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Cross-regional variations in offshore outsourcing choices: evidence from firm-level data

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Abstract

In offshoring, a firm chooses outsourcing to independent suppliers or in-sourcing from their FDI subsidiaries. This paper empirically examines how the factor intensity is related with the firm's offshore make-or-buy decision based on the Japanese direct firm-level data of offshoring across all manufacturing industries. This paper confirms that in-sourcing firms tend to be substantially more capital-intensive than outsourcing firms, even if firm size or industry is controlled for. Among the firms offshoring to China compared with North, firms with wider range of capital-labor ratio choose to integrate but relatively capital-intensive firms are active in outsourcing.

Keywords: outsourcing, offshoring, firm-level data, capital-labor ratio, contracting environment
JEL Classifications: F14; F23; L14; L33

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1. Introduction

The world economy in recent years is strongly characterized by new modes of cross-border activities, including growing international trade in intermediate inputs, more complex integration strategies by multinational corporations, and offshoring of wider varieties of tasks, just to name a few.[1] In spite of ample business episodes, direct statistical data are unavailable for many of them, especially for offshore outsourcing.[2] On the other hand, new theoretical models of international trade have recently formalized how firms organize their production on a global scale.[3] Empirical evidence for these new theories, however, has been so far limited partly constrained by the data availability.[4] This paper fills a part of this gap by using the unique direct firm-level data on offshoring, distinguishing outsourcing vs. in-sourcing as well as offshoring destinations, covering all manufacturing industries in Japan.

As firms expand their offshoring locations around the globe, cross-country variations in the enforcement of contracts and the quality of legal system should become increasingly critical.[5] In some countries attracting many offshoring firms, especially in low-wage developing countries South, the contractibility is supposed to be seriously limited, compared with legally advanced North. A primitive application of the transaction cost economics implies that higher transaction costs in South should compel firms to choose in-sourcing (sourcing from own FDI affiliates within a multinational firm) to circumvent arm's-length market transactions. However, Antràs and Helpman (2007) suggest that limited contractibility may rather raise the share of outsourcing firms in South when contract incompleteness is especially severe for inputs

1 See, for example, Feinberg and Keane (2006), Grossman and Rossi-Hansberg (2006), and Hummels et al. (2001).

2 Intermediate imports or intra-firm trade are not necessarily in customized/specialized, non-contractible inputs but usually rather include standardized goods available at marketplace.

3 See Helpman (2006) for a survey.

4 Tomiura (2007) confirms the theoretical prediction on the productivity ordering among FDI firms, offshore outsourcing firms, exporters, and domestic firms in 118,300 Japanese manufacturers.

5 According to Nunn (2007), the impact of contracting institutions is of the same order of magnitude as the impact of human capital on trade flows.

provided by local suppliers, who should be given stronger incentives to mitigate underinvestment problem. On the offshore make-or-buy decision, Antràs (2003) shows that labor-intensive firms choose outsourcing, though cross-country contractibility differences are assumed away. Feenstra and Hanson (2005) find that the split of factory ownership and input control is common in Chinese export processing, especially in southern coastal regions, where courts are relatively efficient but value-added in processing is higher than in northern and interior provinces. This paper empirically compares the factor intensity of in-sourcing firms with outsourcing firms, with some North-South comparisons. While Nunn and Trefler (2007) investigated the same issue based on trade statistics, our use of firm-level data is an informative contribution since the heterogeneity across firms should not be ignored even within the same product/industry.

To preview the principal results of this paper, firstly, only a limited fraction of firms are active in offshoring, as predicted by Antràs and Helpman (2004). Secondly, the firms engaged in offshore in-sourcing are on average more capital-intensive, larger in size, richer in human capital, and more R&D-intensive, compared with offshore outsourcing firms, confirming previous results from sector-level aggregate data by Antràs (2003) and Yeaple (2006). The capital intensity gap between in-sourcing firms and outsourcing firms is significantly observed irrespective of the destination, and is robust even after the firm-size or industry is controlled for. Lastly, when different destinations are compared, the share of outsourcing firms relative to in-sourcing firms is not noticeably low in China compared with legally advanced North, but the capital intensity gap between in-sourcing firms and outsourcing firms appears narrower in China. These cross-regional differences cannot be explained entirely by different transaction costs, but are partly consistent with the theoretical prediction by Antràs and Helpman (2007).

The rest of this paper is organized as follows. Section 2 describes the data, and

summarizes basic statistics. Section 3 reports firm-level empirical results and discusses the consistency with theoretical predictions. Section 4 adds concluding comments.

2. Data description

2.1. Description of the survey

This paper derives firm-level data from a unique survey linked with official statistics. The questionnaire of the survey was sent, in January 2007, to 14,062 large- or medium-sized firms in Japan.[6] As the population of firms for this survey is chosen as the same as those used for the previous wave of the annual national legal mandatory survey, *The Basic Survey of Business Structure and Activities* (*Kigyo Katsudo Kihon Chosa*, in Japanese), these firms coincide virtually all firms with 50 or more employees in all manufacturing industries, and thus should be regarded as reasonably reliable in deriving implications to the whole manufacturing. Since other previously available firm-level data sets on offshore outsourcing include only a limited number of firms and are not designed to cover the entire manufacturing, this survey has a clear advantage in its coverage.[7]

In discussing offshoring, we concentrate on specialized inputs. The "offshoring," or offshore sourcing, is defined by contracting-out to other firms[8] located overseas[9] based on explicit contracts specifying specifications or other dimensions of the offshored tasks. When a firm is purchasing standardized goods/services readily available at marketplace overseas, such a case is not counted as offshoring. This definition is appropriate for investigating the empirical

6 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).
7 The sample size in previous micro-data studies of offshore outsourcing is generally limited: 652 plants within Irish electronics industries by Görg and Hanley (2005), for example. Establishment-level outsourcing data by Girma and Görg (2004) cover all U.K. sectors, but offshoring is not distinguished.
8 Imports from branch offices/factories are not included as they are not independent legal entities.
9 Offshoring is identified based on the location, not the ownership of suppliers.

implications of make-or-buy decision models in the contract theory or the theory of the firm. Furthermore, not only production but also service are covered as tasks offshored, this survey has a wider coverage of offshoring than previous surveys.[10]

Although no quantitative data are available on how much each firm is offshoring, the survey distinguishes outsourcing vs. in-sourcing. "In-sourcing" is defined by offshoring to own offshore majority-owned subsidiaries, while "outsourcing" is defined as offshoring to all other independent legal entities, including local firms or subsidiaries owned by other multinationals. While 10% threshold is often used in FDI studies, the majority ownership is practically central and conceptually critical in discussing a controlling stake.[11] The comparison of capital intensity between in-sourcing firms and outsourcing firms is the main target of this paper.

The survey also has disaggregated information on the destination of offshoring. This paper identifies the following four regions: (a) China, (b) ASEAN, (c) North (U.S.A. and European countries), and (d) ROW (the rest of the world).[12] This disaggregation by geographical destinations will enable us to discuss the impacts of contracting environment on outsourcing decisions. While China and ASEAN are the two most popular South destinations for Japanese offshoring firms, the distinction of China is important in our context since many firms cite undeveloped legal system or unreliable law enforcement is the most serious business problem in China, not in ASEAN.[13]

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[10] The following eight categories of tasks are covered: (a) production of jigs or dies, (b) production of parts, components, or other intermediates, (c) final assembly or processing of final products, (d) R&D, (e) information services (e.g. software programming), (f) customer supports (e.g. call centers), (g) professional (legal, accounting, or financial) services, and (h) other tasks. Although they depend on input-output tables, Amiti and Wei (2005) examine imports of service inputs.

[11] Based on the Bureau of Economic Analysis data on U.S. FDI, Nunn and Trefler (2007) 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).

[12] Hong Kong and Taiwan are included in China. ASEAN is composed of 10 countries. India, Middle East, Latin America, and Australia are included in ROW, while Eastern Europe or Canada is categorized as a part of "North."

[13] The cost increase is the most serious for business in ASEAN, according to the surveys by public agencies, such as JETRO (Japan External Trade Organization)

2.2. Summary statistics

Table 1 summarizes the basic statistics of the surveyed firms. After excluding the firms with no responses or with no available data on capital, there remain 4,532 manufacturing firms in our sample.

This paper adopts the standard definitions for the key variables as follows. The capital intensity *K/L* is defined by the tangible fixed assets divided by the number of workers (regular employees). The R&D intensity is R&D expenditure divided by sales. The firm size is measured in terms of the number of workers. As a proxy for the human capital intensity, on the other hand, the wage bill share of skilled workers relative to unskilled workers has been frequently used, but this paper uses the per-worker wage because the survey contains no wage or employment data disaggregated by skills or educational attainments. Within the limit of our data availability, these four variables can be regarded as practical proxies for the headquarter intensity, which plays an important role in theoretical models of multinational firms. The firm-level data for these variables are derived from the national mandatory statistics.[14]

The averages as well as standard deviations are reported in Table 1 for each variable. The first column averages over all 4,532 firms, while the second column concentrates on the firms sourcing offshore.[15] Several noteworthy findings emerge from Table 1as follows.

First, merely around one out of five firms are active in offshoring. This low participation rate is in line with previous finding from a different source.[16] One possible interpretation could be non-negligible entry costs for offshore sourcing, as formalized by theoretical models (e.g.

14 The survey results are linked with *The Basic Survey of Business Structure and Activities* at the firm level.
15 The number of firms in the sample varies depending on the variables.
16 Tomiura (2007) reports that only 3% of the firms are outsourcing production offshore at 1998 among 118,300 surveyed firms, of which nearly 80% are with less than 50 employees.

Antràs and Helpman, 2004).

Second, the average offshoring firm is not capital-intensive compared with the average firm sourcing totally within the home country. This contrast may sound counter-intuitive, but the offshoring firms are composed of two distinct groups. As we will confirm in the later sections, while multinationals sourcing from own FDI subsidiaries are highly capital-intensive, the firms outsourcing to China turn out to be very labor-intensive. The overall average is inevitably affected by the latter, since more than half of the offshoring firms are outsourcing to China as will be reported.

Third, the offshoring firms tend to be larger in size and richer in human capital than the domestic firms. The gap is enormous in firm size, but is not necessarily statistically significant especially in human capital, given wide standard deviations. The average R&D-sales ratio of offshoring firm turns out to be not different from that of domestic firms, as labor-intensive outsourcing firms are likely to spend less on R&D.

The upper panel of Table 2 displays the share of in-sourcing firms and outsourcing firms based on the binary question. The sum of the eight cells in the table naturally exceeds 100 as some offshoring firms are procuring from multiple sources. Several points must be noted in this table. First, among various sourcing choices, more than half of the firms are involved in outsourcing to China. The prevalence of outsourcing to China among Japanese manufacturing firms is as expected, given the Japan-China differences in production costs and their geographical proximity. Second, China is the most attractive destination for Japanese offshoring, followed by ASEAN, which is in turn followed by North. This ordering should at least be partly influenced by inter-regional differences in production costs. Third, in every region, more firms are involved in outsourcing compared with in-sourcing.

We must note that more firms are active in outsourcing rather than in-sourcing even in

China, where contracting environment is supposed to be the least developed in our region disaggregation.[17] Although the primitive application of the transaction cost theory suggests inactive outsourcing in China compared with North, our firm-level data demonstrate that more firms are involved in outsourcing than in-sourcing in any region, including China. We need to explore plausible explanations other than those based on transaction costs.[18] In this regard, the theoretical prediction provided by Antràs and Helpman (2007) is clearly a promising candidate.

The lower panel of Table 2 disaggregates the firms sourcing in each region into the following three mutually-exclusive categories: (a) the firms engaged both in in-sourcing and outsourcing (*In & Out*), (b) the firms engaged in in-sourcing but not outsourcing (*In-only*), and (c) the firms engaged in outsourcing but not in-sourcing (*Out-only*).[19] *Out-only* is the most frequent choice in every region, followed by *In-only*, while *In & Out* is the least popular choice. The percentages in the table show that more than eighty percent of the firms choose in-sourcing or outsourcing but not both in any region. This result is in line with a related report from a different source; Feenstra and Hanson (2005) found that more than eighty percent of Chinese processing exports choose only one mode in their four categories of ownership/control regimes.[20]

Before discussing the factor intensity comparisons, it will be informative to compare industries in the offshore make-or-buy choice patterns. Table 3 presents the percentage of the firms involved in each sourcing type in each region across 24 two-digit industries. Cross-industry variations are evident in the table. In-sourcing is relatively often chosen in the

[17] This result is in line with the finding for Chinese pure-assembly processing exports by Feenstra and Hanson (2005); the share of local suppliers ("Chinese-owned factories") is dominant, and is nearly half even in less-developed northern or interior provinces.
[18] The invariance in the share of outsourcers across regions also contradicts with the argument that Chinese offshoring is distorted by FDI ownership regulation.
[19] As the percentage in the table is in the firms sourcing from each region, we cannot exclude that some firms may be in-sourcing from one region simultaneously outsourcing in another region.
[20] They distinguish foreign vs. Chinese in the ownership of the factory as well as in the control of input purchases at the product level.

transport equipment industry (e.g. automobile), while outsourcing is prevalent in the apparel. These differences across industries are generally consistent with our prior, and are also in line with the sectoral contrast in Chinese processing exports reported by Feenstra and Hanson (2005).[21]

3. Empirical results

3.1. Overall comparisons

Table 4 compares in-sourcing firms with outsourcing firms for each region in terms of capital intensity and other firm-level characteristics related with the headquarter intensity. The percentage difference in logarithm between in-sourcing firms and outsourcing firms is displayed. All the firms of which the respective data are available are averaged. Several findings from this table should be noted.

First, in-sourcing firms are on average more capital-intensive than outsourcing firms among offshoring firms. The gap between them is statistically significant at any conventional significance levels, and is substantial in any region, ranging from 29 to 58%. This confirms the theoretical prediction and previous sector-level evidence by Antràs (2003) and Yeaple (2006).

Second, the average offshore in-sourcing firms appear to have higher headquarter intensity compared with the average offshore outsourcing firms. While the gap tends to be narrower in average wage or R&D intensity, the gap in terms of the firm size is again sizable (37-107%). Although we must note the potential measurement errors in these proxies, the unanimous ordering is remarkable.[22]

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[21] They found that "foreign factory ownership and Chinese input control" (close to in-sourcing in our category) "is more common in high-value-added office machines than in low-value-added apparel" (p.758).

[22] While the gap in R&D is not statistically significant in any region, the gap in the firm size is significant in all regions at any conventional significance levels. For the human capital intensity, the gap is significant in ASEAN at 5% and weakly significant in North at 10%, but not significant in

Third, the premium of in-sourcing firms relative to outsourcing firms appears to be slimmer in South, especially in China, compared with North for all four variables in this table. In our sample, the average factor intensity of ASEAN turns out to be proximate to that of North, possibly due to the densely-developed production-procurement networks of Japanese multinationals in ASEAN. The North-China difference in *K/L* gap between in-sourcing firms and outsourcing firms will be further investigated later.

3.2. Controlling for size, industry or overlaps

While the results from the previous table are impressive, these results depending on the overall means should be interpreted with caution. For example, large-sized firms tend to be more capital-intensive, presumably often have stronger headquarter functions, and thus prefer in-sourcing when they are offshoring. Furthermore, as reported in Table 2, some firms are simultaneously sourcing from independent suppliers as well as own FDI subsidiaries in the same region. This overlap may blur the comparison of in-sourcing firms vs. outsourcing firms.

Table 5 summarizes the results after controlling for firm size or industry. We focus on the capital-labor ratio in this table. The first row is on the overall mean as in Table 4 for the comparison purpose. The mean of respective firm-size bin is subtracted in the second row, while the mean of respective 2-digit industry is subtracted in the third row.[23] As an additional robustness check, the last row concentrates on the comparison of *In-only* firms with *Out-only* firms by excluding *In & Out* firms.

Table 5 confirms that in-sourcing firms are substantially more capital-intensive than outsourcing firms in any region and that the *K/L* gap between them appears to be wider in North,

China or ROW.

[23] Firms are divided into 14 firm-size bins, while there are 24 two-digit industries. The firm-size thresholds and the industry list are available upon request.

even if we adjust differences due to firm size or industry or if we exclude firms simultaneously engaged in both in-sourcing and outsourcing. Hence, the principal finding in the previous section appears robust.

Another important finding from the same table is on the absolute capital intensity level. Although we have focused on the K/L gap between in-sourcing and outsourcing, Table 5 also reports the average capital-labor ratio of in-sourcing firms and that of outsourcing firms respectively. Several regularities should be noteworthy.

First, the average capital intensity is higher in North than in China, both for in-sourcing firms and outsourcing firms. This difference in average capital intensity may be partly influenced by obvious North-South difference in factor abundance.

Second, however, the China-North gap appears to be particularly evident in the in-sourcing firms compared with the gap in outsourcing firms. The firms sourcing internally from FDI subsidiaries in North are on average much more capital-intensive than those in China, while the China-North gap seems relatively narrower among outsourcing firms.[24] One possible interpretation could be that firms with *K/L* lower than certain threshold are likely to depend on inputs readily available at marketplace rather than to seek specialized inputs, as formalized in Antràs and Helpman (2004). As relatively labor-intensive firms are likely to choose China as their outsourcing destinations under the clear North-South contrast in factor abundance, the capital intensity of the firms outsourcing to China may be constrained from below by the threshold. Other interpretations based on cross-country differences in contracting institutions will be discussed later.

[24] Even when we exclude all the firms sourcing from multiple regions, the difference is again more evident on the in-sourcing firms in China (the average ln*K/L* as shown in Table 5 is 0.028 for the *In-only* firms sourcing only in China, –0.274 for the *Out-only* firms sourcing only in China).

3.3 Distributions

While the previous investigations depend solely on average values, we cannot neglect the inter-firm distribution among the firms choosing the same sourcing option. Figure 1 displays the cumulative distributions with logarithm capital intensity on the horizontal axis. The upper panel compares *In-only* firms with *Out-only* firms in offshoring to China, while the lower panel compares those in the case of North. These graphs can be regarded as an empirical counterpart of cumulative density function, and reveals rich distributional information, previously unavailable in average comparisons.

First, as demonstrated in the lower panel of Figure 1, among the firm offshoring to North, the distribution of in-sourcing firms is located evidently to the right of that of outsourcing firms. In the upper panel on China, on the other hand, the distance between the two curves is obviously narrower. The maximal vertical difference between the two cumulative distribution curves is 0.231 in North, but merely 0.127 in China.[25] This result clearly confirms our previous finding based on the comparison of averages.

Second, however, the difference between China and North appears to be largely influenced by the differently located distribution curves of in-sourcing firms. Firms sourcing from FDI subsidiaries in North are predominantly distributed over more capital-intensive ranges compared with firms in-sourcing in China. On the other hand, the locations of distribution curves do not vary much between China and North when we compare outsourcing firms. This finding is in line with the previous results from Table 5.

Next, Table 6 presents the percentages of outsourcing firms relative to the total number of offshoring firms within each capital intensity intervals in order to investigate how the frequency

[25] Since the number of offshoring firms is much larger in China, the Kolmogorov-Smirnov stochastic dominance statistics indicates the gap is statistically significant in both regions. However, in China, for the range of upper 40%, two curves are within a range of 5% errors.

of outsourcing relative to in-sourcing changes with the capital-labor ratio. Several points should be noted.

First, the share of outsourcing firms relative to in-sourcing firms declines sharply as the capital intensity rises, except in China, where the change is much milder. The make-or-buy decision in China appears to be less sensitive to the capital-labor ratio. While Antràs (2003) assumes that investment cost sharing is easier for capital than labor, the incomplete contract problems may be severe also for capital in China.[26]

Second, the share of in-sourcing firms tends to be higher in China especially over labor-intensive ranges. In other words, the firms with relatively wide range of capital intensity choose to integrate in China. One possible interpretation may be the internalization forced by higher transaction costs in China.

Third, however, the share of outsourcing firms in China is as high as that in North for capital-intensive ranges. Relatively capital-intensive firms choose to outsource in China, which is in clear contradiction with the transaction cost story. Fixed entry costs for offshoring (minimum threshold *K/L*) cannot explain this observation either. Possible interpretations will be discussed in the next section.

3.4. Interpretations and discussions

This section discusses possible interpretations of our principal findings, especially the cross-regional variations. As has been reported, the capital-intensity difference between in-sourcing firms vs. outsourcing firms appears to be narrower in China compared with that in North. This observation is robust even after firm size or industry is controlled for. We explore

[26] This also suggests that, even if labor-intensive firms are sorted to China based on factor abundance differences, these firms are not necessarily choose outsourcing because the make-or-buy decision is insensitive to *K/L* in China. Therefore, the high share of outsourcers in China is not explained by the North-South difference in factor abundance.

plausible economic interpretations.

The most straightforward interpretation is given by the primitive application of the transaction cost economics as follows. Higher transaction costs in China compared with North lead more firms to source within the boundary of multinational corporations in order to circumvent costly arm's-length transactions at marketplace. As firms with wider ranges of capital intensities (including relatively low *K/L*) choose to integrate, the average capital-labor ratio of in-sourcing firms in China should be lower than that in North.

Some of the findings in this paper are consistent with this transaction cost story. Tables 4 and 5 confirm that the average capital intensity of in-sourcing firms is lower in China than that in North. The visual inspection of the two cumulative distribution curves in Figure 1 confirms this difference, and reveals that more firms choose to integrate in China for any relevant *K/L* over the entire distribution. Besides, Table 6 shows that the firms within the two lowest capital-intensity intervals always to choose outsourcing in North but around one-third of them choose to integrate in China. All these results are favorable to the interpretations based on cross-regional difference in transaction costs.

However, some other findings are *not* consistent with the interpretation based on the simple transaction cost story. If transaction costs are higher in China, the overall share of outsourcing firms relative to in-sourcing firms should be lower in China. Table 2 contradicts with this prediction, as the share of outsourcing firms in all offshoring firms does not noticeably vary across regions (51% in China, and 53% in North). Furthermore, Table 6 demonstrates that the share of outsourcing firms in China (44%) is as high as in North (47%) among the offshoring firms with the highest *K/L* interval. The finding of active outsourcing in China by capital-intensive firms is rather consistent with the theoretical prediction by Antràs and Helpman (2007). In their model, the contract incompleteness problem particularly serious for

labor provided by suppliers should promote outsourcing in order to give stronger incentives to suppliers. Another possible interpretation is that some non-contractible inputs, which are not captured by *K* or *L* in our data, play an important role in China.[27] We cannot reject alternative hypotheses at this moment, but at least some mechanisms working in the opposite direction against the simple transaction cost story should be effective.

As a closely related empirical study, Nunn and Trefler (2007), based on the product-country level U.S. trade data, found that the share of intra-firm trade is lower in products/countries where contracts are less complete among capital-intensive products. Although intra-firm trade data include purchases of standardized goods and are inevitably affected by within-industry firm heterogeneity, their results are consistent with our firm-level finding (active outsourcing by capital-intensive firms in China).

In sum, the relationship between capital intensity and the firm's choice of in-sourcing over outsourcing is confirmed positive for firms offshoring to North (also ASEAN to lesser extent), but the relation becomes somewhat blurred among firms offshoring to China. While some labor-intensive firms internalize possibly due to high transaction costs in China, some capital-intensive firms outsource, possibly to give sufficient incentive to local suppliers to handle incomplete contract problems associated with labor provided locally by suppliers in China, as predicted by Antràs and Helpman (2007). While we cannot reject alternative hypotheses within our descriptive statistics derived from a one-shot survey, the cross-regional variations in the relationship between the make-or-buy decision and the firm's capital intensity is more nuanced than simply implied by the North-South gap in transaction cost levels.

[27] Many firms list up the problem of bill collection as the most serious business troubles in China along with the problems of legal system (including intellectual property right protection), according to the JETRO survey. This suggests the critical role of intermediation activities with local firms.

4. Concluding remarks

This paper empirically documents how the offshore make-or-buy choice is related with the firm's factor intensity based on a firm-level data set covering a major portion of large- and medium-sized firms across all manufacturing industries in Japan. Higher capital intensity of in-sourcing firms relative to outsourcing firms is observed in any region, even after industry or firm-size is controlled for, confirming previously established results.

On the cross-regional comparisons, this paper finds the invariance in the share of outsourcing firms in offshoring firms across regions and the *K/L* gap between in-sourcing firms and outsourcing firms narrower in China than in North. These findings contradict with the simple transaction cost interpretation and rather suggest that undeveloped contractual institutions in China relative to North do not necessarily lead to the prevalence of in-sourcing over outsourcing, which could be consistent with Antràs and Helpman (2007).

While this paper reports informative firm-level observations, several important extensions remain. For example, it will be difficult but desirable to find a proxy of inputs provided by suppliers, especially intermediation activities for local business interface in China. Structural estimations based on longitudinal data will be useful to discriminate among alternative theoretical hypotheses. Fruitful findings will emerge in future independent studies if improvements such as these are accomplished.

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Table 1 Summary statistics

	All firms	Offshoring firms	S. D.
Number of firms	4,532	947	-----
Firm size	369	817	1,581
Capital intensity	0.20	0.05	1.41
Human capital intensity	1.50	1.58	0.45
R&D intensity	0.09	0.08	1.27

Notes: Firms without *K* data are excluded. Capital intensity and human capital intensity are in logarithms. Standard deviations in all firms are shown in the last column S.D.

Table 2 Sourcing choices

	In-sourcing	Outsourcing
China	39.40	54.25
ASEAN	18.73	21.96
North	9.58	13.89
ROW	6.24	17.22

Notes: Shown is the percentage of firms among all the offshoring firms. As some of the firms are sourcing from multiple sources, the sum over the 8 cells exceeds 100. Firms without *K* data are excluded.

	In & Out	In only	Out only
China	17.26	31.92	50.82
ASEAN	11.31	39.76	48.93
North	15.91	30.68	53.41
ROW	4.62	21.54	73.85

Notes: Shown is the percentage of firms among the firms sourcing from the respective region. Each row sums to 100. Firms without *K* data are excluded.

Table 3 Cross-industry variations

	C.I.	C.O.	A.I.	A.O.	N.I.	N.O.	R.I.	R.O.	#
Food manufacturing	20.31	42.19	3.13	10.94	3.13	6.25	3.13	10.94	463
Beverage, tobacco & feeds	30.00	20.00	0.00	20.00	10.00	10.00	0.00	10.00	84
Textiles	30.00	35.00	10.00	15.00	0.00	0.00	10.00	0.00	113
Apparel & textile products	24.56	43.86	3.51	19.30	0.00	7.02	0.00	1.75	84
Timber & wooden products	22.22	44.44	0.00	11.11	0.00	22.22	0.00	0.00	52
Furniture & fixture	8.00	44.00	8.00	24.00	0.00	8.00	4.00	4.00	60
Paper & pulp products	25.00	37.50	6.25	6.25	6.25	6.25	0.00	12.50	162
Printing & publishing	13.33	60.00	0.00	6.67	6.67	6.67	0.00	6.67	219
Chemical products	17.50	22.50	10.00	10.00	10.00	15.83	5.00	9.17	310
Petroleum & coal products	0.00	37.50	12.50	25.00	0.00	25.00	0.00	0.00	17
Plastic products	31.33	34.94	10.84	12.05	1.20	4.82	0.00	4.82	239
Rubber products	31.43	25.71	11.43	17.14	5.71	0.00	5.71	2.86	48
Leather& fur products	12.50	50.00	0.00	25.00	0.00	0.00	0.00	12.50	10
Ceramic, stone & clay	27.03	27.03	24.32	8.11	2.70	5.41	2.70	2.70	219
Iron & steel	23.81	38.10	0.00	14.29	4.76	0.00	4.76	14.29	167
Nonferrous metals	25.00	19.44	25.00	11.11	5.56	5.56	5.56	2.78	109
Metal products	20.00	40.00	4.35	8.70	3.48	8.70	3.48	11.30	384
General machinery	18.79	26.97	9.09	10.30	7.27	9.39	3.33	14.85	539
Electric machinery	25.95	29.19	7.03	13.51	5.41	6.49	4.32	8.11	316
Info-communication mach.	16.28	32.56	11.63	12.79	3.49	6.98	5.81	10.47	112
Electronic parts/devices	22.31	25.62	18.18	18.18	3.31	2.48	0.00	9.92	217
Transport equipment	21.30	21.30	17.75	9.47	7.10	8.28	7.10	7.69	384
Precision instrument	26.09	23.19	7.25	8.70	7.25	11.59	1.45	14.49	137
Miscellaneous	20.00	35.56	13.33	13.33	6.67	2.22	0.00	8.89	87

Notes: Shown are the percentages of firms among all offshoring firms in each industry, while the last column # displays the total number of firms in each industry. The destination China, ASEAN, North, and ROW are abbreviated by C, A, N, and R, while I and O denote in-sourcing and outsourcing, respectively.

Table 4 In-sourcing firms relative to outsourcing firms (overall comparisons)

	China	*ASEAN*	*North*	*ROW*
Capital intensity	28.74	42.22	48.53	58.36
Human capital intensity	4.11	8.87	10.39	10.48
R&D intensity	1.88	12.03	23.94	11.69
Firm size	37.22	63.75	82.34	106.64

Notes: The percentage logarithm difference is shown. Firms with respective data available are averaged.

Table 5 Capital intensity comparisons

	China	*ASEAN*	*North*	*ROW*
Overall means	0.17 / –0.12	0.55 / 0.13	0.64 / 0.16	0.74 / 0.16
Controlling for size	–0.22 / –0.42	0.04 / –0.25	0.01 / –0.29	0.18 / –0.20
Controlling for industry	0.19 / –0.05	0.42 / 0.21	0.57 / 0.13	0.68 / 0.20
Excluding overlaps	0.25 / –0.17	0.52 / –0.02	0.56 / –0.07	0.68 / –0.02

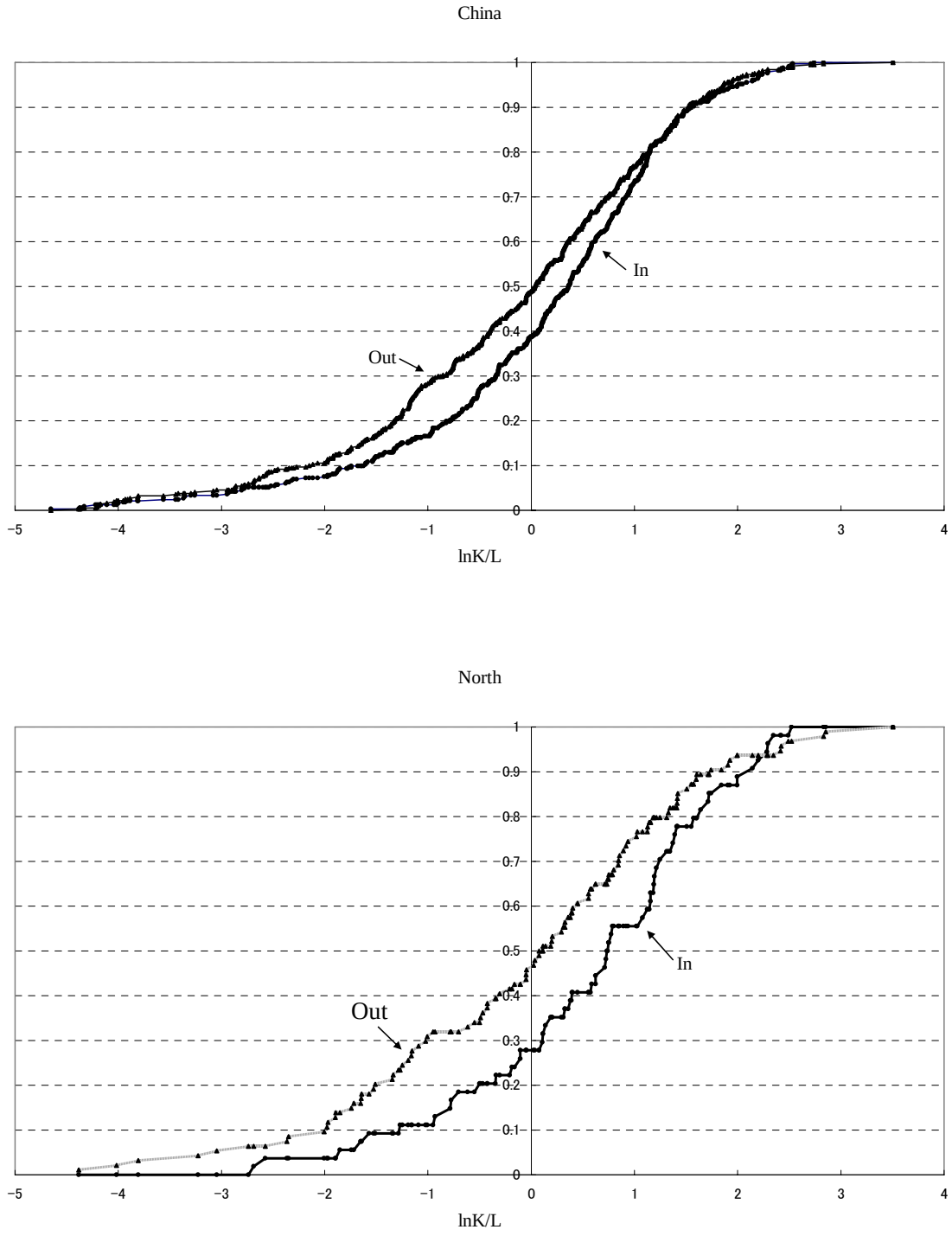
Notes: The average logarithm capital-labor ratio is shown for in-sourcing firms on the left, outsourcing firms on the right in each cell. Firms without *K* data are excluded.

Table 6 Percentages of outsourcing firms within capital-intensity intervals

ln*K/L*	*China*	*ASEAN*	*North*	*ROW*
–3.520 < < –2.634	63.64	100.00	100.00	100.00
< –1.747	68.18	80.00	100.00	100.00
< –0.861	69.70	90.91	71.43	83.33
< 0.025	62.71	50.00	75.00	80.00
< 0.912	68.25	57.58	66.67	86.96
< 1.798	57.00	58.02	61.70	84.48
< 2.685	50.80	52.63	55.22	63.33
< 3.571	58.91	49.28	51.28	63.89
< 4.457	43.75	26.32	47.06	60.00

Notes: Shown are the percentages of outsourcing firms in the total number of firms offshoring to the respective region within each capital-labor ratio interval. The top and bottom *K/L* intervals are omitted.

Figure 1 Cumulative distributions



Notes: The vertical axis measures the cumulative share of firms. *In-only* firms and *Out-only* firms are compared in China (upper panel) and in North (lower panel).