 (0.0182)**
FDI	-------	0.2192 (0.0414)**
Firm size	-------	0.0035 (0.0109)
Capital-labor ratio	-------	–0.0069 (0.0044)
R&D intensity	-------	0.0080 (0.0020)**
Foreign share	-------	0.5112 (0.3011)
Parent share	-------	–0.1019 (0.0237)**
Industry dummies	No	Yes
Wald χ^2	533.11	732.69

Notes: The dependent variable is the employment percentage of workers for overseas management (L_O^{NP}/L). Balanced-panel random-effect GLS estimation results are shown. Robust standard errors are in parentheses. 3,992 firms are covered in both cases. No firms in our sample chose *F*J*. Asterisks denote statistical significance: * at 5%, and ** at 1%.

Appendix

Table A1 Cross-section regressions of disaggregated non-production workers

	(1) L_S^{NP}/L 2001	(2) L_S^{NP}/L 2006	(3) L_U^{NP}/L 2001	(4) L_U^{NP}/L 2006	(5) L_O^{NP}/L 2001	(6) L_O^{NP}/L 2006
Offshore sourcing	0.3383	1.0945	0.3087	0.1771	0.2597	0.3178
	(0.3615)	(0.3363)	(0.3638)	(0.2906)	(0.0558)	(0.0595)
Domestic sourcing	0.3321	0.3254	–0.1853	–0.0548	0.0237	0.0422
	(0.2271)	(0.2280)	(0.2865)	(0.2366)	(0.0220)	(0.0306)
Export	1.3591	0.3935	–0.4135	0.0649	0.4661	0.0942
	(0.3192)	(0.2883)	(0.3126)	(0.2872)	(0.0444)	(0.0388)
Firm Size	–0.4038	0.0809	–0.3435	–0.5629	–0.0107	0.0357
	(0.1081)	(0.1020)	(0.1187)	(0.0822)	(0.0139)	(0.0118)
Capital-Labor ratio	–0.1440	–0.1030	0.0650	0.0304	–0.0139	–0.0108
	(0.0683)	(0.0401)	(0.0882)	(0.0297)	(0.0084)	(0.0045)
R&D intensity	0.2839	0.2048	–0.0556	–0.0177	0.0050	0.0096
	(0.0199)	(0.0184)	(0.0211)	(0.0158)	(0.0022)	(0.0025)
Foreign Share	0.4737	3.0722	1.2540	1.3570	0.6117	0.5474
	(1.8018)	(1.6359)	(1.4798)	(1.1049)	(0.4209)	(0.3099)
Parent Share	–0.0763	–0.7525	–0.0437	–0.0882	–0.0765	–0.1861
	(0.2904)	(0.2710)	(0.3223)	(0.2670)	(0.0281)	(0.0299)
R^2	0.1257	0.1180	0.0304	0.0229	0.1425	0.0658
# of Firms	4,511	4,885	4,511	4,885	4,511	4,885

Notes: The dependent variable of the regression is shown in the top row (%). Robust standard errors are in parentheses. Industry dummies are included in all cases.

Table A2 Cross-section regressions on disaggregated offshore suppliers

	(1) 2001		(2) 2006	
I	–0.0549	(0.0816)	–0.1304	(0.1802)
F	–0.1345	(0.1423)	0.6537	(0.2738)*
J	0.4399	(0.3458)	–0.2552	(0.1246)*
*I*F*	0.3166	(0.4688)	0.0303	(0.3434)
*I*J*	–0.0917	(0.1588)	–0.4149	(0.0670)**
*I*F*J*	1.5081	(0.1445)**	0.5540	(0.3793)
*I*D*	0.3010	(0.1180)*	0.2015	(0.1002)*
*F*D*	0.2230	(0.0914)*	0.3303	(0.1199)**
*J*D*	0.0475	(0.0871)	–0.0751	(0.0581)
*I*F*D*	0.6224	(0.1652)**	0.3024	(0.1194)*
*F*J*D*	0.0949	(0.1817)	0.5096	(0.2134)*
*I*J*D*	–0.0420	(0.2484)	0.1120	(0.2430)
*I*F*J*D*	0.2152	(0.1908)	0.0712	(0.2010)
D	0.0127	(0.0223)	0.0361	(0.0302)
Export	0.4444	(0.0467)**	0.0762	(0.0385)*
FDI	0.1055	(0.0562)	0.3901	(0.0610)**
Firm size	–0.0188	(0.0142)	–0.0022	(0.0128)
Capital-labor ratio	–0.0133	(0.0085)	–0.0101	(0.0044)*
R&D intensity	0.0048	(0.0021)*	0.0076	(0.0025)**
Foreign share	0.6345	(0.4182)	0.5174	(0.3121)
Parent share	–0.0603	(0.0298)*	–0.1309	(0.0319)**
R^2	0.1516		0.0810	
# of Firms	4,511		4,885	

Notes: The dependent variable is the employment percentage of workers for overseas management. Robust standard errors are in parentheses. No firms in our sample chose *F*J*. Industry dummies are included in both cases. Asterisks denote statistical significance: * at 5%, and ** at 1%.