Extending Comparative Advantage Through Cross-Border Acquisitions

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ABSTRACT

We investigate the role of industry specialization in cross-border acquisitions. We find that acquirers from more specialized industries are more likely to buy foreign targets in countries that are less specialized in these same industries. The magnitude of this specialization effect is large with 14.7% more deals when the difference in industry specialization between two countries increases by one standard deviation. This relationship is stronger when the cross-country and cross-industry differences in measures of educational attainment and intangible capital are higher. Post-acquisition performance is higher when specialized acquirers purchase assets in less specialized industries. These results are consistent with management and industry know-how providing a comparative advantage that can be extended across countries.

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“A firm’s motive for international expansion and its success are largely determined by its intangible resources”, Richard E. Caves (2007)

I Introduction

The last thirty years have witnessed a boom in cross-border mergers and acquisitions, with a large range of countries and industries participating in the globalization of corporate acquisitions. A large literature has developed to understand why firms stretch their boundaries internationally by acquiring foreign assets. Existing research highlights that country characteristics play an important role in explaining both the intensity and direction of cross-border acquisition flows. Differences in countries’ institutional quality, corporate governance, tax regimes, labor regulation, currency and stock market valuation, or cultural traits have been found to explain the flow of acquisitions between countries.

In this paper, we focus on the role of industries in explaining the geography of global acquisitions. In particular, we develop and test the idea that cross-border acquisitions are driven by differences between countries in their degree of specialization on particular economic activities. Specialization reflects differences in the relative efficiency of industries across countries. Such heterogeneity arises because of countries’ unequal factor endowments (e.g. labor costs or access to natural resources), but also because of differences in the prevalence of industry-specific assets, such as knowhow, expertise, or human capital. These intangible resources confer some countries a comparative advantage in certain economic areas, such as watch-making in Switzerland, information technology in the United States, financial and legal services in the United Kingdom, or car manufacturing in Germany.

We argue that these industry-specific intangibles are mobile and can be profitably deployed on existing foreign assets. If so, cross-border acquisitions in a given industry should increase with the specialization of the acquirer’s industry, and involve the purchase of assets located in countries that are less specialized in that industry. This idea, which builds on the early intuition of Caves (1971) and Hymer (1976),
forms our main hypothesis. Accordingly, the value of acquiring assets abroad arises from the complementarity between target firms’ immobile capabilities (e.g. existing machines and equipment, distribution network, or political connections) and acquiring firms’ mobile industry-specific resources, reflected by their degree of specialization. This motive is distinct from other motives for cross-border acquisitions such as sourcing cheaper factors of production (Yeaple (2003)), tariff jumping and foreign market access (Brainard (1997)), buying undervalued assets (Erel, Liao, and Weisbach (2012)), extending governance practices abroad (Bris and Cabolis (2008), Rossi and Volpin (2004)), or the presence of institutional investors (Ferreira, Massa, and Matos (2010)).

We measure the degree of specialization of a country in a given industry by comparing the domestic share of production of that industry to the average share of that industry worldwide. Accordingly, countries are specialized in industries whose share of production (i.e. economic importance) are large compared to the rest of the world. We thus rely on the distribution of specialization across countries and industries to capture skill or comparative advantage in particular industries.

Based on a large sample of 38,821 horizontal cross-border transactions involving private and public firms from 46 countries and 97 industries, we find strong evidence that differences in specialization are an important driver of global acquisitions. Univariate tests at the deal level reveal that cross-border horizontal transactions occur primarily between firms operating in relatively specialized industries. However, we observe large differences in the degrees of specialization between acquirers and targets. Overall, more than 60% of all transactions involve acquirers than are more specialized than targets. Across all industries, we find that firms in more specialized industries buy assets in less specialized industries. The difference in specialization is economically large as acquirers display levels of specialization that are roughly 25% larger than that of targets. This pattern is strong and pervasive as it holds with

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1The next section provide details about our theoretical motivation and our main hypothesis.
2Hence, the reason why industry specialization should procure a comparative advantage for global acquirers is outside the scope of the usual Ricardian or Heckscher-Ohlin-Samuelson theories of international trade that focus on cost or factor availability and immobile factors of production.
3Because extending specialized resources abroad mainly operates within industries, our main tests focus on horizontal transactions – transactions taking place between firms from the same industry but from different countries.
various measures of specialization, in every year of the sample period, and is present across most countries and industries.

We further analyze the determinants of cross-border acquisition flows (both in numbers of transactions and dollar value) using a gravity model. Traditionally gravity models are used to examine how geographic distance explain the intensity of cross-border relations (e.g. trade or portfolio flows). We follow a similar approach but focus on differences in specialization space, while controlling for other known determinants of cross-border acquisitions. We find strong evidence that the intensity of acquisition flows across country-industry pairs is positively related to differences in (country-industry) specialization: The larger is the difference in specialization between two countries in a given industry, the larger is the flow of bilateral horizontal acquisitions. The magnitude of the specialization effect is large. For the average industry, a one standard deviation increase in the difference in specialization between two countries leads to an increase of 14.7% in the number of deals, and a 52.9% increase in aggregate transaction value.

The effect of specialization is distinct from that of countries’ characteristics such as country size, the level of economic development, exchange rates, common legal origin, language, or geographical distance between countries. We also show that the role of specialization in cross-border transactions is distinct from that of product market competition. We find that firms are more likely to buy foreign assets in less competitive industries, consistent with Caves (1971) and Neary (2007). We further find that the specialization effect we document mitigates the competitive effect, as firms from more specialized industries are more likely to buy assets in competitive industries, consistent with their mobile intangible resources allowing them to withstand the effects of competitive pressure.

We also explore in a deal-level analysis whether it is possible to predict the countries in which an acquirer would pick targets, and the countries from which a target would attract buyers, based on industry specialization. We estimate selection models (conditional logit models) that predict the probability for a firm in a given country-industry group to become an acquirer or a target. Our findings reveal that industries displaying a higher degree of specialization are significantly less likely to become tar-
gets in horizontal cross-border acquisitions compared to matched industries in other countries that are also targets in cross-border transactions. In contrast, acquirers in cross-border horizontal deals are more likely to come from country-industries that are exhibit a higher level of specialization.

Next, we investigate the hypothesis that the importance of intangible resources amplifies the specialization effect. We first look at this question at the country level. We find that the impact of industry specialization on acquisition intensity varies systematically with country-level proxies for human and technological capital. We document that differences in industry specialization have the largest effect on acquisition flows when the acquirer country has a higher level of educational attainment than the target country. The economic effect of the differences in educational attainment is roughly 50% larger when the acquirer country has a larger share of its population with a tertiary education or when it allocates a larger fraction of public resources to education. The effect of industry specialization is also magnified when the acquirer country benefits from a larger stock of patents, trademarks or published scientific articles per capita.

We then investigate the importance of human capital and intangibles on the country-industry level, where we are limited to a smaller sample. We use data on intangible assets for a sample of 25 European and major OECD countries and data on the use of intangibles in listed firms in our full sample of countries and industries. We find more cross-border horizontal acquisitions when the acquiring country-industry has a larger stock of R&D, larger R&D expenditures, a larger stock of software capital, and employs a higher fraction of skilled people than the industry in a target country.

In the last part of our analysis, we analyze whether differences in specialization are also related to acquisition outcomes. We find that (one- and three-year) operating performance following an international acquisition (by public firms) is significantly better when the acquirer is from a more specialized industry than the target. These results suggest that the benefit acquiring less specialized foreign assets is related to the ability of specialized buyers to operate the purchased assets more efficiently by deploying their mobile intangible resources.
Our results hold across a host of robustness checks. They are robust to controlling for the size and growth prospects of the acquirer and target country-industry. The results remain unaffected when we discard the largest acquirer and target countries, when we modify the estimation method, and when we estimate panel models to further control for time, and country-industry pairs unobserved heterogeneity. In addition, we show that our results are unlikely to reflect reverse causality that would imply that acquirers use their acquisitions in less specialized countries to accentuate the observed differences in specialization. For instance, the role of industry specialization remains strong when we measure specialization over the 1990-1995 period, and use it to explain cross-border acquisitions over the 2006-2010 period.

While we extensively examine cross-border acquisitions in this paper, we do not analyze new investments in foreign countries through building new plants or capacity and thus we do not address the choice between building new capacity (greenfield investments) and acquiring existing producers (brownfield investments). We restrict our attention to international acquisitions for reasons of data availability rather than principle. Company-level transactions data available for a large set of countries allow us to identify two dimensions of bilateral foreign investment flows: by country (country of origin and destination), and by industry (industry of origin and destination). This disaggregation, which is not available for greenfield investment, is central to our examination of the role of industry specialization for global expansion.

Overall our paper adds to the growing literature examining the determinants of cross-border acquisition flows. We depart from most existing studies by focusing on industries and the importance of mobile industry-specific intangibles, as opposed to country-level determinants. The idea that firms acquire foreign assets to deploy mobile intangible resources internationally is not new. It was suggested already by Caves (1971) and Hymer (1976), and was recently formalized by Neary (2007) and Nocke and Yeaple (2007). Yet, to the best of our knowledge, ours is the first study to show that the direction and intensity of cross-border acquisitions is related to differences in specialization, consistent with firms’ willingness to extend specific

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4See Nocke and Yeaple (2007).
intangibles abroad. Our results are broadly consistent with the “organizational capabilities” theory of the firm advanced by Lucas (1978), Rosen (1982), or more recently Garciano and Rossi-Hansberg (2006) according to which higher-quality intangibles (e.g. knowhow and expertise) are spread across a greater set of productive assets. Our findings suggest that this assignment view of firm boundaries extends to foreign assets.

Our results also add to studies that examines the connections between firms’ multinationality and intangible assets (see Caves (2007) for a comprehensive survey). Existing research indicates that firms with a multinational presence tend to have a high proportion of intangible assets (e.g. Harris and Ravenscraft (1991)). Foreign expansions follow the development and accumulation of intangible assets (e.g. Yeaple (2003)). Moreover, the value of being a multinational firm increases with firms’ intangible resources (e.g. Morck and Yeung (1992) or Morck and Yeung (1991). Our findings further show that the distribution of intangibles across countries and industries helps to explain the volume and direction of multinationals’ acquisition activity.

The rest of the paper is organized as follows. We discuss theoretical foundations and develop our hypotheses in Section II. Section III describes the measures of specialization and the sample of cross-border acquisitions. Section IV presents the specialization profiles of acquiring and target firms. Section V presents empirical tests of the effect of industry specialization on cross-border acquisitions. Section VI presents results from a detailed cross-country analysis. Section VII examines post transaction outcomes, whereas Section VIII concludes.

Two papers present results that are related to ours. Brakman, Garretsen, and Marrewijk (2007) look at a sample of cross-border mergers between five OECD countries in 20 aggregate sectors over the period 1980-2004. They document that acquirers are more likely to come from sectors that have a comparative advantage in exporting. Similarly, Feliciano and Lipsey (2010) document the acquisitions of U.S. firms tend to occur in industries in which the acquiring country has a comparative advantage at exporting.
II Hypotheses Development

Our paper draws on the literature on multinational firms and international mergers and acquisitions that is rooted in international economics. Industry specialization plays a prominent role in international economics, going back to David Ricardo’s classical example of trade in wine and cloth. Countries differ in the relative efficiency of their industries, and hence they specialize to capitalize on their comparative advantage. Such comparative advantage might not only arise because of country-level differences in labor costs, productivity, natural resources or factor endowments, but also through industry-specific endowment differences. Comparative advantage leads to trade, but can also stimulate cross-border investment. The literature views the purchase of assets in foreign countries as a way for firms to extend the use of their mobile specialized assets across foreign markets, and hence extend their comparative advantage abroad.

Our hypotheses arise from theory literature on the motives of international acquisitions that is based on formal industrial organization-type models. Our first hypothesis is based on the value of industry specialization for foreign expansion. Neary (2007) and Nocke and Yeaple (2007) develop rationales for cross-border acquisitions based on product market specificities. Their work pertains particularly to horizontal acquisitions that we study. According to Neary (2007), after market liberalization that allows for foreign expansion through acquisitions, firms with a cost advantage – specialized firms – will buy assets in markets with a comparative cost disadvantage. In Cournot-Nash-type models, a horizontal acquisition typically eliminates a competitor and thus produces a bigger advantage for the remaining competitors than for the acquirer itself. Neary (2007) shows that if the cost differential is sufficient, the acquirer will find the acquisition worth its while nonetheless when the acquirer can lower the production cost of its target.

While these papers suggest a link between industry specialization and cross-border acquisitions, they are silent on the sources of comparative advantage (they assume exogenous differences in “costs”). In traditional trade theory, industry specialization is typically the consequence of comparative advantage and not one of
its origins. However, the recent trade literature paints a more complex picture of the relationship between industry specialization and comparative advantage. First, comparative advantage is not solely generated by country-level endowment differences, but also by industry-specific endowment differences. Second, it recognizes that external economies (producers in a specialized industry benefiting from externalities, in particular agglomeration economies) are frequently a key determinant of comparative advantage (e.g. Krugman, Obstfeld, and Melitz (2011) or Grossman and Rossi-Hansberg (2010)). Prominent among these is the importance of industry clusters of development and production know-how (e.g. Porter (1990)). Third, the theory of multinational firms recognizes firm-specific assets, such as technological know-how, marketing knowledge, management expertise and human capital, as the main driver behind a firm’s decision to make cross-border acquisitions (e.g. Caves (2007)). Many of these assets are likely to benefit from spillovers from industry specialization and agglomeration effects.

This literature forms the basis for our first hypothesis:

**Hypothesis 1** Cross-border acquisition intensity increases with industry comparative advantage of acquiring firms and the relative comparative disadvantage of target firms in the same industry.

Our second hypothesis is based on the importance of intangible assets and the difficulties in finding contractual or market solutions in view of market frictions when the use of these assets is extended to foreign markets by multinational firms, as was emphasized in early work by Hymer (1976) and Caves (1971). This work is closely related to the transaction cost theory of the firm (e.g. Williamson (1979)) and the property rights theory of the firm (e.g. Grossman and Hart (1986)), that emphasizes the difficulties and impossibilities of contracting for the use of intangibles firm-specific assets. Even if contracts are feasible, firms may be reluctant to rely on them for fear that they cannot effectively protect their property rights or expose themselves to hold-ups and similar problems. The papers in this tradition of the international business literature frequently refer to the resource-based view of the firm (e.g. Penrose (1959) or Wernerfelt (1984)) according to which a firm’s competitive advantage
is rooted in its complementary capabilities or intangible assets. These papers invariably view intangible assets, in particular firm-specific knowledge, technological know-how, marketing knowledge, management expertise and human capital, as the proprietary resources and capabilities that generate a competitive advantage in international acquisition and foreign direct investment (e.g. Hymer (1976)), but also as the resources that firms can most easily deploy abroad (e.g. Caves (2007)).

In the industrial organization-based literature, Nocke and Yeaple (2007) also emphasize the different role of mobile (intangible assets) and immobile factors of production. Finally, there is substantial empirical evidence showing that firms generate value in international acquisitions when they expand the use of their specific assets abroad (e.g. Doukas and Travlos (1988), Morck and Yeung (1991), Morck and Yeung (1992), or Markides and Ittner (1994)). Based on these theories and findings, we formulate our second hypothesis:

**Hypothesis 2** The flow of cross-border acquisitions explained by industry specialization increases in measures of human capital and intangible assets.

### III Data

This section describes our sample and how we construct the data used in the tests. It consists of three main blocks: (1) the measures of industry specialization, (2) the mergers and acquisition data, and (3) country-level variables.

#### A Industry Specialization

Our objective is to develop a measure of comparative advantage for each country and industry. To do so, we follow the concept of “revealed comparative advantage” that is extensively used in the literature on international trade. As explained in Krugman, Obstfeld, and Melitz (2011) a country is considered to have a comparative advantage in a given industry when the importance of that industry’s exports relative to the rest of the world’s exports in that industry is large. Following our theoretical considerations in Section II, countries tend to be specialized in industries in which
they have a comparative advantage, and specialization further enhances comparative advantage, through economies of scale, external economies and agglomeration effects. Thus we measure comparative advantage in terms of total economic importance of industries, or industry specialization, and not exports.

Following the original formulation by Balassa (1965) and replacing exports by measures of total output or total employment, we define $w_{i,c,t}$ as the share of industry $i$’s production (or employment) in country $c$’s total production (or employment) in year $t$ and compute industry specialization, $SP$, as follows:

$$SP_{c,i,t} = \frac{w_{c,i,t}}{\frac{1}{N_c} \sum_k w_{k,i,t}}$$

where $N_c$ is the number of countries in our sample. At time $t$, country $c$ is defined as being specialized in industry $i$ if the share of $i$’s production ($w_{c,i}$) in country $c$’s total production is larger than the average share of $i$’s production worldwide ($\frac{1}{N_c} \sum_k w_{k,i}$). A country is relatively specialized in industries for which $SP_{c,i,t}$ is higher than one, i.e., when production in these industries is more than expected on the basis of the average importance in worldwide production. As a result, a higher value of $SP$ indicates a higher degree of specialization.

To fix ideas, this definition implies for instance (as shown empirically below) that Switzerland is highly specialized in manufacturing watches and clocks. This is because the share of the watch industry (in the total Swiss output) is much larger in Switzerland than in any other country. In our analysis we remain agnostic about the origin of specialization. We hypothesize that industry specialization reveals strengths in specific economic sectors. This strength could originate from unique country- or industry-specific factors such as natural resources, know-how, expertise, scale, cluster effects, or specific governmental policies. To wit, we abstract from the reasons Switzerland is highly specialized in manufacturing watches, but use the fact that Switzerland has a clear comparative advantage in producing watches relative to the rest of the world to analyze the geography and industry composition of cross-border acquisitions.

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7We discuss the potential endogeneity of our measure of comparative advantage in Section V.C.
We use disaggregated firm-level data for publicly listed companies from Worldscope to measure specialization for each country-industry-year observation ($SP_{c,i,t}$). We focus on the period 1990 to 2010. We consider two variables to capture industries’ importance: total sales and total employment. We define industries based on three-digit International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3) used by the United Nations Statistics Division. We thus classify each firm in Worldscope into a three-digit ISIC code using the primary SIC codes provided by Worldscope and the correspondence between ISIC and SIC described in the Appendix.

The starting sample comprises 1,182,103 observations on 56,343 distinct firms, corresponding to 46 countries, 101 industries, and 21 years. Ideally, we would like to compute $SP_{c,i,t}$ for every country-industry-year observation, that is 97,566 observations ($46 \times 101 \times 21$). However, Worldscope does not contain sales or employment data for each possible country-industry-year observation. Thus, we impose a minimum of three countries with non-missing industry-year observations on sales or employment (across 46 countries) to remain in the sample, and exclude all industry-year that do not meet this requirement. This steps eliminates 6,348 industry-year observations with missing sales, and 6,670 observations with missing employment, corresponding to four industries. For the remaining observations, we assume that a missing country-industry-year observations reflects the absence of economic activities in these industries, and set $w_{i,c,t}$ to zero. Out of 97,766 possible observations, we have 91,218 (non-missing) measures of specialization based on sales ($SP(sales)$) and 90,896 based on employment ($SP(emp)$) spanning 97 distinct industries.

Table 1 presents descriptive statistics on our measures of industry specialization (based on sales and employment) across countries. Panel A reveals that, by construction, the average level of specialization worldwide is equal to unity. Notably, the within-country distribution of specialization appears highly skewed. While there

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9This happens because of incomplete coverage or because of the absence of publicly traded companies in every sector and every country.
10All our results continue to hold if we only consider non-missing observations to compute $w_{i,c,t}$. The resulting sample is however much smaller.
are many industries that are present in each country in similar proportion (i.e. nonspecialized industries), a few industries account for a disproportionately large fraction of each country’s activities. We also note an important heterogeneity in the average degree of specialization across countries. For instance, the United States, Japan, Australia, or Switzerland display a large average degree of specialization (all well above unity – indicating the presence of various highly specialized industries) compared to countries like Venezuela, Hungary, or Czech Republic.\footnote{The link between average country specialization and economic development is strong.}

To further illustrate the differences in specialization patterns across countries and industries, Panel B of Table 1 reports the two most specialized industries in each country, where specialization is based on sales and averaged over the period 1990-2010. For instance, and as indicated above, we observe that the most specialized industry in Switzerland is the “Manufacture of watches and clocks”. Similarly, Australia and Brazil are (relatively) specialized in the “Mining of iron ores”, Germany in “Retail trade”, the UK in “Legal, accounting, and auditing activities”, Russia in “Transport via pipeline”, and the US in “Renting of transport equipment” and “Education”. Overall, Table 1 underlines an important heterogeneity in industry specialization across countries.

We acknowledge that, while informative, our measure of industry specialization is imperfect. Indeed, Worldscope only includes data on public firms, rendering our measures probably biased towards activities that feature more public equity capital. Yet, one advantage of using Worldscope’s is that its broad coverage enables us to measure specialization for a large set of countries, industries, and years. Nevertheless, as an alternative, we use aggregated industry-level data on total output and employment from the United Nation Industrial Development Organization (UNIDO) Indstat4 database. This database has output and employment data that covers all firms - both private and publicly traded. Industries in the UNIDO database are defined at the ISIC three-digit level, covers the manufacturing sector between 1990 and 2006, and is limited to a subset of countries. We have information on 47 manufacturing industries (out of 101) and 43 countries (out of 46).\footnote{The missing countries are Hong Kong, Taiwan, and Venezuela.}
observations if at least three countries report non-missing industry-year observations on sales or employment, and set \( w_{c,i,t} \) to zero for the missing country-industry-year observations. Among the 42,441 possible observations, we have 33,637 measures of specialization based on sales and 32,766 measures of specialization based on employment. Reassuringly, the correlation between Worldscope-based and UNIDO-based measures of specialization is 0.28 (for \( SP(sales) \)) and 0.24 (for \( SP(emp) \)).

B Mergers and Acquisitions Data

Our sample of transactions is obtained from the Security Data Corporation’s (SDC) Mergers and Corporate Transaction database and includes all deals (domestic and cross-border) announced between 1990 and 2010 that are completed by the end of 2012. Similar to Erel, Liao, and Weisbach (2012) we exclude LBOs, spinoffs, recapitalizations, self-tender offers, exchange offers, repurchases, partial equity stakes, acquisitions of remaining interest, privatizations, as well as deals in which the target or the acquirer is a government agency. We consider public, private and subsidiary acquirers and targets. We limit our attention to the 46 largest countries (see Table 1). This subset represents 93% of all SDC transactions and 96% of the world equity market capitalization (in 2010).\(^{13}\) We only retain transactions where both the acquirer and target have non-missing measures of specialization (this eliminates 1,048 transactions). Our sample includes 388,699 transactions with a total value of $24 trillion. We use the primary Standard Industrial Classification (SIC) provided by SDC to assign each acquirer and target to one of 97 distinct ISIC industries.

Table 2 displays the characteristics of our sample of global mergers and acquisitions. Panel A indicates that during our sample period 22.4% of all transactions (87,134) involve firms from different countries. Cross-border deals have a total value of $6.5 trillion, or 27.7% of all deal value.\(^{14}\) In line with Erel, Liao, and Weisbach (2012) and Ahern, Daminelli, and Fracassi (2010), Panel B reveals that the world

\(^{13}\)This figure is based on data from the Worldbank in 2010.

\(^{14}\)UNCTAD (2013) reports a cumulative cross-border M&A volume of $7.18 trillion worldwide for the 1990-2010 period. Thus, our sample appears to cover 90% of the global volume based on values.
market for acquisitions exhibits a substantial geographic heterogeneity. The US, the UK, Canada and Japan account for the majority of transactions. Among the possible 2,116 country pairs (46×46), 1,571 (70.8%) feature at least one transaction. On average, firms in a given country are involved in deals in 34 different countries. Notably, 73% of all cross-border transactions (and 83% of total deal value) occur between firms from developed countries, where development levels are taken from the Standard and Poor’s Emerging Market Database.

Relevant for our investigation, acquisitions comprise a strong industry component. Across all deals (domestic and cross-border) 44% occur between firms operating in the same industries. This fraction is roughly similar between domestic deals and cross-border deals. There is a total of 38,826 cross-border horizontal transactions, representing a total value of $3.5 trillion or 54% of all cross-border transactions. These transactions are the main focus of our analysis. Notably cross-border horizontal deals span a non-negligible part of the potential global network in each industry. Across the 200,790 possible horizontal cross-border pairs (46 × 45 × 97) 12,008 (or 6%) feature at least one transaction. The average industry has horizontal deals involving 125 country-pairs. The analysis below indicates that industry specialization plays an important role in explaining observed acquisition patterns in cross-border horizontal mergers and acquisitions.

C Country Characteristics

Existing research indicates that countries’ economic, institutional, cultural, and geographical characteristics are associated with the direction and intensity of cross-border acquisition activity. Since such characteristics are likely related to the patterns of industry specialization, we control for a host of country factors in our tests. All the variables used in the analysis are further detailed in the Appendix.

Following Ahern, Daminelli, and Fracassi (2010), we use data from the Worldbank on annual GDP and GDP per capital to capture a country’s size and level of development. Using data from the same source, we define a country’s (annual) openness to trade as the ratio of imports and exports to GDP. We obtain data on the
average corporate tax rate for each country from the Economic Freedom Index. We also identify if two countries have double-taxation and bilateral investment treaty agreements for each year in our sample from the United Nation Conference on Trade and Development (UNCTAD) database. We obtain national exchange rates from Datastream, and define the nominal exchange rate returns (between each pairs of countries) as the average annual difference in the logarithm of the monthly exchange rate. We obtain real exchange rate returns by using each country’s consumer price index and convert all nominal returns to the 2000 price level for Europe.

We use data from Djankov, Porta, de Silanes, and Shleifer (2008) to capture different institutional characteristics. Similar to Ahern, Daminelli, and Fracassi (2010) we consider a country’s legal origin. We also consider language and religion as cultural factors related to cross-border acquisitions. As in Stulz and Williamson (2003) we gather data on the primary language spoken in each country (English, Spanish, or Others) from CIA World Factbook 2008. We also consider the dominant religion in each country (Catholic, Protestant, Muslim, Buddhist or Others). We further obtain the geographical distance between each country’s largest city (in terms of population) or its capital from the Centre d’Etude Prospective et d’Information Internationale (CEPII). To alternately measure the geographic closeness between countries, we use a dummy variable that is equal to one if two countries share a common border.

Finally, in order to examine more directly whether our results are related to country-level stock of intangible capital, we consider several factors related to human and technological capital. Following Barro and Lee (2013), we consider the fraction of public spending on education in total government expenditures as well as the fraction of the labor force with a tertiary education to measure the stock of human capital in a given country. These variables are from the Barro-Lee Educational Attainment Dataset.\footnote{Available at http://www.barrolee.com/} Similarly, we measure countries’ stocks of technological capital using information from the Worldbank on the number of patents per capita, the number of trademarks per capital, and the number of articles published in scientific journals per capita.
IV Profile of Acquirers and Targets

We start our investigation by examining the univariate patterns of specialization across all mergers and acquisitions. For each transaction, we compare the degree of specialization of the acquirer’s industry to that of the target. We report these univariate comparisons in Table 3. Several notable results emerge from this table.

| Table 3 Here |

In Panel A, we first observe that across all transactions (including domestic, cross-border, horizontal and non-horizontal), participating firms appear to be relatively specialized. The average values of \( SP \) for both acquirers and targets are larger than one. This suggests that, perhaps unsurprisingly, takeover transactions mostly involve firms operating in industries exhibiting high degrees of specialization. Across all deals, and with both measures of specialization \((SP_{sales} \text{ and } SP_{emp})\), we observe almost no difference in the average (and median) degree of specialization between acquirers and targets.

Yet, we see a very different picture when we look separately at domestic and cross-border deals. In domestic deals, targets appear to be more specialized than acquirers (with average values of \( SP \) between 1.978 and 2.221 for targets and between 1.858 and 1.911 for acquirers). In sharp contrast, acquirers appear to be more specialized than targets in cross-border transactions (with average values of \( SP \) between 1.901 and 1.922 for acquirers and between 1.531 and 1.550 for targets).

The difference in specialization is even larger in Panel B where we focus only on horizontal transactions. Acquirers display degrees of specialization that are roughly 25% larger than targets. These differences are statistically and economically significant. For instance, while the average (median) value of \( SP_{sales} \) is 1.979 (1.252) for acquirers, it amounts to 1.515 (0.860) for targets. This clear pattern indicates that for cross-border transactions involving firms from the same industry, more specialized acquirers buy less specialized target.

The effect of specialization if sizeable. Panel C indicates that more than 60% of all horizontal cross-border transactions involve acquirers that operate in more spe-
cialized industries than targets. Together these transactions amount to $2.2 trillion, or 64% of the total value of cross-border horizontal transactions over our sample period. In all, a substantial fraction of assets ownership is reallocated across borders from less specialized firms in a country to more specialized firms in another country.

[Insert Figures A, B, C, and D Here]

Figures A, B, C and D highlight that the observed difference in specialization between acquirers and targets in horizontal cross-border deals is present across countries, time, and industries. Figures A and B display the average difference in $SP$ (labeled $\Delta SP$) by acquirer and target countries. Consider first acquirer countries. We observe that $\Delta SP$ is positive in 36 countries out of 46 countries in our sample. For target countries, $\Delta SP$ is positive in 41 countries. Figure B further confirms the finding that acquirer is more specialized than target holds for every single year in our sample. Finally, Figure D displays $\Delta SP$ by industry (sorted in ascending order). Here again, $\Delta SP$ is positive in 76% of industries. Precisely, $\Delta SP$ is positive in 76 distinct industries. It is negative in only 18 industries.

The above univariate results reveal important differences in specialization between acquirers and targets in cross-border transactions that involve firms in the same industry. Overall, acquirers are significantly more specialized than targets. This is consistent with the hypothesis that firms acquire foreign assets to extend their comparative advantage overseas. Moreover, the univariate results highlight important variation between countries, industries, and time. We account for these differences in the next section.

V Multivariate Analysis

To more formally examine the interplay between differences in specialization and the distribution of acquisition activities across countries and industries, we turn to a multivariate analysis. We start by discussing the empirical specification, present the main results, and subject our estimates and interpretation to a battery of robustness tests.

\[16^{\text{Peru and Taiwan are outliers with very few deals.}}\]
A Gravity Model

We model the distribution of horizontal acquisition flows across countries with a gravity specification. Gravity models have a long tradition in international economics to study the effect of “geographic” distance on the intensity of cross-country relations such as trade flows (e.g. Anderson and van Wincoop (2004) or Anderson (2011)) or portfolio flows (e.g. Portes and Rey (2005)). They have recently been used to analyze acquisition flows (e.g. Ahern, Daminelli, and Fracassi (2010) and Karolyi and Taboada (2014)). Instead of examining the effect of geographic distance on the intensity of cross-border flows, we focus on the effect of distance in the specialization space. Our baseline specification is as follows:

\[
\log(1 + V_{c,c',i}) = \alpha + \beta \Delta SP_{c,c',i} + \gamma X_c + \delta X_{c'} + \eta X_{c,c'} + \nu_i + \varepsilon_{c,c',i},
\]

where \(V_{c,c',i}\) is the aggregate volume of horizontal acquisitions in industry \(i\) between acquirer country \(c\) and target country \(c'\). We use two measures for \(V\): the total number of acquisitions (#Acq.) and the total dollar value of acquisitions ($Acq.$).

The variable of interest, \(\Delta SP_{c,c',i}\) measures the difference in specialization between countries \(c\) and \(c'\) in industry \(i\). The vectors \(X_c\), \(X_{c'}\), and \(X_{c,c'}\) include acquirer and target country-level characteristics, as well as country-pair characteristics (e.g. common border or language). The vector \(\nu_i\) includes industry fixed effects.

Arguably mergers and acquisitions occur only when the combined expected benefits of the acquirer and target are positive. When benefits are negative we should observe no transaction. As a result the dependent variable \(V_{c,c',i}\) is naturally truncated at zero. In our context, this happens frequently as country-industry pairs featuring at least one transaction over the 1990-2010 period represents only 6% of the sample. We account for this truncation by estimating equation (2) using a Tobit specification. We further account for the possible within-country correlation by clustering standard errors at the acquirer and target country level.

In our baseline tests, we focus primarily on cross-sectional variation and ignore the time-series dimension that we consider in Section V.C. Thus in our cross-sectional tests, we take the average values of all variables over the sample period. We collapse all 21 years into a single cross-sectional regression with 200,790 country-industry pairs.
(46 × 45 × 97 combinations of acquirer country, target country, and industry). As a result of this aggregation, $X_c$ and $X_{c'}$ capture country-level effects. For instance, any effect that occurs because the acquirer country is larger or more developed than a target country is absorbed by the country variables.\(^{17}\) Similarly, any effect that occurs because of particular industry characteristic is absorbed by $\nu_i$. Table 4 provides summary statistics for our all variables used in the gravity estimations.

To wit, the coefficient of interest in equation (2) $\beta$ measures whether, for a given industry $i$, the intensity of cross-border acquisitions between (acquirer) country A and (target) country B is linked to differences in their specialization in $i$, after controlling for country and industry effects. In particular, a positive $\beta$ coefficient would indicate that, for a given industry $i$, acquisitions flow from countries that are more specialized in $i$ (e.g. watch-making in Switzerland) to countries that are less specialized in $i$ (watch-making in the United States).

### B Main Results

Table 5 presents the results of the gravity where the dependent variables are either the (log of the) number of deals ($\ln(#\text{Acq.})$) or the (log of the) aggregate value of deals ($\ln(\$\text{Acq.})$). The measures for the difference in specialization between country-industry pairs $\Delta SP_{c,c',i}$ are based on industry sales $\Delta SP(sales)$ and industry employment $\Delta SP(emp)$ (computed from Worldscope). Notably, the estimated coefficients on $\Delta SP$ ($\beta$) are positive across all specifications. All estimates are highly significant with $t$-statistics ranging between 7.4 and 11.4.

The economic magnitude of the effect of specialization differences on the intensity of cross-border acquisitions is substantial. A one-standard deviation increase in $\Delta SP(sales)$ is associated with a 14.7% increase in the number of deals, and a 52.9% increase in the aggregate value of deals by a staggering 52.9%. Similarly, a one-

\(^{17}\)We obtain similar results if we include acquirer and target country fixed effects instead of country level variable, but prefer to use country variables to compare (and validate) the effects of country characteristics with that documented by existing research. We present the results in the Appendix.
standard deviation change in $\Delta SP(emp)$ is associated with 13.7% more deals, and
an aggregate value of deals that is larger by 48.4%.\textsuperscript{18}

The baseline gravity specifications contain a large number of control variables, capturing effects that are known to influence cross-border acquisition activity. The estimates reported in Table 5 are in line with previous research. For instance larger economies (measured by log GDP) participate more in cross-border acquisitions. More developed countries, as measured by their GDP per capita, also feature more cross-border horizontal transactions. We also see more cross-border deals when countries are more open to trade. Consistent with Erel, Liao, and Weisbach (2012), we find that an appreciation of the acquirer currency relative to the target currency positively influences deal flows. Moreover, transaction intensity increases when countries have a shared border or closer geographic proximity, and also when countries share the same language or the same legal origin (but not when they have the same religion). Finally, we see more transactions between country pairs in which the acquirer country has a larger statutory corporate tax rate than the target country.

Arguably, differences in valuation across country-industry pairs can potentially influence acquisition activity.\textsuperscript{19} Also, we naturally expect to see more transactions between industries that are populated by a larger number of firms. Both factors could be related to industry specialization. To assess whether the above results are driven by differences in industry valuation or size across countries we include proxies for each country-industry level of valuation and size.\textsuperscript{20} We use the average market-to-book ratio in each country-industry to measure valuation, and the (log of the) sum of assets to measure size. Both measures are computed as averages over the sample period. Because some country-industry observations do not feature any publicly listed company in Worldscope, we are able to measure these variables for about half of all country-industry pairs. Panel A of Table 6 indicates that our variable of interest

\textsuperscript{18}The variables $\Delta SP$ are normalized to a unit variance so the coefficients reported in Table 5 and following tables can be interpreted directly.


\textsuperscript{20}Recall that both the acquirer and target industries in horizontal cross-border acquisitions are more specialized on average. This indicates that the effect of specialization is unlikely to fully reflect difference is size, where target industries features very few firms.
ΔSP remains positive and strongly significant in all four specifications. Reflecting that part of the specialization effect is related to differences in valuation and size, the economic significance slightly decreases (by about 20%) but remains substantial.

In Panel B of Table 6, we replace the Worldscope-based specialization measures with measures constructed from all private and public firms from UNIDO (as defined in Section IIIA). Because UNIDO only covers the manufacturing sector for 43 countries, the size of the sample is considerably reduced. Remarkably, the estimated coefficients for ΔSP remains positive and significant in all specifications. Even though the economic magnitude of the specialization effect is reduced in these specification, it remains considerable with a 5% increase in number of deals and a 20% increase in value of deals with a one-standard deviation increase in ΔSP.

C Reverse Causality and Omitted Variables

Overall, the baseline results reported in Tables 5 and 6 are consistent with firms extending their comparative advantage abroad. All else equal, firms in more specialized industries expand abroad horizontally by acquiring firms in less specialized industries. The impact of the difference in specialization on the volume of cross-border acquisitions is large, and is distinct from country determinants identified by previous research.

Yet, there is a possibility that our interpretation suffers from a reverse causality or omitted variable bias. Indeed, one concern is that reverse-causation leads specialization differences to increase in response to cross-border acquisition activity. Another concern is that both industry specialization and the intensity of cross-border acquisition could be correlated with unobserved factors.

To examine the issue of reverse causality, we re-estimate our baseline equation (2) but we allow for a very long time lag between the measurement of specialization and cross-border acquisition activity. The results are shown in Table 7. In Panel A, we measure difference in specialization over the 1990-1999 period, whereas the dependent

[21] For brevity we only report the coefficients on ΔSP.
variables (deal activity) over the interval 2000-2010. In Panel B we further measure difference in specialization over the 1990-1995 period and use it to explain deal activity over the interval 2006-2010 period. Overall, the results remain unchanged. These lagged structures largely mitigate the concern that reverse causality is the driving force behind our results.

To investigate the potential effect of omitted variables, we take advantage of the panel structure of the sample. Introducing the time dimension in the gravity equation (2) allows us to include country-industry-pair fixed effects, and hence capture any fixed difference across country-industry-pair. By doing so, the coefficient of interest ($\beta$) in equation (2) measures how the volume of acquisitions in a given country-industry-pair changes in when the difference in specialization ($\Delta SP_{c,c',i,t}$) changes.

However, estimated on the full panel sample, the gravity model expands to more than 4.2 million observations ($46 \times 45 \times 97 \times 21$). With only 38,826 horizontal acquisitions during the sample period, the number of zeros in the dependent variable inflate to more than 99% of the sample, pushing the unconditional deal incidence in a given country-industry-year pair close to zero. For this reason, we report in Table 9 the results obtained from the full panel of 21 years as well as with a aggregation of three sub-periods of seven years where we average the dependent and independent variables across each sub-period.

The results reported in Table 8 reveal that our conclusions continue to hold when we control for unobserved differences between country-industry pairs (together with country-level controls). When we focus on the three-period aggregation (Panel A), the estimated coefficients on $\Delta SP$ are all positive and significant. Albeit smaller, the economic magnitude of the specialization effect remains substantial. When the difference in specialization in a given country-industry-pair increases by one standard-deviation, we observe an increase of about 1% (0.8% and 1.2%) in the number of deals in this pair and a 7.5% (6.4% and 9.7%) increase in acquisition value. Remarkably, we continue to detect the positive and significant effect of specialization.
in three out of four specifications when we consider the full panel (Panel B). 

D Product Market Competition

In Table 9 we consider the role of product market competition. Caves (1971) argues that imperfect competition, in particular the possession of differentiated products, is an important determinant in international acquisitions as it shields the acquirer from competitive pressure in the foreign market. Similarly, Neary (2007) predicts that firms are less likely to target assets overseas in more competitive industries. In his model, firms make acquisitions in order to limit competition in the industry in which they hold an advantage. The smaller the number of competitors, the larger will be the increase in market share for the remaining firms if one of the competitors is taken over. Thus, Neary (2007) specifically predicts that the less competition in a given industry, the more likely firms will be to enter overseas markets through acquisitions. Overall, as product market competition in a particular country-industry could be related to the degree of specialization, we evaluate the effect of competition on our conclusions.

We measure the intensity of product market competition in target industries using the Lerner Index, or price-cost margin, following Nickell (1996). The price-cost margin we use is operating profits divided by sales (from Worldscope). We measure competition in a given country-industry-year as one minus the average price-cost margin. As explained by Aghion, Bloom, Blundell, Griffith, and Howitt (2005), one advantage of the Lerner Index is that it does not rely on any particular definition of geographic markets (unlike other indicators such as the Hirschman-Herfindahl index). This is particularly relevant in our setting as multinational firms operate in global markets.

[Insert Table 9 Here]

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22 The smaller economic magnitude is somewhat expected as the source of variation in these panel specifications is within country-industry pairs as opposed to between country-industry pairs in our baseline (cross-sectional) estimation. The significance of $\Delta SP$ is further remarkable as industry specialization is highly persistent across countries and industries. The autocorrelation estimates are 0.92 for $SP(sales)$ and 0.87 for $SP(emp)$.

23 A value of one indicates perfect competition (price equal marginal cost) while values below one indicate some degree of market power.
Table 9 reports the results. Panel A reveals that, all else equal, the intensity of international acquisitions is significantly lower in competitive target industries. Estimates on the measures of competition in target country-industry are negative and significant. This is true for both measures of acquisition flows (in number and value) and for both measures of specialization. While intense competition in the product market appears to dampen foreign acquisitions, the effect of specialization on acquisition flows remains positive and substantial.

To further understand the interplay between specialization and competition, we interact the difference in specialization between the acquirer and target industry (\(\Delta SP\)) with the intensity of competition of the target industry. Results are presented in Panel B. The interactive effect is positive and significant across all specifications, indicating that the specialization effect we document above mitigates the competitive effect. The flow of acquisition is markedly larger when the difference in specialization is large and the target industry is more competitive, consistent with the comparative advantage of specialized buyers allowing them to withstand the effects of competitive pressure in foreign markets.

E Deal-level Evidence

To provide a different perspective on the role of specialization in cross-border acquisitions, we estimate selection models at the deal-level that predict the probability for a firm in a given country-industry group to become an acquirer or a target in cross-border horizontal transaction. We run conditional logit regressions where the dependent variable \(Deal_{c,i,m,t}\) is equal to one if the target firm (acquiring firm) in a given deal \(m\) is from country \(c\) and industry \(i\). For each deal, the specification includes one observation for the actual country-industry of the target (acquirer), and multiple similar control observations that could have been potential targets (acquirers) in deal \(m\).

We construct the control sample as follows. For each target (acquirer) of a deal that occurred in year \(t\), we select five country-industry observations corresponding to the same industry as the actual target (acquirer), but located in different countries.
We pick these observations from the pool of target (acquirer) country-industry-year observations that feature at least one cross-border transaction, and select the five closest observations in terms of the number of transactions. The explanatory variables in our conditional logit models include the targets’ (acquirers’) measure of specialization $SP$, country characteristics (similar as in the gravity specification (2)), and deal fixed effects for each target (acquirer) and its controls.

The first two columns of Table 10 presents coefficient estimates from the conditional logit model that predict targets. The estimated coefficient on $SP$ are negative and significant at the 1% level for both measures of specialization. In line with the above gravity results, industries displaying a higher degree of specialization are significantly less likely to become targets in horizontal cross-border acquisitions compared to matched industries in other countries that are also targets in cross-border transactions. Columns 3 and 4 report results relative to the probability of becoming acquirers. We observe positive and significant estimates for $SP$ in both columns, indicating that acquirers in cross-border horizontal deals are more likely to come from country-industries that are exhibit a higher level of specialization.

VI  Intangible Capital

According to our main hypothesis, cross-border acquisitions are driven by relative comparative advantage that originates in localized industry-specific assets, that we capture using differences in specialization across countries and industries. As these specialized assets should be (1) mobile, and (2) difficult to contract upon or replicate by outsiders, they are likely to be intangible. This section provides evidence consistent with this claim. First, we rely on measures of human and technological capital at the country-level and test whether the effect of industry specialization on cross-border acquisition flows is stronger when the acquirer country benefits from a

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24 We match on transaction volume because we showed earlier that participation in cross-border transactions and industry specialization are correlated. As a result, our selection model could produce biased results if we did not limit the set of possible target countries to those with comparable deal activity.

25 Unreported results indicate that these results continue to hold if we further control for the size and growth opportunities of the target industries or acquirer industries.
larger stock of intangible capital compared to that of the target country. Second, we use disaggregated data on human and technological capital at the levels of industries, and directly test if differences in intangibles between country-industries explain the intensity of cross-border acquisitions.

A Country Human Capital

We first consider human capital. We rely on two measures of country-level education as proxies for the stock of human capital. First, following Barro and Lee (2013) we consider on the fraction of population that obtains a higher (tertiary) education. Second, we use the fraction of public spending on education (to total public spending). To assess the role of these two variables on the acquisition-specialization sensitivity, we partition the sample in two sub-samples based on the median of the country-pair differences. Accordingly, we assign to the “High” partition the pairs of country where the difference in education proxies (between the acquirer and the target country) are above the median, and to the “Low” partition the pairs that are below the median.\footnote{Note that because partitioning variables are differences at the country-pair level, the median are zero by construction. Hence, the “High” and “Low” partition capture positive and respectively negative differences in the partitioning variables.} We then estimate the gravity specification \(2\) separately for each partition and compare the estimated coefficients across partition.

Table 11 reports the results of the cross-country-pairs estimations. For brevity we only display the coefficients for \(\Delta SP\) as well as the p-value of the test that assesses whether \(\Delta SP\) is significantly larger in the “High” partition than in the “Low” partition. In support of our hypothesis, we observe that the link between specialization and cross-border horizontal acquisitions larger in the “High” partition than in the “Low” partition. This pattern emerge in all specifications. The differences across partitions are both statistically and economically significant. The effect of specialization on acquisition intensity is roughly two times larger when the acquirer country benefits from a large share of highly education people in its population relative to the target country. In the same vein, the effect of specialization is about 40% larger when there is a large difference in the spending on education between acquirer and
B  Country Technological Capital

Next, we investigate whether the effect of specialization on global acquisition flows also varies with countries’ stock of technological capital. Our hypothesis implies that the benefit for firms to extend their comparative advantage overseas should be positively related to their country’s technological advancement.

We use various measures of technology advancement at the country-level as proxies for the stock of intellectual capital. First, we measure the importance of technology and innovation by using the ratio of (public and private) R&D spending to GDP. Second, following Adams (1990) we measure the stock of technological knowledge with the number of number of patents per capita, the number of trademark per capita, and the number of scientific articles per capita. We again assign each country-pair into a “High” or a “Low” partition based on the median country-pair differences of each variable. Table 12 presents the results of the cross-partition estimations.

We observe notable differences between the “High” and “Low” partitions. Across all specifications, the acquisition-specialization sensitivity is markedly larger when the acquirer country enjoys a larger stock of technological capital (the “High” partitions). The contrasts are economically important as coefficient estimates are almost 50% larger in the “High” partitions. Moreover, the differences across partitions are statistically significant in 11 out of the 16 estimations. Overall, the flow of horizontal cross-border acquisitions from more specialized to less specialized industries increases even more so when country pairs exhibit larger differences in technological capital.

C  Country-Industry Human and Technology Capital

Alternatively, we use more granular measures of human and technological capital at the level of industries for a subset of countries to directly examine whether differences in intangibles between country-industry observations is related to acquisitions inten-
sity. We rely on two variables to measure the stock of human capital. Data comes from the EU KLEMS Growth and Productivity Accounts (KLEMS). This database contains industry-level measures of output, inputs and productivity for 25 European countries, Japan and the US for the period from 1970 onwards. We measure human capital using the ratio of high-skilled labor compensation to total compensation, and the ratio of hours worked by high-skilled persons engaged to total hours worked. We average these variables for each available country and industry over our sample period, which represent 74,472 country-industry observations (22 countries and 91 industries).

We rely on four variables as proxies for the stock of technological capital at the industry level. From the same source, we use the stock of software capital as well as the stock of computing and communication equipment (both measured in 1995 prices). We have 43,288 non-missing country-industry observations (or 11,544 non-missing country-industry pair observations). In addition, we aggregate firm-level data on R&D expenditures from Worldscope to compute the stock of R&D capital (using the perpetual inventory method as detailed in Falato, Kadyrzhanova, and Sim (2014)) and the intensity of R&D expenses (R&D over assets) for each available country-industry observation (135,945 country-industry observations).

[Insert Table 13 Here]

Table 13 reports cross-sectional tobit estimations of gravity models similar to the baseline specification but where we replace the difference in specialization (∆SP) in a given industry between country pairs with direct differences in human and technology capital (that we label ∆Intangibles). Panel A focuses on the number of deals as the dependent variable (ln(#Acq.)). We observe positive and significant coefficients for the measures of human capital, indicating that there are more horizontal transactions between two countries (in a given industry) when the acquiring industry has a larger stock of human capital than that target industry. We also observe positive coefficients for three out of four measures of technological capital. All else equal, acquisition intensity is stronger when the acquiring industry benefits

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27 See O’Maloney and Timmer (2009) for a description of the KLEMS dataset.
28 The KLEMS dataset contains data at the level of 32 industries. We manually map the three-digit ISIC code we use throughout the paper to the KLEMS industries.
from larger stocks of software assets or R&D capital. Although limited to a subset of country-industry pairs, these results lend further support for the idea that the intensity of cross-border acquisitions is related to differences in intangible assets across countries and industries.

VII Ex Post Performance and Robustness

In this section, we examine whether ex post acquisition outcomes depend on the specialization profile of both the acquirers and targets and discuss additional robustness checks.

A Ex Post Performance

An important obstacle to measuring ex post acquisition performance is that two separate firms exist before the transaction, and one or two firms might exist after the transaction, depending on the transaction type. As in Hoberg and Phillips (2012) we avoid this issue by considering only the ex post change in performance of acquirers, measured relative to the first set of numbers available after the transaction effective date. We thus implicitly assume that performance accrues over time as it takes time for specialized acquirers to deploy their comparative advantage on newly purchased foreign assets.\footnote{Note that by examining post-changes only we bias our analysis towards not finding results due to a reduction in power, but we avoid complications of measuring performance in year $t - 1$.}

We examine changes in operating income over assets from year $t + 1$ to year $t + 2$, or $t + 4$ (one- and three-years horizons). As information on performance is available only for public companies, we focus on public firms acquiring public or private targets in horizontal cross-border transactions. To isolate the effect of specialization differences on post-acquisition performance, we restrict our attention to firms that only acquire assets in cross-border horizontal transactions over the horizons we consider. Moreover, because changes in performance can reflect underlying industry trends, we benchmark acquirers’ performance by contrasting it to that of matched industry peers. For each acquirer, we select the closest peer (by size) that operates in the
same country and industry, and (2) that is not involved in any acquisition during a six-year window surrounding the transaction.\footnote{To mitigate the effect of outliers, we winsorize the performance measures at the 1\% level. Moreover, to reduce survivorship issues, we assign any missing values for a given horizon the value of the last known horizon (as in Hoberg and Phillips (2012)).}

Table 14 reports the results of OLS regressions where the ex post changes in performance (at different horizons) are the dependent variables. The sample include 4,787 acquisitions made by 3,997 distinct firms from 46 countries and 94 industries. All specifications include control variables as well as country-pairs, industry, and year fixed effects. We observe that the estimated coefficients for $\Delta SP$ are positive across all performance horizons and with both measures of specialization. They are significant in three specifications out of four. Acquisitions where acquirers are more specialized than targets appear to be associated with increased ex post profitability. The results are economically substantial. For instance, a one standard deviation increase in $\Delta SP(sales)$ is associated with an increase in profitability of 0.70\% over one year, and 0.80\% over three years.

We recognize that looking at acquirers’ ex post outcomes does not necessarily identify the (causal) effects of cross-border transactions on firm performance.\footnote{Indeed, our results could be explained by a selection story where more specialized buyers are better able to find valuable foreign assets, that lead to post-transaction increased in performance.} Our analysis indicates, however, that differences in specialization between acquirers and targets are associated with better operating performance. Consistent with our main hypothesis, this finding suggests that the benefit of extending comparative advantage abroad arise because of the enhanced ability of specialized buyers to operate the acquired assets more efficiently.

\section*{B Additional Robustness Tests}

We perform additional analyses to verify the robustness of our findings, but do not report them her for brevity. These tests are build around our cross-sectional and panel gravity specifications of cross-border horizontal acquisition flows (equation (2)). With respect to our baseline cross-sectional results reported in Table 5, we
first estimate the gravity equation using OLS, and the Poisson Pseudo-Maximum-Likelihood (PPML) method developed by Silva and Tenreyro (2006) to capture the count nature of the dependent variables (in the presence of many zeros)\(^{32}\). Second, we include acquirer and target country fixed effects instead of country level control variables. We also replace these level variables by differences between the acquirer and target country. Third, we scale the flow (both in number and value) of cross-border horizontal acquisitions in a given industry between two countries by the intensity of domestic horizontal acquisition in the target industry. Fourth, we exclude observations from the U.S. and the U.K. as these two countries account for a non-trivial fraction of all transactions. Fifth, we include additional country-level variables capturing various institutional dimensions such as investor protection or the quality of accounting rules. Overall, our findings are robust to these alternative estimations and specifications.

\textbf{VIII Conclusion}

We examine whether industry specialization and industry-specific intangibles are important in explaining the flow and direction of cross-border acquisitions and thus whether firms can extend industry comparative advantage arising from intangible assets by acquiring assets in foreign markets. We find strong empirical support for this proposition, focusing on a large sample of horizontal transactions involving 46 countries and 97 industries.

We find large differences in the degrees of industry specialization between acquirers and targets. For a given industry, the larger the difference in specialization between two countries, the larger is the flow of bilateral acquisitions (both in numbers and dollar value). The direction of acquisitions goes from acquirers in industries in which their home country is more specialized buying targets in countries where that industry is less specialized. The magnitude of the specialization effect is large. For the average industry, the value of transactions between two countries is 24.98 % larger if this country-pair is at the 75th percentile of specialization distance (mea-

\(^{32}\)This estimation is performed using the \texttt{ppml} command available in Stata. Further details are available here: http://privatewww.essex.ac.uk/~jmcss/LGW.html
sured by sales) than if the pair is at the 25th percentile. We can rule out reversed causality based on regressions with long lags.

We further show that the effect of specialization on the intensity of cross-border acquisitions is related to measures of intangibles. We estimate that the specialization effect is stronger when the acquirer countries have higher educational attainment, spend more on R&D, and enjoy larger stocks of patents or trademarks. At the country-industry level we find that industry specialization plays a larger role when the acquirer comes from a country-industry pair with a higher measures of human and technological capital - including R&D, the fraction of high skilled workers and the stock of information and communication technology - than the industry of the target country.

We estimate deal-level selection models to predict the countries in which targets and acquirers are chosen, and find that that acquirers look for targets in countries that are less specialized, and that firms from more specialized countries are selected as acquirers. We also find that the volume of cross-border acquisition is larger when the target industry is more concentrated, consistent with firms wishing to minimize competition when they enter foreign markets, and we report that firms from specialized industries are more likely to enter more competitive industries, consistent with specialization helping firms survive in a highly competitive environment. We also find that difference in specialization between acquirers and targets is related to acquisitions outcomes as we observe better one- and three-year post-acquisition operating performance when more specialized acquirers purchase assets in less specialized industries.

We conclude that the distribution of specialization across countries and industries is important in explaining the geography of global acquisitions, consistent with firms extending industry comparative advantage overseas via foreign acquisitions. Our finding support the proposition that the existence and prevalence of specialized assets such as human capital and intellectual capital are important factors in understanding firms’ international acquisitions.
Appendix 1: Definition of the Variables

- **#Acq.** : Number of cross-border horizontal acquisitions between two countries (Source: SDC)

- **$Acq.$ : Dollar value of cross-border horizontal acquisitions between two countries (Source: SDC)

- **SP(sales)** : Degree of specialization of an industry in a given country, computed as the share of the industry's sales in its country total sales, divided by the average share of sales in the industry across all countries. The sales are aggregated across public firms in each country-industry (Source: Worldscope and own calculations).

- **SP(emp)** : Degree of specialization of an industry in a given country, computed as the share of the industry's employment in its country total employment, divided by the average share of employment in the industry across all countries. Employment is aggregated across public firms in each country-industry (Source: Worldscope and own calculations).

- **GDP** : Gross domestic product (Source: Worldbank)

- **GDP/capita** : Gross domestic product per capita (Source: Worldbank)

- **Openness** : Exports plus imports divided by GDP as a percentage of GDP. Exports and imports are in national currencies (Source: Worldbank)

- **%Tertiary Education** : Fraction of the labor force with a tertiary education (Source: Barro-Lee Educational Attainment Dataset).

- **%Education Spending** : Fraction of public spending on education (Source: Barro-Lee Educational Attainment Dataset).

- **#Patents/capita** : Number of deposited patents per capita (Source: Worldbank)

- **#Trademarks/capita** : Number of deposited trademarks per capita (Source: Worldbank)

- **#Articles/capita** : Number of scientific articles per capita (Source: Worldbank)

- **Exchange rate return** : Difference in the logarithm of the monthly real exchange rate (Source: Datastream)

- **Distance** : Geographic distance between capitals, calculated following the great circle formula, which uses latitudes and longitudes of the most important city (in terms of population) or its official capital (Source: CEPII).

- **Common Border** : Dummy that equals one if two countries share a common border (Source: CEPII).

- **Same Religion** : Dummy that equals one if two countries share the same religion, where the religion is defined as the dominant religion of a country (Source: CIA World Factbook 2008).

- **Same Language** : Dummy that equals one if two countries share the same language, where the language is defined as the primary spoken language of a country (Source: CIA World Factbook 2008).
• **Same Legal System:** Dummy that equals one if two countries share the same legal system, classified into four groups: Common, Civil, German, or Scandinavian (Source: Djankov et al. 2006).

• **Corporate Tax Rate:** Country corporate tax rate (in percentage) (Source: Economic Freedom Index).

• **Double-Tax Treaty:** Dummy that equals one if two countries have signed a double-taxation treaty (Source: UNCTAD).

• **Bilateral Investment Treaty:** Dummy that equals one if two countries have signed bilateral investment treaty (Source: UNCTAD).

• **Total Assets:** Total Assets (Source: Worldscope)

• **Market-to-book:** Book value of assets minus book value of equity plus market value of equity, divided by the book value of assets (Source: Worldscope).

• **1-Lerner:** Measure of product market competition computed as one minus the average price-cost margin ratio in an industry, where the price-cost margin is computed as operating profits before depreciation and amortization over sales (Source: Worldscope)

• **OI/A:** Operating income divided by total assets (Source: Worldscope)

• **R&D Stock:** Stock of R&D capital computed using the perpetual inventory method
  \[ G_{i,t} = (1 - \delta)G_{i,t-1} + R&D_{i,t}, \]
  where \( G_{i,t} \) is the end-of-period stock of R&D capital for firm \( i \) and \( \delta \) is the depreciation rate of R&D capital set to 15% as in Falato, Kadyrzhanova, and Sim (2014) (Source: Worldscope)

• **R&D/Assets:** Ratio of R&D expenditures to total assets (Source: Worldscope)

• **High Skill (%comp):** (country-industry) ratio of high-skilled labor compensation to total compensation (Source: EU KLEMS variable LABHS)

• **High Skill (%hours):** (country-industry) ratio of hours worked by high-skilled persons engaged to total hours worked (Source: EU KLEMS variable H-HIS)

• **Software (%capital):** (country-industry) stock of software capital over total capital, in 1995 prices (Source: EU KLEMS variable K-Soft)

• **ICT Stock (%capital):** (country-industry) stock of computing and communication equipment of total capital, in 1995 prices (Source: EU KLEMS variable K-ICT)
Appendix 2: Mapping between ISIC and SIC

Our various data sources are based on different industry classifications, notably the US Standard Industrial Classification (SIC 1987) classification and the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3) classification. To make the industry classification systems compatible, we define industries as the finest possible partition of industries in the 3-digit ISIC Rev. 3 system such that the 3-digit SIC 1987 classification is a refinement of this partition; that is, none of the 3-digit industries in the SIC 1987 has an intersection with two or more industries in the partition of industries we define. This yields a partition of 101 industries.\(^{33}\)

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\(^{33}\)Existing concordances between ISIC and SIC classifications do not exclude overlap, i.e. individual 3-digit SIC industries corresponding to more than one 3-digit ISIC industries, and vice versa.
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