Does vertical specialization matter for cross-border acquisitions?

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Abstract

This paper posits and provides novel evidence that target country vertical specialization is important in explaining cross-border minority acquisition: foreign minority acquisition, involving less than 50 percent of local targets, is more common in target countries that are more vertically specialized. This association is stronger when target countries show revealed advantage over their peer countries in vertical specialization. These findings are robust to alternative determinants of the choice between minority acquisition and majority acquisition. I interpret these results as supporting evidence for the idea that targets from more vertically specialized countries can leverage their exclusive access to country-specific sources of advantage in vertical specialization, which translates into targets' greater bargaining power vis-à-vis foreign acquirers to retain the larger share of joint profit after acquisition.

JEL Classification: F14, G34
Keywords: Global Value Chain, Vertical Specialization, Cross-border, Mergers and Acquisitions

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1. Introduction

Trade in intermediate goods accounts for two thirds of international trade and extends sequential production processes beyond national borders. A key aspect of such cross-border vertical linkages is vertical specialization: different countries specialize in different stages of a sequential production process and each country adds value to the final product.[2] In light of this, increasing research attention is paid to understand the impact of vertical specialization on firm vertical integration decisions on a global scale. Existing studies focus on the trade-off between outsourcing and vertical integration (Antràs and Chor, 2013; Alfaro, Antràs, Chor, and Conconi, 2016). Little is known, however, about whether the extent to which two firms integrate is also affected by vertical specialization, and if yes, how. To this end, this study investigates the relation between vertical specialization and firm choice between minority acquisition and majority acquisition across borders.

Vertical specialization can affect the extent to which a foreign acquirer integrates a local target. This is because a country's advantage in vertical specialization is determined by factor endowments, technology, institutional strength, and so on. And such country-specific sources of advantage in vertical specialization are only accessible to local firms within that country. When local target firms negotiate with foreign acquirers, they can leverage their exclusive access to those country-specific sources of advantage and bargain for the larger slice of joint profit generated from future collaboration with foreign acquirers. If this exclusive-access mechanism is at work, we should observe the likelihood of foreign majority acquisition decreases with target countries' vertical specialization, all else being equal.

To test this hypothesis, I use a sample of 21,264 cross-border acquisitions between 2004 and 2010 with a total value of USD 2.20 trillion. I use the value-added-adjusted revealed comparative advantage index calculated in Koopman, Wang, and Wei (2014) to measure a country's relative advantage in specializing at certain production stages of the entire production process of a final product. More specifically, Koopman, et al. decompose gross exports into (1) domestic value added ultimately consumed by foreign countries, (2) domestic value added eventually returning to home country, (3) foreign value added returning to foreign countries, (4) and pure double counting of intermediate goods that cross the border more than once. And a country's advantage in vertically specializing in producing a final product is captured by Item (1): domestic value added in exports.

I find strong supporting evidence that foreign majority acquisition is less common in target countries that are more vertically specialized. A one-unit increase in target country vertical specialization decreases the probability of foreign majority acquisition by approximately 2.5 percent. This average marginal effect increases up to 4.4 percent if target countries have an obvious advantage over peer countries in vertical specialization. Results are consistent in both forward and backward vertical

[2] In this paper, I use "production process" and "(global) value chains" interchangeably.

acquisitions. This negative relation between foreign majority acquisition and target country vertical specialization is robust after controlling for the listed status of targets and acquirers, the sector-level interdependence between acquirers and targets, ownership concentration and minority investor protection. The results also persist after controlling for drivers of cross-border acquisition flows, such as differences in market valuation and currency appreciation across countries.

Another reasonable concern is that unmeasurable acquirer heterogeneity induces a self-selection bias: some acquirers may only invest in a minority equity stake and crowd in target countries with advantage in vertical specialization for unknown reasons other than exclusive-access hypothesis. To control for this acquirer heterogeneity, I conduct an analysis on a refined sample composed of acquirers that have made both minority and majority acquisitions over the sample period. The findings remain unchanged. An alternative explanation for the negative relation between foreign majority acquisition and target country vertical specialization is that, to obtain more than 50 percent of local targets from more vertically specialized countries, foreign acquirers must make a series of minority investments. And if the limited sample period used in this study fails to include events where foreign acquirer's accumulative stake size exceeds 50 percent, the negative coefficient could simply capture the higher frequency of minority investments in target countries with greater degree of vertical specialization. To address this concern, I trace all acquisitions conducted by the same acquirer till the most recent available transaction date in SDC mergers and acquisitions database.[3] Then I narrow the sample to targets that have only been invested once by the same foreign acquirer over this extended sample period. Again, main findings remain the same. Furthermore, government protection can be an alternative driver for foreign minority acquisitions. Therefore, I re-examine the relation on the sample that contains only non-strategic sectors, which should be less prone to government protection. The negative effect of target country vertical specialization on foreign majority acquisition stays significant for non-strategic sectors. This indicates that foreign minority acquisition is not solely driven by government protection.

The main contribution of this work is three-hold. First, it directly contributes to the literature on mergers and acquisitions. To my knowledge, this study is among the first to explore sources of bargaining power and the negotiation outcome of cross-border acquisitions, whereas existing literature focuses on the drivers of acquisition flows across countries (Huizinga and Voget, 2009; Erel, Liao, and Weisbach, 2012; Ahern, Daminelli, and Fracassi, 2015; Karolyi and Taboada, 2015; Frésard, Hege, and Phillips, 2017). This paper also complements Ahern (2012). While Ahern identifies sector-level vertical relatedness as a source of bargaining power, this work provides supporting evidence that country-level vertical specialization is another source of bargaining power. In terms of acquisition type and its link to product market, this study is closely related to Frésard, Hege, and Phillips (2017), which also explores how global product market characteristics affect firm decisions regarding global organization. They

[3] Till February 28th 2017 for the current draft version.

focus on horizontal acquisitions and horizontal specialization, whereby countries present different degrees of advantage in producing final products. My work complements theirs by investigating vertical acquisitions and accounting for a rising feature in the globalized product market: that of vertical specialization where countries have different advantages at different stages of a final product's production process. Furthermore, my work extends Ouimet (2013) by uncovering cross-country determinants on the choice between minority acquisition and majority acquisition on the global scale, including variation in target country vertical specialization, corporate governance among target countries as well as relative stock market valuation and temporary purchasing power between acquirer and target countries.

Second, this paper builds on a growing research effort to understand the impact of vertical specialization. Yi (2003) focuses on vertical specialization's role in trade cost and ultimately, economic growth. Costinot, Vogel, and Wang (2013) examine how vertical specialization influences country interdependence. Several other studies investigate how vertical specialization alter conventional wisdom that relied on gross trade data to quantify international trade (Bems, Johson, and Yi, 2011; Koopman, Wang, and Wei, 2014; Patel, Wang, and Wei, 2017). Another group of research investigates the country-industry heterogeneity in vertical specialization in shaping integration versus outsourcing decisions of global firms. In particular, Antràs and Chor (2013) provide theoretical predictions and empirical evidence regarding the importance of the upstreamness of inputs and the elasticity of demand faced by final-good producers. Alfaro et al. (2016) explore the role of contractibility at the input level and firm (acquirer) productivity within industry. Antràs, Fort, and Tindelnot (2017) examine how country-specific characteristics of destination (target) countries affect multinational firms' choice of off-shoring locations. My work directly adds to this literature by uncovering another source of heterogeneity, i.e., destination (target) countries' relative advantage in vertical specialization, and by explicitly providing evidence of its impact on the extent of integration that acquirers decide to exert over their production processes.

Third, this work sheds new light on the literature on the distributional effects of globalization. Existing literature focus on the distribution of gain between government and firm shareholders (Col, Liao, and Zeume, 2016), between employees across different categories (Goldberg and Pavcnik, 2007; Feenstra, 2008; Bustos, 2011; Amiti and Davis, 2012; Bloom, Draca, and Van Reenen, 2016), between customers across different income levels (Fajgelbaum and Khandelwal, 2016), and between countries along global value chains (Timmer, Erumban, Los, Stehrer, and De Vries, 2014). This study focuses on a pertinent but relative unexplored pie-splitting mechanism – local firms versus foreign firms.

2. Related literature and hypothesis development

This work builds on the intersection between the literature of international trade and the literature of vertical integration. In this section, I first develop the prediction that local target firms' exclusive

access to country-specific sources of advantage in vertical specialization can serve as a source of bargaining power for local target firms vis-à-vis foreign acquirers. Then, I explain, though bargaining power cannot be measured, the bargaining outcome between local targets and foreign acquirers can be proxied by acquisition stake size. I end by listing testable hypothesis.

2.1. Exclusive access to sources of vertical specialization as a source of bargaining power

This study develops a hypothesis based on the idea that customer-supplier relations affect bargaining outcome of acquisitions. For example, Ahern (2012) shows that, for a sample of U.S. domestic acquisitions between local suppliers and customers, sector-level vertical relatedness affects the bargaining power. As for cross-border acquisitions, foreign acquirers and local targets are related as supplier and customer through global value chains where different countries specialize at different stages of a final product's sequential production process (Hummels, Ishii, Yi, 2001; Yi, 2003; Johnson and Noguera, 2012). Whether a production stage is worth vertical integration depends on its relative position along the global value chain and its neighbor stages' relative contractibility, and the final product's elasticity of demand (Antràs and Chor, 2013; Alfaro, Antràs, Chor, and Conconi, 2016). After deciding which productions stage to integrate, foreign acquirers negotiate with potential target firms at that particular production stage.

In negotiating with foreign acquirers, target firms would have more bargaining power if they are from countries that are more vertically specialized than other peer countries. This is because sources of advantage in vertical specialization are determined by factor endowments, technology, and institutional strengths that are only accessible to local firms (Chor, 2010; Costinot, 2009). With exclusive access to sources of advantage in vertical specialization, local firms induce foreign acquirers to compete for them. Competing foreign acquirers become local firms' valuable alternatives to reaching an agreement with any particular foreign acquirer. The existence of an outside option affects bargaining outcome only if opting out is credible, as predicted by bargaining theory (see for example Osborne and Rubinstein (1990)). Bargaining theory further predicts that the minimum gain accrued to the party with a credible outside option is equal to the value of his outside option. In line with this thinking, when local targets have exclusive access to sources of advantage in vertical specialization, namely, unique capability to add more value to production processes, to opt out and terminate a negotiation becomes a credible threat to foreign acquirers. For this reason, local targets can bargain for the larger slice of joint profit. This study focuses on examining this exclusive-access factor in acquisition negotiation and leaves negotiation strategies and tactics for future research.

2.2. Extent of ownership as a bargaining outcome

The extent of integration is an negotiation outcome, reflecting bargaining power between foreign acquirers and local targets. Williamson (1979) suggests that the optimal degree of integration is a trade-

off between acquirers' efficiency gain from acquisition and their commitment of resources to obtain such efficiency. More productive local targets can manifest their superior bargaining power by demanding a higher price for the transfer of majority interest. Acquirers would not pay if the price is higher than the efficiency gain of acquisition; consequently, local targets retain majority ownership. Alternatively, Grossman and Hart (1986) predict that when two parties discuss the possibility of integration, majority interest go to the party with higher proprietary content in relationship-specific investments to preserve investment incentives. Local targets from countries with advantage in vertical specialization pose a credible threat of productivity loss to foreign acquirers if the targets lose the incentive to invest after majority interest are transferred to acquirers. To avoid such incentive distortion, foreign acquirers would rather settle for minority interest in joint profit. Both are under the view that the observed degree of integration reflects the bargaining outcome between acquirers and targets.

Ahern (2012) measures bargaining outcome with targets' share in total cumulative abnormal return around acquisition announcement and shows that the party with more bargaining power obtains the larger slice. Though conceptually consistent with the impact of credible outside option, this proxy might capture deals where acquirers overpay and obtain negative acquisition gain but exclude cases where acquirers refuse to overpay. In addition, this proxy requires sufficient stock price information for both acquirers and targets, while cross-border acquisitions mainly involve private targets which do not have stock price information. For those two reasons, this study chooses to use the extent of integration to measure bargaining outcome.

Based on analysis mentioned above, I propose the following testable hypothesis.

Baseline hypothesis: *The likelihood of foreign majority acquisition decreases with target countries vertical specialization, all else being equal.*

3. Data and Methodology

3.1. Measure vertical specialization

I use the value-added-adjusted revealed comparative advantage index calculated in Koopman, Wang, and Wei (2014) to measure advantage in vertical specialization of a certain country relative to its peer countries along a production process. Conventionally, relative advantage is computed as the share of a sector of a country's total gross exports relative to the world average of the same sector in world exports. When the ratio exceeds one, the country is considered to have a revealed comparative advantage in that economic activity (Balassa, 1965). Given countries' participation in global value chains, using gross exports to compute revealed advantage in vertical specialization is subject to double counting of value added embedded in intermediate goods along the production sequence. For this reason, Koopman, Wang, and Wei (2014) decompose gross exports into (1) domestic value added ultimately consumed by foreign countries, (2) domestic value added eventually returning to home country, (3) foreign value

added returning to foreign countries, (4) and pure double counting of intermediate goods that cross the border more than once. Koopman, Wang and Wei calculate country-sector revealed comparative advantage based on Item (1): domestic value added in exports.

The index calculation involves three main steps. First, Koopman et al. collect data on annual flows of goods and services at country-sector level for the entire world economy from the Global Trade Analysis Project database (GTAP, version 7). This dataset covers 129 countries and 41 sectors for the base year 2004. Second, they aggregate the 129 countries into 26 countries and regions. The full lists of sectors and countries/regions are reported in Appendices A. Finally, they use those data to construct a world input-output table. This describes the sale and purchase relationships between suppliers and customers in the world economy by showing flows of final and intermediate goods and services at the country-sector level. Each of the 41 GTAP sectors represents one global value chain and each of the 26 countries/regions within that sector is a participant along the chain.

This revealed comparative advantage index 2004 is going to be used to analyze cross-border acquisitions from 2004 to 2010. I assume that country-sector ranking in the index does not change for the six-year period. This assumption is reasonable because country-level sources of advantage in vertical specialization – technology, factor endowments and institutional strength – change slowly over time. In future versions of this work, I am going to expand the sample by using GTAP version 9. This dataset covers 129 countries and 57 sectors for three base years: 2004, 2007, and 2011. It will allow me to extend acquisition sample to 2016. Specifically, I am going to use country-level vertical specialization for cross-border transactions in the sub-periods of 2004 to 2006, year 2007 for 2007 to 2010, and year 2011 for 2011 to 2016.

[Insert Table 1 Here]

Table 1 Panel A presents descriptive statistics on country-level relative advantage in vertical specialization. Due to space limitations, I report the top 12 sectors ranked by total deal value (in U.S. dollars) of cross-border vertical acquisition. These nine sectors represent 75 percent of the total transaction value. I describe the data collection on acquisitions in the next section. For each GTAP sector, I report the top three and bottom three countries ranked by their relative advantage. For example, Hong Kong has relative advantage in business services and trade, but presents relative disadvantage in sectors that require rich natural resources, such as oil and gas. Most importantly, there is not a single country that consistently dominates a top or bottom ranking across sectors. This feature is desirable because it ensures that the relation between vertical specialization and extent of integration is unlikely to be driven by a subset of countries.

Next, I perform an analysis to verify that country-level relative advantage in vertical specialization is an important component of target firm relative advantage in vertical specialization, namely, the

capability to add incremental value. Specifically, I collect from Worldscope the accounting measure earnings before interest expenses and taxes scaled by book value of total assets (*ROA*) as a proxy for firm productivity. Then, I aggregate this measure at the country-sector level, which are matched to GTAP country-sector pairs classified by Koopman et al. Next, I regress *ROA* on country vertical specialization. Table 1 Panel B presents the estimation results. Clearly, for both target and acquirer countries, there is a positive and statistically significant association between the two variables. This association is robust after controlling for country and year fixed effects, meaning the association prevails across country-sector pairs.

3.2. Cross-border acquisitions

I collect mergers and acquisitions transactions from the Security Data Corporation (SDC) announced between 2004 and 2010. I drop transactions where acquirers have an SIC code between 6000 and 6999 but targets do not have an SIC code between 6000 and 6999 to ensure that transactions in my sample are motivated by product market synergies. I keep transactions that are labeled as cross-border, mergers, acquisitions of majority interests, acquisitions of partial interests, and acquisitions of assets. Among these transactions, I keep those where acquirers do not own a stake equal or greater than 50 percent prior announcement. The extent of integration is measured as the percentage of stake owned by acquirers after acquisitions. If it is less than 50 percent, the acquisition is labeled as a purchase of minority interest. If it is greater than 50 percent, the acquisition is labeled as a purchase of majority acquisition. To better contrast bargaining power between acquirers and targets, I drop mergers of equal, i.e. acquirers owning exactly 50 percent after acquisition. Till this step, the sample contains 56,725 acquisitions.

I match the 41 GTAP sectors to three-digit standard industry classifications (SIC) provided by SDC for each target and acquirer. Then I match the 26 GTAP countries/regions to target and acquirer countries provided by SDC. SDC record target and acquirer countries according to their location of operation. For example, if the U.S. branch of Nestlé acquirers an Italian branch of Danone, the acquirer country will be marked as U.S. and that of target marked as Italy. Therefore, the match of country correctly reflects country-level capability to add value to production processes and vertical linkages between acquirers and targets. I retain transactions where both acquirer and target have non-missing measures of country-level vertical specialization. At this step, the sample has 52,547 acquisitions.

To identify the vertical relatedness between acquirers and targets, I follow Acemoglu, Johnson and Mitton (2009) and use the vertical relatedness index computed by Fan and Lang (2000). The computation of vertical relation is based on the U.S. input-output table reported in 1992 by U.S. Bureau of Economic Analysis (BEA). The input–output table classifies the U.S. economy into 498 six-digit input-output code levels (IO code) and report the dollar value of input used to produce the output of 498 sectors. To use U.S. sector vertical relatedness to describe world economy, I assume that the U.S. input-output tables provide a standardized measure of input requirements internationally. As noted by

Acemoglu et al., the U.S. input-output tables should be informative on input flows across sectors to the extent that these are determined by technology.

To identify vertical acquisition, I follow Ahern (2012) and drop input-output sector pairs that share the same IO code. Then I keep pairs where vertical relatedness is non-missing and non-zero. As the final step, I match IO codes to four-digit SIC codes using the concordance table provided by the BEA. Till now, my final sample contains 21,264 vertical cross-border acquisitions.

[Insert Table 2 Here]

Table 2 reports the summary statistics of cross-border acquisitions for the period between 2004 and 2010. In Panel A, the column – Total– includes all acquisitions, whereas the columns under the tag – Vertical – contains the relevant sample for this study. The column – Majority acquisition – (– Minority acquisition–) consists with vertical acquisitions in which greater (less) than 50 percent is transferred from targets to foreign acquirers. The first row indicates the number of transactions. In 40 percent of acquisitions from 2004 to 2010, acquirers and targets have unambiguous vertical relation in international product market. While foreign acquirers typically seek majority acquisition, there are 20 percent of transactions in which local targets retain majority interest. In unreported table, I find this 20-80 difference a stable pattern throughout the sample period. The second row indicates the deal value in trillion US dollars after adjusting for inflation based on 2015 Consumer Prices Index. It appears that economic significance of minority acquisition decreases to 14 percent, compared to that of majority acquisition. However, it is worth noting that purchases of non-majority acquisition are often through private negotiation. Also, news on minority investment catches less attention. For those two reasons, I cannot exclude the possibility that this seemingly drop in economic significance is due to less deal value information on minority acquisition than on majority acquisition.

Panel B of Table 2 presents summary statistics of the sector-level supplier-customer relatedness between acquirers and targets for the sample of vertical acquisitions. Acquisitions are characterized as forward acquisitions if acquirers sell more to targets more than buy from targets, and as backward if acquirers buy more from targets than sell to targets. Following this identification rule, I identify 10,194 forward acquisitions and 11,070 backward acquisitions. As shown in the Column – Mean – , in forward acquisitions, targets use averagely 3.46 cents worth of goods from acquirers to produce one dollar worth of goods, but their goods are seldom used by acquirers for production, indicating by a mean as low as 0.27. The opposite relations hold for backward acquisitions.

Panel C of Table 2 lists the 15 most active GTAP sector pairs for cross-border acquisitions between 2004 and 2010 and experienced 60 percent of the full sample. Approximately 20 percent of vertical acquisitions take place in the same GTAP sectors mainly because GTAP sectors are highly aggregated. Though such aggregation limits a more precise ranking on country-level vertical specialization beneath

GTAP sector level, it should not pose any major bias in subsequent analysis for two reasons. First, I have already reduced the presence of horizontal acquisitions at six-digit IO code level. Second, relative advantage in vertical specialization should be positively correlated among sub-sectors under each GTAP sector, to the extent that sources of advantage in vertical specialization are transferrable among them. Nevertheless, to ensure robustness, I exclude acquisitions where acquirers and targets share the same GTAP sector, replicate the empirical analysis in Section 4., and reported replication results in Appendix 2-4. In fact, replicated results are not only consistent with but even stronger than main analysis results listed in Section 4..

3.3. Model

I use the following probit regression to test the hypothesis:

$$Pr\left(Y_{c,i,t}=1 \middle| P_{c,i,s}, P_{c',i',s}, X_{c,i,t}, X_{c',i't}, \boldsymbol{X_{c,c',t}}, \boldsymbol{V_{i,i'}}\right) = \Phi\left(\alpha + \beta P_{c,i,s} + \theta P_{c',i',s} + \gamma X_{c,i,t} + \delta X_{c',i',t} + \boldsymbol{\eta' X_{c,c',t}} + \boldsymbol{V_{i,i'}}\right), \quad (1)$$

where Pr denotes the probability and $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution. The dependent variable $Y_{c,i,t}$ is a binary variable equal to one (zero) if the average transfer of ownership from local targets in country c, sector i, and year t to foreign acquirers is greater than (lower than) 50 percent.[4] It means I test the choice between majority and minority acquisitions. Minority acquisitions can be an optimal bargaining outcome when the value of local targets' outside option is lower than staying fully independent of foreign acquirers but no lower than retaining majority interests. For example, a financially constrained target would be better off accepting a minority acquisition by foreign acquirers so that foreign acquirers can certify and facilitate future capital raise of targets (Liao, 2014). I do not test the likelihood of majority acquisitions against that of firms not being targeted by any foreign acquirers because this approach cannot distinguish greenfield investment from no integration. Since the analysis of this work is to be conducted at country-sector level, the pair of targeted firms versus non-targeted firms is an inaccurate proxy for integration decision unless there is complete information on greenfield investment in the same destination country-sector pair. On the contrary, examining the choice between majority and minority acquisition circumvents the trouble to account for all factors that affect the choice of entry mode.

The variable of interest, $P_{c,i,s}$, measures the relative advantage in vertical specialization of target country c in sector i and year s, where s indicates the most recent year with non-missing observation of P (i.e. $s \leq t$). In other words, s indicates 2004, and t indicates years from 2004 to 2010. As explained in Section 3.1., sector i represents one value chain. Given my hypothesis, β should be negative and indicate to what extent greater advantage in vertical specialization deter foreign majority acquisition.

[4] Mergers of equal or transactions where the transfer of ownership is equal to 50 percent are dropped from my sample.

The rest of the variables on the left-hand side of Model (1) are control variables that may affect the likelihood of foreign acquirers buying majority ownership. First, I control for acquirers' country-level relative advantage in vertical specialization. This is because more productive acquirers are more likely to afford high price of majority for they have higher capacity to amortize fixed costs of full integration (Alfaro et al., 2016). Then, I consider the stock-listing status of targets and include in the vector $X_{c,i,t}$ the average percentage of listed targets in country *c*, sector *i*, and year *t*. Unlike unlisted targets, listed targets can learn about themselves from information reflected in their stock market prices (Foucault and Frésard, 2012). As a result, it is more difficult for foreign acquirers to persuade listed targets to agree to a lower offer. Also, as Ouimet (2013) suggests, acquirers avoid buying majority ownership in targets to preserve the incentive of target managers if target firms are listed and managers are compensated by stock options prior to acquisition.

Furthermore, higher ownership concentration and poorer minority investor protection could deter acquisitions of non-majority acquisition and lead to an over-presence of majority acquisition purchases in certain target country-sector pairs. To attenuate this potential bias, I use the percentage of closely-held shares to proxy ownership concentration and anti-director rights index to measure minority investor protection. Closely-held shares are extracted from Datastream and then aggregated from firm level to country-sector level. Anti-director rights index is taken from Spamann (2010). These two governance-related control variables are also in the vector $X_{c,i,t}$.

Next, I control for the stock-listing status of acquirers because they have easier access to external financing and hence higher capability to make a top offer for target majority ownership. $X_{c',i',t}$ is the average percentage of listed acquirers in country *c'*, sector *i'*, and year *t*.

Additionally, Erel, Liao and Weisbach (2012) show that appreciation in acquirer countries' wealth relative to that of target countries facilitates acquirers' cross-border deals. Similarly, such relative purchasing power could enable acquirers to make a better offer for target majority ownership. Thus, I control for differences in stock market valuation and currency appreciation between target and acquirer countries. Those two variables are in the vector $\boldsymbol{X_{c,c',t}}$. Specifically, I download stock prices, exchange rates, and consumer price indices from Datastream database to compute differences between target and acquirer countries in buy-and-hold inflation-adjusted stock market returns and exchange rate returns from 275 trading days to 25 trading days prior to the announcement.

The vector $\boldsymbol{V_{i,i'}}$ includes dummies of GTAP sector pairs between targets and acquirers. As discussed in Section 2.1., previous studies show characteristics of production stages relations affect extent of integration. By holding vertically related sector pairs constant, I remove influence of production stages on choice between majority and minority acquisition. In doing so, I ensure that $P_{c,i,s}$ is a clean rank of country advantage in vertical specialization within the same vertical integration relations.

4. Empirical results

4.1. Univariate results

Table 3 reports summary statistics of key variables and their mean differences between majority and minority acquisitions. Majority acquisition commonly involves an ownership stake over 90 percent. Minority acquisitions tend to involve the transfer of a sizeable stake in the target firm, with a mean of 25.2 percent and a median of 21.2 percent.

The next ten rows report differences across country-sector pairs. Target-country relative advantage in vertical specialization ($P_{c,i}$) is lower in majority acquisition, on average, than that of minority acquisitions. This observation aligns with the prediction in the baseline hypothesis. Compared to the target side, the difference of acquirer-country relative advantage in vertical specialization ($P_{c',i'}$) is smaller between majority acquisition and minority acquisitions. Listed targets are rarely involved in majority acquisitions, indicated by a presence as low as five percent (*Listed Target*). Its presence is higher in minority acquisitions but still significantly less frequent than unlisted firms. On the contrary, listed companies account for most acquirers in both majority and minority acquisitions (*Listed Acquirer*). As expected, minority acquisitions are more common in countries with better investor protection ($ADRI_c$), though the difference to majority acquisition is small. Minority acquisitions is associated with a lower degree of shareholder concentration ($CHS_{c,j}$), which alleviates the potential bias of closely held firms crowded in target country-sector pairs with high relative advantage in vertical specialization. Minority acquisitions are more common when the target country stock market is valued higher than the acquirer country stock market ($MktRet_{c,c'}$) and when the acquirer country experiences a larger local currency appreciation ($FX_{c,c'}$). Minority acquisitions are more common when it is suppliers acquiring customers (*Forward*) and less common when it is customers acquiring suppliers (*Backward*).

Table 3 also presents two deal-level variables. Relative size is estimated as deal value relative to the acquirer's market capitalization 25 trading days prior to the deal announcement. Minority acquisitions are associated with smaller mean relative size ratios than are majority acquisitions. Premium is the offer price scaled by target stock price four weeks prior to the announcement date. Though smaller than majority acquisition, acquirers tend to pay a considerable premium for a non-majority acquisition. As mentioned above, cross-border vertical acquisitions involve mainly unlisted target firms. That is why deal information based on stock price is scarce and the sample size shrinks dramatically.

[Insert Table 3 Here]

4.2. Multivariate results

Table 4 presents baseline estimation results based on Model (1). Coefficients are marginal effects on the likelihood of majority acquisition. Column 1 complements the univariate results and shows that

target country-level relative advantage in vertical specialization ($P_{c,j}$) has a negative effect on the choice to buy majority acquisition. And this effect is economically and statistically significant (z-statistics of 8.14). A one-unit increase in vertical specialization decreases the probability of takeover by approximately 2.5 percent. Column 2 and Column 3 introduces year and GTAP sector pair dummies and a set of control variables. The signs and significance of target country vertical specialization are largely unchanged. Some of coefficients on control variables are consistent with previous studies. Target firms being listed reduces the chance of foreign majority acquisition by 26 percent, whereas acquirers' listed status does not seem to matter. High ownership concentration does not affect foreign acquirers' choice, but a better protection for minority investors does encourage foreign acquirers to buy non-majority acquisition. Notably, coefficients on stock market valuation and purchasing power reveal new insights. When foreign acquirers experience a relative higher valuation and currency appreciation than local targets, foreign acquirers tend to buy non-majority acquisition. This suggests that, while to take advantage of financial arbitrage generally promotes cross-border acquisition flows (Erel, Liao, and Weisbach, 2012), it is the minority interest acquisition that benefits the most. Furthermore, acquirers' country-level relative advantage in vertical specialization appears to have no effect on the bargaining outcome between a majority and minority acquisition. This is not necessarily against the notion that productive firms are more likely to integrate global production (Alfaro et al., 2016). It could be that highly productive firms are overall more likely to internalize production at global scale, but to have higher capacity to amortize high integration costs might not matter much for the choice between full and partial integration. Alternatively, it is possible that the true effect of acquirer vertical specialization is masked by the mixed directions of vertical acquisitions. I examine in the next subsection these two alternative explanations by separating forward and backward acquisitions.

Next, I narrow the sample to those where target countries have an advantage in each production stage, i.e. relative advantage in vertical specialization is no less than one, and report results in Columns 4-6. I expect that targets would be in an even better negotiation position when their countries have established an obvious advantage. Consistent with this line of thinking, the difficulty for foreign acquirers to get a control on targets with obvious productive advantage is now doubled. Changes on coefficients of control variables are also worth mentioning. Compared to results on main sample, acquirers being listed starts to matter for getting majority interest on highly productive targets. This is consistent with my expectation that acquirers with easier external financing have a higher chance to afford high purchasing price for majority interest. Coefficients of capital market valuation and currency appreciation continue to have the same sign but lose statistical significance here.

To reinforce the intuition of estimated coefficients, Figure 3.1 plots predictive marginal effect of target country relative advantage in vertical specialization based on the specification in Column 3 of Table 4. The curve shows how the likelihood of foreign majority acquisition is going to change if target relative advantage in vertical specialization increases by 0.5 at a step from one to eight while other

covariates are held fixed. The vertical lines on each dot indicates the 95 percent confidence interval. The plot indicates that, for example, a country that is eight times as advantageous as another country in providing crops, firms located in the former country have 50 percent less chance (0.9-0.4=0.5) that those located in the latter country of being fully integrated along value chains, all else being equal.

[Insert Table 4 Here]

[Insert Figure 1 Here]

4.3. Do vertical and backward acquisitions receive different effects?

Table 5 presents estimates of Model (1) for forward and backward vertical acquisitions separately. Now that acquisition directions are explicit and separated, I introduce vertical relatedness as an additional control. In this way, I isolate the role of target country-level relative advantage in vertical specialization in capturing sources of advantage in vertical specialization – technology, institutional strength, labor, etc. – from its role in capturing interdependence between acquirers and targets. The effect of target country vertical specialization on foreign majority acquisition is largely consistent between forward and backward acquisitions. And its effect appears to be slightly more pronounced in forward acquisitions.

More interestingly, I obtain additional new insights on the control variables from this analysis. First, acquirer country vertical specialization now becomes statistically significant and has opposite effect on forward and backward acquisitions. It settles the puzzle mentioned in previous section: acquirer country vertical specialization does matter for the extent of integration, but the sign and magnitude of its effect depends on the direction of vertical acquisitions. While its effect in forward acquisitions is consistent with the prediction of Alfaro et al. (2016), that in backward acquisitions lacks theoretical prediction.

Second, there is also a marked difference in the impact of vertical relatedness on the bargaining outcome. The relatedness between acquirers and targets does not seem to matter in forward acquisitions but significantly and negatively affects acquirers' bargaining position in backward acquisitions. More specifically, the more important targets function as supplier to foreign acquirer in international product market, the less likely foreign acquirers would be able to obtain majority interest over targets. This result complements that of Ahern (2012), which finds that relative gain of targets in backward acquisitions is unrelated to product market relations. My findings suggest that product market relations matter for bargaining in backward acquisitions but their effects are reflected in the extent of integration instead of in the division of acquisition gains. Results here reinforce the view of this work that the observed extent of integration is a valid proxy for bargaining outcome and complements the division of total acquisition

gain in scenarios when stock price information is unavailable or acquirers are unwilling to strive for overpriced majority interest and settle for a minority stake.

Finally, the slightly positive effect of listed acquirers found in previous section turns out to be stronger and solely from backward acquisitions. The other relevant control variables continue to have consistent signs between forward and backward acquisitions, though their economic and statistical significances are largely higher in forward than in backward acquisitions.

Taken as a whole, the baseline hypothesis of this work receives consistent and supporting evidence. But there is more to learn about why effects of certain control variables change when the direction of vertical acquisition changes. Future versions of this work are going to investigate those questions in depth.

[Insert Table 5 Here]

4.4. Robustness tests

So far, I have used control variables to ensure that it is target country vertical specialization that reduces the likelihood of foreign majority acquisition. However, results can still be undermined by unmeasurable acquirer heterogeneity. More specifically, some acquirers might only invest in minority equity stakes and others only conduct takeovers. If the former type of acquirers has a disproportionately high presence in target countries with higher relative advantage in vertical specialization, it would be unclear whether the negative effect on foreign majority acquisition comes from target country vertical specialization or acquirer heterogeneity. To address this issue, I conduct an analysis on a refined sample composed of acquirers that have made between 2004 and 2010 both majority and minority acquisitions overseas. Results are reported in Table 6 Column 1 and 2. The findings remain unchanged.

An alternative explanation for the negative relation between foreign majority acquisition and target country vertical specialization is that, to gain majority interest in more productive targets, acquirers must make a series of minority investments before takeover, whereas they can directly buy majority interest of less productive targets. To reduce the impacts of serial acquisitions, I narrow the sample to targets that have only been invested once by the same foreign acquirer over the sample period.[5] Table 6 Column 3 and 4 present robustness test results. Again, main findings remain the same.

To further check for robustness, I examine whether results are biased by regulatory protection against foreign ownership. Dinc and Erel (2013) provide evidence that, for mergers across EU countries, local governments take measures to prevent foreign acquirer from taking control of 'national champions'. In the current version, I address this issue by looking into GTAP sectors that are not commonly regarded as strategic ones. I therefore drop coal, oil and gas, minerals, petroleum and coal products, mineral

[5] I use both 2004-2010 and 2014-2016 periods to detect subsequent acquisitions by the same acquirer. Results stay the same.

products, electricity, gas manufacture and distribution, water, air transportation, communication (including telecommunication), financial services, public admin, public defense, education, and health. Estimates on the rest of GTAP sectors are reported in Table 6 Column 5 and 6. Notably, coefficient of target country vertical specialization loses its significance in the main sample. That means strategic sectors do have less foreign majority acquisition. However, once I restrict the sample to targets that have an obvious advantage, the negative effect of target country vertical specialization on foreign majority acquisition is restored for non-strategic sectors. That suggest that the negative relation is not solely driven by government protection but also driven by target country vertical specialization.

This approach does not account for the fact that sectors of national interest may vary across countries and over time. Also, government intervention could deter foreign acquirers in the future. Thus, in future version of this work, I construct a more refined measure of propensity for government intervention than a country-year invariant dummy on strategic sectors. To do this, I follow Dinc and Erel (2013) and search news about government intervention in the top ten cross-border acquisitions by deal value per target country per calendar year from 2003 to 2016. Then I sort target countries according to their propensity for government intervention a year before the acquisition announcement. If coefficient of target country vertical specialization stays negative and statistically significant in subsamples less prone to government intervention, results should reinforce findings documented here and support the hypothesis of bargaining power.

[Insert Table 6 Here]

5. Conclusion

This paper shows that target country-level relative advantage in vertical is important in explaining the extent of integration cross-border vertical acquisitions. The key insight is that exclusive access to sources of advantage in vertical specialization gives local target firms more bargaining power in the international market of mergers and acquisitions. Targets from countries with higher vertical specialization reduces the likelihood of foreign majority acquisition. Put differently, they are able to retain the larger slice of joint profit from future collaboration with foreign acquirers.

This work also obtains new insights on how determinants of cross-border acquisitions flows documented in previous studies can further affect the choice between majority and minority acquisition size. And such effects may have opposite signs in forward and backward vertical acquisitions. To better understand reasons behind such opposite effects, it is worth investigating into the structure and characteristics of international product market.

The present version of work has two caveats. One caveat is that I do not explicitly distinguish control and cashflow rights. Nevertheless, a rough cut-off level of 50 percent depicts the size of cashflow rights, namely, the distribution of future profit. To this end, the 50-percent threshold is aligned with the division

of joint profit between local targets and foreign acquirers. The other caveat is that the sample period is short and the aggregation of countries is high. Because of such limitations, I am unable to generalize findings beyond 2010 or test my hypothesis on cross-border acquisitions within EU. Therefore, an expansion on dataset awaits in future versions of this work.

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Table 1: Country-level relative advantage in vertical specialization

This table reports descriptive statistics of country relative advantage in vertical specialization in global value chains. Panel A. reports top three and bottom three countries ranked by relative advantage in vertical specialization for the most significant sectors in terms of total deal value in 2015 U.S. dollar. Panel B. presents the association between country vertical specialization as explanatory variable for the proxy for firm-level productivity (operating income over total assets *ROA*). *ROA* is aggregated at country-sector level. Data on operating income and total assets are from Worldscope. *Coef*, *t-stat*, *N*, *Controls*, and *Adj-R*^{2} are estimated coefficients on country relative advantage in vertical specialization, its t-statistics, sample size, the dummies on year and country, adjusted R-squared. *, **, and *** indicate coefficients significantly different from zero at the 0.1, 0.05 and 0.01 levels respectively.

Panel A.

Business Services			Financial Services			Chemical, Rubber& Plastic		
1	SGP	1.86	1	BRA	2.21	1	SGP	2.19
2	E15	1.62	2	TWN	1.94	2	TWN	1.36
3	HKG	1.57	3	USA	1.64	3	USA	1.32
24	PHL	0.19	24	ROW	0.45	24	SSA	0.27
25	MET	0.08	25	PHL	0.32	25	XEA	0.23
26	IDN	0.06	26	MET	0.11	26	HKG	0.19
Electronic Equipment			**Machinery & Equipment**			**Motor Vehicles and Parts**		
1	PHL	7.03	1	KOR	1.89	1	MET	2.81
2	MYS	5.29	2	JPN	1.60	2	JPN	2.60
3	MET	3.88	3	USA	1.45	3	CAN	2.22
24	ZAF	0.56	24	HKG	0.19	24	HKG	0.14
25	RUS	0.09	25	XEA	0.18	25	SGP	0.12
26	SSA	0.03	26	SSA	0.06	26	SSA	0.04
Minerals			**Transportation Equipment**			**Communication**		
1	AUS	5.88	1	USA	2.24	1	ZAF	1.74
2	IDN	4.52	2	BRA	1.97	2	AUS	1.64
3	ZAF	4.03	3	KOR	1.65	3	E12	1.33
24	MET	0.15	24	RUS	0.25	24	THA	0.71
25	JPN	0.10	25	HKG	0.14	25	RUS	0.37
26	SGP	0.04	26	ZAF	0.13	26	MET	0.33
Trade			**Paper Products & Publishing**			**Construction**		
1	HKG	3.85	1	CAN	2.42	1	RUS	2.20
2	ZAF	1.54	2	MET	1.61	2	USA	1.83
3	SSA	1.49	3	USA	1.37	3	E12	1.65
24	KOR	0.42	24	VNM	0.28	24	XEA	0.24
25	MET	0.20	25	SSA	0.24	25	PHL	0.21
26	VNM	0.17	26	PHL	0.22	26	CHT	0.17

Panel B.

	Coef.	t-stat	N	Controls	Adj-R^2
Target ROA	0.007***	7.37	12,238	Country-Year	0.13
Acquirer ROA	0.065***	4.56	14,170	Country-Year	0.02

Table 2: Summary statistics of cross-border vertical acquisitions

This table reports summary statistics of cross-border acquisitions between 2004 and 2010. I include all cross-border mergers and acquisitions that are labeled as mergers, acquisitions of majority interests, acquisitions of partial interests, and acquisitions of assets. Among these transactions, I keep those where acquirers do not own a stake equal or greater than 50 percent prior announcement. Panel A reports the proportions of transactions across cross-border, vertical, majority, and minority acquisitions in the whole sample in terms of the number of deals and the dollar value adjusted for inflation. Panel B presents summary statistics of vertical acquisitions. Vertical relatedness is provided by Fan and Lang (2000) based on BEA 1992 input-output table, and is the fraction the input industry contributes in added-value to the output industry. Vertical acquisitions (forward, backward) are those in which the acquirer and target do not share the same BEA IO industry code and either the acquirer sell (more, less) to the target than the target sell to the acquirer and the target buys (more, less) inputs from the acquirer than the acquirer buys from the targe. Panel C reports the 15 vertically related GTAP sector pairs with the most cross-border acquisitions during the sample period in descending order. GTAP sectors are matched to three-digit SIC codes. BEA IO codes are matched to four-digit SIC codes.

Panel A.

	Total	Vertical					
		Sub-total		Majority acquisition		Minority acquisition	
			% of total		% of sub-total		% of sub-total
Number of deals	52,547	21,264	40%	17,106	80%	4,158	20%
Deal value (in trillion USD)	5.934	2.196	37%	1.893	86%	0.303	14%

Panel B.

				Percentile				
	N	Mean	Std. Dev.	10th	25th	50th	75th	90th
Forward acquisition								
Forward relatedness(%)	10,194	3.46	7.05	0.08	0.35	1.27	3.28	7.28
Backward relatedness(%)	10,194	0.27	0.50	0.00	0.00	0.01	0.36	0.95
Backward acquisition								
Forward relatedness(%)	11,070	0.26	0.52	0.00	0.00	0.02	0.19	0.95
Backward relatedness(%)	11,070	3.69	7.03	0.09	0.34	1.62	3.82	8.15

Acqurier GTAP sector	Target GTAP sector	All vertical acquisitions		Forward		Backward	
		N	%	N	%	N	%
Business Services	Business Services	2,027	10%	1,199	41%	828	59%
Financial Services	Financial Services	1,738	8%	687	60%	1,051	40%
Financial Services	Business Services	1,646	8%	554	66%	1,092	34%
Communication	Business Services	1,041	5%	635	39%	406	61%
Electronic Equipment	Business Services	946	4%	466	51%	480	49%
Trade	Chemical, Rubber & Plastic	833	4%	376	55%	457	45%
Trade	Electronic Equipment	633	3%	263	58%	370	42%
Machinery & Equipment	Business Services	562	3%	211	62%	351	38%
Machinery & Equipment	Machinery & Equipment	552	3%	265	52%	287	48%
Trade	Business Services	546	3%	241	56%	305	44%
Trade	Motor Vehicles & Parts	498	2%	136	73%	362	27%
Minerals	Minerals	477	2%	289	39%	188	61%
Water Transportation	Transportation Equipment	460	2%	130	72%	330	28%
Communication	Communication	426	2%	225	47%	201	53%
Chemical, Rubber & Plastic	Chemical, Rubber & Plastic	422	2%	243	42%	179	58%
Total 15 GTAP pairs		12,807	60%	5,920		6,887	
Total sample		21,264	100%	10,194		11,070	

Table 3: Univariate results

This table reports summary statistics of key variables used in empirical analysis. Column 2-5 (6-9) are majority acquisition (minority acquisitions), defined as stake owned after acquisition is greater (less) than 50 percent. The last column reports p-value of t-test between the majority and minority subsamples. *Stake size (%)* is the percentage of targets' stock shares that acquirers owns after acquisition. $P_{c,i}$ ($P_{c,i}$) is target (acquirer) country-level relative advantage in vertical specialization. *Listed target* (*Listed acquirer*) are dummies equal to one if the target (acquirer) is listed in stock exchange, and zero otherwise. $ADRI_c$ is the Antidirector Rights Index. $CHS_{c,i}$ *(%)* is closely held shares in a firm aggregated at country-industry level. $MktRet_{c,c'}$ is the target-acquirer country pair differences in buy-and-hold inflation-adjusted stock market return from 275 trading days to 25 trading days before announcement. $FX_{c,c'}$ is the difference of annual inflation-adjusted bilateral U.S. dollar exchange rate return of the target country and acquirer country from 275 trading days to 25 trading days. *Relative size* is estimated as deal value relative to the acquirer's market capitalization 25 trading days prior to the deal announcement. *Premium* is the offer price over target stock price four weeks before deal announcement date.

	Majority acquisition				Minority acquisition				Difference of group mean
	N	Mean	Median	Std.dev.	N	Mean	Median	Std.dev.	p-value
Stake size (%)	16,695	94.7	100	13.52	3,388	25.2	21.2	17.07	0.00
$P_{c,i}$	17,106	1.19	1.15	0.77	4,158	1.33	0.99	1.28	0.00
$P_{c',i'}$	17,106	1.17	1.18	0.65	4,158	1.14	0.97	0.75	0.02
Listed target	17,106	0.05	0	0.23	4,158	0.32	0	0.47	0.00
Listed acquirer	17,106	0.57	1	0.49	4,158	0.51	1	0.5	0.00
$ADRI_c$	13,966	3.87	4	1.1	2,888	4.06	4	0.94	0.00
$CHS_{c,i}$ *(%)*	12,290	8.77	3.15	15.03	2,884	7.42	2.32	12.93	0.00
$MktRet_{c,c'}$ *(%)*	16,261	1.59	0.9	18.04	3,844	3.08	2.2	22.14	0.00
$FX_{c,c'}$ *(%)*	14,177	-6.69	-0.48	64.48	2,979	-9.29	-1.26	50.88	0.04
Forward	17,106	0.47	0	0.5	4,158	0.51	1	0.5	0.00
Backward	17,106	0.53	1	0.5	4,158	0.49	0	0.5	0.00
Relative size	3,050	0.02	0	0.07	751	0	0	0.01	0.00
Premium (%)	413	42.4	32.79	34.92	308	28.8	17.3	33.51	0.00

Table 4: Multivariate results

This table reports marginal effects of probit regression, where dependent variable equals one if the acquisition is for a majority acquisition, and zero if the acquisition is for a minority equity stake. The sample is vertical cross-border acquisitions between 2004 and 2010. $P_{c,i}$ ($P_{c,i}$) is target (acquirer) country-level relative advantage in vertical specialization. *Listed target* (*Listed acquirer*) are dummies equal to one if the target (acquirer) is listed in stock exchange, and zero otherwise. $ADRI_c$ is the Antidirector Rights Index. $CHS_{c,i}$ *(%)* is closely held shares in a firm aggregated at country-industry level. $MktRet_{c,c'}$ is the target-acquirer country pair differences in buy-and-hold inflation-adjusted stock market return from 275 trading days to 25 trading days before announcement. $FX_{c,c'}$ is the difference of annual inflation-adjusted bilateral U.S. dollar exchange rate return of the target country and acquirer country from 275 trading days to 25 trading days. *, **, and *** indicate coefficients significantly different from zero at the 0.1 0.05, and 0.01 levels respectively.

	Main sample			$P_{c,i} \geq 1$		
	(1)	(2)	(3)	(4)	(5)	(6)
$P_{c,i}$	-0.025***	-0.021***	-0.025***	-0.061***	-0.044***	-0.044***
	[-8.14]	[-6.97]	[-6.76]	[-19.61]	[-11.98]	[-9.52]
$P_{c',i'}$			0.002			0.007
			[0.26]			[1.01]
Listed target			-0.260***			-0.226***
			[-28.65]			[-21.10]
Listed acquirer			0.011			0.013*
			[1.64]			[1.77]
$CHS_{c,i}$			0.000			0.000
			[1.64]			[0.50]
$ADRI_c$			-0.018***			-0.012***
			[-4.66]			[-2.62]
$MktRet_{c,c'}$			-0.069***			-0.042
			[-2.89]			[-1.49]
$FX_{c,c'}$			-0.016**			-0.011
			[-2.36]			[-1.43]
N	21,264	21,264	11,268	11,941	11,941	7,432
Pseudo R^2	0.004	0.064	0.181	0.036	0.104	0.216
Year dummies	Y	Y	Y	Y	Y	Y
Sector-pair dummies	Y	Y	Y	Y	Y	Y

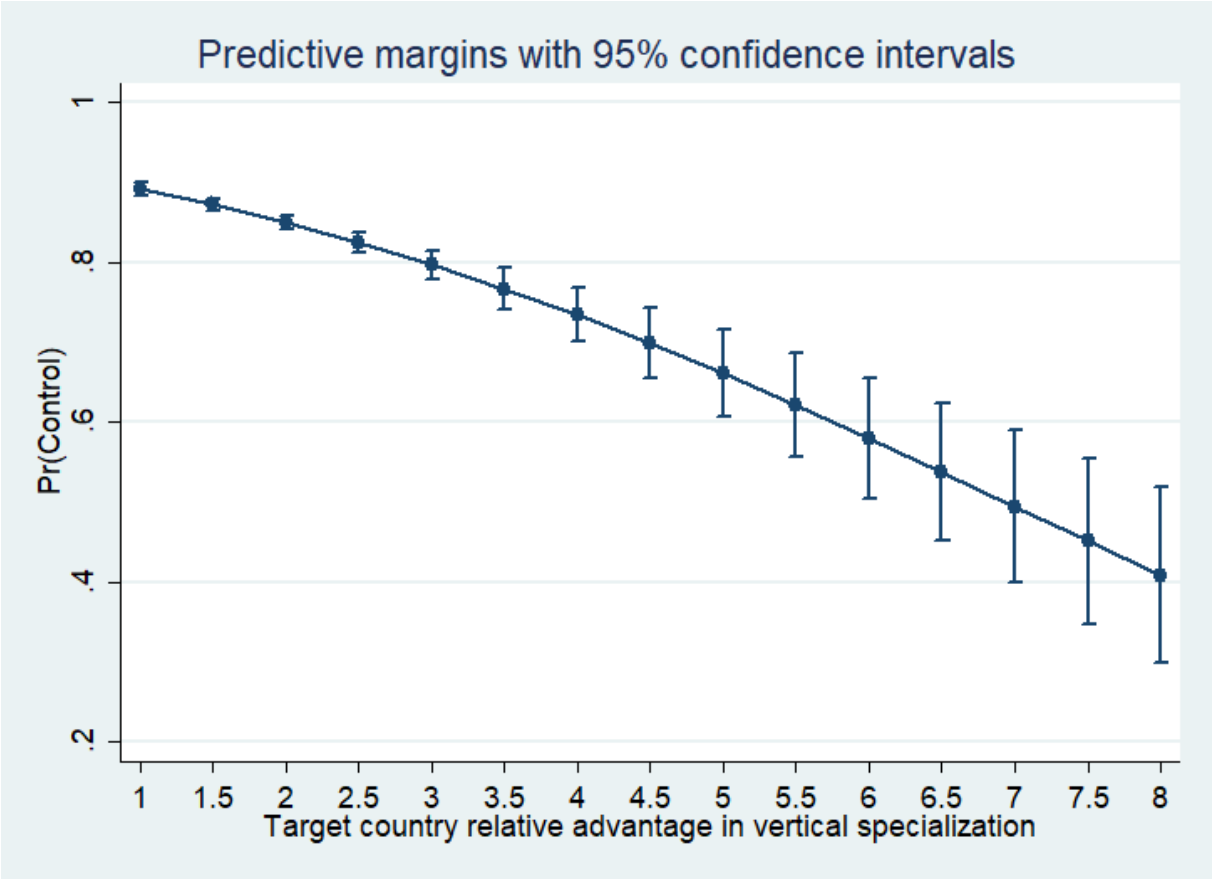

Figure 1:Predictive marginal effect of target country vertical specialization on the likelihood of foreign majority acquisition

This figure plots the marginal effect of target country relative advantage in vertical specialization on the likelihood of majority acquisition by foreign acquirers, estimated based on probit regression. The sample size is composed by cross-border vertical acquisitions from 2004 to 2010. In the probit regression, the dependent variable equals one if the acquisition is for a majority acquisition, and zero if the acquisition is for a non-majority acquisition. The blue dots plot the evolution of mean marginal effect of target country-level relative advantage in vertical specialization if it increases from one to eight with 0.5 unit per time. The vertical lines on each dot indicates the 95 percent confidence interval.

Table 5: Results by subsamples of forward and backward acquisitions

This table reports marginal effects of probit regression for forward and backward acquisitions separately. The dependent variable equals one if the acquisition is for a majority acquisition, and zero if the acquisition is for a minority equity stake. The sample is vertical cross-border acquisitions between 2004 and 2010. $P_{c,i}$ ($P_{c,i}$) is target (acquirer) country-level relative advantage in vertical specialization. *Vertical relatedness* is provided by Fan and Lang (2000) based on BEA 1992 input-output table, and is the fraction the input industry contributes in added-value to the output industry. *Forward* (*backward*) indicates the direction of selling to (buying from) between two sectors. *Listed target* (*Listed acquirer*) are dummies equal to one if the target (acquirer) is listed in stock exchange, and zero otherwise. $ADRI_c$ is the Antidirector Rights Index. $CHS_{c,i}$ *(%)* is closely held shares in a firm aggregated at country-industry level. $MktRet_{c,c'}$ is the target-acquirer country pair differences in buy-and-hold inflation-adjusted stock market return from 275 trading days to 25 trading days before announcement. $FX_{c,c'}$ is the difference of annual inflation-adjusted bilateral U.S. dollar exchange rate return of the target country and acquirer country from 275 trading days to 25 trading days. *, **, and *** indicate coefficients significantly different from zero at the 0.1, 0.05, and 0.01 levels respectively.

	Forward acquisition			Backward acquisition		
	Main sample (1)	Main sample (2)	$P_{c,i} \geq 1$ (3)	Main sample (3)	Main sample (4)	$P_{c,i} \geq 1$ (5)
$P_{c,i}$	-0.032***	-0.026***	-0.055***	-0.024***	-0.018***	-0.046***
	[-6.71]	[-5.30]	[-10.11]	[-4.48]	[-2.96]	[-8.25]
$P_{c',i'}$	0.029***	0.023**	0.029***	-0.015*	-0.015*	-0.006
	[3.08]	[2.56]	[2.70]	[-1.92]	[-1.82]	[-0.62]
Forward relatedness	-0.106	0.126	-0.038			
	[-1.45]	[1.47]	[-0.46]			
Backward relatedness				-0.314***	-0.260***	-0.269***
				[-5.27]	[-3.26]	[-3.87]
Listed target	-0.301***	-0.271***	-0.265***	-0.262***	-0.244***	-0.227***
	[-22.61]	[-20.12]	[-16.68]	[-21.49]	[-19.46]	[-15.93]
Listed acquirer	0.006	0.001	0.010	0.023***	0.021**	0.025**
	[0.64]	[0.07]	[0.84]	[2.68]	[2.33]	[2.54]
$CHS_{c,i}$	0.000	0.000	-0.000	0.000	0.000	-0.000
	[0.67]	[0.44]	[-0.20]	[0.69]	[1.20]	[-0.48]
$ADRI_c$	-0.027***	-0.025***	-0.025***	-0.017***	-0.015***	-0.001
	[-4.44]	[-4.17]	[-3.46]	[-3.22]	[-2.90]	[-0.24]
$MktRet_{c,c'}$	-0.098***	-0.081**	-0.076*	-0.073**	-0.068**	-0.035
	[-2.68]	[-2.30]	[-1.76]	[-2.21]	[-2.09]	[-0.92]
$FX_{c,c'}$	-0.028***	-0.022**	-0.028**	-0.019**	-0.016*	-0.013
	[-2.78]	[-2.15]	[-2.26]	[-2.19]	[-1.76]	[-1.21]
N	5,341	5,326	3,475	5,940	5,843	3,981
Pseudo R^2	0.172	0.220	0.225	0.129	0.175	0.146
Year dummies	Y	Y	Y	Y	Y	Y
Sector-pair dummies	N	Y	N	N	Y	N

Table 6: Robustness tests

This table reports marginal effects of probit regression for subsamples. *Dual-acquirer* indicates the subsample of acquisitions where acquirers have conducted both majority and minority acquisitions between 2004 and 2010. *Non-serial acquisitions* indicated acquisitions in which the same targets only received one investment from the same acquirer between 2004 and 2010. *Non-strategic sectors* indicate acquisitions take place in GTAP sectors other than coal, oil and gas, minerals, petroleum and coal products, mineral products, electricity, gas manufacture and distribution, water, air transportation, communication (including telecommunication), financial services, public admin, public defense, education, and health. The dependent variable equals one if the acquisition is for a majority acquisition, and zero if the acquisition is for a minority equity stake. The sample is vertical cross-border acquisitions between 2004 and 2010. $P_{c,i}$ ($P_{c,i}$) is target (acquirer) country-level relative advantage in vertical specialization. *Listed target* (*Listed acquirer*) are dummies equal to one if the target (acquirer) is listed in stock exchange, and zero otherwise. $ADRI_c$ is the Antidirector Rights Index. $CHS_{c,i}$ *(%)* is closely held shares in a firm aggregated at country-industry level. $MktRet_{c,c'}$ is the target-acquirer country pair differences in buy-and-hold inflation-adjusted stock market return from 275 trading days to 25 trading days before announcement. $FX_{c,c'}$ is the difference of annual inflation-adjusted bilateral U.S. dollar exchange rate return of the target country and acquirer country from 275 trading days to 25 trading days. *, **, and *** indicate coefficients significantly different from zero at the 0.1, 0.05, and 0.01 levels respectively

	Dual-acquirer		Non-serial acquisitions		Non-strategic sectors	
	Main sample	$P_{c,i} \geq 1$	Main sample	$P_{c,i} \geq 1$	Main sample	$P_{c,i} \geq 1$
	(1)	(2)	(3)	(4)	(5)	(6)
$P_{c,i}$	-0.045***	-0.063***	-0.021***	-0.039***	0.006	-0.029***
	[-4.10]	[-4.09]	[-5.85]	[-8.71]	[0.91]	[-3.80]
$P_{c',i'}$	0.023	0.029	-0.003	-0.000	0.002	0.001
	[1.15]	[1.06]	[-0.56]	[-0.03]	[0.22]	[0.09]
Listed target	-0.299***	-0.290***	-0.235***	-0.200***	-0.215***	-0.176***
	[-11.12]	[-8.60]	[-25.95]	[-18.95]	[-22.95]	[-16.15]
Listed acquirer	0.030	0.020	0.013**	0.017**	0.010	0.012
	[1.15]	[0.61]	[1.98]	[2.35]	[1.53]	[1.61]
$CHS_{c,i}$	0.001	0.000	0.000*	0.000	0.000**	0.000*
	[0.83]	[0.06]	[1.94]	[0.50]	[2.01]	[1.75]
$ADRI_c$	-0.006	-0.003	-0.017***	-0.012***	-0.020***	-0.011***
	[-0.47]	[-0.20]	[-4.55]	[-2.60]	[-5.05]	[-2.64]
$MktRet_{c,c'}$	-0.246***	-0.200**	-0.061***	-0.035	-0.054**	-0.026
	[-3.39]	[-2.07]	[-2.62]	[-1.31]	[-2.12]	[-0.90]
$FX_{c,c'}$	-0.020	-0.038	-0.014**	-0.010	-0.018***	-0.015*
	[-0.87]	[-1.26]	[-2.15]	[-1.29]	[-2.74]	[-1.96]
N	2,176	1,401	10,791	7,118	8,361	5,979
Pseudo R^2	0.123	0.148	0.172	0.207	0.146	0.125
Year dummies	Y	Y	Y	Y	Y	Y
Sector-pair dummies	Y	Y	Y	Y	Y	Y

Appendix1:Global Trade Analysis Project (GTAP2004) country and sector lists

Country code	Description	Country code	Description
AUS	Australia	PHL	Philippines
BRA	Brazil	ROA	Rest of Americas
CAN	Canada	ROH	EFTA(Iceland,Liechtenstein,Norway,Switzerland)
CHT	China	ROW	Rest of the world
E12	EU-12(May.2004 - Jun.2013)	RUS	Russia
E15	EU-15(Nov.1993 - Apr.2004)	SGP	Singapore
HKG	Hong Kong	SSA	Rest of South Asia
IDN	Indonesia	THA	Thailand
IND	India	TWN	Taiwan
JPN	Japan	USA	United States
KOR	South Korea	VNM	Vietnam
MET	Mexico	XEA	Rest of East Asia
MYS	Malaysia	ZAF	South Africa

Sector code	Description	Sector code	Description
1	Crop Production	22	Motor Vehicles and Parts
2	Animal Husbandry	23	Transportation Equipment
3	Forestry	24	Electronic Equipment
4	Fishing	25	Machinery and Equipment
5	Coal	26	Manufactures
6	Oil and Gas	27	Electricity
7	Minerals	28	Gas Manufacture and Distribution
8	Meat and Dairy	29	Water
9	Food Products	30	Construction
10	Beverages and Tobacco	31	Trade
11	Textiles	32	OtherTransportation
12	Wearing Apparel	33	Water Transportation
13	Leather Products	34	Air Transportation
14	Wood Products	35	Communication
15	Paper Products and Publishing	36	Financial Services
16	Petroleum and Coal Products	37	Insurance
17	Chemical, Rubber and Plastic Products	38	Business Services
18	Mineral Products	39	Recreational and Other Services
19	Ferrous Metals	40	Public Admin and Defense, Education and Health
20	Non-Ferrous Metals	41	Dwellings
21	Finished Metal Products		

Appendix 2: Baseline results – without acquisitions in the same GTAP sector

This table reports marginal effects of probit regression, where dependent variable equals one if the acquisition is for a majority acquisition, and zero if the acquisition is for a minority equity stake. The sample is vertical cross-border acquisitions between 2004 and 2010. $P_{c,i}$ ($P_{c,i}$) is target (acquirer) country-level relative advantage in vertical specialization. *Listed target* (*Listed acquirer*) are dummies equal to one if the target (acquirer) is listed in stock exchange, and zero otherwise. $ADRI_c$ is the Antidirector Rights Index. $CHS_{c,i}$ *(%)* is closely held shares in a firm aggregated at country-industry level. $MktRet_{c,c'}$ is the target-acquirer country pair differences in buy-and-hold inflation-adjusted stock market return from 275 trading days to 25 trading days before announcement. $FX_{c,c'}$ is the difference of annual inflation-adjusted bilateral U.S. dollar exchange rate return of the target country and acquirer country from 275 trading days to 25 trading days. *, **, and *** indicate coefficients significantly different from zero at the 0.1 0.05, and 0.01 levels respectively.

	Main sample			$P_{c,i} \geq 1$		
	(1)	(2)	(3)	(4)	(5)	(6)
$P_{c,i}$	-0.038***	-0.023***	-0.026***	-0.070***	-0.050***	-0.050***
	[-11.47]	[-6.62]	[-5.71]	[-19.87]	[-11.63]	[-8.36]
$P_{c',i'}$			-0.008			0.005
			[-1.05]			[0.52]
Listed target			-0.284***			-0.239***
			[-24.78]			[-17.53]
Listed acquirer			0.005			0.006
			[0.59]			[0.65]
$CHS_{c,i}$			0.000			-0.000
			[0.62]			[-0.18]
$ADRI_c$			-0.020***			-0.015**
			[-4.09]			[-2.53]
$MktRet_{c,c'}$			-0.070**			-0.041
			[-2.31]			[-1.13]
$FX_{c,c'}$			-0.025***			-0.021**
			[-2.98]			[-2.10]
N	14244	14236	7702	8246	8224	5126
Pseudo R^2	0.004	0.064	0.181	0.036	0.104	0.216
Year dummies	Y	Y	Y	Y	Y	Y
Sector-pair dummies	Y	Y	Y	Y	Y	Y

Appendix 3: Results by subsamples of forward and backward acquisitions – without acquisitions in the same GTAP sector

This table reports marginal effects of probit regression for forward and backward acquisitions separately. The dependent variable equals one if the acquisition is for a majority acquisition, and zero if the acquisition is for a minority equity stake. The sample is vertical cross-border acquisitions between 2004 and 2010. $P_{c,i}$ ($P_{c,i}$) is target (acquirer) country-level relative advantage in vertical specialization. *Vertical relatedness* is provided by Fan and Lang (2000) based on BEA 1992 input-output table, and is the fraction the input industry contributes in added-value to the output industry. *Forward* (*backward*) indicates the direction of selling to (buying from) between two sectors. *Listed target* (*Listed acquirer*) are dummies equal to one if the target (acquirer) is listed in stock exchange, and zero otherwise. $ADRI_c$ is the Antidirector Rights Index. $CHS_{c,i}$ *(%)* is closely held shares in a firm aggregated at country-industry level. $MktRet_{c,c'}$ is the target-acquirer country pair differences in buy-and-hold inflation-adjusted stock market return from 275 trading days to 25 trading days before announcement. $FX_{c,c'}$ is the difference of annual inflation-adjusted bilateral U.S. dollar exchange rate return of the target country and acquirer country from 275 trading days to 25 trading days. *, **, and *** indicate coefficients significantly different from zero at the 0.1, 0.05, and 0.01 levels respectively.

	Forward acquisition			Backward acquisition		
	Main sample (1)	Main sample (2)	$P_{c,i} \geq 1$ (3)	Main sample (3)	Main sample (4)	$P_{c,i} \geq 1$ (5)
$P_{c,i}$	-0.043***	-0.033***	-0.069***	-0.026***	-0.024***	-0.048***
	[-7.18]	[-5.07]	[-9.42]	[-4.21]	[-3.11]	[-7.44]
$P_{c',i'}$	0.020	0.029**	0.021	-0.028***	-0.029***	-0.012
	[1.62]	[2.35]	[1.36]	[-3.17]	[-3.17]	[-1.12]
Forward relatedness	-0.176	-0.087	-0.255			
	[-1.31]	[-0.41]	[-1.17]			
Backward relatedness				-0.357***	-0.295**	-0.265**
				[-4.22]	[-2.09]	[-2.23]
Listed target	-0.327***	-0.314***	-0.281***	-0.263***	-0.249***	-0.214***
	[-18.55]	[-17.29]	[-13.07]	[-17.88]	[-16.76]	[-12.61]
Listed acquirer	0.005	-0.004	0.006	0.012	0.015	0.014
	[0.38]	[-0.31]	[0.37]	[1.21]	[1.48]	[1.26]
$CHS_{c,i}$	0.000	0.000	-0.000	-0.000	0.000	-0.000
	[0.68]	[0.13]	[-0.25]	[-0.65]	[0.09]	[-0.90]
$ADRI_c$	-0.035***	-0.033***	-0.038***	-0.016***	-0.015**	-0.004
	[-4.24]	[-4.01]	[-3.72]	[-2.75]	[-2.40]	[-0.61]
$MktRet_{c,c'}$	-0.147***	-0.106**	-0.068	-0.048	-0.043	-0.047
	[-2.97]	[-2.23]	[-1.12]	[-1.23]	[-1.14]	[-1.05]
$FX_{c,c'}$	-0.047***	-0.039***	-0.040**	-0.025**	-0.017*	-0.018
	[-3.50]	[-2.92]	[-2.32]	[-2.41]	[-1.68]	[-1.48]
N	3405	3389	2166	4312	4252	2986
Pseudo R^2	0.186	0.237	0.241	0.135	0.183	0.150
Year dummies	Y	Y	Y	Y	Y	Y
Sector-pair dummies	N	Y	N	N	Y	N

Appendix 4: Robustness tests – without acquisitions in the same GTAP sector

This table reports marginal effects of probit regression for subsamples. *Dual-acquirer* indicates the subsample of acquisitions where acquirers have conducted both majority and minority acquisitions between 2004 and 2010. *Non-serial acquisitions* indicated acquisitions in which the same targets only received one investment from the same acquirer between 2004 and 2010. *Non-strategic sectors* indicate acquisitions take place in GTAP sectors other than coal, oil and gas, minerals, petroleum and coal products, mineral products, electricity, gas manufacture and distribution, water, air transportation, communication (including telecommunication), financial services, public admin, public defense, education, and health. The dependent variable equals one if the acquisition is for a majority acquisition, and zero if the acquisition is for a minority equity stake. The sample is vertical cross-border acquisitions between 2004 and 2010. $P_{c,i}$ ($P_{c,i}$) is target (acquirer) country-level relative advantage in vertical specialization. *Listed target* (*Listed acquirer*) are dummies equal to one if the target (acquirer) is listed in stock exchange, and zero otherwise. $ADRI_c$ is the Antidirector Rights Index. $CHS_{c,i}$ *(%)* is closely held shares in a firm aggregated at country-industry level. $MktRet_{c,c'}$ is the target-acquirer country pair differences in buy-and-hold inflation-adjusted stock market return from 275 trading days to 25 trading days before announcement. $FX_{c,c'}$ is the difference of annual inflation-adjusted bilateral U.S. dollar exchange rate return of the target country and acquirer country from 275 trading days to 25 trading days. *, **, and *** indicate coefficients significantly different from zero at the 0.1, 0.05, and 0.01 levels respectively

	Dual-acquirer		Non-serial acquisitions		Non-strategic sectors	
	Main sample	$P_{c,i} \geq 1$	Main sample	$P_{c,i} \geq 1$	Main sample	$P_{c,i} \geq 1$
	(1)	(2)	(3)	(4)	(5)	(6)
$P_{c,i}$	-0.054***	-0.071***	-0.023***	-0.044***	0.003	-0.042***
	[-3.75]	[-3.54]	[-5.00]	[-7.70]	[0.35]	[-4.24]
$P_{c',i'}$	0.006	0.021	-0.010	-0.003	-0.003	-0.005
	[0.22]	[0.58]	[-1.44]	[-0.31]	[-0.40]	[-0.49]
Listed target	-0.285***	-0.275***	-0.263***	-0.215***	-0.250***	-0.199***
	[-7.71]	[-6.01]	[-22.70]	[-16.03]	[-20.90]	[-14.38]
Listed acquirer	-0.012	-0.012	0.008	0.011	0.011	0.013
	[-0.32]	[-0.25]	[1.03]	[1.19]	[1.35]	[1.42]
$CHS_{c,i}$	-0.000	-0.001	0.000	-0.000	0.000	0.000
	[-0.16]	[-0.58]	[1.19]	[-0.07]	[1.62]	[1.62]
$ADRI_c$	-0.014	-0.032	-0.020***	-0.016***	-0.023***	-0.015***
	[-0.77]	[-1.40]	[-4.31]	[-2.82]	[-4.66]	[-2.76]
$MktRet_{c,c'}$	-0.309***	-0.235*	-0.073**	-0.044	-0.063**	-0.032
	[-3.03]	[-1.77]	[-2.47]	[-1.27]	[-2.02]	[-0.91]
$FX_{c,c'}$	-0.023	-0.052	-0.025***	-0.023**	-0.025***	-0.025***
	[-0.69]	[-1.25]	[-3.15]	[-2.37]	[-3.01]	[-2.61]
N	1248	829	7387	4915	5837	4145
Pseudo R^2	0.151	0.170	0.184	0.224	0.156	0.133
Year dummies	Y	Y	Y	Y	Y	Y
Sector-pair dummies	Y	Y	Y	Y	Y	Y