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No. 9029

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*INTERNATIONAL TRADE AND
REGIONAL ECONOMICS*



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ABSTRACT

Language, Ethnicity and Intra-firm Trade*

We study the significant variation in intrafirm versus arm's-length trade with micro data. Exploiting the fact that Korean is an uncommon second language and that Korean culture is relatively homogenous, we show how intrafirm sourcing by South Korean affiliates abroad increases with their share of South Korean employees. This positive association is pervasive and nontrivial. Parsing the data more carefully, we find that South Korean employees are primarily high skilled, and that their presence matters for internal trade, not for trade with South Korea per se. The share of South Koreans is also higher in affiliates from nonroutine sectors in host countries that are culturally distant from South Korea. Our empirical evidence thus supports especially Costinot, Oldenski and Rauch (2011)'s view of multinational in-house production for nonroutine activities that require adaptation and internal communication.

JEL Classification: F1

Keywords: intra-firm trade and multinationals

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*The authors benefitted from helpful suggestions by Melissa Thomas-Hunt, Kristin Behfar, Alan Beckenstein, John McLaren, Ariell Reshef, James Harrigan, Daniel Millimet, and Pravin Krishna (who saw an earlier version of the paper). All remaining errors are ours. Peter Debaere received research funds from the Darden Foundation.

Submitted 15 June 2012

1 Introduction

A common language and common ethnic background are known to facilitate transactions between countries. Language and ethnic differences, on the other hand, insert transaction and information costs into international exchanges, which make them more difficult. Ample evidence for foreign direct investment, international trade and migration flows between countries illustrate such regularities.¹ In this paper, we study the multinational corporation that is an active player in many international transactions. We use language and ethnicity to better understand the boundaries of the multinational and the tradeoffs that it faces between its in-house and arm's-length transactions.

Multinationals and foreign direct investment are arguably characteristic features of the current wave of globalization.² Foreign direct investment flows have been substantial and multinationals employ ever more people. In Europe, for example, every fifth manufacturing worker is employed by a foreign-owned multinational, and so is every seventh in the U.S.³ Multinationals also mediate a major portion of international trade: For the U.S., for example, exports by multinationals account for more than 50% of total exports.⁴ In spite of multinationals' prominence, understanding their complex international organization is still a challenge.⁵ In this paper, we use a unique micro dataset for South Korean multinationals to investigate multinational transactions from the perspective of the affiliates that are spread around the globe. We exploit the fact that Korean is the language of a well-defined, relatively homogenous ethnic community that is not commonly studied

¹In gravity equations that explain international trade flows, language differences often proxy for frictions or barriers; see Bergstrand and Egger (2011) for a survey. Rauch (2001) reviews social networks and how they facilitate international transactions. As he points out, empirical work often focuses on ethnic networks, not because they are the only important ones, but rather because many other types of networks are hard to observe or measure; see also Rauch and Trindade (2002). Language also play a role in migration. The ability to speak English makes integration into the U.S. labor market easier and allows immigrants to perform more high level tasks; see Peri and Sparber (2009). Several papers use ethnic and national links as proxies for information or transaction costs in the literature on foreign direct investment as well; see Head, Ries and Swenson (1995) and Debaere, Lee and Paik (2010)

²See Bordo, Eichengreen and Irwin (1999).

³Navaretti and Venables (2004).

⁴See Slaughter (2000).

⁵See Helpman (2006). Hanson, Mataloni and Slaughter (2001) early on pointed out the significant variation in expansion strategies beyond those of the traditional theories. Antras and Rossi-Hansberg (2009) more broadly call for integrating international economics and organizational economics.

and spoken as a second language. We find that the share of (mostly high skilled) South Koreans that are employed in affiliates abroad consistently predicts the extent to which affiliates source intrafirm versus at arm’s length, whereas it does not help predicting an affiliate’s overall trade with South Korea. This evidence links South Korean workers to within-network communication. In addition, our results indicate that more South Korean workers are employed abroad by South Korean affiliates in especially less routine sectors and in environments in which communications within a South Korean network should be more challenging (i.e, in host countries that are culturally most different from South Korea). We argue that this novel evidence supports new interpretations of multinationals and intrafirm trade from the point of view of incomplete contracts. In particular, it is consistent with the view that multinationals internalize problem-solving tasks that require good internal communication and that are not easily described by contracts; see Costinot et al. (2011). We can also relate our evidence to theories about language and the boundaries of the firm; see Cremer, Garicano and Prat (2007).

With an unpublished benchmark dataset for South Korean multinationals that links 850 affiliates from all over the world with 500 parents in South Korea, we study the variation in intrafirm vs. arm’s-length sourcing of affiliates. Micro level data on intrafirm trade challenge the commonly used distinction between horizontal and vertical multinational corporations that has defined our understanding of multinational transactions for quite some time.⁶ If multinationals only went abroad to be close to the customers and to save on transportation costs, we and Feinberg and Keane (2006) should hardly observe the extensive intrafirm goods flows from parent to affiliate and back. Similarly, if multinationals that fragment their production across the globe were only interested in sourcing from low wage countries, we should mainly see flows from the affiliate to the parent.⁷ Still, there are major intrafirm trade flows in the other direction.

Our micro-level analysis of intrafirm trade complements the emerging analyses of intrafirm trade at the more aggregate product or sector level. Antras (2003) studies the

⁶Markusen (1984) and Brainard (1997) are classic examples of the horizontal multinationals, whereas Helpman (1984) illustrates vertical multinationals.

⁷Feinberg and Keane (2006) study with firm-level data the bilateral interactions between U.S. multinationals and their Canadian affiliates. They use a full-fledged structural model for their analysis.

cross-country and cross-sector variation in the share of intrafirm trade as a fraction of overall trade, and so do the studies of Bernard, Jensen, Redding and Schott (2010), Nunn and Trefler (2008), and Costinot et al. (2011). Those papers emphasize the difference between multinational and stand-alone firms at the sector/goods level. They use country- and sector/goods level characteristics to explain the tradeoff between intrafirm and arm’s length trade.⁸ Instead, we study the tradeoff between intrafirm and arm’s-length transactions at the level of the affiliate and explicitly allow for variation within sectors. This approach is warranted by the data themselves. It is not the case that all purchases of affiliates are intrafirm transactions, as is sometimes implicitly assumed. As a matter of fact, on average about 53% of affiliates’ total purchases are *not* intrafirm. Moreover, there is significant variation in intrafirm transactions across affiliates. An additional benefit of our micro data is that we can include the international as well as the domestic intrafirm transactions. Like Feinberg and Keane (2006), our study is one of the few that has actual data on the intrafirm flows at the affiliate level.⁹

Our finding also relates to a growing business literature that recognizes the challenges of dealing with cultural and language differences within multinationals; see Ghemawat (2011).¹⁰ Ghemawat (2011) estimates that about 80% of General Electric’s top managers are Americans even though GE earns about half of its revenue abroad and even though it should benefit from English as a popular second language. Also South Korean companies seem acutely aware of the language and cultural challenges that they face for internal communication. They sometimes rely on the Korean expatriate community abroad to resolve the tension between “localization” (affiliate abroad) and “global integration” (headquar-

⁸See also Fernandes and Tang (2010) who focus on Chinese export processing at the 6-digit level. Feenstra and Hanson (2005) also study processing from China and questions of control and ownership of the Chinese plant and the intermediate goods with HS 8-digit data.

⁹Kohler and Smolka (2011) and Corcos, Irac, Mion and Verdier (2009) were among the first to use firm-level data for both multinationals and stand-alone firms and they focus on explaining the different modes of operation of firms. Kohler and Smolka (2011) have qualitative information on the mode of sourcing (arm’s length, domestic or international intrafirm) for Spanish firms which they link to firm productivity. Similarly, Corcos et al. (2009) relate whether or not French firms import intrafirm to firm characteristics.

¹⁰Govindarajan and Gupta (2001) report that executives view overcoming internal communication barriers and creating trust a key challenge in building a global organization. Ghemawat (2001) emphasizes the importance of distance, including cultural distance. Mor Barak (2005) surveys a variety of ways in which diversity will affect the workplace in a global context, emphasizing beyond the language barriers, the importance of cultural differences for communication.

ters), see Kang (2009).¹¹

In the next section we explicitly position our investigation to Costinot et al. (2011). In section 3, we describe the data that we use. In sections 4 and 5, we discuss our estimation results and conclude, respectively.

2 Investigating Costinot et al. (2011)

The literature on intrafirm trade has incomplete contracts at its core. Ethier (1986) and Markusen (1995) argue that trade secrets and intellectual property are more easily protected if the entire production process is kept within the firm. More recently, the focus has been on noncontractual relationship-specific costs that the headquarters and the supplier have to incur as in Antras (2003), Antras and Helpman (2004), Antras and Helpman (2008) and Costinot et al. (2011).

The stylized framework of Costinot et al. (2011) is relatively straightforward and easiest to apply to our analysis. A final goods producer can choose between executing tasks in-house and outsourcing tasks. Costinot et al. (2011) hypothesize that when problems arise ex post that could not be fully specified in a contract between supplier and headquarters, both parties have to adapt, which is costly. Adaptation is most efficient when it takes place within the firm because there is an internal communication structure in place within the firm and there is less room for opportunistic behavior. The premise of the analysis is that problems that require adaptation on both ends are more likely to arise the less routine the tasks that have to be executed are. Therefore, integration and intrafirm trade should be most prevalent; the less routine tasks are.

Costinot et al. (2011) employ sector-level data for U.S. imports that can be broken down into intrafirm vs. arm's-length transactions, to test their hypothesis. There is no reason, however, why the empirical analysis should be restricted to the sector level, or why the focus should only be on international transactions. We apply the basic idea of Costinot

¹¹See also Khanna and Song (2011) for a description of Samsung's effort to increase language and cultural understanding within the multinational and especially for its MBAs and PhDs. Evidence for German multinationals points in the same direction: Chang (2004) reports that German multinationals rely on German expatriates in its South Korean affiliates to transfer know-how between the German headquarters and the Korean affiliate.

et al. (2011) at the micro level and to *all* (domestic and foreign) purchases of the affiliates of South Korean multinationals abroad. We investigate whether the share of intrafirm sourcing as a fraction of total purchases increases as nonroutine problems become more likely. A particular challenge we face is to provide affiliate-level measures that capture the likelihood that nonroutine tasks and problem solving are involved.

We rely on a measure of internal communication and the extent to which an affiliate facilitates the communication within the multinational. In particular, we use the share of South Korean workers in the total labor force of the affiliates that are spread across the globe. In doing so, we follow through on the link that Costinot et al. (2011) established between their analysis, which identifies internal communications as an important way of minimizing adaptation costs, and Cremer et al. (2007). Cremer et al. (2007) study language and the theory of the firm. They argue that there is a benefit of developing a common, specialized language to facilitate communication, especially in a complex environment. At the same time, developing such a language may make communication harder with those who do not share this language. Therefore, a specialized language should only be applied when it ensures most gains: in a complex environment with high skilled labor. Commenting on Cremer et al. (2007), Costinot et al. (2011) note that: “*Building up (a) communications infrastructure is a superfluous expense when a standard contract can convey all necessary information to a supplier ex ante, but if problems arise ex post that a contract does not cover, a common language that headquarters and the supplier share will reduce the cost of the communication necessary to resolve them.*” (p. 300). We apply this basic idea to communication in Korean.

Some 80 million people speak Korean. Predominantly, Korean is spoken in South Korea, North Korea and in some pockets of China. We hypothesize that employing South Koreans in affiliates abroad should facilitate the communication between the affiliate, the South Korean headquarters and the other affiliates, especially since Korean is not a very common second language and Korea is culturally fairly homogenous.¹² In very influential books, Hofstede (1980) and Hofstede, Hofstede and Minkov (1997) found that differences in

¹²On Korean as a second language, see <http://www.nationsonline.org/one-world/most-spoken-languages.htm>, which draws on Lewis (2005). See also Weber (1997).

national cultures vary substantially along four dimensions (i.e, power distance, uncertainty avoidance, masculinity/femininity, and individualism). Hofstede created ordinal scales for countries for each of these dimensions based on a standardized factor analysis of questionnaires administered between 1968 and 1972 to 88,000 national employees in more than 40 overseas subsidiaries of a major American corporation. Most relevant for our analysis, Korea ranked 43rd (out of 50), implying that Korea is rather culturally different from other countries. At the same time, employing South Koreans locally is costly, as it complicates communication within the affiliate, inserting cultural and language differences in communication with the locals.¹³ Accordingly, it is difficult to imagine that multinationals and affiliates would incur the cost of employing South Koreans abroad when production would involve strictly routine operations that can easily be covered by standard contracts. We therefore hypothesize that more South Korean employees will be active in the affiliates when it is increasingly likely that noncontractual issues may arise. In other words, more South Korean employees are needed especially in less routine activities and in culturally different environments from South Korea.

3 The Data

Our dataset is one of the few that directly observes intrafirm vs. arm's-length transactions at the micro level. We draw on unpublished data from the South Korean Export Import (EXIM) Bank. Since 2000, the EXIM Bank has been pursuing a benchmark survey of South Korean multinational affiliates abroad. The EXIM Bank has included increasingly more firms in the survey, starting with about 100 parents and their 200 foreign affiliates in 2000. The number of firms and affiliates that are consistently surveyed each year varies too

¹³In a widely cited review paper of 40 years of research on diversity in organizations, Williams and O'Reilly (1998) conclude that ethnic diversity typically has a negative effect on social integration, communication and conflict and the ability of groups to function effectively over time. Alternatively, within culturally homogeneous groups, members will communicate more and also in more varied ways. With the exception of some laboratory experiments, most research strongly supports this conclusion. Applied to our research question, this evidence suggests that the communication between South Korean employees and others may be more difficult; at the same time, one would expect easier and more sophisticated communication among the South Koreans in the affiliate and in the parents. For a reference about the challenges of dealing with East-West cultural differences in the workplace, see Sanchez-Burks, Lee, Choi, Nisbett, Zhao and Jasook (2003).

much to make a panel analysis meaningful. We therefore focus on the cross-section of 2006, which is the last year of the survey. We concentrate on manufacturing, which has more complete data than services. Manufacturing takes 65% of the data.¹⁴ Note also that it is easier to identify the parents for manufacturing and link them with the KIS datasets that contain parent information; see below. After dropping affiliates with incomplete purchase and employment data, we are left with 500 parents and 850 foreign affiliates.

The dataset provides the general information for the foreign affiliates such as their location, industry, sales, purchases, and employment numbers. Critical for our empirical analysis, the dataset includes information on the total employment of each affiliate as well as the number of South Korean employees, which lets us construct the share of Korean employees. The dataset also includes quite detailed information on the intrafirm trade values. In particular, the affiliate reports its total purchases that are composed of six items: purchases from the parent, purchases from other Korean firms, purchases from other affiliates sharing the same parent in the host country, purchases from others in the host country, purchases from other affiliates sharing the same parent abroad, and purchases from others abroad. It should be clear that the purchases from the parent and from the other affiliates in the host country or abroad comprise intrafirm sourcing. The rest constitute arm's-length sourcing.

The EXIM survey dataset does not provide information on the parent of the South Korean multinational. It only provides the parent firm identification number. We therefore link the data from the EXIM Bank with the Korean Information System (KIS) database of Korea Investors Services Co., Ltd. This latter, extensive dataset contains the balance sheets and the profit and loss statements of most South Korean firms that are registered as corporations in South Korea. Most of these corporations are listed on the Korea Stock Exchange. After merging both KIS and EXIM, we draw on the KIS data for information on the parents' sales and employment as well as on their capital stock. Obviously, the multinationals of the EXIM benchmark survey are but a sample of the overall population

¹⁴The survey reports representative affiliate data that are not exhaustive. It, for example, does not include the data of all foreign affiliates belonging to a parent firm, which is why we take the affiliate as the unit of analysis and do not aggregate by parent firm.

of South Korean multinationals. For reference: in 2006, the 500 parents we consider were responsible for about 50% of South Korea's total outward foreign direct investment.

Table 1 provides information about average intrafirm sourcing. The first column presents the affiliate's total purchases from related parties (including the parent) as a fraction of its total (intrafirm and arm's-length, domestic and international) purchases. The second column focuses on intrafirm purchases from the parent. The third column provides the share of Korean workers in an affiliate's work force. Table 1 also breaks the data down according to the regions and sectors in which the affiliates are active. The last column provides the number of affiliates that are active in each region and in each sector. As one can see, the majority of affiliates are located in Asia, particularly in China. Indeed in recent years, there has been a surge of South Korean multinational activity in China. The U.S. (North America) and Europe also account for a significant portion of the affiliate locations. As for the sectors in which the affiliates are active, they are clearly dominated by electronics and vehicles. Note that the affiliates and parents are classified by the two-digit Korean Standard Industrial Classification that is closely related to the Standard Industrial Classification (SIC) or the North America Industry Classification System.

By construction, the average share of intrafirm purchases are less than 1. On average, the intrafirm purchases coming directly from the parent account for 35% of the affiliates' total purchases, and the sum of all intrafirm purchases (including the other affiliates) accounts for 47%. The data in the second and third columns clearly illustrate that it is not the case that all multinational trade is intrafirm trade as is sometimes assumed in the theory or implied by empirical literature that studies the variation of intrafirm trade to overall trade at the sector level. From our perspective, the significant variation in intrafirm vs. arm's-length transactions at the affiliate level warrants an analysis that tries to identify the specific characteristics at the affiliate and multinational level that can explain this variation.

Affiliates are part of a production network, as the work of Chen (2011) has shown. Table 2 illustrates the variation in the operations of affiliates. Some, but not all, affiliates export to the parent company. Others import from the parent and/or from other affiliates,

and most affiliates source from nonaffiliated parties at the same time. As is clear, only a minority of firms would fit the simple scheme of horizontal vs. vertical multinational that was quite prominent not so long ago. In light of the common take on horizontal multinationals that primarily seek to supply the local market, there should be hardly any transactions between parent and affiliate. It turns out, however, that only 43% of the affiliates do not export back to the parent and only 30% of the affiliates do not import from the parent. As for vertical specialization, which should be geared toward sourcing especially from low wage countries, 43% of the affiliates do not export back to the parent. In line with a network view of multinationals, it is quite possible that how much affiliates source from the South Korean parents or from all affiliates combined could well be affected by the transactions with the other affiliates that are part of a multinational's network.

Table 3 presents estimates from a simple regression of the share of intrafirm imports that come from the parent in an affiliate's total purchases on a set of dummies that specify the network. Note that we include a battery of country and sector dummies in the regression. Some results are quite intuitive and consistent with what one would expect. Affiliates that source more from affiliates abroad or domestically will source less from the parent.¹⁵ Some of the other correlations are quite suggestive. Some time ago, Yi (2003) launched the hypothesis that intrafirm trade was perhaps an important factor to consider when explaining the growth of international trade. Interestingly enough, the dummy on whether an affiliate exports to the parent relates to the extent of imports from the parent in a nonnegligible way. Indeed, the positive and significant coefficient suggests the importance of back-and-forth trade between parents and affiliates. Finally, we find that sales to local affiliates increase the share of imports from the parent, whereas sales to the affiliates abroad (even though not significant) would tend to decrease the imports from the parent. These results are potentially suggestive about the role of the affiliate as an export platform. Table 3 also contains the regression results for the affiliate's total (parent plus affiliate) sourcing, which are largely consistent with those for sourcing from the parent.¹⁶

¹⁵To make sure, this pattern is not just an accounting regularity since purchases also includes purchases from local unaffiliated firms.

¹⁶We do not include dummies for imports from different types of affiliates in this regression as they are included in the left-hand variable.

In this paper, we relate the share of South Korean workers to the literature on tasks in order to explain the variation in the extent of intrafirm sourcing. Before focusing on the firm-level data we have, we want to point out some sector-level evidence that supports for South Korea the hypothesis that less routine tasks are more likely to be associated with intrafirm trade than routine tasks. Costinot et al. (2011) perform for a whole range of countries and 77 sectors a pairwise comparison of sectors' ratio of intrafirm imports over total imports with a measure of routineness for these sectors. They report for South Korea a (significant) 59% correspondence in signs, which supports the notion that less routine sectors will have a higher share of intrafirm imports than routine sectors.

Of primary importance for our analysis is the share of South Korean employees as a fraction of the affiliates' total employment. As the first line of Table 1 indicates, about 6% of the affiliates' total labor force is Korean. We do not have firm-level measures that assess the extent to which tasks are routine, but we can relate the sectoral routine measures mentioned above with the South Korean share as in Table 4. In order to do this, we aggregate the measures from Costinot et al. (2011) up to the 19 sectors in which our firm-level data are categorized. The share of South Korean workers increases as tasks are less routine (there are no comparable data for publishing). The 0.554 correlation between South Korean worker share and nonroutine tasks in Table 6 confirms the raw data. This positive correlation is consistent with the notion that less routine tasks may need better communication with the South Korean parent (and the other essential affiliates). Also supportive of this association is Table 1, which indicates that the share of South Korean personnel is higher in the affiliates that are located in more advanced countries (the U.S. and Europe) where it is likely that higher-quality (more complex) goods are being produced. Consistent with the production of more complex (higher quality) goods is also Table 5: It shows that firms located in North America and Europe tend to be more capital-intensive and also more productive on average.

Finally, we know from Table 6 that the share of South Korean employees increases with the skill intensity. The exact correlation is 0.406. Moreover, Table 7 shows that about 80% of South Koreans are active in director or nonproduction worker positions rather than

in production positions. These qualifications together with their language competence suggests that South Koreans are more likely to communicate with the parent company and other affiliates of the same multinational, which is consistent with their role in handling nonroutine situations. Since South Koreans on average occupy about 23% of the high-skill positions (and about 80% of the management (directors) positions), the presence of South Korean nationals will significantly affect the culture of the firm and come at a cost for communication with locals. It is consistent to see that this cost is more commonly incurred for what should be more human-capital-intensive and nonroutine activities.

To assess cultural distance (CD in the tables), we follow Kogut and Singh (1988), who use Hofstede (1980)'s seminal indices on cultural differences to construct a composite index on the deviation between the culture of the host countries of South Korea's affiliates and South Korea itself along the four cultural dimensions that Hofstede identified. Algebraically,

$$CD_j = \sum_{i=1}^4 [(I_{ij} - I_{ijsk})^2 / V_i] / 4$$

where I_{ij} stands for the index for the i th cultural dimension and j th country, V_i is the variance of the index of the i th dimension, sk indicates South Korea, and CD_j is the cultural difference of the j th country from South Korea. Important to note is that there are relatively high shares of South Korean workers in host countries that are relatively different from South Korea. Table 8 relates the cultural distance from South Korea with the South Korean workers' share. The share of South Korean workers increases as the degree of a host country's cultural difference from South Korea increases. The correlation is 0.4. This positive correlation is consistent with the notion that culturally tough environments may need better communication with the South Korean parent and the other essential affiliates. In addition, note also that there is a significant 0.16 correlation between the share of South Korean workers and the interaction of the nonroutineness of the sector and the cultural distance of the affiliate's host country. This correlation is quite suggestive, indicating that especially those tasks that need more internal communication with the multinational's internal network because they are less routine will make affiliates attract

more South Korean workers especially when the environment is culturally different from South Korea.

4 Estimation Equations and Empirical Results

There is a positive, unconditional correlation between the ratio of an affiliate’s intrafirm transactions to its total purchases and South Korean workers. In this section, we first document that this correlation is very robust and not a proxy for other commonly used characteristics of the affiliate (multinational) that are omitted from the regression. Next, we parse the data carefully to tease out more clearly the meaning of the South Korean share. We trace it to the internal workings of the multinational, show how it is not necessarily related to trade with South Korea per se, and interact it with measures of cultural distance. We finally instrument the South Korean share with the interaction of sectoral nonroutineness and the cultural distance of the host country. The reduced form estimation equation that we propose for the analysis is the following:

$$\left(\frac{S_I}{S}\right)_{ijc} = \alpha_j + \alpha_c + \beta\left(\frac{L_{SK}}{L}\right)_{ijc} + Z's + \varepsilon_{ijc} \quad (1)$$

where i represents the affiliate, j the sector, and c the host country. The dependent variable stands for intrafirm sourcing out of total sourcing. The South Korean share variable, $\frac{L_{SK}}{L}$, stands for the share of South Korean employees in the affiliates out of the total labor force. As indicated, we expect a positive β coefficient. The Z s are additional controls. We will include country and sector fixed effects, allowing us to investigate the intra sector/country variation that is not considered in sector-level studies. Table 9 reports summary statistics of the variables that we use.

Estimating equation (1) is not straightforward, however. The dependent variable is a fractional response variable that is bounded by 0 and 1. The usual OLS estimation is likely to produce predicted variables outside the bounds. That is, if the model is specified by $E(y|x) = x\beta$ and y is bounded between 0 and 1, the effect of any particular x cannot be constant throughout the range of x . The most common econometric approach to overcome

this problem is to use the log-odds ratio, which is defined by $E(\log[y/(1-y)]|x) = x\beta$. In this way, the left-hand side variable can be bounded between 0 and 1. A concern with the log-odds ratio is, however, that the equation cannot be true if y takes on the values 0 or 1 with positive probability, which happens in some instances in our case.

Papke and Wooldridge (1996) introduce quasi-maximum likelihood estimator (QMLE) to overcome those shortcomings. They assume there is a known function $G(\cdot)$ that satisfies $0 < G(z) < 1$ for all $z \in \mathbb{R}$, so that for all i ,

$$E(y_i|x_i) = G(x_i\beta) \quad (2)$$

This ensures that the predicted values of y lie in the interval (0,1) and the equation is defined even if y_i can take on 0 or 1 with positive probability. The two most popular functions chosen for $G(\cdot)$ are the logit function and the standard normal cdf. To simplify the computational implementation and produce efficient estimates, Papke and Wooldridge (1996) propose the following Bernoulli log-likelihood function:¹⁷

$$l_i(b) = y_i \log[G(x_i b)] + (1 - y_i) \log[1 - G(x_i b)]$$

which is well defined for $0 < G(\cdot) < 1$. The QML estimator of β obtained from the maximization problem $\max_b \sum_{i=1}^N l_i(b)$ is consistent for β provided that equation (3) holds. Using the Bernoulli QMLE, our estimation equation becomes equation (4).¹⁸

$$E[(\frac{S_I}{S})_{ijc}|X] = G(\alpha_j + \alpha_c + \beta(\frac{L_{SK}}{L})_{ijc} + Z's + \varepsilon_{ijc}) \quad (3)$$

We take $G(\cdot)$ to be the standard normal cdf.¹⁹ The partial effect of $(\frac{L_{SK}}{L})$ on $E[(\frac{S_I}{S})|X]$ is $dE[(\frac{S_I}{S})|X]/d(\frac{L_{SK}}{L})$, or, for specification (4), $g(\cdot)\beta$, where $g(\cdot)$ is the standard normal pdf.

¹⁷Estimating (3) using nonlinear least squares (NLS) produces consistent but inefficient estimates because $var(y_i|x_i)$ is unlikely to be constant when $0 < y < 1$. At the same time, obtaining NLS estimates and heteroscedasticity-robust standard errors and test statistics requires additional and special programming.

¹⁸From a qualitative perspective, note that regular OLS estimates will be fairly consistent with our QLME estimates.

¹⁹In the implementation, we use the Stata *glm* command with the option of Bernoulli distribution and probit function.

In Table 10 we find the estimation results for the ratio of total intrafirm purchases to overall affiliate purchases. In column (1) we provide the basic positive correlation between intrafirm trade and the South Korean share that is significant at the 1% level. In Columns (2) and (3) we introduce country and sector fixed effects. As we add explanatory variables, the share of South Korean employees remains positively and significantly correlated with the extent of intrafirm sourcing. We first establish that this correlation is very robust and pervasive before we parse the data more finely to provide more evidence that is the interpretation of our findings in line with Costinot et al. (2011).

The fixed effects let us focus on the intra sector/country variation. Country effects should capture the extent to which access to the markets or physical distance from South Korea plays a role in affecting intrafirm trade, or the extent to which factor price differences between South Korea and the host countries matter for the organization of the firm. Similarly, to the extent that firms in some sectors are more prone to sourcing, they should be captured by the sector effects. More importantly, the fixed effects also ensure that unobservable sector- and country-level characteristics are not behind the correlation between the South Korean share and the share of intrafirm sourcing. For example, a larger market might trigger more of an orientation to the local market and thus change the composition of South Korean versus local employees since locals might have more information about the local markets.

One may be concerned that the share of South Korean employees might just pick other characteristics of the affiliate that are associated with the literature that tests Antras (2003) and Antras and Helpman (2004). We include the affiliate’s labor productivity, proxied for by the sales-to-labor ratio. Only in some instances is affiliate productivity significant and does it positively affect intrafirm trade.²⁰ We also include the affiliate’s capital intensity, as this is sometimes considered a proxy for a firm’s residual right or investment intensity. For fear that the South Korean share captures skill intensity, we introduce the affiliate’s skill-labor intensity as well.²¹ Neither capital nor skill intensity prove to be significant. In

²⁰While it is well-known that there are nonnegligible productivity differences between multinationals and nonmultinationals, it is, perhaps not surprising, that productivity has a harder time telling different types of multinationals apart.

²¹We take the ratio of directors and nonproduction workers relative to total workers as the proxy for

all the above instances, the South Korean share remains positive and significant.

Affiliates are part of the production network of a multinational. In the next set of regressions we want to control for this. As is well-known, there are large business organizations called *chaebol* in South Korea that sometimes cover multiple sectors. As Rauch (2001) surveys the literature on (business) networks, he points out several reasons why internal trade might be affected by a business conglomerate such as a *chaebol* or *keiretsu*. Members of a *chaebol* may, for example, drop the markups on internal trade in an attempt to increase overall *chaebol* profits. Another possibility is that affiliates that are part of a *chaebol* have to make relationship-specific investments that are hard to observe and that may look like collusion to the outsider.²² Additionally, *chaebol* may simply have more extended vertically integrated production networks. To control for these potential impacts of *chaebol* membership, we include a dummy in case an affiliate is part of a *chaebol* network. In our dataset, 47% of the affiliates are part of a *chaebol* network. The *chaebol* membership seems to compete with productivity and only in some instances is it positive and significant. The share of South Korean employees remains positive and significant, however.

In a following step, we add a whole battery of dummies to characterize the network among the affiliates beyond *Chaebol* membership. In particular, one might be worried that the higher share of South Korean employees might be a function of the sales orientation of the affiliate, in which South Koreans might be especially useful. In particular, if selling to affiliates abroad or domestically is a prime focus, it might be that the multinational decides to hire more South Korean workers. Including sales to the parent and to affiliates abroad and at home does not affect the positive and significant correlation between South Koreans and intrafirm sourcing.

Finally, one may be concerned that there is a dynamic story behind intrafirm trade that we cannot capture in the cross-section. In his review of the literature on social networks,

skill-labor intensity. See the result in Appendix A1, column (1).

²²Spencer and Qiu (2001) consider relationship-specific investments in a *Keiretsu* that may be unobservable to outsiders and justify a higher price. Head, Ries and Spencer (2004) find evidence that in the production of auto parts, Japan's *keiretsu* system promote relationship-specific investments, resulting in improved competitiveness relative to the U.S.

Rauch (2001) explains that an ethnic affiliation can often be especially valuable when it provides market information about preferences, reliable suppliers, etc. The longer affiliates are present in the host country, however, the more one expects them to become familiar with the economic environment of the host country. In this case, affiliates might gather more information as to what the good suppliers are, for example, and rely less on the South Korean supplies from the parent the longer they operate. To capture this effect, we include the log value of the affiliate age in the regressions.²³ As expected, the age of the affiliate decreases the ratio of intrafirm imports in some instances. However, inserting the age of the affiliate does not alter the correlation between the South Korean share and intrafirm trade.

In column (8) of Table 10, we focus on a subset of our affiliates that have the same parent, since they allow us to control more accurately for any unobserved characteristics of the parent that might confound the impact of our share variable. There are 144 parents that have multiple affiliates with 488 affiliates in total. We include a fixed effect that is specific to the parent in this case. Also this fixed effect does not undo the positive and significant relation between the share of South Korean employees and intrafirm trade.²⁴

In the empirical analysis so far, we have emphasized the predictive power of the regression and the correlation between the South Korean share and intrafirm sourcing. This correlation turns out to be very robust. The coefficient estimates do not vary too much as other controls are inserted. The correlation is also economically meaningful. Consider the marginal effects associated with the estimates in column (7) of Table 10. The marginal effect for the South Korean share (evaluated at the sample mean) would be 0.346, implying that an increase in one standard error of the South Korean share would be associated with about 5% increase in the share of intrafirm trade. The effect of affiliate age is -0.049, implying that one standard deviation increase in age would bring about a 2.5% decrease in the share of intrafirm trade. One can also calculate the marginal effects of dummy variables. Being a *chaebol* increases intrafirm trade by 4%. If the affiliate exports back to the parent

²³We subtract the year of establishment from 2007. The average age of South Korean affiliates in the data is 7 years.

²⁴The results for the remaining affiliates remain significant as well, see column (2) in Table A1.

or sells to other local affiliates, intrafirm trade increases by 7% or 25%, respectively. On the other hand, if the affiliate exports abroad, intrafirm trade decreases by 5%.

In what follows, we cut the data in various ways to support the interpretation of our findings as in line with Costinot et al. (2011). One could imagine there could be an almost mechanical relationship between intrafirm sourcing and the South Korean share. For example, if transactions with the multinational require many logistical interactions with the affiliate and the parent, an increase in intrafirm sourcing would almost automatically require an increase the South Korean share in a way that would not support our interpretation. The fact that the South Korean employees are high skilled and in many instances even part of management makes such a trivial interpretation implausible. As a matter of fact, should the intrafirm sourcing require multiple communications with high skilled employees and management, it is quite likely that the reason for these communications would be problem-solving or other (unobservable) headquarters services, which is consistent with our reading of the evidence. To drive home this point, we specifically choose a variant for our share variable. We exclude all South Koreans in low skilled positions from the numerator in column (9). In column (10), we go one step further and only consider the ratio of South Koreans in core management positions (these are the directors) as a fraction of the affiliate's total number of employees. In both instances, we obtain a positive and significant coefficient.

In column (11), we introduce an interaction that is key for our overall interpretation. In column (11) we interact the South Korean share with a measure of the cultural difference between the host country of the affiliate and South Korea. The positive coefficient for the interaction term between the South Korean share and cultural distance is quite intuitive. It suggests that intrafirm trade is more prevalent in those countries that are culturally more different from South Korea so long as there are more (high skilled) South Korean employees active in the affiliate. It is important to note in this context that the South Korean workers tend to be especially high skilled. Note that this result also helps explain why a simple interaction of nonroutineness and the South Korean employees that does not

correct for the cultural environment of the host country is not significant.²⁵

So far, we have considered the share of the total amount of intrafirm trade as a fraction of all sourcing expenses. Since the imports from the parent are the most important part of intrafirm sourcing, we run our main regression with as left-hand side variable sourcing from the parent as a share of the affiliate purchases. The results are largely consistent with the ones presented above, and we report the main regression in column (1) of Table 11. We also include a regression with the more limited, international intrafirm sourcing from South Korea. In particular, we consider the ratio of intrafirm imports from South Korea over the affiliate's total imports from South Korea as the left-hand side variable. We focus on international sourcing from South Korean, as this is consistent with the typical left-hand side variable that more aggregate studies of intrafirm trade have studied at the sector level. Note that the average ratio of imports from South Korean parents over total imports from South Korea is 0.86, and there is also less variation. The specification with South Korean sourcing as the left-hand side variable has the advantage that distance or any other characteristics that are specific to sourcing from South Korea will be neutralized. This specification confirms the previous results and is reported in column (2) of Table 11. Finally, especially since we emphasize the importance of South Korean workers especially for internal communication (related to complex tasks), it is important to parse the data even more. In column (3) we consider the ratio of the affiliate's imports from unaffiliated South Korean firms out of its total outsourcing as the left-hand side variable. As the estimates suggest, this specification does not produce any significant results. This finding is important for our overall interpretation. The insignificant estimate suggests that internal communication with the network of other affiliates, in South Korea and abroad, is key and that the communication with South Korea per se is not.

When studying the relationship between different parts of one and the same multinational, it is hard to argue exogeneity. However, we have one candidate to help us identify why more South Korean employees are employed. As mentioned before, South Koreans are

²⁵As mentioned before, the share of South Korean employees is positively correlated with the interaction of nonroutineness and the cultural difference. It is also worth emphasizing that the positive correlation that we obtain in column (11) conditions on having decided to open a subsidiary in a particular part of the world.

employed especially when the affiliate operates in sectors whose activities are less routine (which require more interaction with the other affiliates) and in countries that are culturally fairly far removed from South Korea. In particular, we go back to the interaction between our measure of cultural distance of the affiliate’s host country and the measure of sector’s nonroutineness and we use it as instrument for the South Korean share of employees in the affiliate. Table 12 presents the first- and second-stage estimates that prove to be significant in the key variable.

5 Conclusion

Since World War II, there has been a fairly persistent increase in globalization that has manifested itself in more international trade, more foreign direct investment and also in significant waves of migration. Accompanying this trend has been the rhetoric of a world that is flat and of truly global corporations that are footloose and stateless.²⁶ However, as more goods, people and financial flows have crossed borders and connected countries, we have grown increasingly aware of what makes international transactions more difficult. There is a long tradition of considering differences in language and differences in ethnic origins as potential sources of friction in international transactions. In this paper, we extend this tradition and take language and ethnicity inside the operations of the multinational. We exploit the fact that Korean is the language of a relatively homogenous community that is not often studied as second language to better understand the transactions and borders of the multinationals. In particular, using a micro dataset on South Korean affiliates we find that the share of South Korean employees working in affiliates is a good predictor of the extent to which a South Korean affiliate sources intrafirm vs. arm’s length. We provide evidence that this correlation is pervasive and nontrivial and also show how it emerges. In particular, we show that the share of South Korean employees increases with the nonroutineness of the affiliates’ tasks in culturally distant host countries.

In the context of studies that use micro data, one sometimes wonders about how general the empirical findings are. Future research should document to what extent we indeed

²⁶See Ghemawat (2011).

observe across countries that the share of affiliate employees that stem from the multinational's country of origin positively relates to intrafirm transactions. We hypothesize that such a relationship should be more outspoken for more homogenous countries with languages that are not very popular as second language, which is why we applied the study to South Korea. We would expect comparable results for countries such as, say, Japan (less open, uncommon second language), and weaker results for countries such as German (more open, uncommon second language) and Canada or the U.S. (more open, common second language).²⁷ It should be clear, however, that our primary interest in using the share of South Korean affiliate employment in the empirical analysis is to get at key determinants of intrafirm transactions that should be pervasive across multinationals of *any* country but that are hard to measure: the importance of internal communication between parent and affiliate, the need for adaptation by headquarters and affiliate especially in nonroutine activities, or more broadly, the use of headquarters services in the affiliates abroad. The nice thing about the South Korean case is that because of language and cultural barriers, the share of South Koreans in affiliates can be seen as a proxy for these hard-to-observe attributes of multinational activity.

In their operations, multinationals have to make decisions as to what activities are performed in-house and which ones are kept at arm's-length. Less routine tasks are hard to fully describe in contracts between multinational headquarters and their suppliers. Problems that are not easily captured by contracts are likely to arise and dealing with such problems will require adaptation on the part of both the supplier and the headquarters. In order to minimize such adaptation costs, to avoid adverse incentives and to take advantage of internal communication, multinationals are likely to decide that such tasks should be performed in-house. Our evidence, which links intrafirm trade and the share of South Korean employees that are primarily high skilled, captures this idea.

By choosing language and ethnicity as a way to illuminate the intricate interaction between multinational and affiliate, our study relates to analyses of specialized languages and the boundary of the firm. A specialized language improves the efficiency of communication,

²⁷This hypothesis builds on the assessment of cultural differences in Hofstede (1980) and Hofstede et al. (1997).

but it also implies costs, since communication with those who do not speak that language becomes more difficult. Therefore, specialized languages should only be used when most appropriate (i.e, when the gains are largest or in a complex, nonroutine environment). In our view, this basic insight is applicable in many different contexts that go beyond the strictly technical language and leads into the realms where often cultural aspects play a role. It is here that the analysis of international transactions meets the insights of psychology, management, and daily practice, and it is here that insights from organizational economics can inform future international analysis.

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Table 1: Intrafirm Sourcing

	Purchase from All Related Parties / Total Purchase	Purchase from Parent / Total Purchase	Korean Workers / Total Employees	Obs
1. Average	0.473	0.351	0.06	850
2. By region				
China	0.466	0.348	0.041	530
Asia excl. China	0.488	0.362	0.065	186
N. America	0.495	0.377	0.179	59
Europe	0.534	0.362	0.097	50
S. America	0.303	0.175	0.052	16
Rest of the World	0.407	0.292	0.062	9
3. By sector				
Food products	0.224	0.043	0.05	32
Textile	0.439	0.353	0.053	53
Apparel	0.492	0.366	0.031	70
Leather, bags, footwear	0.479	0.434	0.021	9
Wood products	0.441	0.104	0.018	3
Pulp, paper products	0	0	0.171	3
Publishing, printing products	0.276	0.276	0.506	4
Chemical	0.379	0.315	0.092	66
Rubber and plastic	0.502	0.383	0.077	17
Nonmetallic mineral	0.213	0.032	0.022	16
Primary metal	0.427	0.228	0.096	42
Fabricated metal	0.376	0.267	0.051	77
Machinery	0.477	0.375	0.059	47
Computer, office products	0.587	0.511	0.071	14
Electrical machinery	0.526	0.397	0.033	22
Electronics	0.572	0.436	0.054	180
Medical, scientific	0.486	0.473	0.168	23
Vehicle	0.568	0.413	0.035	114
Other vehicle	0.424	0.424	0.025	8
Other manufacturing	0.445	0.311	0.077	50

Data: Export-Import Bank of Korea.

Table 2: Intrafirm Trade - Number of Affiliates

	Num. of Affiliates
Total affiliates	850
Sourcing from parent	600
Sourcing from all related parties	666
Sourcing from unrelated parties	677
Exports back to parent	487
Sales to all related parties	604

Data: Export-Import Bank of Korea.

Table 3: Intrafirm Sourcing and Networks

	Intrafirm Sourcing from Parent	Intrafirm Sourcing from All
Dummy on Sourcing from Local Affiliates	-0.428*** (0.102)	
Dummy on Sourcing from Affiliates abroad	-0.322** (0.140)	
Dummy on Export to Parent	0.418*** (0.0790)	0.212*** (0.0791)
Dummy on Sales to Local Affiliates	0.226** (0.0982)	0.681*** (0.0864)
Dummy on Sales to Affiliates abroad	-0.168 (0.126)	-0.178* (0.107)
Fixed Effect Sector	Yes	Yes
Fixed Effect Country	Yes	Yes
R2	0.211	0.192
Observations	850	850

The dependent variable is the ratio of intrafirm sourcing from the parent or all related parties out of total purchase of the affiliate. Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 4: South Korean Workers' Share vs. Routineness

Sector	South Korean Share	Routineness
Wood products	0.018	0.440
Leather, bags, footwear	0.022	0.548
Nonmetallic mineral	0.023	0.463
Other vehicle	0.025	0.468
Apparel	0.032	0.523
Electrical machinery	0.033	0.437
Vehicle	0.036	0.477
Food products	0.050	0.526
Fabricated metal	0.052	0.443
Textile	0.054	0.513
Electronics	0.054	0.394
Machinery	0.059	0.443
Computer, office products	0.071	0.308
Other manufacturing	0.078	0.448
Rubber and plastic	0.078	0.449
Chemical	0.092	0.353
Primary metal	0.097	0.486
Medical, scientific	0.168	0.388
Pulp, paper products	0.171	0.353
Publishing, printing	0.507	

Routineness averages the measure from Costinot et al. (2011). Costinot et al. (2011) do not have a reference index for publishing and printing sector. The correlation between South Korean workers' share and nonroutineness is 0.554.

Table 5: South Korean Affiliates Characteristics

	$\ln(Y)$	$\ln(L)$	$\ln(K/L)$	$\ln(Y/L)$
1. Average	9.531	5.453	3.313	4.087
2. By regions				
China	9.428	5.521	3.215	3.916
Asia excl. China	9.621	5.858	2.815	3.762
N. America	9.749	4.032	4.709	5.748
Europe	9.891	5.002	4.411	4.902
S. America	10.181	5.779	3.658	4.523
Rest of the World	9.149	4.165	4.105	4.983

Data: Export-Import Bank of Korea.

Table 6: Correlation

	Korean Workers' Share	Capital-Intensity	Skill-Intensity	Nonroutineness
Korean Workers' Share	1			
Capital-Intensity	0.329	1		
Skill-Intensity	0.406	0.41	1	
Nonroutineness	0.554	0.226	0.499	1

The correlation of Korean workers' share with other variables is statistically significant at the 5% level. The correlation of Korean workers' share with capital-intensity and skill-intensity is at the affiliate level (850 observations) and with routineness is at the sector level (19 observations averaging Costinot et al. (2011)).

Table 7: Workers' Occupation

	Directors	nonproduction	Production	Other
Korean workers	27%	53%	13%	7%
Local workers	1%	16%	77%	6%
Korean share	82%	19%	2%	16%

Data: Export-Import Bank of Korea.

Table 8: South Korean Workers' Share vs. Cultural Distance

Country	South Korea Workers' Share	Cultural Distance
Chile	0.095	0.110
Egypt	0.013	0.117
Bulgaria	0.006	0.123
Taiwan	0.123	0.159
Turkey	0.017	0.220
Thailand	0.078	0.251
Portugal	0.032	0.274
Brazil	0.073	0.352
Morocco	0.083	0.373
Spain	0.028	0.533
Bangladesh	0.003	0.727
Russia	0.015	0.852
Indonesia	0.030	0.905
Mexico	0.051	1.003
Czech	0.025	1.080
Luxembourg	0.097	1.263
France	0.175	1.390
Poland	0.034	1.391
Vietnam	0.071	1.572
Belgium	0.030	1.780
India	0.131	1.822
Hong Kong	0.065	1.878
Philippines	0.028	2.037
Germany	0.057	2.244
China	0.042	2.293
Malaysia	0.023	2.365
Japan	0.357	2.833
Canada	0.001	2.890
Netherlands	0.667	3.091
Singapore	0.091	3.140
New Zealand	0.143	3.480
Australia	0.086	3.738
Hungary	0.011	3.795
United States	0.182	3.931
United Kingdom	0.378	4.558
Slovakia	0.056	6.051

The cultural distance is constructed according to Kogut and Singh (1988). The correlation between the South Korean workers' share and the cultural distance is 0.4.

Table 9: Summary Statistics

	Mean	St. Dev
Sourcing from All Related Parties	0.473	0.4
Sourcing from Parent	0.351	0.372
L_{SK}/L	0.06	0.155
$L_{SK.SL}/L$	0.041	0.105
$L_{SK.Directors}/L$	0.016	0.069
$\ln(K/L)$	3.313	1.638
$\ln(\text{Labor Productivity})$	4.087	1.886
Skill-Intensity	0.195	0.207
$\ln(\text{Age})$	2.188	0.489
Cultural Distance (CD)	2.22	0.868

Affiliate level variables are from Export-Import Bank of Korea. As shown in Table 7, the occupation of workers is categorized into directors, nonproduction workers, productions workers, and others. We group directors and nonproduction workers as skilled workers. Cultural distance is constructed according to Kogut and Singh (1988).

Table 10: Estimation Results on Intrafirm Sourcing from All Related Parties

	1	2	3	4	5	6	7	8	9	10	11
<i>LSK/L</i>	0.801*** (0.250)	0.816*** (0.277)	1.043*** (0.292)	0.937*** (0.307)	1.049*** (0.319)	1.075*** (0.341)	1.078*** (0.340)	1.013** (0.478)			-0.848 (0.562)
<i>LSK.SL/L</i>									1.862*** (0.534)		
<i>LSK.Directors/L</i>										2.758** (1.185)	
ln(K/L)				-0.0150 (0.0320)	-0.0316 (0.0331)	-0.0361 (0.0335)	-0.0518 (0.0348)	0.0703 (0.0587)	-0.0559 (0.0349)	-0.0282 (0.0340)	-0.0538 (0.0349)
ln(Y/L)				0.0495* (0.0266)	0.0349 (0.0280)	0.0137 (0.0284)	0.0268 (0.0298)	-0.0508 (0.0513)	0.0281 (0.0297)	0.0285 (0.0301)	0.0219 (0.0299)
<i>Chaebol</i>					0.172** (0.0847)	0.121 (0.0866)	0.130 (0.0868)		0.136 (0.0867)	0.111 (0.0868)	0.157* (0.0863)
D(Export Parent)						0.198** (0.0797)	0.208*** (0.0803)	0.216 (0.138)	0.210*** (0.0804)	0.213*** (0.0806)	0.217*** (0.0808)
D(Sales Local Aff.)						0.653*** (0.0899)	0.652*** (0.0898)	0.218* (0.130)	0.655*** (0.0891)	0.667*** (0.0892)	0.659*** (0.0903)
D(Sales Aff. abroad)						-0.190* (0.111)	-0.171 (0.112)	0.00343 (0.147)	-0.167 (0.112)	-0.192* (0.112)	-0.167 (0.112)
ln(Aff. Age)							-0.153* (0.0894)	-0.478*** (0.157)	-0.148* (0.0897)	-0.130 (0.0907)	-0.157* (0.0895)
<i>LSK/L x Cultural Distance</i>											0.846*** (0.229)
Fixed Effect Sector	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effect Country	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effect Parent	No	No	No	No	No	No	No	Yes	No	No	No
R2	0.013	0.083	0.143	0.143	0.15	0.203	0.204	0.683	0.202	0.196	0.207
Observations	839	839	839	836	836	836	836	488	836	835	819

The dependent variable is the ratio of intrafirm sourcing from all related parties out of total purchases of the affiliate. Robust standard errors in parentheses.
* significant at 10%, ** significant at 5%, *** significant at 1%.

Table 11: Estimation Results on Different Dep. Variables

	1	2	3
L_{SK}/L	0.953*** (0.316)	1.449** (0.629)	-0.153 (0.461)
ln(K/L)	-0.0366 (0.0354)	-0.146** (0.0631)	0.0214 (0.0653)
ln(Y/L)	0.0199 (0.0311)	0.0661 (0.0504)	0.0579 (0.0481)
<i>Chaebol</i>	0.184** (0.0860)	0.01000 (0.149)	0.0440 (0.148)
D(Sourcing Local Aff.)	-0.478*** (0.101)	0.0978 (0.168)	-0.177 (0.158)
D(Sourcing Aff. abroad)	-0.371** (0.147)	-0.299 (0.202)	0.0777 (0.188)
D(Export Parent)	0.412*** (0.0802)	0.644*** (0.135)	-0.205* (0.119)
D(Sales Local Aff.)	0.214** (0.0991)	-0.145 (0.160)	0.317** (0.143)
D(Sales Aff. abroad)	-0.167 (0.131)	-0.336* (0.180)	0.159 (0.173)
ln(Aff. Age)	-0.104 (0.0912)	-0.0854 (0.152)	-0.177 (0.160)
Fixed Effect Sector	Yes	Yes	Yes
Fixed Effect Country	Yes	Yes	Yes
R2	0.224	0.209	0.113
Observations	836	635	669

The dependent variable in (1) and (2) is the ratio of intrafirm sourcing from parent out of total purchases and out of total imports from Korea, respectively. The dependent variable in (3) is the ratio of outsourcing from South Korea out of total outsourcing. Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 12: IV Estimation Results

	1st stage	2nd stage
nonroutiness x Cultural Distance	0.216*	
	(0.128)	
L_{SK}/L		9.394*
		(4.869)
ln(K/L)	0.0353***	-0.345*
	(0.00426)	(0.177)
ln(Y/L)	0.0105***	-0.0650
	(0.00370)	(0.0606)
<i>Chaebol</i>	-0.0495***	0.563**
	(0.0109)	(0.263)
D(Export Parent)	-0.00655	0.243***
	(0.0103)	(0.0836)
D(Sales Local Aff.)	0.00410	0.620***
	(0.0118)	(0.0937)
D(Sales Aff. abroad)	-0.0257*	0.0419
	(0.0147)	(0.171)
ln(Aff. Age)	-0.00177	-0.117
	(0.0114)	(0.0907)
Residuals from 1st Stage		-8.338*
		(4.881)
Fixed Effect Sector	Yes	Yes
Fixed Effect Country	Yes	Yes
Observations	816	816

The dependent variable is the ratio of intrafirm sourcing from all related parties out of total purchases of the affiliate. We apply Papke and Wooldridge (2008) on IV for fractional variables. Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A. Additional Estimation Results

	1	2	3
L_{SK}/L	1.048*** (0.351)	1.351** (0.564)	1.053*** (0.344)
ln(K/L)	-0.0543 (0.0351)	-0.114* (0.0623)	-0.0577 (0.0356)
ln(Y/L)	0.0254 (0.0301)	0.0737 (0.0583)	0.0243 (0.0307)
<i>Chaebol</i>	0.130 (0.0868)	0.0212 (0.158)	0.162* (0.0918)
D(Export Parent)	0.210*** (0.0806)	0.146 (0.134)	0.222*** (0.0820)
D(Sales Local Aff.)	0.653*** (0.0898)	0.994*** (0.167)	0.650*** (0.0918)
D(Sales Aff. abroad)	-0.168 (0.112)	-0.147 (0.283)	-0.204* (0.113)
ln(Aff. Age)	-0.154* (0.0894)	-0.221 (0.153)	-0.142 (0.0926)
Skill-Intensity	0.0968 (0.218)		
Residuals from 1st Stage			
Parent Labor Productivity			-0.0139 (0.0482)
Parent Capital-Intensity			-0.0198 (0.0327)
Sector	Yes	Yes	Yes
Country	Yes	Yes	Yes
R2	0.205	0.312	0.212
	836	348	802

The dependent variable is the ratio of intrafirm sourcing from all affiliated parties. Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.