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The location of cross-border and national mergers and acquisitions within the United States

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Abstract

Research on the location choice of foreign direct investment (FDI) focuses on the choice between countries. The within-country location choice is either not analyzed at all or restricted to greenfield investments only. The majority of FDI, however, takes the form of cross-border mergers and acquisitions (M&As). We develop and test a pair of hypotheses regarding location-target selection for both cross-border and national M&As across the United States, expecting differences in line with the liability of foreignness argument. Using a detailed firm-level data set for M&As in the period 1985–2012, we compare location choices of cross-border versus national M&As. We find that cross-border M&As are more spatially concentrated, and tend to sort into larger agglomerations than national M&As. This finding holds both for urban agglomerations in isolation, as well as for agglomerations that take the economic geography of the United States into account.

1 | INTRODUCTION

In International Business (IB), a large literature examines the country's choice of multinational enterprises (MNEs) investing abroad (e.g., S.-J. Chang & Park, 2005; Dunning, 1998; Makino & Tsang, 2011). A much smaller literature studies the MNEs' within-country location choice (Beugelsdijk & Mudambi, 2013; Nielsen et al., 2017). Moreover, to the extent that within-country choice is studied in IB, this is mainly done by taking this choice as an independent variable to explain MNE performance (e.g., Chan et al., 2010; Gao et al., 2018; Ma et al., 2013). In the current paper, we adopt a different lens, focusing on MNE within-country choice as the dependent variable (cf. Gao et al., 2018). Specifically, we seek to answer the question whether or not the MNEs' within-country location choice is, on average, different from that of the MNEs' national counterparts. That is, does the within-country location choice of MNEs reveal a pattern that is different from that of national enterprises?

Beugelsdijk and Mudambi (2013) argue that "While border-crossing remains the key research context of IB, placing it within a general spatial framework that recognizes both international and subnational spatial heterogeneity opens up vast new vistas for research … subnational spatial heterogeneity is often the characteristic that drives firm strategy as MNEs decide to locate in particular agglomerations and not at random locations within a country" (p. 413). An important reason to study this "subnational heterogeneity" is that particular location within a country might be better suited to overcome the downsides of the liability of foreignness (LOF; see Zaheer, 1995; or for a more recent analysis, see Iammarino & McCann, 2013). Our study precisely examines this idea empirically. Moreover, to see whether MNEs are different here vis-à-vis national enterprises, as suggested by the LOF argument, we explicitly compare the location choice patterns of both types of firms.

We do so by analyzing national versus cross-border merger and acquisition (M&A) location patterns. This implies an additional contribution. Although the vast majority of foreign direct investment (FDI) takes the form of cross-border M&As, the within-country location choice literature often does not distinguish between MNE greenfield investments and cross-border M&As. A priori, one would expect that the possible location choices for both forms of foreign investment are different. Greenfield investments have an additional degree of freedom compared with M&As; in principle, any location is possible for a greenfield investment. For M&As, however, the location choice is more restricted; they have to make a choice between firms that are willing to merge or can be taken over. This reduces the number of possible target locations. The difference can be important. From a policy perspective, for example, tax competition between two locations is more likely to occur for greenfield investments than for M&As (see f.i. Amerighi & Giuseppe, 2017; Duranton, 2011).

However, most analyses regarding within-country location choice do not differentiate between these separate modes of entry, although doing so is standard practice in IB (see, e.g., Dikova & van Witteloostuijn, 2007). In the field of IB, the analysis of cross-border M&As is, almost by the very definition of the IB field, a major topic, but it is increasingly also studied in International Economics (IE; Anand & Delios, 2002; Bertrand & Zitouna, 2006; Brakman et al., 2013; Dikova et al., 2010; Fumagalli & Vasconcelos, 2009; Halvorsen, 2012; Head & Ries, 2008; Muehlfeld et al., 2012; Nocke & Yeaple, 2007, 2008). But both in IB and IE, the *within-country* host location choice of cross-border M&As is largely neglected.

This void implies the implicit assumption that if foreign firms decide to engage in an M&A, they purposely choose a specific country but are indifferent regarding the target location within that country. This observation, with respect to cross-border M&As, stands in contrast to the literature regarding greenfield FDI in IE, which analyzed in depth the issue of within-country location choice. The study by Head et al. (1995) was pivotal, and initiated a large and growing body of literature, examples being Fontagne and Mayer (2005), Basile et al. (2008), Defever (2006), and Mataloni (2011). Similar analyses for cross-border M&As are largely absent, however. This is remarkable, given that the bulk of FDI involves cross-border M&As, and given that there is no reason to assume that the location decision of greenfield investments and M&As are similar (see, e.g., Evenett, 2004). M&As involve, by definition, merging with or acquiring *existing* firms at a specific location, whereas greenfield investments can, in principle, locate anywhere. For M&As, cherry (or lemon) picking is possible, because acquirers can obtain prior information on potential targets, such as information on the profitability or productivity of potential target firms.

Specifically, in this paper, we analyze the location patterns of cross-border M&As within the United States, using national M&As as our benchmark to see whether the MNEs' cross-border within-country location choice pattern is different from that of their national counterparts, as IB theory would suggest. From IB theory, we expect that (a) cross-border M&As sort into larger agglomerations than national M&As, (b) not only in view of the mere size of the host location, but also in terms of the broader market access associated with this location (see also Goerzen et al., 2013 or Stallkamp et al., 2018). We use the global M&A database of *Thomson Financial Securities Data* that includes location information. We analyze all manufacturing cross-border and national M&As within the United States for the period 1985–2012. Our data set covers 192,000 individual M&As. Building on the work of Sattinger (1978, 1993), we use the empirical methodology developed by Davis and Dingel (2020), introducing two tests—an elasticity test and a pairwise comparison test—to identify potential differences.[1]

So, our main contribution is that we combine insights, methods, and theories from IB and IE to develop hypotheses regarding MNEs' within-country choice (vis-à-vis their national counterparts) in the context of M&A activity, and to test these hypotheses in a large sample of US cross-border and national M&As, also responding to a plea for more fine-grained analysis of within-country differences in IB (see, e.g., Asmussen et al., 2020; Beugelsdijk & Mudambi, 2013; Chan et al., 2010; Ma et al., 2013).

In advance, one disclaimer is in order. Our findings may or may not be *consistent* with the notion that larger agglomerations offer additional benefits (e.g., stronger agglomeration economies), which makes it especially for foreign MNEs worthwhile to locate there since they, as compared with national acquirers, have to overcome additional M&A costs associated with the LOF. But to be clear, consistency does not imply causality. We do not want to claim that we are able to show that superior agglomeration economies, and not some sorting mechanism, make foreign firms to prefer, say, New York City (NYC) as a location for their cross-border M&As as opposed to some small town in the Midwest of the United States. The main aim of the paper is to use and develop a very rich data set that is (among) the first to show that there is considerable within-country spatial heterogeneity in the location choices by foreign firms for their cross-border M&As, a heterogeneity that also outstrips the spatial variation observed for national M&As in the United States. Once we have established these novel and important stylized facts, the next research step would be to lay bare the (causal) mechanisms in future research. We discuss this in our concluding section.

The structure of the paper is as follows. In Section 2, we motivate the two main hypotheses of the paper. The data set is introduced and discussed in Section 3. In Section 4, we also illustrate the spatial concentration of M&As in the United States based on the Ellison and Glaeser (E-G) index (Ellison & Glaeser, 1997). Section 5 presents the main findings for the elasticity and the pairwise comparison tests, as developed by Davis and Dingel (2020). Section 6 provides sensitivity analyses. Finally, Section 7 concludes.

2 | WITHIN-COUNTRY LOCATION CHOICE

The general question is: What accounts for the preference of acquiring firms for targets in certain within-country locations? A location-specific answer is: nonmobile *agglomeration rents* and/or *market access*. In our analysis, we focus on the target in terms of both population size and the geographic position of the target city, as an approximation of agglomeration rents and market access. In this way, we link our discussion of M&As to that of Head et al. (1995, 1999) with respect to greenfield FDI. They find that industry-relevant and location-specific agglomeration rents are important for greenfield FDI location decisions. In general, this conclusion has been corroborated by subsequent literature (see Alfaro & Chen, 2014; Blonigen et al., 2007; Bobonis & Shatz, 2007; Brülhart & Mathys, 2008; Halvorsen, 2012; Kim et al., 2003; see Antras & Yeaple, 2014 for a survey, and Jones, 2017 for a meta-study). Similar results for (cross-border) M&As have yet to be established. Below, we argue what we expect with reference to differences in cross-border vis-à-vis national M&As.

Davis and Dingel (2020) as well as Mrázová and Neary (2019) indicate that, compared with national firms, cross-border firms can be expected to be found more often in larger agglomerations. Larger agglomerations are associated with higher agglomeration rents and larger market size or higher market access. The definition of a large agglomeration is not trivial. Locations can, for example, be large in terms of a large market, a large group of interconnected firms, a huge amount of knowledge spillovers, or an abundant supply of (specialized) factor endowments. For practical purposes we define "large" in terms of population size within the (administrative) boundaries of a relevant spatial unit. The assumption is that the relevant aspects of large agglomerations are correlated with population size (see Brakman et al., 2020 for a detailed discussion). For cross-border M&As to be profitable in a certain location, they require larger agglomeration benefits and higher market access, other things equal, to offset the larger entry or location costs that they face as foreign firms. This relates to IB's well-known concept of the LOF (Nielsen et al., 2017; Zaheer, 1995): Compared with domestic firms, MNEs have to bear a wide variety of additional costs, because domestic firms are more locally embedded than their foreign counterparts (cf. Beugelsdijk & Mudambi, 2013).

LOF is a well-established concept in IB, being a fundamental element in the theory of the MNE (see, e.g., Caves, 1982), referring to all factors that are associated with competitive disadvantages of foreign firms in host countries due to the very fact that these firms are not domestic. Liability is defined as "the costs of doing business abroad that result in a competitive disadvantage for an MNE" (see, e.g., Hymer, 1976; Zaheer, 1995, p. 342). Examples range from lack of knowledge of local practices to regulatory liabilities (see, e.g., Wu & Salomon, 2017). Hence, to compensate for the higher costs associated with the LOF, foreign entrants may well sort into larger agglomerations. Indeed, albeit in the context of a study of foreign entry only, Gao et al. (2018) find that their control variable referred to as "firm agglomeration" is positively related to Japanese FDI in a specific within-country location within China.

Moreover, the fact that larger agglomerations are associated with higher productivity is well-established. Empirical research reveals that firms in larger agglomerations or cities are more productive than firms in smaller agglomerations (see the survey by Ahlfeldt & Pietrostefani, 2017; Melo et al., 2009). In general, two separate reasons, in isolation or jointly, can be responsible for this relationship: (a) *sorting* of more productive firms and of workers into larger agglomerations, and (b) *agglomeration economies*, such as knowledge spillovers. Baldwin and Okubo (2006) show, for example, that more productive firms sort into larger agglomerations or cities because firms benefit from forward and backward linkages (or network externalities: see, e.g., S.-J. Chang & Park, 2005), and only the most productive firms can cope with the more intense competition in larger markets. More productive *workers* also tend to sort into larger agglomerations, making firms located there more productive (Combes, Duranton, et al., 2008).

In an important study, Combes et al. (2012) try to separate sorting from agglomeration economies. They find, using a detailed data set regarding French firms, that sorting is relatively unimportant compared with agglomeration economies. In a similar vein, De la Roca and Puga (2017) reveal that sorting more productive workers is not the main reason that workers in large cities are more productive than in smaller cities. Rather, learning in larger agglomerations seems to be a relatively more important factor. For our study, it is sufficient to note that firms in larger agglomerations are more productive than those in smaller locations, no matter whether this higher productivity of firms in larger agglomerations is caused by sorting, agglomeration economies, or a combination of both forces: Larger agglomerations or markets are, for whatever (combination of) reason(s), home to more productive firms and workers, on average.

Additionally, there is extensive empirical evidence that the distribution of firm efficiency (measured as a firm's [total factor] productivity) is *higher* for foreign firms than for their national counterparts (see Bernard et al., 2018; H.-H. Chang & van Marrewijk, 2013; Feenstra, 2016; Helpman et al., 2004; Yeaple, 2009), as these foreign firms have to overcome larger foreign market entry costs, as compared with domestic firms, due to the LOF. Cross-border M&A activities thus select relatively more efficient firms. Since larger cities are relatively more "skill" abundant and house relatively more "skill"-intensive sectors, we can expect to observe relatively more cross-border M&A activity in larger cities, compared with national M&As.

Although the higher productivity of MNEs relative to national firms is widely established in both advanced and developing countries, one may wonder whether firms from *developing* countries with FDI in the United States are more productive than national US firms.[2] Data limitations do not allow us to directly measure firm productivities, but we can show that this issue is not relevant from an empirical point of view. Our data are from 1985 to 2012. So, to illustrate our point, we combine information from the Bureau of Economic Analysis on the FDI position in the United States detailed by country in 2012 with information for income and population from the World Bank. Figure 1 shows the cumulative share of the population, ordered by income, on the horizontal axis and the cumulative share of the population (the diagonal), income, and the share of FDI in the United States on the vertical axis. It also includes two vertical lines, one at the average level of income per capita ($14,526 in purchasing power parity [PPP], constant 2017 international dollars) and one at twice this level of income per capita ($29,052).

The share of FDI in the United States is very unevenly distributed. If we take "developing country" to indicate an income level below the world average, then all developing countries are taken together (with 75.5% of world population and 40.1% of world income) and only account for 0.6% of all FDI in the United States in 2012. In contrast, the countries above twice the world average income line account for 97.5% of all FDI in the United States. Indeed, the top 18 FDI source countries by size, starting with the UK, Japan, The Netherlands, France, and Canada (in that order), all have an income level above twice the world average, and together account for 96.0% of total FDI. Number 19 is Mexico, which takes care of 0.5% of the FDI position. In short, FDI in the United States is a rich-country phenomenon, taken care of by productive multinational firms from those countries.

Larger agglomerations also come with additional costs. For instance, congestion might occur and prices of nontradable services may increase with sizes, such as facility rents and land prices. Firms considering a takeover in a

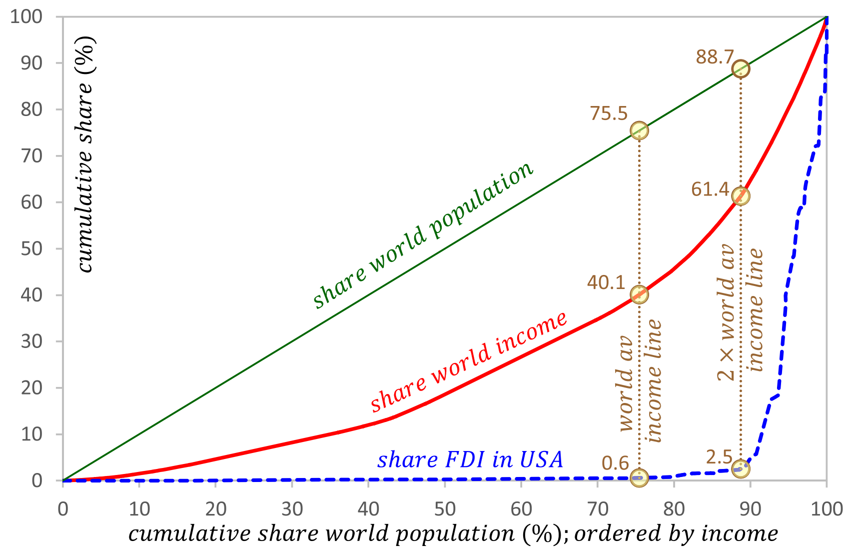

FIGURE 1 Cumulative share of population, income, and FDI in the United States; percent, 2012. *Source*: Own creation using data from Bureau of Economic Analysis (www.bea.gov) on FDI position in the United States (detailed by country) and World Development Indicators online on income (GDP per capita PPP in constant 2017 international dollars) and population; 195 countries included; cumulative share excludes the United States; av, average, used to indicate (twice) the world average income line. FDI, foreign direct investment; GDP, gross domestic product. [Color figure can be viewed at wileyonlinelibrary.com]

specific location have to weigh the benefits and costs of that particular place. For the value of a firm after an M&A, we see that firms have to be (i) productive enough and (ii) select locations that offer sufficient agglomeration rents to cover the location costs; it is the combination of these two elements that will make an M&A viable. Given that MNEs must compensate for the higher costs associated with their LOF, ceteris paribus, they face an even higher incentive to enter into high-benefit and/or low-cost locations. Indeed, Gao et al. (2018) find that "Japanese firms choose [Chinese] provinces with low costs (i.e., distance, infrastructure, and agglomeration)" (p. 10).

In Appendix A, we develop this reasoning more formally, based on an interpretation of Davis and Dingel (2020). This framework applies the LOF argument to location choices; only the more productive firms can overcome the higher entry costs of foreign markets. These firms tend to locate in larger agglomerations because these locations are more expensive, but also offer larger market access. The two elements combined lead to a sorting process in which foreign firms prefer larger agglomerations. This trade-off results in the sorting process that is the basis of our main hypothesis.

Hypothesis 1 (H1). *Cross-border M&As are located in agglomerations associated with larger populations, on average, than national M&As.*

By extension, we know that agglomeration rents are not only a function of the market in a location itself, but also of the broader issue of market access or market potential, which is particularly relevant from the perspective of market-seeking MNE entry (Dunning & Lundan, 2008). That is, taking the city as our anchor of location, we must distinguish between a narrow definition of a city and the market access of a city. Market access follows from the location of a city relative to other locations, operating as a gateway to a (much) larger area. This gives, mutatis mutandis, our second hypothesis.

Hypothesis 2 (H2). *Cross-border M&As are located in agglomerations associated with larger market access, on average, than national M&As.*

Both hypotheses are in line with the underlying model on the within-country location choice for M&As as set out in Appendix A. Similar hypotheses could be derived for greenfield investments, but the latter are not the focus of our paper. After all, as we already stated in Section 1, whereas there is already convincing evidence on the relevance of agglomerations for greenfield foreign investment (see, for instance, Basile et al., 2008 or Mataloni, 2011), no such evidence exists for (cross-border) M&As, notwithstanding the fact that cross-border M&As make up for the bulk of FDI.

3 | DATA SET AND GEOGRAPHICAL MATCHING

3.1 | Data set

Motivated by Davis and Dingel (2020)—see Appendix A for details—we seek to compare the location behavior of cross-border M&As to national M&As in large versus small agglomerations. Therefore, we need to assign each M&A to a location. In this section, we will build up an explanation of how this assignment process takes place in our empirical analysis.

The most extensive data source for M&As is the "Global Mergers and Acquisitions" database of *Thomson Financial Securities Data* (Thomson, hereafter). Our sample from the Thomson data set starts in 1985 and runs until July 2012. As in Alfaro and Chen (2014), we differentiate between foreign and domestic firms. We focus on all countries and selected those firms that merged with or took over a firm in the United States. Table 1a provides an overview of the resulting 192,281 M&As that make up our sample. National M&As refer to an American-based firm merging with or acquiring another American-based firm, whereas cross-border M&As involve firms from outside the United States that take over a US-based firm (not necessarily US-owned). Most M&As are national rather than cross-border (86% vs. 14%).[3]

We have information on the value of the transaction in 45% of the cases. In general, the larger the deal, the more likely it is that there is information regarding the value of the transaction. Since cross-border M&As are, on average, larger than their national counterparts, this explains why the value of the transaction is available for 51% of the cross-border M&As compared with 44% of the national M&As.[4] For both types of M&As, employment information is only provided for 10% of the cases, while information on both value and employment is available for only 8% of the M&As. Data for the acquirer refer to headquarters, whereas target location data are more varied. The employment data indicate that these (often) refer to the firm, whereas the value of the transaction data involves plants or establishments at a specific location (which could be the headquarters of the target).

TABLE 1 American M&A data, 1985–2012

	National	%	Cross-border	%
(*a*) *Overview*				
Total number of M&As	165,401	100	26,880	100
With value of transaction	72,561	44	13,688	51
With employment data	17,102	10	2789	10
Both value and employment data	13,847	8	2231	8
(b) *Geographic matching*				
With value	72,561	100	13,688	100
With value and city	60,266	83	71,300	83
48 contiguous states + DC	60,055	83	71,038	82
Geographically matched	59,961	83	70,924	82

Note: The total number of M&As is 192,281, of which 14% is cross-border; data up to July 2012.
Abbreviations: DC, District of Columbia; M&A, merger and acquisition.

In general, target data refer to plants at a specific location, which is critical for what we try to do here. Hence, given the limited number of observations for which we have employment data and the peculiarities of the employment data—often covering not establishment data, but data that are aggregated over all establishments of the firm—we will focus on the M&As for which the value of the transaction is available.

Before we can perform any tests, we have to identify possible locations and allocate M&As to these locations. We did this in two main steps. In Step 1, we use the address details of Thomson (state and name of the city) to allocate each individual M&A to a geographic location (longitude and latitude), which we label M&A Locations. Note that this creates a selection bias by construction as it only identifies locations with M&As and not locations without M&As. In Step 2, to avoid the selection bias problem, we use the 2010 US Census information on Urban Areas (population ≥ 50,000) and Urban Clusters (population from 2500 to 50,000), which we together refer to as Urban Locations, as *possible* locations. We then use the information from Step 1 to allocate M&As to the nearest Urban Location in Step 2.

3.2 | Step 1: M&A Location matching

To provide more detailed information on the location of M&As, we matched the Thomson data with geographic information (longitude and latitude). As a starting point, we took the 86,249 M&As for which the value of the transaction is known; see Table 1b for details. Of these M&As, Thomson provides the "city" as well as the State for about 83% of the observations. Restricting attention to the 48 contiguous States and Washington, DC reduces the number of M&As to 71,038 observations (82% of the total).

We used location information on about 43,500 locations provided by the University of Groningen (available upon request), to connect the State and city in the Thomson data to longitude and latitude coordinates (necessary for distance calculations). We manually corrected the information where needed and possible in about 9000 cases (10% of the total). In most cases, this involved correction of spelling errors, such as "Birmingham" instead of "Bermingham" in Alabama or "Phoenix" instead of "Phoeniz" in Arizona. In other cases, we needed to delete a comma or excess information, such as the "N" in "N Hollywood" in California. When the location could not be matched directly, we used Google Earth, and allocated the location to a nearby big(ger) city. The location "Newbury Park" in California, for example, is thus allocated to "Thousand Oaks." In case the "city" refers to a wider area, such as the "Piceance basin" in Colorado or the "Gulf of Mexico" in Texas, we looked up this area on Google or used common knowledge to allocate this place to a central location within the area—in casu "Meeker" and "Corpus Christi," respectively. In some exceptional cases (114 times, 0.1% of the total), we were not able to allocate the M&A to any location in particular. This happened, for example, for "California" and "Lakeview Terrace" in the State of California, and for "Suite 630" in Minnesota. These cases are excluded from further analysis.

As Table 1b indicates, there is little difference in the success rate of matching to specific locations between national and cross-border M&As. The fact that we define and measure the geographical "address" of the M&A at the zip-code level and match these addresses (see below) to a very fine-grained set of urban locations is important for our analysis since it has been shown, for instance, that agglomeration effects associated with location choice typically play at low levels of spatial aggregation, and that this also holds for FDI (see Asmussen et al., 2020).

Figure 2 illustrates the geographic distribution of the national and cross-border M&A Locations. The size of the bubbles is proportional to the total value of M&As in that location in the period 1985–2012. The contours and main locations of the United States are clearly visible from this geographical distribution. Comparing panels (a) and (b) in Figure 2, we observe that there are both similarities and differences between national and cross-border M&As. Regarding the differences, we note that there are many more locations visible for national M&As than for cross-border M&As (more dots: 5153 compared with 2046 locations, or 2.5 times as many). This is a consequence of the fact that there are many more national than cross-border M&As (about 5.5 times as many), but also that cross-border M&As tend to be more concentrated (see below).

3.3 | Step 2: Urban location matching

The 2010 US Census identifies 3592 Urban Locations, consisting of 497 "Urban Areas" (population ≥ 50,000) and 3095 "Urban Clusters" (population from 2500 to 50,000). Together, these Urban Locations account for about 253 million people or about 82% of the total American population. From now on, we ignore the 57 Urban Locations in Alaska, Hawaii, and Puerto Rico, and concentrate on the 3535 remaining Urban Locations. The largest urban area is New York—Newark (18.35 million),

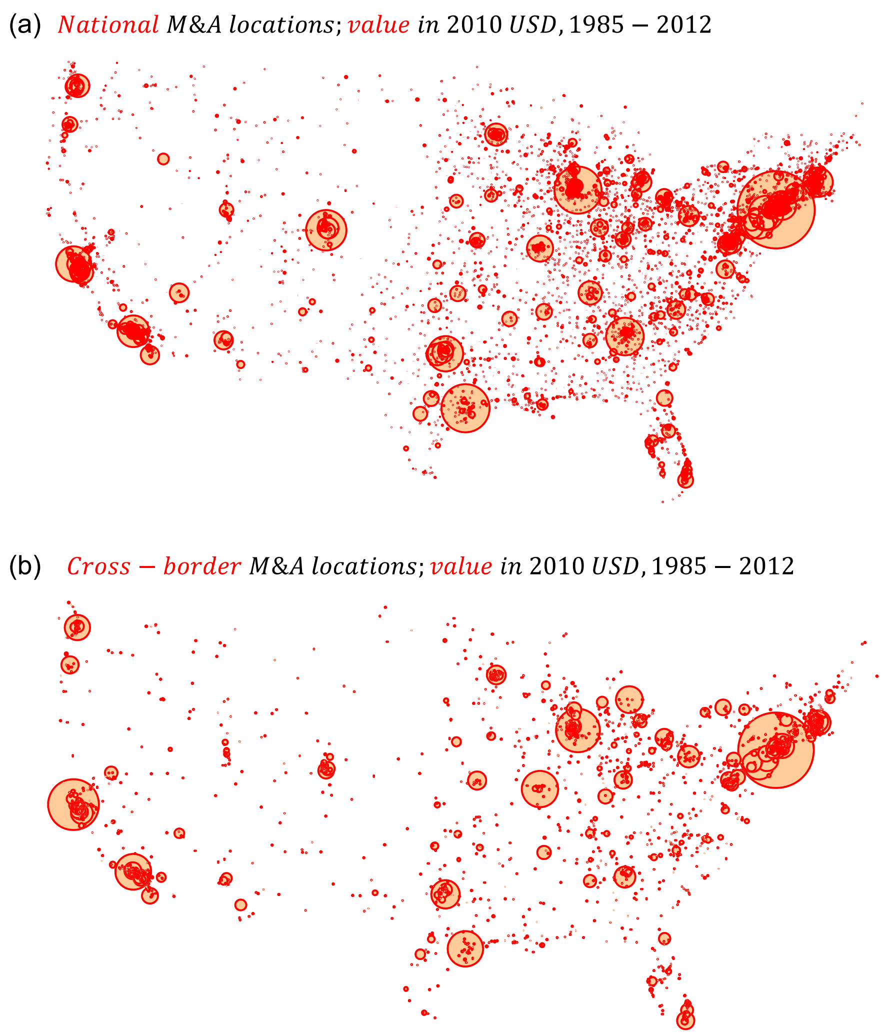

FIGURE 2 Geographic distribution of American national and cross-border M&As. *Source*: Own calculations, see main text; 5153 national and 2046 cross-border M&A Locations; bubbles proportional to the total value of M&As in a location. M&A, merger and acquisition. [Color figure can be viewed at wileyonlinelibrary.com]

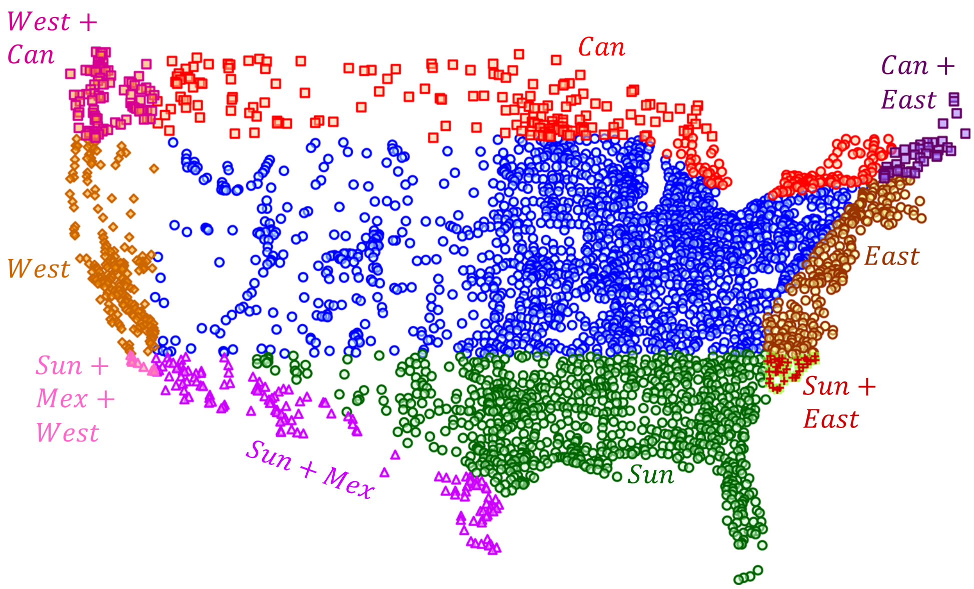

FIGURE 3 Urban locations.
Source: Own creation; Can, Canadian Border; East, East Coast; Mex, Mexican Border; Sun, Sun Urban Locations; West, West Coast. [Color figure can be viewed at wileyonlinelibrary.com]

followed by Los Angeles—Long Beach—Anaheim (12.15 million) and Chicago (8.61 million). Figure 3 provides an overview of the distribution of Urban Locations and the regional classification used in Section 6.[5] Figure 3 shows the Urban Locations along three dimensions: coastal (East, West), climate (Sun-State), and border (Can, Mex), and combinations of those dimensions.

We link M&A Locations to Urban Locations in two stages. First, for all M&A Locations, we check if there is an Urban Location with the same name. If so, we link the M&A Location to this Urban Location, and impose a distance of zero between the two locations. This happens for 1799 M&A Locations. Second, for the remaining M&A Locations, we calculate the minimum distance from this location to all Urban Locations using latitude and longitude. We link the M&A Location to the nearest Urban Location while recording the distance between the two locations.[6] Using this procedure, the 5504 M&A Locations are linked to 2459 different Urban Locations. This implies that the remaining 1076 Urban Locations do not have any M&A Location linked to them. They can be found throughout the country. Our estimation procedure takes the Urban Locations as the point of departure. Note that the "zero" observations in the data set provide valuable information as they indicate that some Urban Locations are not suitable for takeovers.

4 | SPATIAL CONCENTRATION OF M&As

We illustrate the spatial concentration of M&As in this section in two main steps. First, we analyze a limited number of locations, namely, the 50 US States and Washington, DC, for a range of different sectors. We will conclude that cross-border M&As tend to be more spatially concentrated than national M&As at the state level. Note that at this stage M&A activity could be concentrated somewhere in a US desert as the method we use (see below) looks at agglomeration regardless of the location within States. Second, therefore, we proceed to explore the question as to *where* the M&A activity is located much more precisely by analyzing the 3535 Urban Locations for all sectors combined (see also Section 6). We will, again, conclude that cross-border M&As are more concentrated than national M&As, but in addition provide information to suggest *where* this concentration takes place, namely, in larger Urban Locations as measured by population size.

4.1 | Concentration at the state level

Table 2 provides the geographical distribution of M&As across the 50 federal states and the District of Columbia, in number, value, and percentage of the respective total. The number of observations is reduced by about 2% since we

TABLE 2 State distribution of US target M&As; number, value, and employment, 1985–2012

	Total value and total # of M&As				Percentile distribution of M&As			
	Cross-border M&As		National M&As		Cross-border M&As		National M&As	
State	#	Value	#	Value	#	Value	#	Value
Alaska	36	2	91	17	0.3	0.1	0.1	0.1
Alabama	91	22	614	107	0.7	0.6	0.9	0.6
Arkansas	31	12	297	110	0.2	0.3	0.4	0.6
Arizona	199	31	1083	185	1.5	0.8	1.5	1.0
California	2520	653	11,478	2534	19.0	16.9	16.2	13.3
Colorado	350	77	1818	813	2.6	2.0	2.6	4.3
Connecticut	286	103	1443	595	2.2	2.7	2.0	3.1
District of Columbia	59	15	314	117	0.4	0.4	0.4	0.6
Delaware	270	47	885	316	2.0	1.2	1.2	1.7
Florida	590	98	3875	507	4.5	2.5	5.5	2.7
Georgia	284	61	2051	614	2.1	1.6	2.9	3.2
Hawaii	42	7	168	23	0.3	0.2	0.2	0.1
Iowa	50	12	454	92	0.4	0.3	0.6	0.5
Idaho	39	2	180	42	0.3	0.0	0.3	0.2
Illinois	560	285	3189	1318	4.2	7.4	4.5	6.9
Indiana	104	13	1022	199	0.8	0.3	1.4	1.0
Kansas	68	11	505	81	0.5	0.3	0.7	0.4
Kentucky	71	23	601	98	0.5	0.6	0.8	0.5
Louisiana	106	12	853	97	0.8	0.3	1.2	0.5
Massachusetts	691	215	2898	686	5.2	5.6	4.1	3.6
Maryland	205	69	1267	232	1.5	1.8	1.8	1.2
Maine	48	17	172	21	0.4	0.4	0.2	0.1
Michigan	288	117	1434	393	2.2	3.0	2.0	2.1
Minnesota	230	61	1404	291	1.7	1.6	2.0	1.5
Missouri	153	136	1011	332	1.2	3.5	1.4	1.7
Mississippi	23	1	298	56	0.2	0.0	0.4	0.3
Montana	35	2	160	14	0.3	0.0	0.2	0.1
North Carolina	215	31	1384	291	1.6	0.8	2.0	1.5
North Dakota	9	2	106	16	0.1	0.1	0.1	0.1
Nebraska	38	9	246	63	0.3	0.2	0.3	0.3
New Hampshire	93	12	368	66	0.7	0.3	0.5	0.3
New Jersey	572	211	2602	1103	4.3	5.5	3.7	5.8
New Mexico	43	3	298	39	0.3	0.1	0.4	0.2
Nevada	236	27	696	130	1.8	0.7	1.0	0.7
New York	1323	573	5768	2462	10.0	14.8	8.1	12.9
Ohio	343	99	2217	482	2.6	2.6	3.1	2.5

(Continues)

TABLE 2 (Continued)

State	Total value and total # of M&As				Percentile distribution of M&As			
	Cross-border M&As		National M&As		Cross-border M&As		National M&As	
	#	Value	#	Value	#	Value	#	Value
Oklahoma	90	21	822	168	0.7	0.5	1.2	0.9
Oregon	103	28	600	108	0.8	0.7	0.8	0.6
Pennsylvania	509	182	2808	673	3.8	4.7	4.0	3.5
Rhode Island	47	19	199	26	0.4	0.5	0.3	0.1
South Carolina	78	12	538	76	0.6	0.3	0.8	0.4
South Dakota	10	3	86	8	0.1	0.1	0.1	0.0
Tennessee	140	36	1004	335	1.1	0.9	1.4	1.8
Texas	1072	272	6758	1923	8.1	7.0	9.5	10.1
Utah	135	11	598	81	1.0	0.3	0.8	0.4
Virginia	267	49	1713	534	2.0	1.3	2.4	2.8
Vermont	15	2	114	10	0.1	0.0	0.2	0.1
Washington	277	91	1245	435	2.1	2.4	1.8	2.3
Wisconsin	123	52	830	143	0.9	1.3	1.2	0.7
West Virginia	28	3	243	32	0.2	0.1	0.3	0.2
Wyoming	43	2	165	12	0.3	0.1	0.2	0.1
Total	13,238	3857	70,973	19,107	100	100	100	100

Note: Value of transaction in billion 2010 USD.

Abbreviation: M&A, merger and acquisition.

exclude "Guam," "Virgin Islands," and "Unknown" from the analysis. The total value of the national M&As (in constant 2010 dollars) is $19.1 trillion, compared with $3.9 trillion for cross-border M&As. The average value for the national M&As is therefore $269 million, compared with $291 million for cross-border M&As. The largest target State for national M&As is California, which attracts 16.2% of the number of deals and 13.3% of the total value. It is followed by Texas in terms of the number of deals and by New York in terms of the total value.

At this aggregate level, we can already see that the distribution of cross-border M&As deviates from that of national M&As. California is more popular among foreign firms, attracting 2.9 percentage points more deals than for national M&As and 3.7 percentage points higher value. New York is also more popular among MNEs from abroad, with 1.9 percentage points more deals and 2.0 percentage points higher value. Texas, in contrast, is less popular among foreign enterprises, with 1.4 percentage points fewer deals and 3.0 percentage points lower value. Taken over all States, the average absolute deviation in the distribution for the number of deals is 0.38 percentage points, and for the total value 0.56 percentage points.

To illustrate our data set and to get the first indication of spatial concentration of M&A activity in the United States, we measure the concentration of M&As at the federal state level via the index introduced by Ellison and Glaeser (1997), which we henceforth refer to as the E-G index. We use the federal state level because we can compare our results at this level with the findings of Ellison and Glaeser (1997) for US firms (see also Holmes & Stevens, 2004). The advantage of the E-G index is that it corrects for industry or sector differences (for a detailed description, see Combes, Mayer, et al., 2008). Some industries are highly specialized (the sector consists of a limited number of firms), while others are not (hosting many firms). If an industry houses, for example, two firms, at most two regions account for all production, which could create the illusion of concentration. We should not mix specialization with concentration.[7] We focus on the value of M&As, measured in constant 2010 dollars. Like Ellison and Glaeser (1997), we analyze standard industrial classification sectors in a State, restricting attention for the moment to the three-digit level.[8]

Table 3 summarizes our findings, both for national and cross-border M&As. For comparison purposes, the table restricts attention to sectors for which the E-G index is available for both national and cross-border M&As. The maximum E-G index for M&As is somewhat higher in both cases. The minimum E-G index for national M&As is similar to that

TABLE 3 Summary of Ellison–Glaeser concentration index for the United States

	Ellison–Glaeser	Holmes–Stevens	National M&As	Cross-border M&As
Minimum	−0.013	−0.203	−0.278	−0.022
Maximum	0.630	0.909	1.157	1.311
Mean	0.051	0.034	0.219	0.421
Median	0.026	0.017	0.142	0.325
# Sectors	459	1086	341	341

Source: Ellison and Glaeser (1997) data for establishment size, four-digit SIC sectors; Holmes and Stevens (2004) data for establishment size, six-digit the North american industry classification system sectors; mean and median are weighted averages by a number of sectors; own calculations for mergers and acquisitions (M&As) based on three-digit SIC sectors, 1985–2012. Areas refer to the states of the United States.

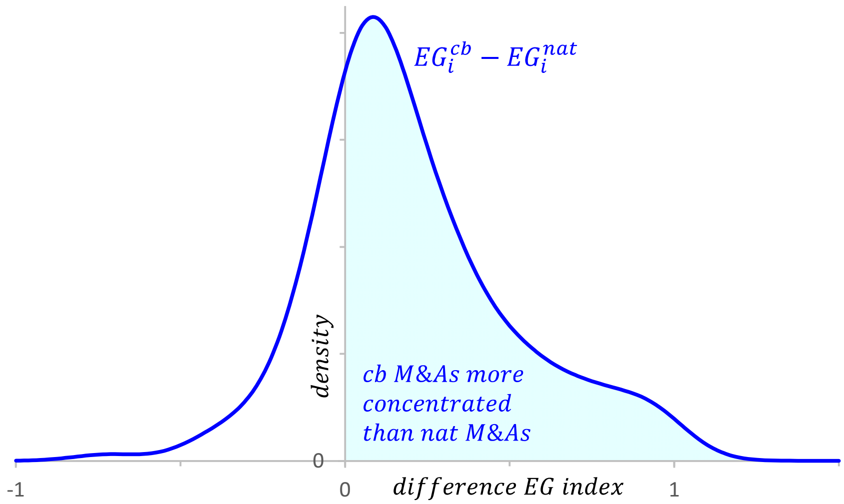

FIGURE 4 Kernel density function of difference in EG index. *Source*: Own creation; 341 sectors; standard normal kernel function with bandwidth $1.06\hat{\sigma}\, n^{-0.2}$, where $\hat{\sigma}$ is the standard deviation and $\boldsymbol{n}$ is the number of observations. E-G index, Ellison and Glaeser index; M&A, merger and acquisition. [Color figure can be viewed at wileyonlinelibrary.com]

reported by Holmes and Stevens (2004), and for cross-border M&As to that found by Ellison and Glaeser (1997). More importantly, however, the mean and median E-G index for *national* M&As (0.219 and 0.142, respectively) are markedly *higher* than for Ellison and Glaeser's (1997) and Holmes and Stevens' (2004) establishments. This suggests that, at least at the federal state level in the United States, national M&As are more geographically concentrated than the distribution of establishments. As discussed above, we attribute this finding to the selection effect: Only sufficiently successful and viable establishments are M&A targets. Moreover, the mean and median E-G index for *cross-border* M&As (0.421 and 0.325, respectively) are also *higher* than for national M&As. This indicates that the selection of establishments for cross-border M&As is, at the federal state level, more stringent to overcome the higher costs to compensate for the LOF.

Analyzing the more stringent selection effect for cross-border M&As compared with national M&As for the 341 sectors in more detail, we find that the cross-border E-G index is *higher* than the national E-G index for 267 sectors, or for 78.3% of all sectors.[9] The difference is illustrated in Figure 4 using a kernel density function. On the basis of this information, we conclude in line with our theoretical argument that cross-border M&As are significantly more concentrated than their national counterparts at the state level, and that this holds for almost all sectors.[10] To enable a more detailed geographical analysis in the next steps, we aggregate all sectors in line with the suggestion in Figure 4. In Section 6, however, we briefly analyze the two main types of sectors separately—namely, those sectors where cross-border M&As are more concentrated than national M&As at the state level using the E-G index (78.3% of the sectors), and those for which the opposite holds.

4.2 | Concentration at the urban location level

As explained in Section 3.3, we match the M&A information to Urban Locations. We provide information on the degree of concentration and where the concentration is located in particular in the three panels of Figure 5. We start in Figure 5a with a simple Herfindahl index for the distribution across the 3535 Urban Locations of population, and the number and value of national and cross-border M&As. The theoretical minimum Herfindahl index (if a variable is

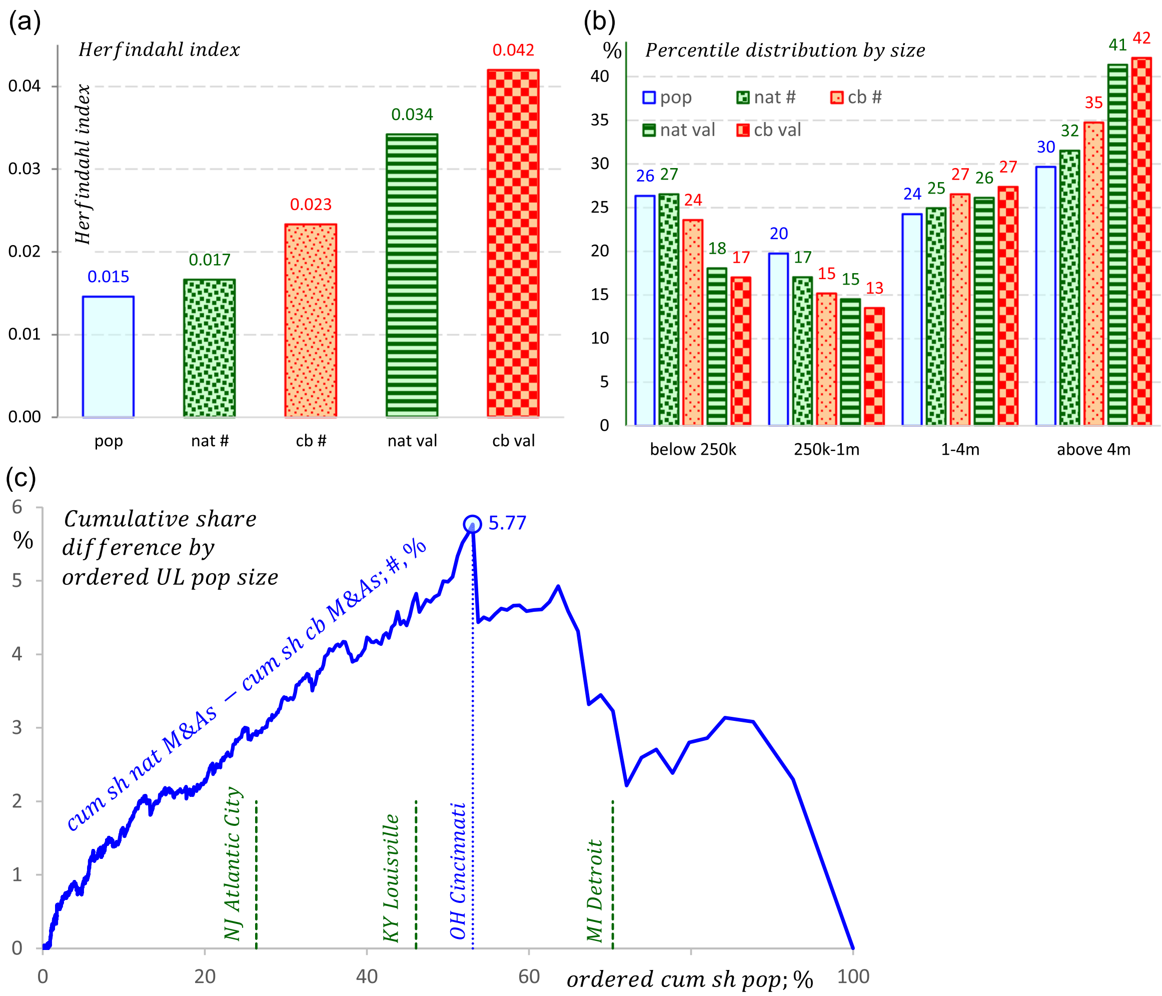

FIGURE 5 Concentration of M&As in urban locations. *Source*: Own creation based on 3535 Urban Locations; pop, population; nat, national; #, number; val, value; see main text for details. M&A, merger and acquisition; UL, Urban Locations. [Color figure can be viewed at wileyonlinelibrary.com]

equally distributed across all locations) is 1/3535 = 0.0003. Evidently, relative to this benchmark, all variables are distributed unequally. More importantly, however, relative to the distribution of population, the number of M&As is more unevenly distributed, and the value of M&As is even more so. Moreover, both in terms of number and value, cross-border M&As are more unevenly distributed than national M&As.

Figure 5b provides information regarding the size of Urban Locations and the distribution of M&As by identifying four population size categories: (i) below 250,000 (borderline city is Atlantic City in New Jersey); (ii) between 250,000 and 1 million (borderline city is Louisville/Jefferson in Kentucky); (iii) between 1 million and 4 million (borderline city is Detroit in Michigan); and (iv) above 4 million. The panel illustrates that the small-city categories have a *lower* share of the number and value of M&As than their share of population, while the big-city categories have a *higher* share of the number and value of M&As than their share of population.[11] Moreover, this effect is more pronounced for the value of M&As than the number of M&As, and more pronounced for cross-border M&As than for national M&As. This suggests that M&As are relatively more concentrated in large cities, and that this effect is stronger for the value of M&As and for cross-border M&As.

Figure 5c provides an alternative illustration of this sorting effect by *ordering* the Urban Locations from small to large. On the horizontal axis, we show the ordered cumulative share of the total population (in percent); on the vertical axis, we have the *difference* between the cumulative share of the number of *national* M&As and the cumulative share of the number of *cross-border* M&As. It shows that the national M&As are much more concentrated in the smaller Urban Locations than the cross-border M&As, with a peak of 5.77% difference in Cincinnati, Ohio (with about 1.6 million inhabitants). Section 5 analyzes two formal tests of descriptive observations.

5 | TESTING SPATIAL CONCENTRATION OF M&As WITHIN THE UNITED STATES

After our discussion of the geographical concentration of M&As at the State and Urban Location level, we now proceed to test *where* the M&A activity is located. Davis and Dingel (2020) analyze a detailed model that can be interpreted in our framework to argue that more productive firms tend to sort relatively more in larger agglomerations under certain conditions.[12] The key aspect in our tests is whether there is a systematic difference between the sorting into large or small agglomerations between cross-border M&As and national M&As. Each of these firm types faces a trade-off between higher costs in a large agglomeration versus better market access. We test whether this trade-off plays out differently for these two types of M&As—cross-border versus national. Davis and Dingel (2020) provide two tests of this sorting implication: an elasticity test and a pairwise comparison test (see Equation A2 in Appendix A). We will conduct both tests, for the sake of robustness.

5.1 | Methodology: Two tests

In Table 4, we list all variables we used in our analyses, including their definitions and sources. A critical variable, next to H1's population size (a straightforward population count), is H2's market access. Market access of an Urban

TABLE 4 Variable definitions and sources

Variable	Description	Source
nat tot #	The number of M&A targets with value information available at a given location taken over by national (American) firms in the period 1985–July 2012	Thomson Financial Securities matched with University of Groningen location data
cb tot #	The number of M&A targets with value information available at a given location taken over by foreign firms in the period 1985–July 2012	Thomson Financial Securities matched with University of Groningen location data
nat tot val	The real value in 2010 $ million (using GDP deflator) of the nat tot # variable M&A targets at a given location taken over by national (American) firms in the period 1985–July 2012	Thomson Financial Securities matched with University of Groningen location data
cb tot val	The real value in 2010 $ million (using GDP deflator) of the cb tot # variable M&A targets at a given location taken over by foreign firms in the period 1985–July 2012	Thomson Financial Securities matched with University of Groningen location data
MSA dist	Distance from M&A Location (or Urban Location) to nearest MSA location in km; connection with relevant MSA variables	Calculated based on coordinates, US Census Bureau and Proximityone.com
MA pop	Market Access of Urban Location based on 2010 population distance to all other Urban Locations; distance decay = – 1; internal distance $\left(\left(\frac{2}{3}\right)\sqrt{(area/\pi)}\right)$ is used if bigger than distance based on coordinates	Calculated based on coordinates, US Census Bureau and Proximityone.com
Urban location	List of 3592 Urban Locations (urban areas and urban clusters) in the United States with at least 2500 inhabitants in 2010; variables:	US Census Bureau
	Longitude in decimals; Latitude in decimals; Population size in 2010; Land area in square km; population density = population/area; Near Sea; dummy variable = 1 if distance to nearest seaport ≤70 km; Near Aea; dummy variable = 1 if distance to nearest international airport ≤70 km; Unemploy%; unemployment in % in 2010 of nearest MSA; High-skill%; share of high-skill workers in 2010 in % of nearest MSA, employment in (information + finance + professional + education); CAN; Canadian border; North of lat 45 OR north of line through points (lon, lat) = (−88, 45); (−82, 42); (−65, 44); SUN; Sun location; south of lat 35; MEX; Mexican border; South of lat 35 AND south of line through points (lon, lat) = (−125, 39); (−95, 28); WEST; West coast; west of lon −119; EAST; East coast; east of lon −80 AND south of line through points (lon, lat) = (−88, 29); (−64, 52); Global City; dummy variable = 1 for internationally connected cities, see https://www.kearney.com/global-cities/2019. The list contains Atlanta, Boston, Chicago, Dallas, Houston, Los Angeles, Miami, New York, Philadelphia, Phoenix, San Francisco, Seattle, and Washington.	

Abbreviations: GDP, gross domestic product; M&A, merger and acquisition; MSA, metropolitan statistical area.

Location is based on the 2010 population distance to all other Urban Locations. So, market access is a measure of demand reach as witnessed by the position of an Urban Location as a node in the country's Urban Location web.

First, the *elasticity test* compares the slope elasticities β_{1i} in the following regression:

$$M_{ij} = \beta_{0i} Y_j^{\beta_{1i}} \eta_{ij}, \tag{1}$$

where the index i refers to the type of M&A (*nat* for national M&As and *cb* for cross-border M&As), the index j indicates the location ($j = 1, ..., 3535$; see below), the variable M_{ij} is a measure of the M&A intensity of type i at location j (measured as the total *number* of M&As [#] or as the total *value* of those M&As [*val*]), the variable Y_j is a measure of the attractiveness of location j (measured as the population size of a location [*pop*] or its population-based market access [MA_{pop}]), the β's are parameters to be estimated, and η_{ij} is an error term. Since the variable M_{ij} is zero for many locations (see below), we use Poisson regressions to estimate Equation (1) (see Head & Mayer, 2014, Section 5.2; Santos-Silva & Tenreyro, 2006). Our test checks, in line with H1 and H2, whether the elasticity is larger for cross-border M&As than for national M&As: $\beta_{1cb} \geq \beta_{1nat}$.[13]

It is important to realize that this elasticity test is *not* intended to explain the *value* or the *number* of M&As in a location; that would require an analysis of locational traits that are relevant for a particular firm (like done by, for instance, Alfaro & Chen, 2014; see the meta-study of Jones, 2017; for a survey of relevant factors). Our aim is different. Specifically, if $\beta_{1cb} \geq \beta_{1nat}$, this implies a certain distribution of national and cross-border M&A activity—that is, a relative selection of more efficient foreign firms (cross-border M&As) in larger agglomerations, as measured by the slope elasticities (see Appendix A); the elasticity only indicates that location size matters as measured by population size and market access, and especially so for cross-border M&As.

Second, in the *pairwise comparison* test, we compare any two arbitrary locations and check if the larger location (measured by population size or market access) has relatively more cross-border M&As than the smaller location. We call the comparison a "success" (value = 1) if this condition holds, and a "failure" (value = 0) if this is not the case. The extent to which the average success rate exceeds the random distribution benchmark of 0.5 can then be taken as an indication regarding the sorting-predictive power of the model, providing evidence in support of H1 and H2. Because of log-supermodularity, we can create different "bins" of locations for our comparisons. For example, a bin of two locations consisting of all locations larger than the median size and a group of all locations smaller than the median size, which we can test in one way only. Or a bin of three locations consisting of a group of all one-third largest, middle, and smallest locations, which we can test in three ways (large vs. middle; large vs. small; and middle vs. small). In the analysis below, we divide the locations from 2 up to 3000 bins into discrete steps. Again, and similar to the elasticity test, the aim of the pairwise comparison test is not to explain the number of M&As.

5.2 | Elasticity test results

The elasticity test (Poisson estimates) is illustrated in Figure 6 for both the value of M&As (panel a) and the number of M&As (panel b). The graphs illustrate the size of national and cross-border M&As relative to the population size (*pop*) of the Urban Locations. The slope of the regression lines (which are also depicted) provides the elasticity of M&As (either in number or value) with respect to market access. In all cases, M&As tend to increase with population. According to the elasticity test, this rise should be faster for cross-border M&As than for national M&As. The slope of the cross-border regression line is indeed steeper for both the number of M&As and the value of M&As (in both panels of the figure). Figure 7 is similar to Figure 6, but this time using market access (MA_{pop}) as an explanatory variable. Table 5 provides the estimates for M&As in value and number terms, with either *pop* or MA_{pop} as the independent variable.[14] Panels (5a) and (5b) provide the estimates for value and number, respectively. In panel (5c), we test explicitly for the equality of the coefficients, and answer the question of whether we can drop the assumption of equality.

Only for M&A in value terms and *pop* as the dependent variable, we cannot rule out equality of the elasticities (note that for M&A in value terms and MA_{pop} as an independent variable significance is close to 10%). For M&As in numbers, equality of elasticities can be ruled out with high levels of significance. See Section 6 for an analysis of the robustness of our findings.

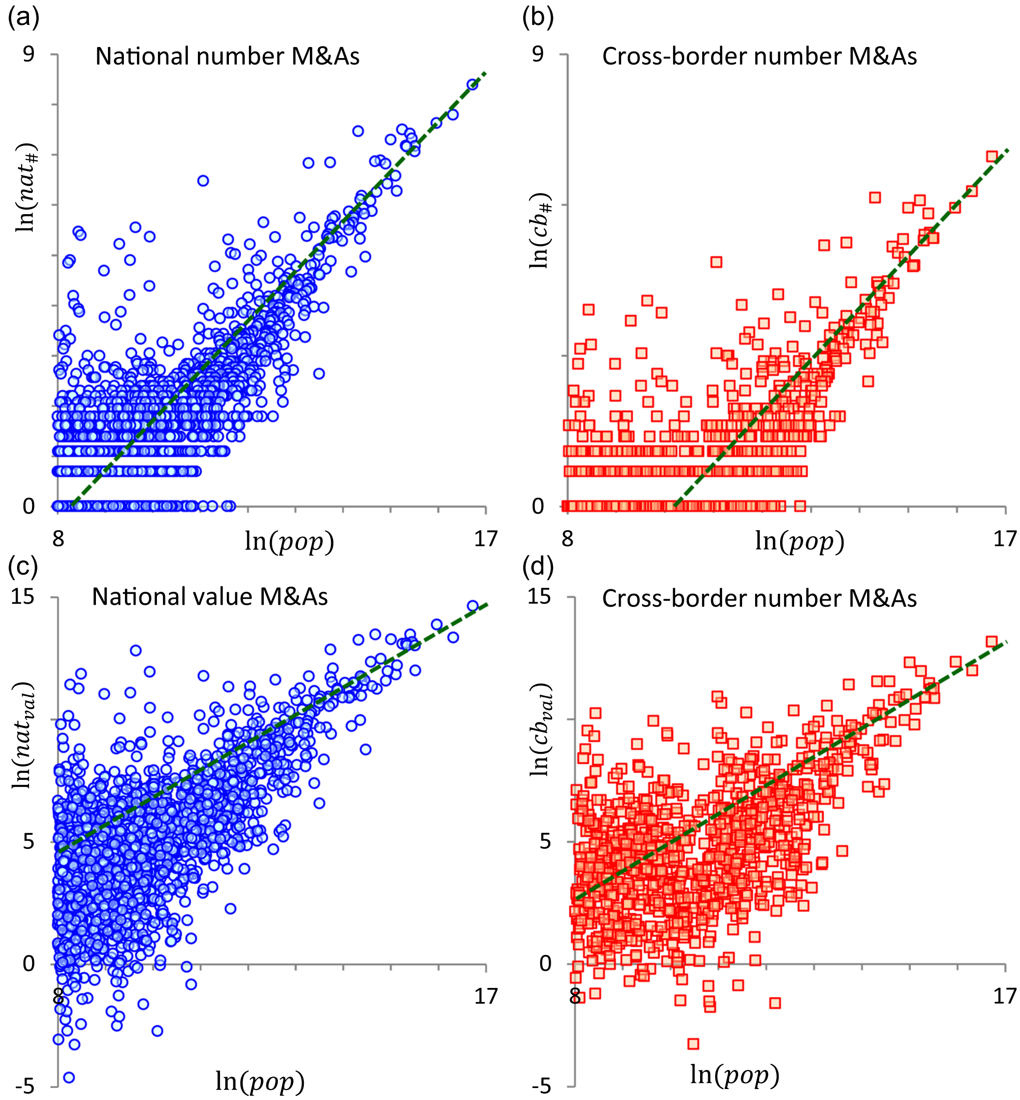

FIGURE 6 Elasticity test urban locations—population size. Regression lines based on Poisson regression (see Table 5); only positive observations are shown. M&A, merger and acquisition. [Color figure can be viewed at wileyonlinelibrary.com]

5.3 | Pairwise comparison test results

As explained above and in Davis and Dingel (2020), we can create a range of pairwise comparison tests by grouping together Urban Locations in different "bins." Each bin consists of the same number of Urban Locations. Since we have 3535 Urban Locations and we want to create bins of the same size, we looked for a suitable number of locations to include in our pairwise comparison test, which is a large number (close to 3535) with a large number of divisors. We opted to do this for the 3000 largest Urban Locations, so we can create 31 different bins (see Table 6), each with its associated size (number of Urban Locations) and relevant number of (unique) comparisons.[15]

We then determine if there are relatively more cross-border M&As in the larger location. We do this both for the number of M&As and for the value of M&As, while we measure location size either in terms of population or in market access. Moreover, since the outcome of a comparison is more informative if the difference in size is large—say, comparing New York to Lima-Ohio, rather than comparing Davis-California to Lima-Ohio—we also calculate *pop* weighted and MA_{pop} weighted success rates, where we use the log difference in size as weight. For each possible scenario, we perform more than 6.9 million bilateral comparisons, leading to more than 55.3 million bilateral comparisons, in total.

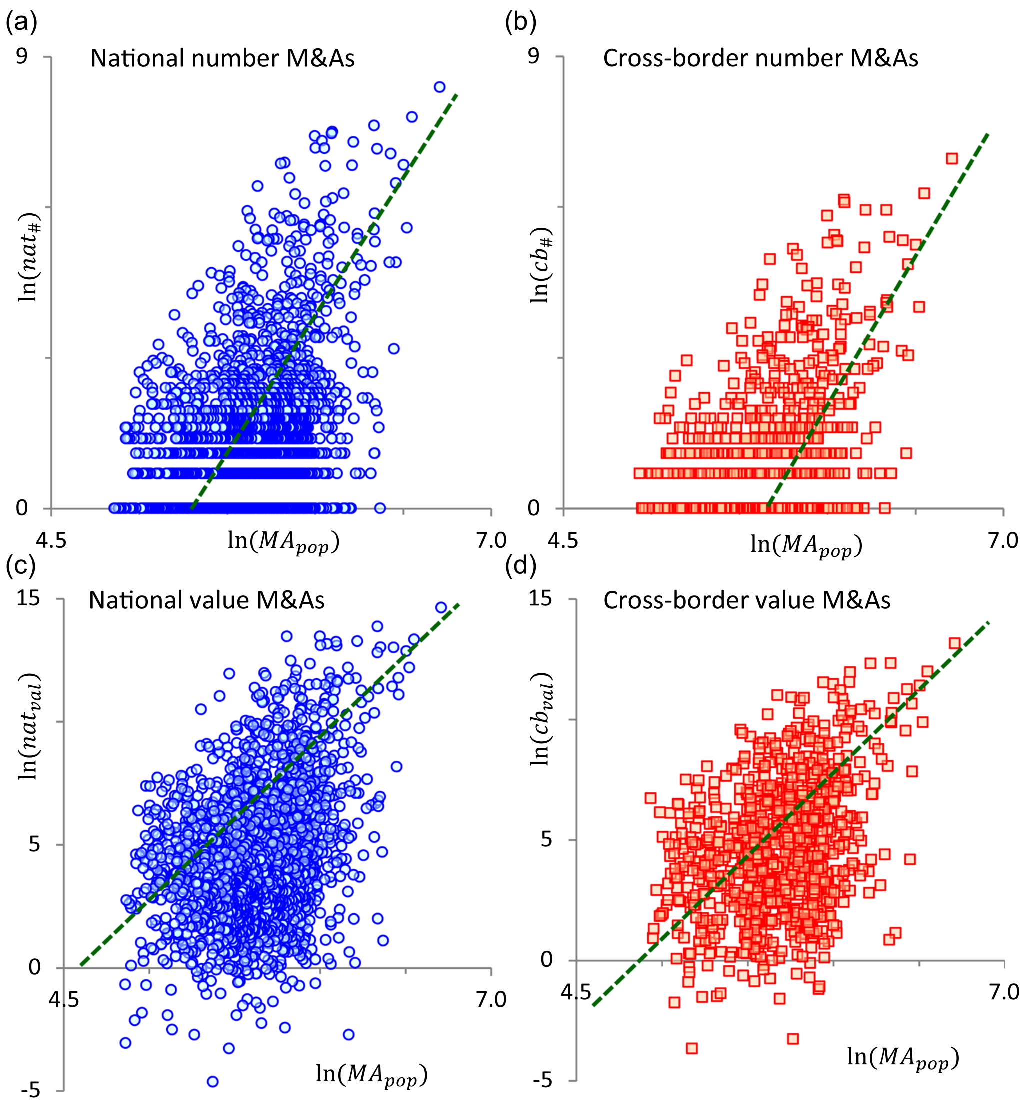

FIGURE 7 Elasticity test urban locations—market access. Regression lines based on Poisson regression (see Table 5); only positive observations are shown. M&A, merger and acquisition. [Color figure can be viewed at wileyonlinelibrary.com]

The results of the pairwise comparison test are illustrated in Figure 8. Panels (a) and (b) use population as the relevant size measure, while panels (c) and (d) take market access as the relevant size measure. Similarly, panels (a) and (c) focus on the number of M&As as the measure of M&A intensity, and panels (b) and (d) on the value of M&As as the measure of M&A intensity. The picture is similar in all four panels: (i) we start with a 100% success rate for bin 2 (one comparison); (ii) this success rate is somewhat erratic for low bin numbers (with only a few comparisons), and usually within the confidence limits (comparing to the random—fair—coin benchmark); (iii) the success rate is higher than the upper confidence limit if the bin number is sufficiently large (and thus the bin size decreases and the number of comparisons increases); (iv) after reaching some minimum, the success rate rises again for large bin numbers (after around 250 bins for population and 500 bins for market access); and (v) the success rate is high at the individual Urban Location level (3000 bins; at least 85.9% success rate, compared with the random coin benchmark).

On the basis of the two tests in this section, we can conclude that, in line with both Hypotheses H1 and H2, cross-border M&As are found more often in relatively larger agglomerations than national M&As, in terms of both population size (H1) and market access (H2). This suggests that agglomeration economies are more important for cross-border M&As, due to the need to overcome the LOF. Before we conclude, Section 6 explores the robustness of our findings by running a series of additional sensitivity analyses.

TABLE 5 Elasticity tests for urban locations—Poisson regressions

(a) *Value of M&As*				
Variables	**(1) CB**	**(2) NAT**	**(3) CB**	**(4) NAT**
ln(*pop*)	1.157***	1.118***		
	(0)	(0)		
ln(MA_{pop})			6.869***	6.593***
			(0)	(0)
Constant	−6.469***	−4.302***	−33.42***	−30.11***
	(0)	(0)	(0)	(0)
Observations	3535	3535	3535	3535
(b) *Number of M&As*				
Variables	**(1) CB**	**(2) NAT**	**(3) CB**	**(4) NAT**
ln(*pop*)	1.036***	0.987***		
	(0)	(0)		
ln(MA_{pop})			5.910***	5.478***
			(0)	(0)
Constant	−10.52***	−8.150***	−33.31***	−29.00***
	(0)	(0)	(0)	(0)
Observations	3535	3535	3535	3535
(c) *Test on equality of coefficients*				
***P* (*coef equal*)**	**(1) CB/NAT *Prob* > χ^2**	**(2) CB/NAT *Prob* > χ^2**	**(3) CB/NAT *Prob* > χ^2**	**(4) CB/NAT *Prob* > χ^2**
Value; *pop*	0.2286			
Value; MA_{pop}		0.1060		
Number; *pop*			0.0000	
Number; MA_{pop}				0.0000

Note: Panels (a) and (b), *p* value in parentheses; robust standard errors.

***$p < .01$; **$p < .05$; *$p < .1$.

6 | SENSITIVITY ANALYSES

In this section, we briefly provide various sensitivity analyses. With each sensitivity analysis, which is all done for the model underlying the elasticity test (see Equation 1), the main aim is to see, just like with the estimation results in Table 5, whether the elasticity of cross-border M&As to location size, as proxied by population size or market access, is higher than that of national M&As. We do so in five main steps, as summarized in four tables.

First, we note that in our procedure in Section 3 we allocate M&A Locations to the nearest Urban Location, irrespective of the distance between the two locations. We analyzed the impact of introducing a cut-off value for the maximum range for an M&A to be allocated to an Urban Location of 100, 80, 60, 40, and 20 km. Up to 40 km this has virtually no impact on the estimated coefficients (the same up to two decimals for log population and up to one decimal for log market access), while in all cases (including 20 km) the cross-border elasticity is higher than the national elasticity (and the difference is rising for the market access elasticities).[16]

TABLE 6 Overview of number of bins, bin size, and number of comparisons per bin

Bin	Size	# Comparisons	Bin	Size	# Comparisons
2	1500	1	75	40	2775
3	1000	3	100	30	4950
4	750	6	120	25	7140
5	600	10	125	24	7750
6	500	15	150	20	11,175
8	375	28	200	15	19,900
10	300	45	250	12	31,125
12	250	66	300	10	44,850
15	200	105	375	8	70,125
20	150	190	500	6	124,750
24	125	276	600	5	179,700
25	120	300	750	4	280,875
30	100	435	1000	3	499,500
40	75	780	1500	2	1,124,250
50	60	1225	3000	1	4,498,500
60	50	1770	Total # comparisons		6,912,620

Note: This table based on 3000 Urban Locations; bin refers to the number of bins (divisions); size refers to the number of Urban Locations per bin; # comparisons refer to the (unique) number of bilateral comparisons for a given number of bins.

Second, we allow the number and value of both cross-border and national M&As to not only be determined by population size or market access, but also by regional geographic features of the 3535 Urban Locations in our sample; see Figure 3. We distinguish between border locations (Canadian or Mexican border), locations on the East coast and West coast, and locations in the Sun. The main motivation to look at these various regional features is that they all might be relevant for the location choice of M&As, in particular for cross-border M&As, for reasons that are not necessarily related to population size or market access. On the basis of extensive literature, for example, Glaeser and Gottlieb (2009) show that particular regions in the United States are favored locations for firms as well as workers because they offer particular amenities—hence, we single out urban locations that are coastal or sunny locations in the United States. Again, the focus is not so much on the significance of these geographical features as such, but to check whether the results from estimating Equation (1) in Section 5 for the two main location variables in our analysis, population size, and market access, still hold after the inclusion of these geographical features

Table 7 shows that our main results are unchanged, where panel (a) indicates the impact of borders, coast, and sun on the *value* of M&A Location decisions and panel (b) on the *number* of M&A Location decisions. The coefficients for the two proxies for the size of the urban location (population and market access) indicate not only for both cross-border and national M&A deals that, as expected, the number and value of these deals increases with the size of the urban location, but also that this increase is typically larger for cross-border M&As.

Third, we analyze the impact of international access for locations close to major airports or seaports (within a 70 km radius) or international attractiveness associated with Global Cities in the United States (see www.kearney.com). Nearness to an airport or access to sea, ceteris paribus, should favor a location as (cross-border) M&A, and Global Cities might be preferred because they are by definition locations that are well-connected to the rest of the world. Table 8 shows again that our main results are unchanged, where panels (a) and (b) analyze the impact of Near Air and Near Sea, panels (c) and (d) analyze the impact of Global Cities, with panels (a) and (c) for the *value* of M&As and panels (b) and (d) for the *number* of M&As. In all cases, the coefficients for the two proxies for the size of the urban location (population and market access) are positive; and in all cases, the elasticity is larger for cross-border M&As than for national M&As.

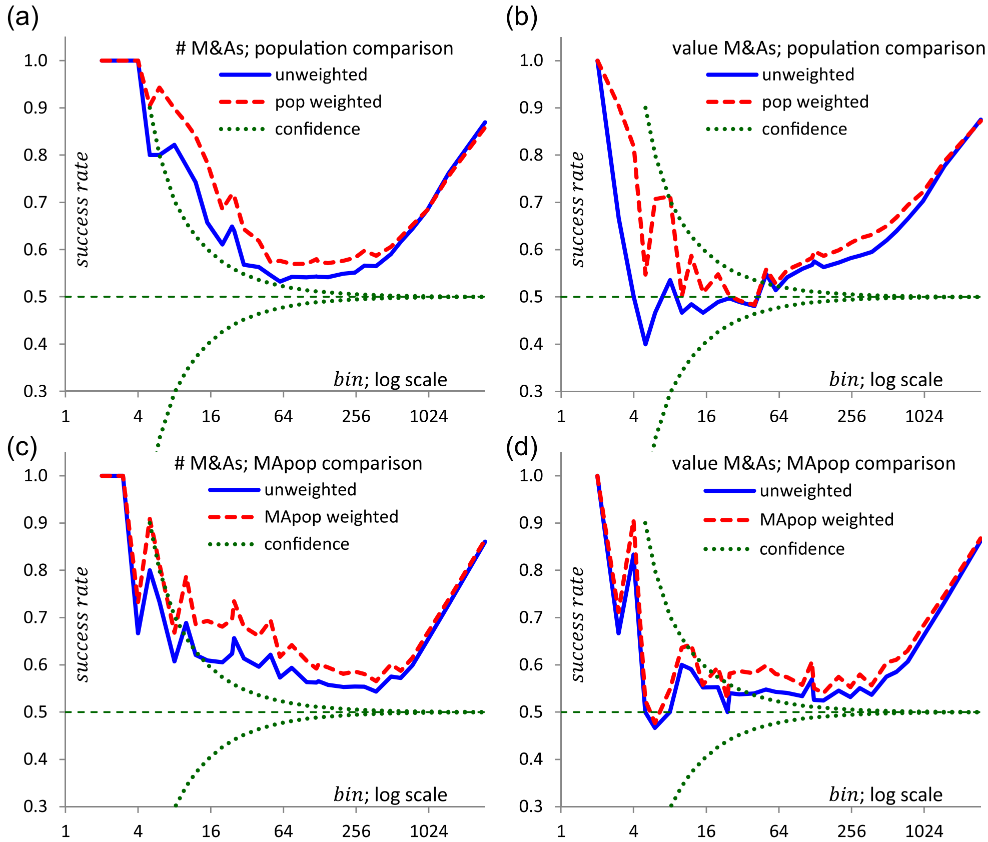

FIGURE 8 Pairwise comparison—national and cross-border M&As. Panels (a) and (c) for a number of M&As; panels (b) and (d) for the value of M&As; panels (a) and (b) based on the population size of Urban Location; panels (c) and (d) based on $MA_{population}$ size of Urban Location; the confidence lines indicate the limits of a 95% confidence interval for tossing a fair coin; based on the central limit theorem for eight bins (28 pairs) and higher and exact below (not shown below five bins); each line is based on almost 7 million comparisons, the total figure is based on 55.3 million comparisons. M&As, mergers and acquisitions. [Color figure can be viewed at wileyonlinelibrary.com]

Fourth, we analyze the idea that urban locations might offer certain (potential) assets that make these locations preferred M&A Locations irrespective of the urban location's size or other geographical features. We focus on the share of high-skilled workers (measured as the percent of information + finance + professional + education workers in 2010), with the share of unemployment (in percentage in 2010) and income per capita (in 2010) as additional control variables. More high-skilled people could ceteris paribus imply a location with more potential knowledge or innovation networks or a better trained and more skilled workforce (Agrawal et al., 2014; Awate & Mudambi, 2018). This can be seen as potential assets that make such a location attractive for (in particular) cross-border M&As.

Table 9 shows that our main results are again unchanged, where panel (a) indicates the impact of unemployment, high skills, and income on the *value* of M&A Location decisions and panel (b) on the *number* of M&A Location decisions. The coefficients for population and market access are positive; and in all cases, the elasticity is larger for cross-border M&As than for national M&As.

Fifth, we analyze the impact of sectoral aggregation for our results based on the state-level Ellison–Glaeser index analysis of Section 4. Recall that this analysis concluded that in most three-digit sectors (78%) cross-border M&As are more concentrated than national M&As at the state level, while the opposite holds for 22% of the three-digit sectors (see the kernel density illustration in Figure 4). So far, we have aggregated M&As in all sectors. We now distinguish between two types of M&As, namely, by aggregating M&As in sectors where cross-border M&As are *more concentrated* than national M&As at the state level (see Table 10 panel a for value and panel b for number of M&As) and by aggregating M&As in sectors where cross-border M&As are *less concentrated* than national M&As at the state level (see Table 10 panel c for value and panel d for number of M&As).

Note that compared with the other sensitivity analyses reported in this section, the estimation results in Table 10 are based on a change in (the measurement of) the dependent variable only, while the model specification is the same

TABLE 7 Borders, coast, and sun—Poisson regressions

Variables	(1) CB	(2) NAT	(3) CB	(4) NAT
(a) Value of M&As; borders, coast, and sun				
ln(*pop*)	1.141***	1.097***		
	(0)	(0)		
$\ln(MA_{pop})$			9.386***	9.121***
			(0)	(0)
West	0.561***	0.388***	2.404***	2.073***
	(0)	(0)	(0)	(0)
East	0.385***	0.413***	−1.273***	−1.262***
	(0)	(0)	(0)	(0)
Sun	−0.554***	−0.175***	1.868***	2.106***
	(0)	(0)	(0)	(0)
Mex	0.0631***	−0.449***	−2.367***	−2.738***
	(0)	(0)	(0)	(0)
Can	−0.0338***	−0.539***	1.987***	1.287***
	(0)	(0)	(0)	(0)
(b) Number of M&As; borders, coast, and sun				
ln(*pop*)	1.004***	0.966***		
	(0)	(0)		
$\ln(MA_{pop})$			7.584***	7.230***
			(0)	(0)
West	0.625***	0.304***	2.280***	1.943***
	(0)	(0)	(0)	(0)
East	0.537***	0.364***	−0.626***	−0.729***
	(0)	(0)	(0)	(0)
Sun	−0.0878***	0.0126	1.786***	1.774***
	(0.00244)	(0.270)	(0)	(0)
Mex	0.254***	0.0150	−1.189***	−1.232***
	(0)	(0.339)	(0)	(0)
Can	−0.300***	−0.305***	1.318***	1.085***
	(1.06e-10)	(0)	(0)	(0)

Note: All regressions have 3535 observations; constants not reported; *p* value in parentheses; Robust standard errors.
Abbreviations: CB, cross-border; M&A, merger and acquisition; NAT, national.
***$p < .01$; ** $p < .05$; * $p < .1$.

as in Section 5. As expected, the results are confirmed for the sectors that are *more concentrated* cross-border than national at the state level with coefficients for population and market access that are positive and larger for cross-border M&As than for national M&As. More remarkable, however, is the fact that the results are *also* confirmed for the sectors that are *less concentrated* cross-border than national at the state level, again with coefficients for population and market access that are positive and larger for cross-border M&As than for national M&As. The much more detailed Urban Location geographical analysis thus reverses the sectoral suggestion at the state level.

TABLE 8 Airports, seaports, and global cities—Poisson regressions

(a) Value of M&As; airports and seaports				
Variables	(1) CB	(2) NAT	(3) CB	(4) NAT
ln(*pop*)	0.945***	0.886***		
	(0)	(0)		
ln(MA_{pop})			5.515***	4.984***
			(0)	(0)
Near Air	1.112***	1.256***	2.103***	2.199***
	(0)	(0)	(0)	(0)
Near Sea	0.263***	0.331***	−0.657***	−0.469***
	(0)	(0)	(0)	(0)

(b) Number of M&As; airports and seaports				
Variables	(1) CB	(2) NAT	(3) CB	(4) NAT
ln(*pop*)	0.856***	0.847***		
	(0)	(0)		
ln(MA_{pop})			4.241***	3.914***
			(0)	(0)
Near Air	1.011***	0.819***	1.996***	1.837***
	(0)	(0)	(0)	(0)
Near Sea	0.318***	0.258***	−0.168***	−0.0682***
	(0)	(0)	(8.84e − 09)	(7.69e − 08)

(c) Value of M&As; global cities				
Variables	(1) CB	(2) NAT	(3) CB	(4) NAT
ln(*pop*)	1.054***	1.048***		
	(0)	(0)		
ln(MA_{pop})			3.742***	3.734***
			(0)	(0)
Global city	0.538***	0.379***	3.436***	3.265***
	(0)	(0)	(0)	(0)

(d) Number of M&As; global cities				
Variables	(1) CB	(2) NAT	(3) CB	(4) NAT#
ln(*pop*)	0.971***	0.938***		
	(0)	(0)		
ln(MA_{pop})			3.278***	3.072***
			(0)	(0)
Global city	0.391***	0.320***	3.297***	3.234***
	(0)	(0)	(0)	(0)

Note: All regressions have 3535 observations; constants not reported; p value in parentheses; robust standard errors; # for convergence reasons estimated using GLM, Poisson in stata 17.

Abbreviations: CB, cross-border; GLM, generalized linear model; M&A, merger and acquisition; NAT, national.

***$p < .01$; **$p < .05$; *$p < .1$.

TABLE 9 Unemployment, skills, and income—Poisson regressions

Variables	(1) CB	(2) NAT	(3) CB	(4) NAT
(a) *Value of M&As; unemployment, skills, and income*				
$\ln(pop)$	0.985***	0.969***		
	(0)	(0)		
$\ln(MA_{pop})$			5.438***	5.241***
			(0)	(0)
unemploy%	0.108***	0.0531***	0.110***	0.0664***
	(0)	(0)	(0)	(0)
$high - skill\%$	−0.00920***	−0.0179***	0.00107***	−0.00582***
	(0)	(0)	(0)	(0)
$\ln(inc\ per\ cap)$	4.120***	3.882***	2.924***	2.976***
	(0)	(0)	(0)	(0)
(b) *Number of M&As; unemployment, skills, and income*				
$\ln(pop)$	0.894***	0.879***		
	(0)	(0)		
$\ln(MA_{pop})$			4.342***	4.124***
			(0)	(0)
unemploy%	0.0805***	0.0420***	0.123***	0.0982***
	(0)	(0)	(0)	(0)
$high - skill\%$	−0.00731**	−0.00587***	0.00482*	0.00608***
	(0.0147)	(1.72e − 06)	(0.0626)	(1.20e − 08)
$ln(inc\ per\ cap)$	3.469***	2.696***	3.241***	2.876***
	(0)	(0)	(0)	(0)

Abbreviations: CB, cross-border; M&A, merger and acquisition; NAT, national.

We conclude this section by pointing out that our results hold for all sensitivity analyses performed in this section.

7 | CONCLUSIONS

In both the IB and IE literatures, the location choice of foreign entries within the host country has largely been neglected. In this paper, we respond to the plea in IB to examine MNEs' within-country location choice, next to the widespread focus on country selection (Beugelsdijk & Mudambi, 2013; Chan et al., 2010; Ma et al., 2013; Nielsen et al., 2017). Moreover, the majority of FDI consists of cross-border M&As, but the limited within-country location choice FDI literature focuses on greenfield entries (see the survey by Nielsen et al., 2017). By explicitly adding the within-country location pattern of M&As and by comparing cross-border and national activities, we contribute to our understanding of M&As because location patterns not only reveal where a merger or acquisition takes place, but also whether the location pattern of cross-border M&As differs from that of national M&As (or from location patterns in general).

Location selection is not random, and we hypothesize, based on the IB literature on the LOF, and the IE work of Davis and Dingel (2020) and Mrázová and Neary (2019), that cross-border firms are more selective than national firms, as they have to overcome larger market entry costs—or, put differently, as they have to compensate for the LOF. This implies that cross-border M&As sort into relatively larger agglomerations as these offer larger markets, measured in terms of population size or market access, and these more efficient or productive firms can afford to pay higher local prices in these larger agglomerations.

TABLE 10 Sector concentration at state level—Poisson regressions

Variables	(1) CB	(2) NAT	(3) CB	(4) NAT
(a) *Value of M&As; sectors CB M&As more concentrated than NAT at the state level*				
$\ln(pop)$	1.175***	1.121***		
	(0)	(0)		
$\ln(MA_{pop})$			6.891***	6.590***
			(0)	(0)
(b) *Number of M&As; sectors CB M&As more concentrated than NAT at the state level*				
$\ln(pop)$	1.065***	0.992***		
	(0)	(0)		
$\ln(MA_{pop})$			6.132***	5.545***
			(0)	(0)
(c) *Value of M&As; Sectors CB M&As less concentrated than NAT at the state level*				
$\ln(pop)$	1.122***	1.112***		
	(0)	(0)		
$\ln(MA_{pop})$			6.821***	6.597***
			(0)	(0)
(d) *Number of M&As; Sectors CB M&As less concentrated than NAT at the state level*				
$\ln(pop)$	0.975***	0.969***		
	(0)	(0)		
$\ln(MA_{pop})$			5.392***	5.238***
			(0)	(0)

Note: All regressions have 3535 observations; constants not reported; p value in parentheses; Robust standard errors.
Abbreviations: CB, cross-border; M&A, merger and acquisition; NAT, national.
$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$.

To test our hypotheses, we analyze all manufacturing cross-border M&As in the United States in comparison with all manufacturing national M&As from 1985 to 2012. Using the Ellison–Glaeser index to describe the data, we note that M&As tend to be more concentrated than firms in general at the state level (by comparing our results to those in existing studies), and that cross-border M&As are even more concentrated than firms in general and national M&As. On the basis of novel tests introduced by Davis and Dingel (2020), we then establish for 3535 Urban Locations that cross-border M&As are more concentrated (measured by the number of M&As or the total value of M&As) in larger agglomerations (measured by population size or market access) than national M&As. The fact that we can map individual M&As into a fine-grained spatial level of aggregation is a contribution to the FDI literature as such, where location choice is mostly only studied at a high level of spatial aggregation (federal States or countries) notwithstanding the fact that agglomeration effects associated with FDI location choice are most relevant at these lower levels of spatial aggregation (Asmussen et al., 2020).

Larger agglomerations might offer higher agglomeration rents and/or provide better market access. The elasticity test shows that, in general, the elasticity for cross-border M&As with respect to the size of an Urban Location is larger than for national M&As. The pairwise comparison test reveals convincingly that the number of cross-border M&As is relatively higher in larger agglomerations. At the individual Urban Location level, the success rate of this test (with about 4.5 million comparisons at this level) is 86% or higher, compared with the 50% benchmark. Our main findings continue to hold after conducting various sensitivity analyses.

Before concluding, we would like to emphasize three contributions of our study, all linking to potential future research issues we consider promising (see also Asmussen et al., 2020; Nielsen et al., 2017). First, we apply the LOF argument to the setting of MNE within-country location choice, illustrating how hypotheses derived from this argument can be corroborated in this nontypical setting, from an IB perspective. This further increases the validity of this concept. However, in future work, we can move beyond this by including the implications of different types of distance (cf. Eden & Miller, 2004). Does, for example, the cultural and/or institutional distance (see, e.g., Dikova & van Witteloostuijn, 2007) between the MNE's home and host country codetermine were to enter within the host country? For instance, the institutional theory would suggest that, given the prominence of mimicking behavior, the MNE might be more likely to look for a target in a location with more establishments owned by MNEs from its home country (Brouthers et al., 2005; Stallkamp et al., 2018). More generally, including these concepts would also perhaps allow for a causal explanation of the location choices underlying the M&A deals, which was specifically *not* the aim of the present paper.

Second, we contribute to the large (international) M&A literature by providing evidence in favor of the larger impact of agglomeration and market access effects for international vis-à-vis national M&As. A follow-up question is whether or not this impact differential is different across different entry and establishment modes. Other studies have examined the role of agglomeration and market access in the context of greenfield entry (see, e.g., Basile et al., 2008; Mataloni, 2011). Future research could adopt a comparative design, assessing effect differences across different entry and establishment modes (e.g., alliance, greenfield, and M&A MNE entries). By opting for a mixed methods approach, complementary qualitative work could explore the theoretical mechanisms underlying differences across different modes, if any. When it comes to future research, a comparative design would also be useful in the sense of including both host and home-country variables. Our data set only allows us to focus on host-country factors, whereas we know from other studies (e.g. Erel et al., 2012) that home-country factors are equally or perhaps even more important. For instance, the MNEs that enter into foreign countries, through M&A or otherwise, may well stand out in their home country in terms of, for example, efficiency and innovativeness.

Third, we are the first, to the best of our knowledge, to adopt the novel methodologies introduced by Davis and Dingel (2020)—the elasticity and pairwise comparison tests—in an IB context. We believe that both tests can also be applied in IB contexts other than the one of within-country MNE M&A entry location choice explored in the current study. An obvious candidate is the traditional IB issue of country choice (see, e.g., Makino & Tsang, 2011). Taking countries as our "bins," for instance, we can examine the extent (again, for different entry and establishment modes) to which agglomeration does or does not occur at the scale of regions, and whether or not the (absence of) agglomeration can be explained by features of the MNEs' home countries or the distance with the host countries in those regions (see our first future research suggestion; cf. Nachum et al., 2008).

Our main finding is that there is not only substantial within-county heterogeneity in FDI location choice, here for cross-border M&As, but also has policy implications. Basically, where FDI policies are typically traditionally conceived at the country level, our analysis adds a regional policy angle. Given that larger urban locations are preferred target locations, policies aimed at attracting FDI may strengthen already existing core-periphery patterns that might or might not be an unwarranted policy outcome, but it is something that (national) policymakers need to be aware of. At the local level, specific regions or cities often pursue policies aimed at attracting foreign firms, but our results make clear that larger and smaller urban locations stand a very different chance of succeeding to attract new foreign (or even domestic) firms.

With our study, we illustrate the potential of the IB study of within-country heterogeneity, an important topic that is clearly underresearched in both IB and IE (see the survey on FDI location choice by Nielsen et al., 2017). With this type of work, we can explicitly examine the extent to which, and how, MNEs behave differently vis-à-vis their national counterparts. In our case, this provides strong evidence in favor of IB's well-known concept of the LOF. Of course, our study is only a first step in this journey. In line with the suggestions made by Beugelsdijk and Mudambi (2013) and Nielsen et al. (2017), much more work lies ahead. For instance, apart from the three suggestions emphasized above, and given the dominance of the case of the United States in FDI research, we may explore whether our findings for the United States hold across different host countries.

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ENDNOTES

[1] In Appendix A, we indicate how the model developed by Davis and Dingel (2020) provides a framework for our hypotheses.

[2] We are grateful to an anonymous referee for raising this question.

[3] Note that our M&A coverage is much larger than that of, for instance, Anand and Delios (2002), who have 2175 entries for the UK, Germany, and Japan into the United States.

[4] Note that all our remarks and findings are based on the data included in the analysis (for which the value of the transaction is known) and may not hold for the excluded M&As (for which the value of the transaction is not known).

[5] In the sensitivity analyses, we distinguish these regions from each other and are able to analyze, for example, whether the M&A behavior along the Mexican border is different from coastal regions or the Canadian border.

[6] In Section 6, we discuss a distance cut-off value before allocating M&As to an Urban Location.

[7] The E-G index is sensitive to administrative definitions of spatial units. Duranton and Overman (2005, 2008) correct for this, by treating space as a continuum (see also Maurel & Sédillot, 1999).

[8] We have sector data available at the four-digit SIC level. However, the number of transactions within the four-digit classification is too limited. We thus restrict attention to three-digit sectors or higher levels of aggregation. The underlying Herfindahl index per sector is based on the distribution of national M&As in that sector. There are still very few observations (one or two) for certain three-digit sectors, causing outliers in the E-G index. We therefore apply the concomitant two-digit sector Herfindahl index throughout our analysis. The correlation of the E-G index using two-digit and three-digit Herfindahl indices is high (e.g., 0.82 for cross-border M&As). Alternatively, we could impose a minimum number of observations before a sector is included in the analysis, reducing the number of included sectors. The Herfindahl index for the number of transactions is, of course, simply $1/n$, where n is the number of transactions in that sector. We used the number of M&As as a robustness check, generating similar results (available upon request).

[9] The average increase in the E-G index is 0.202, almost a doubling of the value. These differences are highly significant. A formal test of the extent of the deviation of the diagonal and a PP-plot for the two distributions, using the method of Hinloopen et al. (2012), soundly rejects that the underlying distribution is the same: mean difference test = 9.48 and distribution difference test = 2.749, both significant at the 1% level.

[10] In the sensitivity analyses, we also restrict the analysis to this group of concentrated M&As.

[11] Only the share of the number of national M&As is slightly higher (26.5%) than the share of population (26.3%) for cities below 250,000 people.

[12] Log-supermodularity plays a central role in the conditions. In this study's context, this essentially means that more efficient firms are relatively better in efficiency (skill)-intensive sectors, resulting in a sorting of more efficient firms and sectors in larger locations. This idea is developed and illustrated in Appendix A.

[13] As shown in Davis and Dingel (2020), this regression can be understood as a first-order Taylor approximation, where β_{i1} is increasing in i, due to the assumption of log-supermodularity. See Appendix A for a discussion of how this assumption is used in a model of location choice.

[14] Note that the correlation between *pop* and MA_{pop} is relatively small at 0.37.

[15] We thus exclude the smallest Urban Locations for either *pop* or MA_{pop}, ignoring less than 1.4% of the observations, on average, and less than 2.2%, at most.

[16] Details available upon request.

[17] That is, $\varphi > \varphi', \sigma > \sigma' \Longrightarrow H(\varphi, \sigma)H(\varphi', \sigma') > H(\varphi, \sigma')H(\varphi', \sigma)$.

[18] Note that by including market access, the location of a city relative to other locations becomes implicitly part of the analysis.

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APPENDIX A: MODEL OF LOCATION-TARGET SELECTION

Our empirical work is based on a reinterpretation of the general theoretical model of Davis and Dingel (2020) in which individuals with certain skills make location choices and sort over cities, sectors, and locations within cities to maximize utility. In our adaptation of the model, firms with certain efficiency levels make similar location choices to maximize profits. Essentially, the LOF in this model is translated into the requirement that foreign firms are sorting into locations that offer sufficiently high market access (profitability) to survive. The largest market access is found in larger cities that are also more expensive. This is the trade-off in the model: the trade-off between the higher location costs in a large agglomeration (think of land prices, et cetera) versus larger market access.

There are L heterogeneous firms with a continuum of efficiency φ that sort over a continuum of sectors σ by choosing from a continuum of locations δ within C discrete cities, $c \in \mathbb{C} = \{1, ..., C\}$. Their objective is to maximize profits, π, which is equal to the value of net revenue $R(c, \delta, \sigma; \varphi)$ minus the location-specific rent costs $r(c, \delta)$. The rent costs only depend on the city and the location within the city, the revenue depends on local market size or market access of c. The value of a firm's net revenue incorporates all nonlocation costs and is determined by the price $p(\sigma)$, the city-level total factor productivity $A(c)$, which is taken as given by the firms, but depends on the city's size or market access and the distribution of efficiency within the city, interacted with location $D(\delta)$ and the choice of the sector combined with productivity $H(\varphi, \sigma)$, multiplicatively. This gives.

$$\pi(\varphi, c, \delta, \sigma) = R(\cdot) - r(\cdot) = A(c)D(\delta)H(\varphi, \sigma)p(\sigma) - r(c, \delta). \tag{A1}$$

As a normalization, higher δ locations in a city are less attractive/productive, so $D'(\delta) < 0$. Note that because we analyze individual firms, the location or postal code is relevant; some firms are part of the Central Business District, whilst others are located in the suburbs. The function H is assumed to be strictly log-supermodular (in φ and σ) and strictly increasing in efficiency.[17] This ensures that more efficient firms are more productive, and also *relatively* more productive in higher σ (more efficiency-intensive) sectors. Firms pay rent to absentee landlords, who engage in Bertrand competition.

In a competitive equilibrium, firms choose locations within the city and the sector independently as these enter the objective function separably. We order the system of cities in terms of total factor productivity such that $A(C) \geq A(C-1) \geq \cdots \geq A(1)$. Define the *attractiveness* γ of a location δ within a city c as $\gamma = A(c)D(\delta)$. In equilibrium, $A(c)D(\delta) = A(c')D(\delta')$ for a given efficiency level. This equation describes a trade-off between $A(c)$ and $D(\delta)$. A higher $A(c)$ implies a lower implies $D(\delta)$. If a firm considers a location decision it has a choice between a "not-so-good" location in a productive city or a "wonderful" location in a less productive city (and likewise within a city). In equilibrium, a firm is indifferent between these two choices (otherwise it would relocate). Since the most efficient firms can afford to choose the most attractive locations, there will be a range of highly efficient firms located in large cities (like NYC) that cannot be found in smaller cities (like Buffalo in the State of New York), followed by a range of firms with similar efficiency levels found in both cities. Since more efficient firms work in the more efficiency-intensive sectors, larger cities contain relatively more efficiency-intensive sectors.

Under a regularity condition (namely, that the supply of locations in a city is decreasing and log-concave), the distribution of efficiency over cities (say, $f(\varphi, c)$, which is integrated over sectors and locations within the city), is log-supermodular. So,

$$f(\varphi, c)f(\varphi', c') \geq f(\varphi, c')f(\varphi', c) \quad \text{for } c \geq c' \text{ and } \varphi \geq \varphi'. \tag{A2}$$

Note that Equation (A2) is directly tested by the pairwise comparison test in the main text. The inequality in Equation (A2) satisfies the so-called monotone likelihood ratio property, which says that the relative returns to increasing efficiency (φ) or the efficiency-intensity of sectors (σ) are *in*creasing in city size (Costinot, 2009; Costinot & Vogel, 2015; Milgrom, 1981). This property is directly related to the elasticity test in the main text. Note that, for our purpose, we do not need to know the location of firms within cities; only the relation between the size of cities and φ is relevant in Equation (A2).

We illustrate the model with two graphs. Note that these graphs motivate our tests in the main text; the trade-off between location costs versus market access. Figure A1 focuses on the relationship between firm efficiency and market size or market access for cities 1 and 2 at a certain location δ. Viability requires that net revenue R is at least as high as the rent costs r (see Equation A1). For city 1 at location δ, this implies that firm efficiency must be at least φ_1^*; see point E_1 in Figure A1. Firms with an efficiency below the cut-off value φ_1^* are not viable at location δ in city 1. Two things change for the larger city 2. First, city 2 has higher average productivity $[A(2) > A(1)]$ such that for a given location the net revenue curve is higher, as indicated by the counterclockwise rotation of the function R and the curved arrow in Figure A1. Second, the rent costs increase from $r(1, \delta)$ to $r(2, \delta)$. At the old rent cost level $r(1, \delta)$, the cut-off efficiency level at location δ would fall to φ^* at point E in Figure A1. At the new, higher rent cost level $r(2, \delta)$, the cut-off efficiency level actually rises to φ_2^* at point E_2 in Figure A1. Firms thus have to be more efficient to be able to occupy the same location in larger cities. Note that for $\varphi_2^* > \varphi_1^*$ it is necessary that the rents are higher in the larger city compared with the smaller city, which is a reasonable assumption as the cost of living is usually higher in larger cities compared with smaller ones.

Figure A2 illustrates the relationship between firm efficiency and target selection for two acquiring firms (a and b) with efficiency levels φ_a and φ_b, respectively. As in Guadalupe et al. (2012), we assume that after the M&A the acquiring firm determines the final productivity level of the new (target) firm. This is a standard and simplifying assumption in the theoretical M&A literature, but is also reasonable because if after an M&A productivity of the new firm would go down, the M&A decision becomes questionable in the first place (see also Guadalupe et al., 2012). Furthermore, we assume that firm b is more efficient than firm a, so $\varphi_b > \varphi_a$. We can now compare the profitability of these two firms in two different cities, 1 and 2, and two different locations, δ_1 and δ_2. The net revenue curves are $R(j, \delta_j, \sigma; \varphi)$ for $j = 1,2$. We refer to these as $R_j(\cdot)$ for simplicity in Figure A2, and similarly for the rent costs $r_j(\cdot)$. We denote the net revenue for a firm with productivity φ_i by $R_{j,i}$ for $i = a, b$.

In the situation depicted in Figure A2, the more efficient firm b prefers to be in location δ_2 in the large city 2 over being in location δ_1 in the smaller city 1 since $R_{2,b} - r_2(\cdot)$ is larger than $R_{1,b} - r_1(\cdot)$. Note that both options are viable for

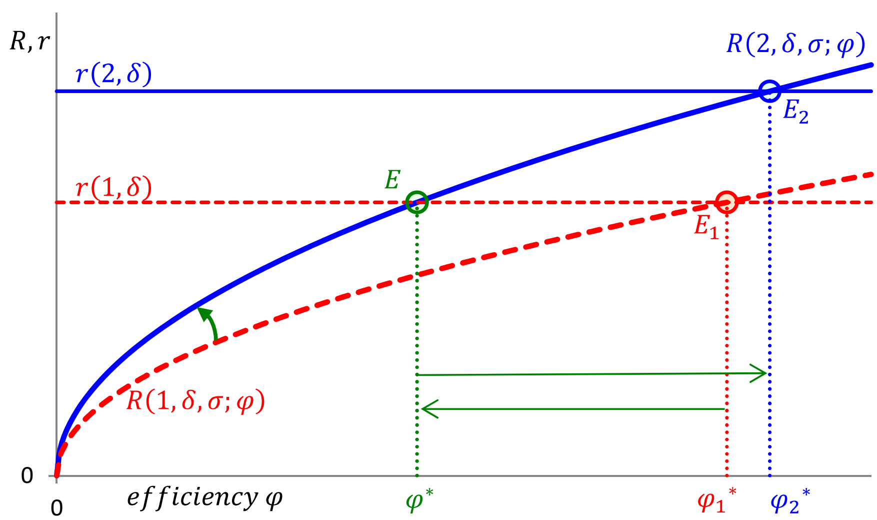

FIGURE A1 Firm efficiency and market size firm b. For the less efficient firm a, the location choice is simpler. The high costs in the large city 2 make location δ_2 in that city not viable: $R_{2,a} < r_2(\cdot)$. The only option is to go for location δ_1 in the smaller city 1: $R_{1,a} > r_1(\cdot)$. In the example illustrated in Figure A2, therefore, the more efficient firm b selects a location in the large city and the less efficient firm a selects a location in the small city. Under the conditions provided in the theoretical model discussed above, this selection effect holds in general. Note that the model does not simply identify cherries (high R) versus lemons (low R); it is the trade-off between higher R and higher r versus lower R and lower r that counts. According to the model, MNEs or, in our model, cross-border M&As select, on average, higher R and r, compared with domestic firms or, in our model, national M&As.

On the basis of the above model setup, for the value of a firm after an M&A, we see that firms have to be (i) productive enough and (ii) select locations that offer sufficient agglomeration rents to cover the location costs; it is the combination of these two elements that will make an M&A viable. Agglomeration rents are not only a function of the market in a city itself, but also of market access or market potential.[18]

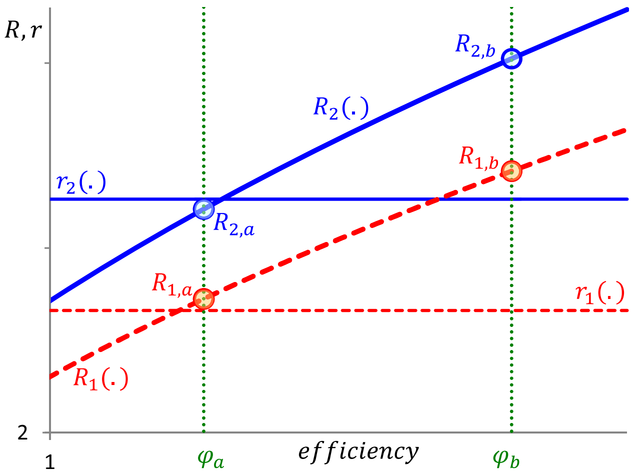

FIGURE A2 Firm efficiency and target selection