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Essays on the Geographical, Product, and Technological Dimensions of the Market for Corporate Control

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by

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ABSTRACT OF THE DISSERTATION

Essays on the Geographical, Product, and Technological Dimensions of the Market for Corporate Control

by

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Doctor of Philosophy in Management
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Mergers and acquisitions (M&As) play a central role in companies' strategies. This dissertation investigates how the location of merging companies and their competitors in the geographical, product market, or technological space influences key aspects of M&As, including the takeover price, the acquiring and the target companies' returns, the method of payment, and the spillover effects on the valuation of competitors. In particular, Chapter 1 studies how the geographical location of acquiring and target companies affects the competitiveness of the acquisition process and therefore the acquisition price. Chapter 2 investigates whether face-to-face interactions with the target's employees before an acquisition provide informational advantages to the acquirer and translate into higher acquisition returns. Chapter 3 looks at the perspective of the seller and studies how the geographical distance to the acquiring company affects the seller's incentives to retain partial ownership of the combined entity. Chapter 4 analyzes the market value spillovers of an acquisition announcement on competitors, and proposes a way to empirically disentangle the negative product market rivalry effect from a positive technological signaling effect.

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To my family and dearest friends,

for encouraging me to start this journey

and for supporting me throughout.

While some of the chapters of this dissertation

argue that geographical distance is important,

you showed me that for some things,

the most important ones, distance doesn't matter.

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CHAPTER 1

The Spatial Scope of Competition in the Market for Corporate Control: Evidence from Transportation Networks Data

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What conditions limit competition in strategic factor markets? In this paper, I investigate whether the spatial distribution of companies can introduce frictions to perfect competition in the market for corporate control, and affect the acquirers' ability to appropriate value from mergers and acquisitions (M&As). I argue that competition to acquire a firm is limited to a circumscribed geographical area surrounding the target, and the faster the information flow from the target decays with distance, the smaller will be this geographical area. This framework suggests that proximity allows acquirers to appropriate more value from M&As by allowing them to tap into less competitive segments of the market, in which competition is more spatially bounded. Using the introduction or removal of airline routes in the United States during the period 1979–2016 as a source of variation in proximity between cities, I provide results that are consistent with the theoretical predictions: a reduction in the transportation time between the acquirer's city and the target's city increases the probability of an acquisition bid, reduces the chances of observing a competing acquisition offer, reduces the average target's returns and acquisition premium, and increases the average acquirer's returns. Moreover, the target's returns are lower, and the acquirer's returns higher, the more isolated the target's city is from other cities.

"The frequency with which markets for corporate control are perfectly competitive [..] is ultimately an empirical question." J. B. Barney (1988: 73)

1.1 Introduction

The resource-based view of strategy considers the firm as a collection of sticky and imperfectly imitable productive factors that enable the firm to compete in its product markets (Barney, 1986; Wernerfelt, 1984). For a factor to generate superior returns to the firm, there need to be some limits to competition in the factor market (Peteraf, 1993). This condition prevents rents from being appropriated by factor owners when resources are acquired. Because firms are often constrained in their ability to develop resources and capabilities internally, mergers and acquisitions (M&As) are a central tool firms use to expand their scope and scale (Capron and Mitchell, 2012; Lee and Lieberman, 2009; Villalonga and McGahan, 2005; Wang and Zajac, 2007). A common finding in the empirical literature on M&As is that while acquisitions tend to produce positive combined returns, the target firm's shareholders typically obtain the majority of the gains and the acquirer's shareholders obtain close to zero or negative returns (see Haleblian *et al.*, 2009, for a review of these findings). This empirical regularity suggests that, in general, markets for corporate control tend to be competitive (Barney, 1988; Capron and Pistre, 2002).

From the viewpoint of strategic management, understanding which conditions can limit competition in factor markets is a central area of inquiry. In this paper, I build on the economics and management literature on geography to investigate how the spatial distribution of companies can affect the competitiveness of the market for corporate control. Previous research indicates that acquiring firms have a strong and persistent preference for geographically close targets (Chakrabarti and Mitchell, 2013; Kang and Kim, 2008; Ragozzino and Reuer, 2011). Geographical proximity facilitates access to company-specific information (Baum *et al.*, 2000; Chakrabarti and Mitchell, 2013; Coval and Moskowitz, 1999; Ragozzino and Reuer, 2011), control (Arora *et al.*, 2011; Bernstein *et al.*, 2016; Giroud, 2013; Kang and Kim, 2008; Lerner, 1995), and knowledge transfer (Bell and Zaheer, 2007; Catalini, 2018;

Jaffe *et al.*, 1993; Lahiri, 2010; Tsai, 2002). Hence, when the exchange of valuable information between two companies decreases with distance, acquirers can become reluctant to acquire distant targets.

I argue that this so-called home bias introduces a spatial component of competition in the market for corporate control. When the flow of valuable information from the target company decays with distance, potential bidders are likely to be located within a circumscribed geographical area surrounding the target. The broader this area, the more likely the target is to find alternative bidders, and therefore the higher its bargaining power vis-à-vis the acquirer. I introduce a theoretical model that follows this intuition. The model assumes that information flows from the target firms decay with distance. Targets have heterogeneous information-decay rates and can be acquired only by bidders that have access to enough information from them. This feature allows me to encapsulate the home bias effect in the theoretical framework. Under these assumptions, the model indicates that proximity allows acquirers to tap into segments of the M&A market in which competition is more spatially bounded and that are therefore less competitive. Hence, nearby acquirers will on average be able to appropriate a greater fraction of the value created from synergies. Moreover, acquirers will be better off—and targets worse off—when targets are in relatively isolated locations and are therefore distant from the pool of other potential bidders.

I test these predictions by investigating how changes in the U.S. passenger transportation network due to the introduction of new airline routes affected the probability of and the returns to M&A announcements during the period 1980–2017. For every year, I computed the minimum transportation time between each pair of cities in the United States, where cities are defined by core-based statistical areas (CBSAs).[1] Transportation time is computed by considering road and airline transportation (see also Giroud, 2013). As a consequence of the introduction or removal of airline routes, the fastest itinerary from the centroid of a city

[1]CBSAs are defined by the Office of Management and Budget (OMB) and consist of one or more counties (or equivalent entities) associated with one urban center with population of at least 10,000, plus adjacent counties having a high degree of socioeconomic integration with the urban center as measured through commuting ties.

to the centroid of another city can change from road to flight, indirect to direct flight, indirect to faster indirect flight, or direct to faster direct flight (i.e., another direct flight from a closer airport), or vice versa. The results support the predictions of the model: a reduction in the transportation time between the acquirer's city and the target's city increases the probability of an acquisition bid, reduces the chances of observing a competing acquisition offer, reduces the average target's returns and acquisition premium, and increases the average acquirer's returns. Moreover, the target's returns are lower, and the acquirer's returns higher, the less connected the target's city is to other cities.

This study contributes to strategy research on M&As and corporate strategy in different ways. First, while previous research shows that the market for corporate control is generally quite competitive (Barney, 1988; Capron and Pistre, 2002; Haleblian *et al.*, 2009), this paper indicates that the geographic distribution of companies can introduce significant frictions to perfect competition. Hence, a firm's location can affect its ability to appropriate value through an external growth strategy. Second, this paper contributes to the body of literature on M&As and geography (Chakrabarti and Mitchell, 2013, 2016; Kang and Kim, 2008; Ragozzino and Reuer, 2011). While previous studies have described the presence of a proximity bias in the M&A market, this paper highlights what the implications are of such preference on acquirers' and targets' value appropriation. Finally, it provides insights on how an increase in connectivity due to the evolution of transportation networks can impact strategic factor markets (Barney, 1986). The findings of this study suggest that whenever resources require physical proximity to be acquired (Baum and Sorenson, 2003; Baum *et al.*, 2000; Sorenson and Stuart, 2001), a more connected world can intensify the competition firms need to face to obtain those resources.

1.2 Theory and hypotheses

1.2.1 Acquirers' proximity preference

Spatial proximity facilitates social interactions and communication among employees and other stakeholders of two merging companies. Below I describe three types of information flows that can affect an acquirer's willingness to buy a given target and that can decay with distance: an *ex ante information flow*, which allows the acquirer to evaluate the target before the transaction; an *ex post vertical information flow*, which allows the acquirer to control the target after the acquisition; and an *ex post horizontal information flow*, which facilitates communication and knowledge exchange with the target after the transaction. Importantly, for every channel, the literature has highlighted that the informational benefits provided by spatial proximity are not equally important for every type of transaction.

1.2.1.1 Ex ante information flow

When making an acquisition, the acquirer needs to collect extensive information about the target's internal strengths, weaknesses, knowledge base, and strategic and organizational fit with the acquirer (Chatterjee *et al.*, 1992; Coff, 1999, 2002; Reuer and Ragozzino, 2008; Reuer *et al.*, 2004; Zaheer *et al.*, 2010). When such information is hard to obtain, the acquirer faces an adverse selection problem and might be reluctant to acquire the target (Capron and Shen, 2007; Ragozzino and Reuer, 2011). Because geographical proximity facilitates the transfer of information through social interactions (Baum *et al.*, 2000; Bell and Zaheer, 2007; Coval and Moskowitz, 1999; Sorenson and Stuart, 2001), the adverse selection risk can be lower when two companies are near each other (Chakrabarti and Mitchell, 2013, 2016; Ragozzino and Reuer, 2011). Indeed, Chakrabarti and Mitchell (2013) argue that because geographical proximity reduces the cost of obtaining information about targets, acquirers have a strong and persistent preference for geographically close targets. Nevertheless, the literature has also highlighted that the informational advantages provided by spatial proximity are not equally important for every type of acquisition. For instance, proximity becomes more important when the target's value is harder to appraise from the external, as in the case of a young, private, or knowledge-intensive company (Ragozzino and Reuer, 2011; Uysal *et al.*, 2008).

1.2.1.2 Ex post vertical information flow

When two merging companies are close to each other, the same managers can oversee and control operations in different locations, effectively running the two companies as a single entity. This can be especially valuable when the acquirer's control can improve the performance of the target, or when centralization of decision making is desirable. For instance, Kang and Kim (2008) find that block acquirers that are geographically close to the target company are more likely to engage in post-acquisition target governance activities than are remote acquirers. Similarly, Lerner (1995) and Bernstein *et al.* (2016) show that geographical proximity facilitates venture capitalists' oversight of their portfolio companies. Giroud (2013) indicates that manufacturing firms invest more in plants that are located closer to their headquarters, which makes monitoring easier. Moreover, centralization of decision making can be important to coordinate the actions of interdependent organizational units, as in the case of R&D units (Argyres and Silverman, 2004; Arora *et al.*, 2011, 2014). However, also in this case, M&As differ in the extent to which a worse vertical information flow deriving from geographical distance can reduce a bidder's willingness to buy a target. For instance, intense oversight of the target is important as long as the target is relatively inefficient or informationally opaque (Kang and Kim, 2008), or as long as the realization of synergies requires extensive coordination between the merging companies and therefore centralization of decision making (Acemoglu *et al.*, 2007; Alonso *et al.*, 2008; Bloom *et al.*, 2010; Chang and Harrington, 2000).

1.2.1.3 Ex post horizontal information flow

Acquirers might also prefer a nearby target to facilitate knowledge exchange and communication with the target. By increasing the quality and frequency of interactions, proximity can promote learning and knowledge transfer (Bell and Zaheer, 2007; Borgatti and Cross, 2003;

Tsai, 2002), especially when knowledge is complex and includes tacit elements (Jaffe *et al.*, 1993; Lahiri, 2010; Leiponen and Helfat, 2011; Storper and Venables, 2004). For instance, studies show that the quality and direction of scientific research can be affected by how easy it is for scientists to meet (Agrawal and Goldfarb, 2008; Catalini, 2018; Catalini *et al.*, 2018). Moreover, social interactions within an organization can positively affect its ability to innovate (Lahiri, 2010; Tsai and Ghoshal, 1998). Face-to-face interaction becomes less important when knowledge is easily codifiable and transferable between distant locations (Storper and Venables, 2004) or when companies have little to learn from each other (Ahuja and Katila, 2001; Lahiri, 2010; Larsson and Finkelstein, 1999). Moreover, acquirers can actively seek distant targets to absorb knowledge in remote locations (Lahiri, 2010; Leiponen and Helfat, 2011) or to gain market access to new geographical areas (Helfat and Lieberman, 2002).

To summarize, whenever valuable ex ante, ex post vertical, or ex post horizontal information flows decay with distance, acquirers can become less likely to acquire a distant target. Below I discuss how acquirers' proximity preference can affect competition to acquire a target and therefore the returns from M&As.

1.2.2 Theoretical model and empirical predictions

If an M&A deal generates synergies, the value created by the transaction is split between the acquirer and the target. The more competitive the bidding process is, the more the price of the target rises, allowing the target to appropriate a greater fraction of the value created from the acquisition (Barney, 1988; Capron and Pistre, 2002). In the extreme case of perfect competition in the bidding process, the target price is high enough that the net present value (NPV) for the winning bidder is zero (i.e., the gain from synergies is equal to the premium paid), and the target captures all the value created by the acquisition.[2]

[2] In the other extreme case of a single potential bidder, the market for corporate control takes on the attributes of a bilateral monopoly, where the exact distribution of distribution of rents is indeterminate and depends on the bargaining ability of the two parties.

To prevent the competitive bidding process from fully unfolding, there needs to be some source of heterogeneity among potential bidders (Barney, 1986, 1988; Hendricks and Porter, 1988; Peteraf, 1993). Such heterogeneity could derive from companies' geographic location. As described above, spatial distance can reduce an acquirer's willingness to acquire a given target, by reducing the acquirer's ability to evaluate, control, and exchange knowledge with the target. It follows that the pool of companies interested in buying a given target is likely to be limited to those that are located within a limited geographic area surrounding the target. The larger this area, the easier it will be for the target to improve its bargaining position by finding competing bidders. Below I introduce a simple theoretical model that encapsulates this intuition. The central claim of the model is that, on average, a nearby acquirer has more bargaining power vis-à-vis its target, because the target is less likely to be of interest to other potential bidders. Since nearby bidders are generally less threatened by competition from other potential bidders, they are able to appropriate a greater fraction of the value created through M&As. Given the empirical focus of this paper, I discuss the key elements of the model below, leaving the mathematical derivations to the appendix. The model makes different simplifying assumptions to concisely provide the intuitions of this study, but similar results can be obtained from more elaborate auction models with asymmetric information or valuations (e.g., see Choi *et al.*, 2017; Hendricks and Porter, 1988; Milgrom and Weber, 1982).

1.2.2.1 Model setting

Suppose that there are N targets located in the same city. Potential bidders are uniformly distributed in space around the targets' city. In particular, within an area of radius d around the city, there are $n(\sigma, d)$ potential bidders, where parameter σ is a constant that defines the density of bidders around the city. The higher σ, the more the number of bidders increases as the radius d increases.

Bidders expect to generate value v from the acquisition of target $i \in \{1, ..., N\}$ if they have access to enough information to assess, control, or communicate with the target, and are not interested in the acquisition otherwise.[3] Suppose that the ability of a bidder to access such information drops with distance d from the target, and targets differ to the extent to which their information flow decays with distance. Specifically, target i can be acquired only by potential bidders within a radius d_i^* from the targets' city.[4] For example, information flows will decay faster with distance for targets that are harder to evaluate externally (Capron and Shen, 2007; Coff, 1999; Ragozzino and Reuer, 2011), those that are relatively inefficient or informationally opaque and require monitoring (Giroud, 2013; Kang and Kim, 2008), or those whose knowledge-based assets are mostly tacit and require intense day-to-day interactions to be absorbed (Storper and Venables, 2004).[5] For these types of targets, distant bidders are less likely to be interested in making an acquisition, and therefore the radius d_i^* will be smaller. It follows that d_i^* represents the geographical boundary of competition for acquiring target i. Then, $n(\sigma, d_i^*)$ measures the total number of potential bidders for target i.

Figure 1.1 provides an example of three types of targets with different cutoff values d_i^*. Target 1 has the fastest rate of information decay and therefore can only be acquired by bidders located in region A, at a distance less than d_1^*. Target 2 has an intermediate rate of information decay and can be acquired by bidders in regions A and B, at a distance less than d_2^*. Finally, target 3 can be assessed, be controlled, or communicate at greater distances and can therefore be bought by any bidder in regions A, B, or C, at a distance less than d_3^*. Hence, the pool of potential bidders progressively increases when moving from target 1 to

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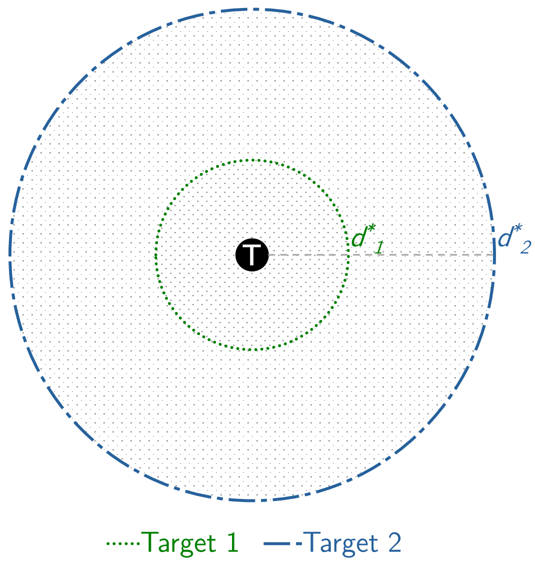
[3] For simplicity, I assume that the valuation of targets is constant. In the results section, I empirically test the robustness of this assumption.

[4] I am assuming that potential bidders are all identical. A more general assumption is that bidders differ to the extent to which they can acquire a target at a distant location. For instance, large and profitable companies might have more resources to devote to searching for potential targets at a greater distance or to manage subsidiaries in remote locations (e.g., Chakrabarti and Mitchell, 2013). In this framework, an increase in a bidder's ability to acquire a distant target is equivalent to "shifting" the bidder closer to the targets' city.

[5] The same target can be acquired by different bidders for different reasons and therefore can require a different degree of integration and information exchange. For instance, a bidder can be interested in financial synergies and require little integration of the target, while another bidder can expect to generate operational synergies and therefore require more intense day-to-day interactions. In this framework, I am implicitly assuming that the information requirement of a target is determined by the best possible use of the target among potential bidders.

target 3 (i.e., $n(\sigma, d_1^*) < n(\sigma, d_2^*) < n(\sigma, d_3^*)$).

Figure 1.1: Example of three targets with different information-decay patterns.



Suppose that not all potential bidders have free financial resources to make an acquisition offer in a given period, and the actual number of bidders for target i is drawn with some probability from the pool of potential bidders (i.e., from $n(\sigma, d_i^*)$ firms). The winning bidder pays a price p_i and obtains a profit of $v - p_i$ from the acquisition, while the target obtains the price p_i. When more than one bidder is drawn, bidders compete for the target and bid up the price to the point where it equals the expected value of the acquisition. Hence, the target obtains all the surplus and the acquirer is left with zero. If instead a single bidder is drawn, the acquirer is able to appropriate some of the value v created by the acquisition.[6]

In this setting, the expected price obtained by target i increases with the cutoff distance d_i^* (see equation (4.1) in the appendix). In particular, the slower information from target i decays with distance, the larger will be the geographical boundaries within which competing bidders can be drawn, and therefore the more likely the acquisition process will be

[6]More precisely, if a single bidder is drawn, the auction becomes a bilateral monopoly, where the exact distribution of rents is indeterminate. In this case, I assume that the bidder is strictly better off and the equilibrium price is $p_i^* = \alpha v$, where α is a constant in the interval $[0, 1)$ that represents the average bargaining ability of the bidders vis-à-vis the targets.

competitive. Returning to the example in Figure 1.1, the average price of target 3 will be higher compared with the other companies, since this target has the largest pool of potential bidders, and therefore the highest probability of finding competing bidders. Instead, because target 1 is limited to a smaller pool of potential bidders, on average, it will appropriate less value from the acquisition compared with the other companies. In other words, relative to the other targets, the price of target 1 is discounted because it is only appealing to nearby bidders.

1.2.2.2 Distance and probability of acquisition bids

A first implication of the model is that the probability of observing an acquisition bid between two locations decreases with the distance between them. Intuitively, at any distance $d = x$ we could observe only acquisitions of targets that can be bought by bidders at distance greater than or equal to x. Hence, because the number of feasible acquisitions drops as x increases, the probability of a bid also decreases with x (see expression (4.2) in the appendix). For example, bidders in region C in Figure 1.1 can only buy one target, while bidders in region A can buy all three targets. Hence, the probability of observing an acquisition bid from a point in region C will be lower than the probability of observing a bid from a point in region A. The same logic applies to a dynamic setting: if a bidder moves from region C to one of the inner regions, it will gain access to more targets, and it will therefore be more likely to make an acquisition bid.

This pattern is a direct consequence of the assumption that information flows decay with distance, and it is consistent with previous research describing the home bias effect in the M&A market (Chakrabarti and Mitchell, 2013; Kang and Kim, 2008; Ragozzino and Reuer, 2011). Empirically, we can identify the effect of distance by using variation in the transportation time between the acquirer's city and the target's city. Based on the above discussion, we can then predict that an increase in transportation time between the acquirer's city and the target's city reduces the probability of observing an acquisition bid between. Thus:

Hypothesis 1: The greater the transportation time between two cities, the lower the probability of observing an acquisition bid between them.

A second implication of the model is that, conditional on observing an acquisition offer at distance $d = x$, the probability of observing competing acquisition bids increases with x (see equation (1.10) in the appendix). Intuitively, the larger the area defined by the cutoff d_i^*, the more potential bidders can be drawn. Then, the greater the distance x, the more deals that are feasible at that distance will have a broader pool of potential bidders and therefore a higher probability of drawing at least two bidders. In Figure 1.1, an acquisition announcement made by a bidder in region C can only be for target 3, which has the broadest pool of potential bidders. Instead, because a bidder in an inner region can also acquire target 1 or 2, on average, the probability of observing a competitive bidding process will be lower for bidders in these regions. Also in this case, the result equally applies to a dynamic setting: a bidder that moves from region C to one of the inner regions becomes more likely to buy a target for which there are fewer potential competing bidders.

Empirically, in some of the deals for which there are multiple interested buyers, the bidders publicly announce their intention to compete for the target. Based on the argument above, we can predict that announced competing acquisition bids are more likely to occur for distant deals than for local transactions. Thus:

Hypothesis 2: The greater the transportation time between the acquirer's city and the target's city, the greater the probability of observing a competing acquisition offer from another city.

It is important to note, however, that publicly announced competing acquisition offers are rare in practice. In most cases, the seller agrees on the terms of the acquisition during the negotiation phase. Despite this caveat, relatively high chances of finding a competing bidder are likely to improve the bargaining position of the target vis-à-vis the acquirer. Hence, we should think of this result as a measure of the average competitive threat faced by an acquirer making an acquisition offer at a given distance, irrespective of whether a competing acquisition offer is publicly announced.

1.2.2.3 Distance and value appropriation

The model also allows us to derive predictions on how distance affects the expected value appropriation of the acquirer and of the target. The previous hypothesis implies that nearby bidders will have, on average, more bargaining power relative to more distant ones. This pattern derives from the fact that targets acquired locally are less likely to find other interested buyers. Hence, under the assumptions of the model, the distance at which an acquisition announcement is observed is a proxy for the (partly unobservable) competitive threat faced by the acquirer. We can then predict that the average price paid by a bidder will also change with distance. In particular, because nearby acquirers can also buy targets with a smaller pool of potential bidders, they will on average pay a lower price than more distant acquirers. Therefore, the higher the distance at which a deal is observed, the higher the average fraction of value appropriated by the target and the lower the average fraction of value appropriated by the acquirer (see equation (1.11) in the appendix). In Figure 1.1, because the expected price paid for target 3 is higher than the expected price of the other two targets, bids announced from region C will on average involve a higher price than bids announced in region A or B. It follows that the average price paid by a bidder that moves from an outer to an inner region will decrease.

Thus, we can expect that the greater the travel time between two cities, the more targets will be able to appropriate value from M&As at the expense of the acquirers' shareholders. Empirically, I measure targets' and acquirers' returns with the abnormal returns on the companies' stock after the acquisition is announced. We can then predict that an increase in the travel time between the acquirer's city and the target's city will increase the average target's returns and will decrease the average acquirer's returns. The following two hypotheses summarize this intuition.

Hypothesis 3: The greater the transportation time between the acquirer's city and the target's city, the greater the average target's abnormal returns at the acquisition *announcement.*

Hypothesis 4: The greater the transportation time between the acquirer's city and the target's city, the lower the average acquirer's abnormal returns at the acquisition announcement.

1.2.2.4 Distribution of potential bidders and value appropriation

Up to this point we have kept the distribution of potential bidders around the targets' city fixed. However, we can think that the competitive threat faced by an acquirer also depends on how close the target is to all the potential bidders. If more potential bidders are located near the targets' city, it should be easier for any target to improve its bargaining position by finding other interested bidders.[7] Hence, each target will appropriate a greater fraction of the value created from M&As, the closer it is to all the potential bidders. Empirically, we can therefore predict that the targets' returns should decrease when their city becomes more isolated from the other cities. Thus:

Hypothesis 5: The more isolated the target city is from other cities, the lower the target's abnormal returns at the acquisition announcement.

Conversely, the connectivity of the target city should be detrimental to the acquirer's returns. If many cities are clustered around the target's city, the target can draw from a broader pool of potential bidders and the market for corporate control in that location will be relatively competitive. Hence:

Hypothesis 6: The more isolated the target city is from other cities, the higher the acquirer's abnormal returns at the acquisition announcement.

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[7] Returning to the example in Figure 1.1, each target should benefit as the area defined by its cutoff distance d_i^* becomes populated by more bidders. The density of bidders is controlled by parameter σ in the model (see expression (1.6) in the appendix).

1.3 Methods

1.3.1 M&A data

Data on M&A transactions are collected from the Thomson SDC Platinum database, companies' financial data from Compustat, and stock market data from CRSP. The data set includes U.S. domestic acquisition announcements by public companies between 1980 and 2017. I consider both majority acquisitions of companies and acquisitions of assets. As is common in the literature on M&As (e.g., Savor and Lu, 2009; Uysal *et al.*, 2008), I exclude the small and economically insignificant deals in SDC. Specifically, I consider only deals where the target's value is at least $5 million. Finally, companies are assigned to the CBSA with the closest centroid. The geographic coordinates of the CBSAs' centroids are computed by considering the 2013 CBSAs definitions from the OMB, while companies' coordinates are defined with the centroid coordinates of the zip code of their headquarters.

1.3.2 Econometric models

1.3.2.1 Test of Hypothesis 1: Travel time and probability of an acquisition bid

I test Hypothesis 1 with the following conditional fixed-effects logistic regression (Cameron and Trivedi, 2010):

$$Pr(bid_{p,t} = 1 \mid t, time_{p,t\text{-}1}) = F(\tau_p + \omega_t + \beta \; time_{p,t\text{-}1}), \tag{1.1}$$

where $bid_{p,t}$ is a dummy variable indicating whether an acquisition bid is announced between the city pair p (i.e., a bid from city i to city j, or from city j to city i) in year t, F is the cumulative logistic distribution $F(z) = \exp(z)/(1 + \exp(z))$, ω_t is a year fixed effect, τ_p is a city-pair fixed effect, and $time_{p,t\text{-}1}$ is the round-trip average travel time for the city pair p in year $t - 1$. β captures the home bias effect and—based on Hypothesis 1—we would expect $\beta < 0$.

1.3.2.2 Test of Hypotheses 2–4: Travel time, probability of competing bids, and value appropriation

To test Hypotheses 2 to 4, I estimate two alternative models. First, I introduce a regression model with industry, acquirer city × year, and target city × year fixed effects:

$$y_{a,d,i,j,t} = \delta_d + \eta_{i,t} + \kappa_{j,t} + \theta\, log(time_{i,j,t\text{-}1}) + \upsilon_{a,d,i,j,t}, \tag{1.2}$$

where $y_{a,d,i,j,t}$ is the dependent variable of interest for acquisition announcement a with acquirer operating in industry d and located in city i, target located in city j, and that was disclosed in year t. δ_d, $\eta_{i,t}$, and $\kappa_{j,t}$ are, respectively, the industry, acquirer city × year, and target city × year fixed effects, and $\upsilon_{a,d,i,j,t}$ is the error term. $Log(time_{i,j,t\text{-}1})$ is the logarithm of the transportation time from the acquirer's city to the target's city in year $t-1$. Acquirer's industry d is defined by the firm's two-digit standard industrial classification (SIC) code. All the reported results are substantially unchanged by replacing the acquirer's industry fixed effects with the target's industry fixed effects.

Second, I introduce a model with industry (μ_d), year (ν_t), and acquirer city × target city ($\phi_{i,j}$) fixed effects:

$$y_{a,d,i,j,t} = \mu_d + \nu_t + \phi_{i,j} + \lambda\, log(time_{i,j,t\text{-}1}) + \xi_{a,d,i,j,t}. \tag{1.3}$$

Therefore, in equation (1.2), the effect of $log(time)$ is identified by controlling for the unobserved characteristics of each city in a given year (including, for example, the level of economic development), while in equation (1.3) the effect is identified by looking at the time-series variation in transportation time for each city dyad.

The econometric models do not include acquirer, target, or deal-specific covariates since the theoretical model presented in the previous section predicts that the average acquisition type should change as a consequence of a change in transportation time (Chakrabarti and Mitchell, 2013; Kang and Kim, 2008; Ragozzino and Reuer, 2011; Uysal *et al.*, 2008). Returning to the example in Figure 1.1, as a bidder moves from an outer to an inner region, the average acquirer's returns increase because the bidder is able to acquire different types of targets (see also equation (1.11) in the appendix). Hence, any variable that could proxy for the target's informational opacity, or the acquirer's ability (or need) to monitor or exchange information with the target, would absorb the effect of travel time. In other words, in this case deal-specific covariates are "bad controls" (Angrist and Pischke, 2009), and including them would bias our coefficients of interest.

The dependent variable used to test Hypothesis 2 is a dummy variable indicating whether the acquisition offer of the acquirer is followed by a competing acquisition bid from another acquirer in a different city. Hence, Hypothesis 2 is tested by estimating equations (1.2) and (1.3) with linear probability models. Nonlinear models with many fixed effects can produce severely biased estimators because of the incidental parameter problem (Greene, 2004), and therefore linear probability models are likely to produce more reliable results in this setting. To test Hypotheses 3 and 4, the dependent variables are the cumulative abnormal returns (CAR) at the announcement of the acquisition bid on the target's stock and on the acquirer's stock, respectively. I further check the robustness of Hypotheses 3 by using the premium price offered by the acquirer as an alternative dependent variable. For Hypothesis 3, the sample is restricted to M&A announcements for public targets with nonmissing returns.

Because errors might not be independent between announcements in the same industry or city, I estimate models (1.2) and (1.3) with robust standard errors that are multi-way-clustered by acquirer's industry, acquirer's city, and target's city (Cameron *et al.*, 2011). The results are substantially unaffected by substituting the acquirer's industry clusters with the target's industry clusters.

1.3.2.3 Test of Hypotheses 5–6: Target's city isolation and value appropriation

Hypotheses 5 and 6 predict that as the target's city becomes more isolated, the target's returns decrease, and the acquirer's returns increase, respectively. Unlike the previous hypotheses, this statement should hold also conditional on the type of deal. Referring to Figure

1.1, *holding fixed* the target type, the target's value appropriation should increase as more bidders move closer to city T. Instead, the effects predicted in the previous hypotheses rely on a *change* in the average target type (due to a shift in the bidder's location). Hence, we can test Hypotheses 5 and 6 by controlling for deal-specific covariates. In particular, I test these hypotheses with the model:

$$y_{a,j,t} = \iota_j + \rho\, c_{j,t\text{-}1} + X_{a,t}\gamma + \epsilon_{a,j,t}, \tag{1.4}$$

where $y_{a,j,t}$ is either the target's or the acquirer's CAR from acquisition announcement a in year t, ι_j the target's city fixed effect, $c_{j,t\text{-}1}$ a measure of the target's city isolation—as specified below—in the year before the announcement, $X_{a,t}$ a vector of covariates of deal a, γ the corresponding vector of coefficients, and $\epsilon_{a,j,t}$ the error term. I estimate model (1.4) on the subsample of acquisition announcements between public companies for which all the deal-specific control variables are available. The model is estimated with robust standard errors that are multi-way-clustered by the acquirer's industry, the target's industry, and the target's city (Cameron *et al.*, 2011).

1.3.3 Dependent variables

1.3.3.1 Acquisition bid

The dependent variable used to test Hypothesis 1 in model (1.1) is a dummy variable that equals one if an acquisition bid is announced by a public company in year t from city i to city j or from city j to city i, and zero otherwise.

1.3.3.2 Competing bid from other cities

The dependent variable used to test Hypothesis 2 with models (1.2) and (1.3) is a dummy variable indicating whether the acquisition offer of the acquirer is followed by a competing acquisition bid from another acquirer in a different city. Data on competing bidders is reported in SDC.

1.3.3.3 Announcement cumulative abnormal returns

Cumulative abnormal returns on the target's or acquirer's stock are calculated over a window of time starting three trading days before the acquisition announcement ($e = 0$) and ending three trading days after. Specifically, I estimate on the 240-day pre-acquisition period from $e = -260$ to $e = -21$, the market model $r_{fe} = \vartheta_f + \varphi_f r_{me} + \varepsilon_{fe}$ (Fama *et al.*, 1969), where r_{fe} is the stock return of firm f on trading day e, r_{me} is the daily market return on the CRSP value-weighted index, ϑ_f and φ_f are parameters specific to the company, and ε_{fe} is the error term. Abnormal returns are then calculated as the residuals $\hat{\varepsilon}_{fe} = r_{fe} - \hat{r}_{fe}$, where $\hat{r}_{fe} = \hat{\vartheta}_f + \hat{\varphi}_f r_{me}$ are the predicted returns, and $\hat{\vartheta}_f$ and $\hat{\varphi}_f$ the estimated coefficients. Finally, the cumulative abnormal returns are calculated by summing the daily abnormal returns $\hat{\varepsilon}_{fe}$ over the window of $[-3, +3]$ trading days around the announcement date. Cumulative abnormal returns are expressed as percentages. For the subsample of deals with a public acquirer and a public target, I also compute the total abnormal returns at the announcement, as measured by the weighted average of the acquirer's CAR and the target's CAR, with weights given by the market value of equity of each firm one year before the announcement of the transaction.

1.3.3.4 Acquisition premium

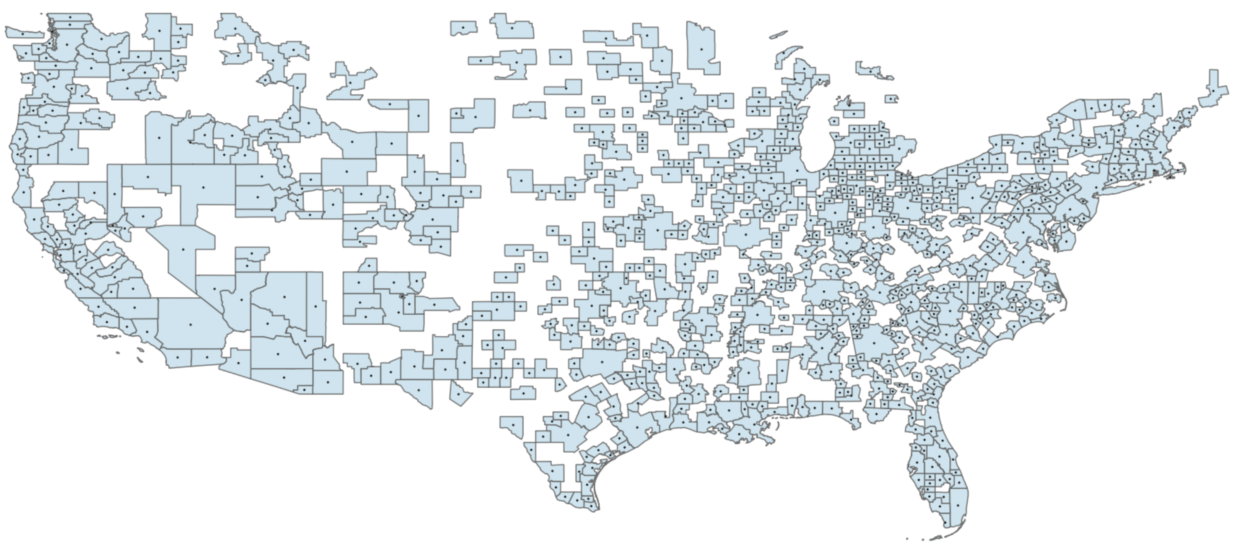
I further test Hypothesis 3 by considering the price premium offered for public targets, as reported in SDC. The premium is calculated as the difference between the offer price and the target closing stock price one day prior to the announcement, divided by the closing stock price. Acquisition premium is expressed as a percentage. Because the distribution of this variable is highly skewed with some extreme outliers, I winsorized premiums at the 2nd and 98th percentiles. However, results do not substantially change by selecting alternative thresholds (e.g., 0.25th and 0.75th, 0.5th and 99.5th, 1st and 99th, or 2.5th and 97.5th percentiles).

1.3.4 Transportation network

1.3.4.1 Travel time

To map the evolution of the U.S. passenger transportation network between 1979 and 2016, for each year and CBSA pair I measured the minimum transportation time required to move from the centroid of the first CBSA to the centroid of the second CBSA. Figure 1.2 shows the distribution of CBSAs and their centroids. The reported analysis considers CBSAs in the contiguous United States (909 CBSAs), thus excluding Alaska, Hawaii, and U.S. territories. However, the results are not affected by adding these locations.

Figure 1.2: Core-based statistical areas and their centroids.



To calculate the travel time between CBSAs, I follow Giroud (2013) and assume that managers choose the route and means of transportation—car or plane—that minimize transportation time. Travel time by car is calculated using MS MapPoint. Transportation time by flying is calculated by considering all the possible origin and destination airports and minimizing the sum of three components: (i) the driving time from the first CBSA centroid to the origin airport, (ii) the flight time—considering both direct and indirect flights—to the destination airport, and (iii) the driving time from the destination airport to the second CBSA centroid. The driving time from each CBSA centroid to the respective airport is computed using MS MapPoint. Data on flight routes for the years 1990–2016 are obtained from the T-100 Domestic Segment Database provided by the Bureau of Transportation Statistics, and for the years 1979–1989 from the ER-586 Service Segment Data, available as mainframe files[8] at the National Archives. These databases contain information on all airline flights that have taken place in the United States and include monthly data on flight duration (ramp-to-ramp time) between any two airports. Based on these data, I find, for each airport pair, the fastest route for each year considering both direct and all the possible indirect connections. Like Giroud (2013), I assume that one hour is spent at the origin and destination airports combined and—for indirect flights—each layover takes one hour. I assume that the flight duration of a direct flight between any two airports is constant and equal to the average ramp-to-ramp time over the entire period. Hence, any change in travel time between CBSA pairs is due to a change in the optimal itinerary rather than to idiosyncratic changes in flight duration between airports. Finally, driving time within the same CBSA is assumed to be 20 minutes, but results are not affected by making alternative assumptions (e.g., 5, 15, or 30 minutes).

1.3.4.2 Target's city isolation

To test Hypotheses 5 and 6, I introduce two alternative measures of isolation of the target's city. First, I compute, for every year, the average travel time from every city to the target's city. Second, I measure how much a city near the target's city has a locational advantage compared with all the other cities. Specifically, I use a Herfindahl-Hirschman index (HHI) of proximity to the target's city, defined as:

$$HHI_{j,t} = \sum_{i=1}^{909} \left(\frac{p_{i,j,t}}{\sum_{i=1}^{909} p_{i,j,t}} \right)^2, \tag{1.5}$$

[8]I am grateful to Arianna Ornaghi for helping me with the conversion of these data.

where proximity $p_{i,j,t}$ is the inverse of the travel time from city i, to the target's city j in year t. HHI is an index ranging from zero to one. When there are a few cities located near the target's city and the rest are located far away, the index will be high, while if many cities are clustered around the target's city, the HHI will move closer to zero. The regressions are run on the standardized HHI, to make the coefficients interpretable in terms of standard deviation increments.

1.3.5 Deal-specific control variables

As indicated in model (1.4), Hypotheses 5 and 6 are tested by controlling for deal-specific covariates. *Relative size* is the ratio of the deal value to the sum of the deal value and the acquirer's market value of equity one year before the announcement. *Unrelated* is a dummy variable indicating whether the primary two-digit SIC code of the two companies is different. *Acquisition of assets* is a dummy variable indicating whether the transaction is an acquisition of assets, as reported in SDC. *All-stock payment* is a dummy variable that equals one if the deal is entirely paid in stock and zero otherwise. I also control for the target's and the acquirer's financials: *Log(assets)* is the logarithm of total assets;[9] *M/B* is the ratio of the market value of equity to total assets; *ROE* is the return on equity; *Leverage* is the ratio of total debt to total assets; *R&D intensity* is the ratio of R&D expenses to total assets. All the accounting variables are measured at the end of the fiscal year before the announcement. I control for the intensity of M&A activity in the target's industry with the variable *number of M&As industry*, which is the number of acquisition bids for companies in the target's two-digit SIC code in the 12 months before the announcement. Targets might have more bargaining power if they are located in a city with a fast growing economy and with highly valuable companies. Hence, I also control for the stock market valuation of companies located in the target's geographic area with the variable *log(city market equity)*,

[9]Because the acquirer's and the target's total assets are highly correlated (see the correlation matrix reported in the appendix), in the regressions I only include either the logarithm of the target's total assets (in the regressions for the target's CAR) or the logarithm of the acquirer's total assets (in the regressions for the acquirer's CAR).

which is the logarithm of the sum of the market value of equity of the other companies located in the target's city, measured the year before the announcement. Finally, I control for the acquirer's and the target's primary two-digit SIC code.

1.4 Results

Table 1.1 provides details on how the optimal travel route between city pairs changed from the beginning to the end of the sample period (i.e., from 1979 to 2016). The optimal route changed for about 75% of the pairs. On average, these route changes reduced the round-trip average transportation time by about 20 minutes, with a standard deviation of about 50 minutes. The most common route change is from an indirect to a faster indirect flight, followed by a change from an indirect to a direct flight.

Table 1.1: Change in optimal route between city pairs: 2016 vs. 1979.

Number of city pairs	413,595			
% whose optimal route changed from:				
Car to flight	0.27			
Flight to car	3.07			
Indirect to direct flight	17.77			
Direct to indirect flight	5.24			
Indirect to faster indirect flight	25.68			
Indirect to slower indirect flight	11.70			
Direct to faster direct flight (airport change)	11.22			
Direct to slower direct flight (airport change)	4.25			
Total % with optimal route change	74.74			
	Mean	*S.D.*	*Min*	*Max*
Effect of route change on travel time (hours)	-0.33	0.83	-4.88	3.80

Notes. A city pair includes both the case from city i to city j and from j to i. The change in travel time refers to the change in the average round-trip travel time. The sum of the % of the different categories of route change is slightly greater than the total % because in a few cases the type of change in optimal route is different between the outbound and the inbound trip.

Table 1.2 provides the descriptive statistics of the dependent variables for the M&A announcements. The data include 20,144 announcements by public acquirers, of which

19,708 have nonmissing acquirer's returns and 5,676 are for public targets with nonmissing returns. Consistent with the previous literature (Haleblian *et al.*, 2009), targets typically obtain high returns from M&As, while acquirers earn little or no returns (the median CAR for acquirers is 0.5%). Targets that received competing bid announcements from different cities are relatively rare: they occur in only 2.2% of the cases.

Table 1.2: Descriptive statistics of the dependent variables for the M&A announcements.

	Observations	Mean	S.D.	Min	Max	Data source
Competing bid from other city	20,144	0.02	0.15	0	1	SDC
Returns (when available):						
Acquirer CAR (%)	19,708	1.30	10.54	-61.67	179.33	CRSP
Target CAR (%)	5,676	21.53	25.80	-132.82	291.00	CRSP
Premium price (%)	5,676	32.48	29.54	-18.28	133.33	SDC

Table 1.3 reports the descriptive statistics for the travel time between the acquirer's city and the target's city and the target city's isolation. M&As occur between 7,138 city pairs, and the average travel time between companies is about 4 hours. Acquirers are clustered in fewer cities compared with the targets (458 vs. 771). The average travel time between the target city and all the other cities is about 6 hours and 25 minutes. The Herfindahl-Hirschman index of proximity to the target city is low, indicating that, in general, targets are evenly connected to most other cities.

Table 1.3: Travel time between acquirer and target city and target city isolation.

	Observations	Mean	S.D.	Min	Max
Travel time from acquirer city to target city	20,144	4.05	2.52	0.33	13.87
Avg. travel time to target city	20,144	6.41	1.01	4.66	11.93
HHI proximity to target city (%)	20,144	0.16	0.01	0.14	0.25
Number of acquirer cities	458				
Number of target cities	771				
Number of acquirer city × target city pairs	7,138				

1.4.1 How travel time affects the probability of acquisition bids

Hypothesis 1 predicts that a reduction in transportation time between cities allows more deals to take place, by reducing the informational distance between acquirers and targets. Table 1.4 presents the test for this prediction. Columns (1) and (2) report the estimate for a logit model with and without year fixed effects, respectively. The results indicate that travel time negatively affects the probability of an M&A announcement between cities. This result is consistent with previous findings on the home bias of the M&A market (Chakrabarti and Mitchell, 2013; Kang and Kim, 2008; Ragozzino and Reuer, 2011). In particular, the elasticity on travel time (reported at the bottom of the table) indicates that a 1% increase in travel time reduces the probability of an M&A announcement by 4%. Because acquisition bids between cities are relatively rare events, in columns (2) and (3) I test the robustness of these results with the rare events logit model developed by Tomz *et al.* (1999) and King and Zeng (1999a,b, 2001). The results remain stable by correcting for the rare event bias.

Finally, columns (5) and (6) present the estimates for conditional fixed effect models, which control for city-pair fixed effects. Supporting Hypothesis 1, the results indicate that a reduction in the transportation time between two cities increases the probability of an acquisition bid between them. In this case, the year dummies absorb some of the effect of travel time, although its effect remains statistically significant. The elasticities of the models with and without year fixed effects indicate that an increase of 1% of travel time reduces the probability of an acquisition announcement by 1.3% and 0.04%, respectively. The rare event bias is less of a concern in the conditional fixed effects model since the coefficients are estimated only from city pairs that have variation in the outcome variable (i.e., at least one year with an M&A announcement and one year without an announcement).

Table 1.5 reports a test for Hypothesis 2. The dependent variable is a dummy indicating whether an acquisition offer is followed by a competing offer from another city. The results from the models without (columns (1)–(3)) and the model with acquirer $\times$ target city fixed effects (column (4)) suggest that acquisition offers made by more distant bidders are more likely to be followed by a competing offer. Hence, in line with Hypothesis 2, if a bidder has

Table 1.4: The effect of travel time on the probability of an acquisition bid between cities.

	(1)	(2)	(3)	(4)	(5)	(6)
	Logit		Rare events logit		Conditional FE logit	
	Pr(bid)		Pr(bid)		Pr(bid)	
Travel time	-0.57***	-0.57***	-0.57***	-0.57***	-0.32***	-0.08**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)
Constant	-3.68***	-6.29***	-3.68***	-6.27***		
	(0.06)	(0.20)	(0.06)	(0.20)		
Fixed effects:						
Year	-	Yes	-	Yes	-	Yes
Cond. on city pair	-	-	-	-	Yes	Yes
Avg. elast. on tr. time	-4.03	-4.04	-4.03	-4.04	-1.30	-0.04
Pseudo R^2	0.096	0.110			0.001	0.066
Observations	15,716,610	15,716,610	15,716,610	15,716,610	232,940	232,940

Notes. The dependent variable is a dummy variable indicating whether an acquisition bid by a public company is announced from city i to city j, or from j to i in a given year. The number of observations in each column excludes singleton observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Rare events logit models are estimated with the method described in Tomz *et al.* (1999) and King and Zeng (1999a,b, 2001). In the logit and rare events logit models (columns (1)–(4)), standard errors are clustered by city pair.

access to enough information from the target to make an acquisition offer from a remote location, it is more likely that there are other interested bidders that have equal access to this information flow and that can therefore make a competing offer. The coefficient of $log(traveltime)$ becomes insignificant once the year fixed effects are included together with the acquirer $\times$ target city fixed effects. Hence, in this case, the year fixed effects absorb most of the effect of transportation time.[10]

1.4.2 How travel time affects value appropriation

Hypotheses 3 and 4 predict that a reduction in travel time allows acquirers to tap into less competitive segments of the M&A market and therefore to appropriate more value. In

[10]Results do not substantially change by replacing the last three columns with a conditional fixed effects logit model that controls for acquirer $\times$ target city fixed effects.

Table 1.5: Probability of observing a competing offer from another city, conditional on bidding.

	(1)	(2)	(3)	(4)	(5)	(6)
			Competing bid (%)			
Log(travel time)	0.20*	0.26**	0.29***	16.53***	4.75	4.30
	(0.12)	(0.12)	(0.10)	(4.89)	(4.06)	(4.03)
Fixed effects:						
Year	-	Yes	-	-	Yes	Yes
Industry	Yes	Yes	Yes	-	-	Yes
Acquirer city	Yes	Yes	-	-	-	-
Target city	Yes	Yes	-	-	-	-
Acquirer city × Year	-	-	Yes	-	-	-
Target city × Year	-	-	Yes	-	-	-
Acquirer city × Target city	-	-	-	Yes	Yes	Yes
R^2	0.05	0.06	0.30	0.17	0.18	0.19
Observations	19,883	19,883	15,169	15,296	15,296	15,294

Notes. The dependent variable is a dummy variable that equals 100 if the acquisition offer of the acquirer is followed by a competing acquisition bid from another acquirer in a different city, and 0 otherwise. Coefficients are estimated with a linear probability model to avoid the incidental parameter bias (Greene, 2004). The sample includes acquisition announcements by public companies. The number of observations in each column excludes singleton observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Standard errors are multi-way-clustered by industry, acquirer's city, and target's city (Cameron *et al.*, 2011).

other words, because targets acquired locally, on average, have a smaller pool of potential bidders, local acquisitions will result in lower returns for the targets and higher returns for the acquirers. Table 1.6 tests this prediction by looking at the cumulative abnormal returns of public targets. The estimates across all the specifications provide strong support for Hypothesis 3. For instance, column (6) indicates that controlling for year and industry, if there is a 1% reduction in travel time between two cities, the average target's CAR decreases by 0.5 percentage points.

Table 1.7 further tests the effect of travel time on targets' value appropriation by looking at the acquisition premiums offered for public targets. The results provide additional support for Hypothesis 3. Similarly to before, the model with year, industry, and acquirer × target city fixed effects indicates that a reduction of 1% in travel time decreases the av-

Table 1.6: The effect of travel time on target's abnormal returns at the M&A announcement.

	(1)	(2)	(3)	(4)	(5)	(6)
			Target CAR (%)			
Log(travel time)	1.00**	0.85**	1.44***	27.37*	50.20***	50.13***
	(0.43)	(0.43)	(0.40)	(16.13)	(14.08)	(13.83)
Fixed effects:						
Year	-	Yes	-	-	Yes	Yes
Industry	Yes	Yes	Yes	-	-	Yes
Acquirer city	Yes	Yes	-	-	-	-
Target city	Yes	Yes	-	-	-	-
Acquirer city × Year	-	-	Yes	-	-	-
Target city × Year	-	-	Yes	-	-	-
Acquirer city × Target city	-	-	-	Yes	Yes	Yes
R^2	0.11	0.14	0.45	0.22	0.24	0.27
Observations	5,401	5,401	3,189	3,865	3,865	3,863

Notes. Observations include acquisition announcements by public acquirers for public targets with nonmissing returns. The number of observations in each column excludes singleton observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Standard errors are multi-way-clustered by industry, acquirer's city, and target's city (Cameron *et al.*, 2011).

erage acquisition premium by about 0.4 percentage points. In this case, the effect is less statistically significant without the city-pair fixed effects.

Table 1.8 presents the test for Hypothesis 4, on the sample of announcements with nonmissing acquirer's returns. The results provide strong support for Hypothesis 4: a reduction in travel time increases acquirer's CAR. In particular, column (6) suggests that a reduction of 1% in travel time increases bidders' returns by about 0.04 percentage points.

So far, we have assumed that a change in travel time affects the returns of targets and acquirers by changing the average fraction of the total value created that each party appropriates. However, it is also possible that targets that are acquired locally create higher overall value. Table 1.9 tests this possibility by analyzing the effect of travel time on total returns for the sample of M&A announcements between public companies with nonmissing total returns. As described in the methods section, total returns are measured by the weighted average of the acquirer's CAR and the target's CAR, with weights given by the

Table 1.7: The effect of travel time on acquisition premiums.

	(1)	(2)	(3)	(4)	(5)	(6)
	Premium price (%)					
Log(travel time)	0.68*	0.65	1.19**	33.99**	36.49***	36.52***
	(0.40)	(0.42)	(0.46)	(13.08)	(11.03)	(11.34)
Fixed effects:						
Year	-	Yes	-	-	Yes	Yes
Industry	Yes	Yes	Yes	-	-	Yes
Acquirer city	Yes	Yes	-	-	-	-
Target city	Yes	Yes	-	-	-	-
Acquirer city × Year	-	-	Yes	-	-	-
Target city × Year	-	-	Yes	-	-	-
Acquirer city × Target city	-	-	-	Yes	Yes	Yes
R^2	0.10	0.13	0.45	0.22	0.24	0.26
Observations	5,401	5,401	3,189	3,865	3,865	3,863

Notes. Observations include acquisition announcements by public acquirers for public targets with non-missing premium price. The number of observations in each column excludes singleton observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Standard errors are multi-way-clustered by industry, acquirer's city, and target's city (Cameron *et al.*, 2011).

market value of equity of each firm before the acquisition. The results indicate that travel time does not have a statistically significant effect on total returns. Hence, the value created from M&As between firms close to each other is not necessarily higher (nor lower) than the value created from M&As between more distant firms.

1.4.2.1 Alternative explanations

The introduction of a faster airline route might be more likely if two cities develop the same or highly interconnected industries and, as a consequence, the intensity of economic exchange between the two cities increases. At the same time, firms operating in these industries could have higher potential for synergies and therefore greater incentives to merge. If targets in these industries have little bargaining power for reasons unrelated to geographic location, the previous results could be spurious. To investigate whether the patterns described above are largely driven by the industrial composition of cities, I run alternative regression models.

Table 1.8: The effect of travel time on acquirer's abnormal returns at the M&A announcement.

	(1)	(2)	(3)	(4)	(5)	(6)
	Acquirer CAR (%)					
Log(travel time)	-0.28**	-0.28**	-0.28***	-4.34**	-4.51***	-4.34***
	(0.12)	(0.12)	(0.10)	(1.88)	(1.66)	(1.57)
Fixed effects:						
Year	-	Yes	-	-	Yes	Yes
Industry	Yes	Yes	Yes	-	-	Yes
Acquirer city	Yes	Yes	-	-	-	-
Target city	Yes	Yes	-	-	-	-
Acquirer city × Year	-	-	Yes	-	-	-
Target city × Year	-	-	Yes	-	-	-
Acquirer city × Target city	-	-	-	Yes	Yes	Yes
R^2	0.06	0.06	0.25	0.13	0.14	0.15
Observations	19,447	19,447	14,773	14,901	14,901	14,899

Notes. Observations include acquisition announcements by public acquirers with nonmissing returns. The number of observations in each column excludes singleton observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Standard errors are multi-way-clustered by industry, acquirer's city, and target's city (Cameron *et al.*, 2011).

In particular, I introduce additional fixed effects for merging firms' industry pair (i.e., a bid from industry x to industry y, or from y to x), city pair (i.e., a bid from city i to city j, or from j to i), and 5-year intervals.

Table 1.10 presents the robustness checks for the regressions on the target's CAR and acquisition premium. Columns (1) and (4) show that the results are robust to the inclusion of industry-pair, city-pair, and 5-year interval fixed effects. In other words, a reduction of the travel time between two cities reduces the average target's CAR and acquisition premium, after controlling for the industry pair and the time period. Columns (2) and (5) add the interaction between the industry-pair and the 5-year interval fixed effects. This specification allows us to estimate the coefficient by controlling for the unobservable characteristics of M&As, announced in the same time interval, of companies that operate in the same industries. The results indicate that the coefficients remain largely stable also in this case. Finally, columns (3) and (6) include the time-period fixed effects and the interaction

Table 1.9: The effect of travel time on total abnormal returns at the M&A announcement.

	(1)	(2)	(3)	(4)	(5)	(6)
			Total CAR (%)			
Log(travel time)	-0.19	-0.20	0.02	-3.90	-5.95	-5.25
	(0.14)	(0.14)	(0.13)	(7.88)	(7.17)	(6.30)
Fixed effects:						
Year	-	Yes	-	-	Yes	Yes
Industry	Yes	Yes	Yes	-	-	Yes
Acquirer city	Yes	Yes	-	-	-	-
Target city	Yes	Yes	-	-	-	-
Acquirer city × Year	-	-	Yes	-	-	-
Target city × Year	-	-	Yes	-	-	-
Acquirer city × Target city	-	-	-	Yes	Yes	Yes
R^2	0.09	0.10	0.41	0.22	0.23	0.25
Observations	4,972	4,972	2,836	3,502	3,502	3,500

Notes. Observations include acquisition announcements between public companies with nonmissing returns. The number of observations in each column excludes singleton observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Standard errors are multi-way-clustered by industry, acquirer's city, and target's city (Cameron *et al.*, 2011).

between industry-pair and city-pair fixed effects. Hence, this specification allows us to compare announcements that involved firms in the same cities and in the same industries, while controlling for the year interval. The coefficients remain comparable to the previous estimates also in these regressions. Table 1.11 presents the same tests for the acquirer's returns. The coefficient remains largely stable across specifications, although it loses statistical significance in the model with the industry-pair and city-pair interaction. Hence, overall, the previous results do not seem to be driven by the industrial composition of cities.

1.4.3 How target's city isolation affects value appropriation

Finally, we can test the effect of the target's city isolation on the target's and the acquirer's returns. Hypotheses 5 and 6 predict that the target will be worse off, and acquirer better off, when the target's city is relatively isolated from the other cities. In other words, if the target is relatively distant from the pool of all the potential bidders, it will have less bargaining

Table 1.10: Robustness regressions for target's abnormal returns and acquisition premium.

	(1)	(2)	(3)	(4)	(5)	(6)
	Target CAR (%)			Premium price (%)		
Log(travel time)	33.41**	33.67**	26.92**	29.00**	27.11**	44.29***
	(14.45)	(15.14)	(12.07)	(14.62)	(13.64)	(14.33)
Fixed effects:						
5-year interval	Yes	-	Yes	Yes	-	Yes
Industry pair	Yes	-	-	Yes	-	-
City pair	Yes	Yes	-	Yes	Yes	-
Industry pair × 5-year int.	-	Yes	-	-	Yes	-
Industry pair × City pair	-	-	Yes	-	-	Yes
R^2	0.27	0.34	0.39	0.27	0.35	0.38
Observations	3,933	3,420	1,939	3,933	3,420	1,939

Notes. Observations include acquisition announcements by public acquirers for public targets with nonmissing returns. The number of observations in each column excludes singleton observations. Five-year intervals are symmetric intervals centered at years multiples of 5. Industry pairs include bids from industry x to industry y, or from y to x. City pairs include bids from city i to city j, or from j to i. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Standard errors are multi-way-clustered by industry pair and city pair (Cameron *et al.*, 2011).

power vis-à-vis the acquirer. As discussed in the methods section, this statement should hold for each type of target. Hence, in this case, we can control for deal-specific covariates. Tables 1.12 and 1.13 report the regression results for the subsample of M&A announcements between public companies for which the control variables are nonmissing. The descriptive statistics of the control variables are reported in the appendix. The key explanatory variable is either the yearly average travel time between the target's city and all the other cities (columns (2)–(4)), or the standardized value of the proximity HHI (columns (5)–(7)), as defined in expression (1.5). The regressions include the target's city fixed effects, which allow us to compare the returns from acquisitions of targets located in the same city over time. In line with Hypothesis 5, Table 1.12 indicates that both isolation measures negatively affect the target's CAR. In other words, if the target's city is relatively isolated from the rest of the country, or if there are a few cities with a locational advantage over the target's city, the target appropriates less value from the acquisition. In line with Hypothesis 6, Table 1.13 shows an opposite pattern for the acquirer's returns: the acquirer's returns increase the

Table 1.11: Robustness regressions for acquirer's abnormal returns.

	(1)	(2)	(3)
	Acquirer CAR (%)		
Log(travel time)	-3.17*	-4.01**	-4.85
	(1.81)	(1.94)	(3.33)
Fixed effects:			
5-year interval	Yes	-	Yes
Industry pair	Yes	-	-
City pair	Yes	Yes	-
Industry pair × 5-year int.	-	Yes	-
Industry pair × City pair	-	-	Yes
R^2	0.16	0.21	0.23
Observations	15,426	14,488	7,943

Notes. Observations include acquisition announcements by public acquirers with nonmissing returns. The number of observations in each column excludes singleton observations. Five-year intervals are symmetric intervals centered at years multiples of 5. Industry pairs include bids from industry x to industry y, or from y to x. City pairs include bids from city i to city j, or from j to i. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Standard errors are multi-way-clustered by industry pair and city pair (Cameron *et al.*, 2011).

more isolated the target's city is. In this case, the coefficients of the isolation measures lose some statistical significance in the regressions with the industry fixed effects: the p-value of the coefficient of the average travel time measure (column (4)) is 0.117, while the p-value of the proximity HHI measure (column (7)) is 0.065.

Lastly, Table 1.14 tests whether the target's city connectivity affects total returns at the M&A announcement. As the regressions indicate, neither the average travel time nor the proximity HHI has a significant effect on total value creation.

1.5 Conclusions

The ownership of superior productive factors forms the basis for a firm's competitive advantage (Wernerfelt, 1984). Hence, understanding the conditions under which rents are appropriated by factor owners is a key objective of strategy research (Barney, 1986; Peteraf, 1993).

Table 1.12: The effect of target's city isolation on target's abnormal returns at the M&A announcement.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Target CAR (%)			
Avg. travel time		-16.42***	-8.55***	-8.00**			
		(4.34)	(2.92)	(3.27)			
Z(HHI proximity)					-15.15***	-8.00***	-7.30***
					(3.80)	(2.29)	(2.58)
Unrelated	0.22		0.28	-0.79		0.28	-0.79
	(1.18)		(1.11)	(1.19)		(1.07)	(1.19)
Acquisition of assets	-28.77***		-28.67***	-28.26***		-28.70***	-28.28***
	(9.35)		(9.28)	(9.93)		(9.28)	(9.95)
All-stock payment	-5.45***		-5.35***	-4.32***		-5.35***	-4.33***
	(0.97)		(0.96)	(1.07)		(0.96)	(1.07)
Relative size	-19.67***		-19.14***	-18.54***		-19.14***	-18.55***
	(2.86)		(2.91)	(2.65)		(2.92)	(2.67)
Log(target assets)	-0.62		-0.77*	-0.61		-0.77*	-0.61
	(0.43)		(0.42)	(0.48)		(0.42)	(0.48)
Target M/B	-0.50		-0.50	-0.56		-0.50	-0.56
	(0.42)		(0.42)	(0.39)		(0.42)	(0.39)
Acquirer M/B	0.12		0.13	0.03		0.13	0.03
	(0.30)		(0.30)	(0.27)		(0.31)	(0.27)
Target ROE	0.44		0.54	0.33		0.54	0.32
	(1.60)		(1.59)	(1.62)		(1.60)	(1.62)
Acquirer ROE	3.16**		3.22**	1.97		3.23**	1.98
	(1.40)		(1.38)	(1.52)		(1.38)	(1.52)
Target leverage	-3.08		-2.76	-0.57		-2.77	-0.60
	(2.83)		(2.93)	(2.90)		(2.91)	(2.89)
Acquirer leverage	0.12		0.25	2.25		0.26	2.27
	(2.03)		(2.02)	(1.76)		(2.02)	(1.78)
Target R&D int.	22.57***		21.92***	14.64***		21.91***	14.65***
	(4.51)		(4.67)	(4.26)		(4.71)	(4.29)
Acquirer R&D int.	9.56		9.57	-4.39		9.53	-4.42
	(7.38)		(7.38)	(7.90)		(7.38)	(7.91)
Num. of M&As ind.	-0.01		-0.01	-0.05***		-0.01	-0.05**
	(0.01)		(0.02)	(0.02)		(0.02)	(0.02)
Log(city market eq.)	1.70***		1.19***	1.67***		1.18**	1.67***
	(0.52)		(0.44)	(0.43)		(0.46)	(0.44)
Fixed effects:							
Target city	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer industry	-	-	-	Yes	-	-	Yes
Target industry	-	-	-	Yes	-	-	Yes
R^2	0.13	0.06	0.13	0.17	0.06	0.13	0.17
Observations	4,756	4,756	4,756	4,747	4,756	4,756	4,747

Notes. Observations include announcements with a public target and a public acquirer for which the control variables are nonmissing. The number of observations in each column excludes singleton observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Standard errors are multi-way-clustered by acquirer's industry, target's industry, and target's city (Cameron *et al.*, 2011).

This paper tackles this objective by investigating how the spatial distribution of companies can limit competition when resources are acquired through M&As. The central claim of this

Table 1.13: The effect of target's city isolation on acquirer's abnormal returns at the M&A announcement.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Acquirer CAR (%)			
Avg. travel time		2.23**	2.50**	2.06			
		(0.92)	(1.25)	(1.29)			
Z(HHI proximity)					2.27**	2.60**	2.22*
					(0.87)	(1.15)	(1.18)
Unrelated	-0.16		-0.18	-0.38		-0.19	-0.38
	(0.33)		(0.33)	(0.26)		(0.33)	(0.26)
Acquisition of assets	-2.43		-2.43	-2.20		-2.42	-2.19
	(1.57)		(1.59)	(1.67)		(1.58)	(1.67)
All-stock payment	-1.38***		-1.41***	-1.17**		-1.41***	-1.17***
	(0.40)		(0.41)	(0.44)		(0.41)	(0.44)
Relative size	-3.75***		-3.71***	-3.70***		-3.70***	-3.69***
	(1.19)		(1.18)	(1.28)		(1.17)	(1.28)
Log(target assets)	-0.24*		-0.20	-0.16		-0.20	-0.16
	(0.12)		(0.13)	(0.13)		(0.13)	(0.13)
Target M/B	-0.19*		-0.19**	-0.20*		-0.19**	-0.20*
	(0.10)		(0.10)	(0.11)		(0.09)	(0.11)
Acquirer M/B	-0.13		-0.12	-0.11		-0.12	-0.11
	(0.13)		(0.13)	(0.11)		(0.14)	(0.11)
Target ROE	-0.75		-0.77	-0.82*		-0.78	-0.82*
	(0.45)		(0.47)	(0.47)		(0.47)	(0.47)
Acquirer ROE	-0.71		-0.74	-0.72		-0.74	-0.72
	(0.65)		(0.66)	(0.63)		(0.66)	(0.63)
Target leverage	-0.86		-0.89	-1.00		-0.88	-1.00
	(0.77)		(0.75)	(1.08)		(0.75)	(1.08)
Acquirer leverage	1.59**		1.51**	1.61**		1.50**	1.59**
	(0.70)		(0.71)	(0.77)		(0.70)	(0.76)
Target R&D intensity	3.13		3.24	3.69		3.26	3.70
	(2.07)		(2.08)	(2.43)		(2.08)	(2.43)
Acquirer R&D intensity	-8.41***		-8.31***	-7.92**		-8.29***	-7.91**
	(3.09)		(3.11)	(3.46)		(3.11)	(3.45)
Num. of M&As industry	-0.01**		-0.01**	-0.01		-0.01*	-0.01
	(0.00)		(0.00)	(0.01)		(0.01)	(0.01)
Log(city market equity)	-0.00		0.15	0.08		0.17	0.10
	(0.19)		(0.19)	(0.19)		(0.19)	(0.19)
Fixed effects:							
Target city	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer industry	-	-	-	Yes	-	-	Yes
Target industry	-	-	-	Yes	-	-	Yes
R^2	0.06	0.03	0.06	0.09	0.03	0.06	0.09
Observations	4,756	4,756	4,756	4,747	4,756	4,756	4,747

Notes. Observations include announcements with a public target and a public acquirer for which the control variables are nonmissing. The number of observations in each column excludes singleton observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Standard errors are multi-way-clustered by acquirer's industry, target's industry, and target's city (Cameron *et al.*, 2011).

study is that proximity allows acquirers to appropriate more value from M&As, by allowing them to tap into less competitive segments of the market, in which competition is more

Table 1.14: The effect of target's city isolation on total abnormal returns at the M&A announcement.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Total CAR (%)			
Avg. travel time		1.72	-0.20	-0.21			
		(1.09)	(1.05)	(1.01)			
Z(HHI proximity)					1.74*	0.03	0.10
					(1.03)	(1.06)	(1.02)
Unrelated	-0.20		-0.20	-0.46		-0.20	-0.46
	(0.31)		(0.32)	(0.32)		(0.32)	(0.32)
Acquisition of assets	-7.69***		-7.69***	-7.42***		-7.69***	-7.42***
	(1.48)		(1.48)	(1.68)		(1.49)	(1.69)
All-stock payment	-1.76***		-1.76***	-1.51***		-1.76***	-1.51***
	(0.34)		(0.35)	(0.39)		(0.35)	(0.39)
Relative size	7.53***		7.53***	7.83***		7.53***	7.83***
	(1.06)		(1.06)	(1.04)		(1.06)	(1.04)
Log(acq. assets + tar. assets)	-0.41***		-0.41***	-0.36*		-0.41***	-0.36*
	(0.14)		(0.15)	(0.18)		(0.15)	(0.18)
Target M/B	-0.18		-0.18	-0.19*		-0.18	-0.19*
	(0.11)		(0.11)	(0.11)		(0.11)	(0.10)
Acquirer M/B	-0.16		-0.16*	-0.17		-0.16	-0.17*
	(0.10)		(0.10)	(0.11)		(0.10)	(0.10)
Target ROE	-0.28		-0.27	-0.34		-0.28	-0.34
	(0.51)		(0.50)	(0.53)		(0.50)	(0.53)
Acquirer ROE	-0.30		-0.30	-0.51		-0.30	-0.51
	(0.61)		(0.62)	(0.65)		(0.62)	(0.65)
Target leverage	-1.25		-1.25	-1.23		-1.25	-1.24
	(0.98)		(0.98)	(1.28)		(0.98)	(1.27)
Acquirer leverage	1.13*		1.14	1.42**		1.13*	1.41**
	(0.59)		(0.70)	(0.70)		(0.68)	(0.69)
Target R&D intensity	2.08		2.07	1.46		2.08	1.47
	(2.02)		(2.02)	(2.23)		(2.02)	(2.23)
Acquirer R&D intensity	1.92		1.92	-0.06		1.93	-0.06
	(2.82)		(2.83)	(2.51)		(2.83)	(2.51)
Num. of M&As industry	-0.01**		-0.01*	-0.01*		-0.01*	-0.01
	(0.00)		(0.00)	(0.01)		(0.00)	(0.01)
Log(city market equity)	0.28		0.27	0.26		0.28	0.28
	(0.22)		(0.23)	(0.23)		(0.24)	(0.23)
Fixed effects:							
Target city	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer industry	-	-	-	Yes	-	-	Yes
Target industry	-	-	-	Yes	-	-	Yes
R^2	0.10	0.04	0.10	0.14	0.04	0.10	0.14
Observations	4,756	4,756	4,756	4,747	4,756	4,756	4,747

Notes. Observations include announcements with a public target and a public acquirer for which the control variables are nonmissing. The number of observations in each column excludes singleton observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses. Standard errors are multi-way-clustered by acquirer's industry, target's industry, and target's city (Cameron *et al.*, 2011).

spatially bounded. The empirical results support this claim: a lower transportation time between the acquirer's city and the target's city increases the probability of an acquisition bid, reduces the chances of observing a competing acquisition offer, reduces the average target's returns and acquisition premium, and increases the average acquirer's returns. Overall, these findings suggest that the returns to an external growth strategy (Capron and Mitchell, 2012; Lee and Lieberman, 2009; Villalonga and McGahan, 2005; Wang and Zajac, 2007) are affected by a firm's location relative to the resources to be acquired.

The theoretical motivation of this paper builds on previous research documenting the presence of a home bias in the M&A market (Chakrabarti and Mitchell, 2013, 2016; Kang and Kim, 2008; Ragozzino and Reuer, 2011). This study complements this previous literature by showing that the same forces that drive the proximity bias effect can also influence the firms' ability to appropriate value from M&As. The proximity preference and the variance in value appropriation among acquirers described in the results section are two sides of the same coin: without this preference, the differences in returns due to geographic location would also vanish. In particular, acquirers' proximity preference induces a price discount for targets that can only be acquired locally.

The results also indicate that targets' returns are lower, and acquirers' returns higher, the more isolated a target's city is from other cities. This finding suggests that in a better connected world, the market for corporate control becomes more competitive, allowing targets to appropriate more value from M&As, at the expense of acquirers. Future research could investigate whether this conclusion equally applies to an international setting.

It is worth mentioning a limitation of this paper that could motivate future research. While developing the hypotheses, I distinguished three types of information flows that could affect a bidder's willingness to buy a target and that could be affected by distance. Each category is motivated by insights from previous theoretical and empirical research. However, in the empirical analysis I do not attempt to distinguish these three components and to determine their relative importance. Future research could provide new evidence of the relative importance of these three channels on M&A decisions and further enrich our understanding of how geography affects firms' behavior.

1.6 Appendix

1.6.1 Model

1.6.1.1 Model setting

Suppose that there are N targets located in the same city. Potential bidders are uniformly distributed in space around the targets' city. In particular, within an area of radius d around the targets' city, there are $n(\sigma, d)$ potential bidders, where:

$$n(\sigma, d) = \max\{n \in \mathbb{N} \mid n \leq \sigma \pi d^2,\ \sigma > 0\}. \tag{1.6}$$

Parameter σ is a constant specific to the targets' city that defines the density of bidders around the city. The higher σ, the more the number of bidders increases as the radius d increases.

Bidders expect to generate value v from the acquisition of target $i \in \{1, ..., N\}$ if they have access to enough information to assess, control, or communicate with the target, and are not interested in the acquisition otherwise. Suppose that the ability of a bidder to access such information drops with distance d from the target, and targets differ to the extent to which their information flow decays with distance. Specifically, target i can be acquired only by potential bidders within a radius d_i^* from the targets' city.[11] Targets are labeled in increasing order of d_i^* (i.e., $\forall\ i \geq j,\ d_i^* \geq d_j^*$). Then, $n(\sigma, d_i^*)$ measures the total number of potential bidders for target i.

Suppose that not all potential bidders have free financial resources to make an acquisition offer in a given period, and the actual number of bidders b_i for target i is drawn with probability $s(b_i)$ from a binomial distribution with parameters $(n(\sigma, d_i^*), \mu)$, with replacement (i.e., if a bidder is drawn for target i, it can still be drawn for target j). The winning bidder

[11] I am assuming that potential bidders are all identical. A more general assumption is that bidders differ to the extent to which they can acquire a target at a distant location (e.g., Chakrabarti and Mitchell, 2013). In this framework, an increase in a bidder's ability to acquire a distant target is equivalent to "shifting" the bidder closer to the targets' city.

pays a price p_i and obtains payoff $v - p_i$, while the target gets payoff p_i. If at least two bidders are drawn for a target, bidders compete to win the target in a first-price auction. Because it is a common-value auction, the Nash-Bertrand equilibrium price is $p_i^* = v$. Hence, the target obtains all the surplus and the bidders are left with zero. If instead a single bidder is drawn, the auction becomes a bilateral monopoly, where the exact distribution of rents is indeterminate. In this case, I assume that the bidder is strictly better off and the equilibrium price is $p_i^* = \alpha v$, where α is a constant in the interval $[0, 1)$ that represents the average bargaining ability of the bidders vis-à-vis the targets.

1.6.1.2 Expected price of a target

The expected price obtained by target i, conditional on receiving an offer is given by:

$$\begin{aligned} \mathbb{E}(p_i^* \mid b_i > 0) &= \alpha v \frac{s(b_i = 1)}{s(b_i > 0)} + v \frac{s(b_i > 1)}{s(b_i > 0)} \\ &= \alpha v \frac{\binom{n(\sigma, d_i^*)}{1} \mu (1-\mu)^{n(\sigma, d_i^*)-1}}{1 - (1-\mu)^{n(\sigma, d_i^*)}} + v \frac{\sum_{b_i=2}^{n(\sigma, d_i^*)} \binom{n(\sigma, d_i^*)}{b_i} \mu^{b_i} (1-\mu)^{n(\sigma, d_i^*)-b_i}}{1 - (1-\mu)^{n(\sigma, d_i^*)}}. \end{aligned} \tag{1.7}$$

From this expression we can observe that the expected price increases with the cutoff distance d_i^*. Thus, the expected payoff of the acquirer, given by $v - \mathbb{E}(p_i^* \mid b_i > 0)$, decreases with d_i^*. In other words, the broader the geographical boundaries within which competing bidders can be drawn, the more likely the acquisition process will be competitive.

1.6.1.3 Distance and probability of acquisition bids

The probability that a specific bidder located at distance $d = x$ from the targets' city makes an acquisition bid is given by:

$$1 - (1-\mu)^{\sum_{i=1}^{N} \mathbb{1}(d_i^* \geq x)}, \tag{1.8}$$

which is the probability that the bidder makes an offer for at least one of the targets that can be bought at that distance. This probability is a decreasing function of x, since the number of feasible acquisitions drops as x increases.

Another implication of the model is that, conditional on observing an acquisition offer at distance $d = x$, the probability of observing competing acquisition bids increases with x. Specifically, for any target i, the probability of receiving more than one offer conditional on receiving at least one is:

$$s(b_i > 1 \mid b_i > 0) = \frac{\sum_{b_i=2}^{n(\sigma,d_i^*)} \binom{n(\sigma,d_i^*)}{b_i} \mu^{b_i}(1-\mu)^{n(\sigma,d_i^*)-b_i}}{1-(1-\mu)^{n(\sigma,d_i^*)}}, \tag{1.9}$$

which is an increasing function of d_i^*. Then, for a bidder that makes an offer at distance $d = x$, the average probability of observing a competing bid is given by the average probability over all the targets that can be acquired at that distance. Specifically, the expected probability is given by:

$$\mathbb{E}[s(b > 1 \mid d = x, b > 0)] = \sum_{i \mid d_i^* \geq x}^{N} \frac{s(b_i > 1 \mid b_i > 0)}{m(x)}, \tag{1.10}$$

where $m(x) \leq N$ is the total number of targets for which $d_i^* \geq x$. This equation shows that the average probability increases with x. Intuitively, the larger is the area defined by d_i^*, the more potential bidders can be drawn. Then, the higher the distance x, the more deals that are feasible at that distance will have a broader pool of potential bidders and therefore a higher probability of drawing at least two bidders.

1.6.1.4 Distance and value appropriation

The expected price paid by a bidder that makes an offer at distance $d = x$ is given by:

$$\mathbb{E}(p^* \mid d = x, b > 0) = \sum_{i \mid d_i^* \geq x}^{N} \frac{\mathbb{E}(p_i^* \mid b_i > 0)}{m(x)}, \tag{1.11}$$

where $\mathbb{E}(p_i^* \mid b_i > 0)$ is defined in (2). Because $\mathbb{E}(p_i^* \mid b_i > 0)$ increases with the boundary d_i^*, the average payoff of the target increases with x. Moreover, we can write the average payoff of a bidder at distance $d = x$ as $v - \mathbb{E}(p^* \mid d = x, b > 0)$, which is a decreasing function of x. In other words, because deals that can be observed at high distances tend to be more competitive, the higher the distance at which a deal is observed, the higher the average fraction of value appropriated by the target.

1.6.1.5 Distribution of potential bidders and value appropriation

If more potential bidders are located near the targets' city, it is easier for any target to find other interested bidders. Parameter σ in expression (1.6) controls how quickly the number of potential bidders increases as radius d increases. The larger σ is, the more the number of potential bidders rises as the area around the targets' city expands. We can easily notice from expression (4.1) that for every target i, the expected price conditional on receiving an offer increases as a function of σ. In other words, if bidders are more clustered around a city, every target in that city benefits from a broader pool of potential bidders.

1.6.2 Descriptive statistics for the deal-specific control variables

Table 1.15 reports the descriptive statistics and the correlation matrix for the deal-specific control variables and the target's city isolation measures. The sample includes M&A announcements between public companies for which the control variables are nonmissing (4,915 observations).

Table 1.15: Descriptive statistics for the deal-specific control variables.

		Mean	St. dev.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)
(1)	Avg. travel time	6.39	0.99	4.66	11.03						
(2)	Z(HHI proximity)	-0.03	0.96	-1.76	5.22	0.84					
(3)	Unrelated	0.36	0.48	0.00	1.00	0.00	-0.02				
(4)	Acq. of assets	0.00	0.07	0.00	1.00	0.02	0.02	0.02			
(5)	All-stock paym.	0.35	0.48	0.00	1.00	0.05	0.05	-0.10	-0.04		
(6)	Relative size	0.29	0.23	0.00	1.00	-0.08	-0.08	-0.03	-0.02	0.05	
(7)	Log(acq. assets)	7.33	2.12	0.32	14.45	-0.09	-0.07	-0.04	-0.03	-0.11	-0.37
(8)	Log(tar. assets)	5.62	1.88	0.33	12.65	-0.18	-0.16	-0.13	-0.02	-0.03	0.27
(9)	Tar. M/B	1.19	2.09	0.00	64.50	0.13	0.10	0.04	0.00	0.11	-0.07
(10)	Acq. M/B	1.31	2.55	0.01	78.56	0.12	0.08	-0.01	0.00	0.12	-0.11
(11)	Tar. ROE	-0.06	0.54	-3.58	0.73	-0.09	-0.07	0.00	-0.11	-0.01	0.12
(12)	Acq. ROE	0.08	0.28	-1.91	0.62	-0.05	-0.05	0.03	-0.01	-0.12	-0.12
(13)	Tar. leverage	0.55	0.26	0.00	1.00	-0.14	-0.09	-0.12	-0.01	0.01	0.05
(14)	Acq. leverage	0.58	0.24	0.01	1.00	-0.15	-0.08	-0.07	-0.03	0.01	0.01
(15)	Tar. R&D int.	0.05	0.11	0.00	1.50	0.21	0.20	-0.02	0.00	0.06	-0.16
(16)	Acq. R&D int.	0.03	0.07	0.00	1.10	0.21	0.19	-0.03	0.02	0.12	-0.06
(17)	Num. M&As ind.	46.12	53.70	0.00	251.00	0.07	0.09	-0.18	-0.04	0.21	-0.12
(18)	Log(city mkt. eq.)	10.70	3.10	0.00	15.10	-0.20	-0.37	0.01	0.00	0.00	0.02

		(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(8)	Log(tar. assets)	0.63										
(9)	Tar. M/B	-0.06	-0.25									
(10)	Acq. M/B	-0.18	-0.18	0.29								
(11)	Tar. ROE	0.16	0.24	-0.18	-0.10							
(12)	Acq. ROE	0.28	0.17	-0.07	-0.11	0.23						
(13)	Tar. leverage	0.31	0.47	-0.35	-0.30	-0.03	0.11					
(14)	Acq. leverage	0.45	0.41	-0.27	-0.36	0.16	0.10	0.61				
(15)	Tar. R&D int.	-0.13	-0.32	0.36	0.22	-0.42	-0.16	-0.30	-0.32			
(16)	Acq. R&D int.	-0.24	-0.25	0.26	0.28	-0.23	-0.33	-0.34	-0.35	0.57		
(17)	Num. M&As ind.	0.07	-0.03	0.12	0.14	-0.05	-0.09	0.06	0.07	0.12	0.14	
(18)	Log(city mkt. eq.)	0.06	0.07	0.13	0.11	-0.08	-0.06	-0.18	-0.18	0.14	0.14	0.03

Notes. Observations include 4,915 M&A announcements with a public target and a public acquirer for which the control variables are nonmissing.

CHAPTER 2

Do Pre-Announcement Face-to-Face Interactions Increase the Returns to Acquisitions? Evidence from Smartphone Geolocational Data

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Information asymmetries make acquisitions risky, reducing firms' ability to gain from these transactions. We test whether face-to-face interactions with the target's employees before the acquisition provide informational advantages to the acquirer. For a sample of U.S. domestic acquisitions, we use smartphone geolocational data to measure the movement of people between merging companies' headquarters in the months before the acquisition announcement and use the number of visits between the two companies as a proxy for face-to-face interactions. Using bad weather conditions in the two companies' locations as a source of exogenous variation in intercompany mobility, we find evidence that more intense face-to-face interactions increase the acquirer's abnormal returns at the acquisition announcement.

2.1 Introduction

Mergers and acquisitions (M&As) are important means to expand the scale and scope of a firm (Villalonga and McGahan, 2005; Wang and Zajac, 2007). Acquiring existing firms allows the firm to save time and resources that would be required to set up a new business unit (Root, 1994). However, information asymmetries make M&A transactions risky (Capron and Shen, 2007; Coff, 1999; Ragozzino and Reuer, 2011), and many studies find that most acquisitions are not profitable for the shareholders of the acquirers (Andrade *et al.*, 2001; Haleblian *et al.*, 2009; Jensen and Ruback, 1983). Face-to-face interactions with the target company's employees before the acquisition can provide managers with more information about the target. Such knowledge could be leveraged to make better M&A decisions and increase the acquirer's returns.

Despite the development of modern information and telecommunication technologies, face-to-face interaction remains a central channel for information and knowledge transfer in our economies (Calabrese *et al.*, 2011; Flaherty *et al.*, 1998; Gaspar and Glaeser, 1998; Maznevski and Chudoba, 2000; Mokhtarian, 2002; Tillema *et al.*, 2010). Indeed, business travel grows faster than output and trade, suggesting that firms assign great economic value to this form of communication (Hall, 1998; Hausmann, 2016; Storper and Venables, 2004). Face-to-face contact provides unique advantages: it is an efficient communication method, especially suitable for the transfer of non-codifiable information and learning (Gaspar and Glaeser, 1998; Storper and Venables, 2004); it can also transfer information unintentionally, which is valuable in contexts where information is imperfect and parties have incentive to lie (Storper and Venables, 2004); and it facilitates socialization, which further enhances communication (Jarvenpaa and Leidner, 1999; Storper and Venables, 2004; Tsai and Ghoshal, 1998). Accordingly, previous research has highlighted the importance of face-to-face contact to collaborate in knowledge-intensive contexts (Agrawal and Goldfarb, 2008; Catalini, 2018; Catalini *et al.*, 2018), monitor the other party in relationships with moral-hazard problems (Bernstein *et al.*, 2016; Giroud, 2013; Kang and Kim, 2008; Lerner, 1995), and develop social ties that foster the transfer of knowledge (Bell and Zaheer, 2007; Coval and Moskowitz, 1999; Fracassi, 2017; Gulati, 1995; Singh, 2005; Sorenson and Stuart, 2001; Tsai, 2002).

We argue that face-to-face interactions with the target's employees before an acquisition are a powerful knowledge transfer mechanism that can help the acquirer's managers to increase the returns from the acquisition. A superior pre-acquisition information flow between the two merging companies can benefit the acquisition performance by providing a better deal-selection mechanism (Capron and Shen, 2007; Ragozzino and Reuer, 2011), conferring a competitive advantage in the bidding process (Barney, 1988; Cai and Sevilir, 2012; Capron and Pistre, 2002), lowering transaction costs (Cai and Sevilir, 2012; Coff, 1999; Reuer and Ragozzino, 2008), and providing more insights on how to structure the integration process and maximize the value of synergies (Datta, 1991; Larsson and Finkelstein, 1999; Wulf and Singh, 2011; Zaheer *et al.*, 2010). These advantages should be positively reflected in the stock market performance of the acquirer when the acquisition is announced.

While anecdotal evidence suggests the importance of pre-announcement interactions for the success of M&As (Cullinan *et al.*, 2004; Wheelwright *et al.*, 2000), we still have limited empirical evidence of the causal effect of an improved information flow on the acquirer's returns. Previous literature on M&As has proposed different proxies for information availability, such as geographical proximity (Chakrabarti and Mitchell, 2013, 2016; Ragozzino and Reuer, 2011; Uysal *et al.*, 2008), industry relatedness (Capron and Shen, 2007), board interlocks (Cai and Sevilir, 2012), or the presence of previous alliances between merging companies (Lin *et al.*, 2009; Reuer and Ragozzino, 2008; Yang *et al.*, 2011; Zaheer *et al.*, 2010). Testing the effect of knowledge transfer on acquisition returns using these proxies is complicated by the fact that companies that share the same location, industry, directors, or a prior partnership might have unobserved complementarities that could increase the acquisition value.

To overcome this challenge, we introduce a more direct measure of face-to-face contacts between merging companies. Using smartphone geolocational data, we define the "employees" of a company as those who appeared in the acquirer's or in the target's headquarters during business hours in the eight months preceding the acquisition announcement. We proxy face-to-face interactions with the number of times employees visited the other company's headquarters. Because managers can choose how often to interact with the other company, face-to-face interactions are likely to be endogenous. For instance, visits might be more frequent if two companies share greater complementarities, or if the merger is more problematic and presents greater uncertainties. To identify the effect of face-to-face contacts on the acquirer's returns, we use the number of bad weather days in the merging companies' locations in the months preceding the acquisition as an exogenous source of variation in intercompany visits. The number of bad weather days is the number of days with precipitation, maximum temperature below 32°F, or maximum temperature above 90°F in either the acquirer's or the target's location. Bad weather conditions make mobility between two companies more problematic due to traffic and delays, in addition to making any visit less pleasant, especially while walking outdoors (Horanont *et al.*, 2013). On the other hand, we argue that weather is exogenous to M&A performance and should affect returns only by influencing the employees' ability to interact between companies. Applying this empirical strategy and using data on U.S. domestic acquisitions by public acquirers announced between July 2016 and January 2018, we find evidence that more face-to-face contacts between merging firms positively affect the acquirer's abnormal returns at the acquisition announcement.

This study contributes to the literature in several ways. First, we contribute to the strategy literature on M&As. Whether and how acquisitions create economic value are key questions in strategy research (Haspeslagh and Jemison, 1991; Hitt *et al.*, 2001; Natividad, 2014). Especially, how acquirers and targets can contribute to acquirers' superior returns is an important research issue (Barney, 1988; Capron and Pistre, 2002; Chatterjee, 1986; Chatterjee *et al.*, 1992; Mingo, 2013). However, only a few studies (e.g., Capron and Shen, 2007; Zaheer *et al.*, 2010) test how knowledge about the target company can improve M&A performance. Building upon this literature, we provide evidence that face-to-face contacts between the acquirer and the target before the acquisition can enhance the acquirer's returns.

Another contribution of our study is to provide a novel measure of knowledge flow. Past studies on strategy, innovation, and entrepreneurship have used patent citations (Jaffe *et al.*, 1993; Thompson and Fox-Kean, 2005) or worker job changes (Agarwal *et al.*, 2004; Song *et al.*, 2003) as proxy for knowledge flow. In their study of M&As, Tate and Yang (2015) use the U.S. Census Bureau's LEHD data to identify worker job changes of target firms after acquisitions and examine how the retention of the workers of target firms differ in related diversification where human capital is transferable. If knowledge transfer requires face-to-face contacts (Gaspar and Glaeser, 1998; Storper and Venables, 2004), geolocational data could provide a more direct measure to capture knowledge flows.

Similarly, direct measures of monitoring are also limited. For example, Bernstein *et al.* (2016) assume that the introduction of new direct airline routes increases venture capitalists' monitoring of their portfolio firms. Kang and Kim (2008) use board representation and nonroutine top executive turnover as a proxy for post-acquisition monitoring. We argue that company visits can provide a more fine-grained measure to quantify monitoring.

2.2 Theory

2.2.1 Face-to-face interaction and knowledge transfer

While the development of information and communication technologies greatly improved our ability to instantly transfer information between remote locations, face-to-face interaction remains a key conduit for knowledge transfer in our economies (Calabrese *et al.*, 2011; Flaherty *et al.*, 1998; Gaspar and Glaeser, 1998; Maznevski and Chudoba, 2000; Mokhtarian, 2002; Tillema *et al.*, 2010). Indeed, Agrawal and Goldfarb (2008) examine how the introduction of Bitnet (an early version of the internet) affected university collaboration and find that collaborations that benefited the most from this new technology were those between researchers at nearby universities, suggesting the complementarity between network communication and face-to-face interactions.

Different features underpin the lasting superiority of face-to-face interaction relative to other forms of communication. First, it is an efficient communication method, providing visual and body language cues, and high-frequency and simultaneous feedback (Storper and Venables, 2004). These advantages facilitate learning and enable the transfer of information that is not easily codifiable (Gaspar and Glaeser, 1998). For example, studies have shown that the quality and direction of scientific research are affected by how easy it is for scientists to meet (Agrawal and Goldfarb, 2008; Catalini, 2018; Catalini *et al.*, 2018).

Second, by making it easier to observe a person's behavior and environmental context, face-to-face interaction can also transfer information unintentionally. This feature makes face-to-face interaction especially valuable in contexts where information is imperfect and one party has incentive to lie (Storper and Venables, 2004). For instance, studies have shown that by facilitating interactions, geographical proximity increases venture capitalists' monitoring of their portfolio companies (Bernstein *et al.*, 2016; Lerner, 1995), block acquirers' oversight of their target firms (Kang and Kim, 2008), and headquarters' monitoring of their manufacturing plants (Giroud, 2013).

Finally, face-to-face interaction facilitates socialization, which can enhance communication. The development of a social tie increases people's willingness to reciprocally share information, increases the perceived trustworthiness of messages (Jarvenpaa and Leidner, 1999; Storper and Venables, 2004; Tsai and Ghoshal, 1998), and promotes the development of shared languages and similar cognitive structures (Ahuja and Katila, 2001; Cohen and Levinthal, 1989; Lane and Lubatkin, 1998). Indeed, research has shown that social ties developed through collaborations or other interactions are important conduits for knowledge transfer between inventors (Singh, 2005), venture capitalists (Sorenson and Stuart, 2001), mutual fund managers (Bell and Zaheer, 2007), investment managers and local companies (Coval and Moskowitz, 1999), executives and directors of different companies (Fracassi, 2017), organizational units within a company (Tsai, 2002), and partner firms in alliances (Gulati, 1995, 1998).

2.2.2 Pre-announcement face-to-face interaction and acquisition returns

Before an acquisition is announced, employees or executives of two merging companies can interact for a variety of reasons. For instance, managers of companies with no prior relationship can visit the other company and interact with their counterparts before the acquisition as part of their due diligence process (Cullinan *et al.*, 2004; Wheelwright *et al.*, 2000). In addition, companies can collaborate in the context of alliances or vertical relationships (Porrini, 2004; Zaheer *et al.*, 2010), or they may share a common director (Cai and Sevilir, 2012).

The central thesis of this study is that such pre-announcement face-to-face interactions are an effective conduit for knowledge transfer between merging companies that can benefit the acquirer's returns from the acquisition.

Previous literature used different proxies to measure the pre-acquisition information flow between merging companies. For example, Uysal *et al.* (2008) find that the acquirer's abnormal returns at the acquisition announcement are higher when the target is nearby, suggesting that acquirers could benefit from informational advantages in local acquisitions. Cai and Sevilir (2012) show that acquirers obtain higher abnormal returns if they share direct or indirect board connections with their targets. Zaheer *et al.* (2010) test whether the presence of a prior alliance between merging companies increases the acquirer's abnormal returns and find that prior alliances improve returns only in cross-country transactions. In this paper, we take a novel approach by measuring the intensity of face-to-face interactions using smartphone geolocational data to track the movement of employees between the headquarters of the two merging companies before the acquisition announcement. We posit that prior interactions can positively affect the acquirer's returns through at least four channels, as described below.

2.2.2.1 Better selection

If the acquirer is not fully aware of the target's quality and the target's strategic and cultural fit with the acquirer, it incurs the risk of selecting a value-destroying acquisition deal (Capron and Shen, 2007; Chatterjee *et al.*, 1992; Coff, 1999). Observing the target's internal strengths, weaknesses, knowledge base, and culture can be critical to properly evaluate the realizable benefits of an acquisition (Chakrabarti and Mitchell, 2013; Ragozzino and Reuer, 2011). Pre-announcement interactions could provide more information to the acquirer about the quality of the target and its fit with the acquirer. Such knowledge could help managers of the acquirer to reduce the probability of picking a bad deal. Hence, the average quality of a deal should increase with face-to-face interactions. In other words, an informational advantage could arise from a better draw mechanism at the deal selection stage.

2.2.2.2 Advantage in the bidding process

Competition among potential acquirers drives up the price of the target company, reducing the fraction of value created by the acquisition that is appropriated by the winning bidder (Barney, 1988; Capron and Pistre, 2002). If other competing bidders are less able to interact with the target (perhaps due to greater geographical distance), an acquirer can gain an advantage in the bidding process and pay a lower price relative to the expected synergies. Company visits and the development of personal relationships with the target's executives can provide the acquirer with "insider" information about the value of the target or the value of the achievable idiosyncratic synergies. In such contexts, bidders with no prior relationship with the target face greater information asymmetry problems and could avoid bidding for the target or bid less aggressively if they do (Choi *et al.*, 2017; Hendricks and Porter, 1988). For instance, Cai and Sevilir (2012) show that sharing a board interlock with the target benefits acquirers with lower takeover premiums.

2.2.2.3 Lower transaction costs

A better information flow between the two companies can increase managers' awareness of the strengths and weaknesses of the other firm and facilitate the identification of synergy sources. Such improved communication could reduce the need to write complex acquisition contracts (Coff, 1999; Reuer and Ragozzino, 2008) or to hire external agents—such as consultants and investment bankers—to gather information about the other company, and therefore reduce the transaction costs of the acquisition (Cai and Sevilir, 2012).

2.2.2.4 Better expected integration and synergies

Previous research has highlighted that an effective integration process is a critical determinant of an acquisition's performance (Birkinshaw *et al.*, 2000; Datta, 1991; Larsson and Finkelstein, 1999; Wulf and Singh, 2011). A superficial assessment of a target company often leads managers to underestimate the integration costs and overestimate the potential for synergies. Indeed, some case studies highlight how managers often postpone a detailed planning of the integration process until after the deal is signed (Cullinan *et al.*, 2004). Pre-acquisition interactions can expose merging companies to the internal processes of each other, revealing where critical expertise resides within each firm and details of their organizational routines (Dyer and Singh, 1998; Porrini, 2004; Zaheer *et al.*, 2010). Such knowledge can be leveraged to develop a better-defined roadmap for the post-acquisition integration process. In other words, more face-to-face interactions can provide managers with better insights on how to structure the deal and which strategic and organizational levers they need to pull to maximize the value of any given transaction.

In sum, we expect pre-announcement face-to-face interactions to increase the acquirer's returns from the acquisition. As common in the literature (e.g., Cai and Sevilir, 2012; Capron and Shen, 2007; Uysal *et al.*, 2008; Zaheer *et al.*, 2010), we measure acquisition performance with the abnormal returns on the acquirer's stocks at the acquisition announcement, which capture the stock market's expectations of future cash flows related to the acquisition (Haleblian *et al.*, 2009). Thus, we predict:

> *Hypothesis: The greater the intensity of face-to-face contacts between the employees of two merging companies in the months preceding the deal announcement, the greater the acquirer's abnormal returns from the acquisition.*

2.3 Methods

2.3.1 Data

2.3.1.1 M&A Data

The sample includes U.S. domestic acquisitions by public companies announced between July 2016 and January 2018. Data on M&A transactions are collected from the Thomson SDC Platinum database. We exclude deals involving financial firms (companies with primary Standard Industrial Classification (SIC) codes from 60 to 69), acquisitions of minority interests, and cases where the buyer purchased only certain assets or the division of a firm. As is common in the literature (e.g., Cai and Sevilir, 2012; Savor and Lu, 2009; Uysal *et al.*, 2008), we avoid considering the small and economically insignificant deals in SDC. Specifically, we include only transactions where the target's value is at least $10 million and at least 1% of the market capitalization of the acquirer. Acquirers' accounting data are retrieved from Compustat and stock market data from CRSP.

For every firm in the sample, we verified and sometimes corrected the addresses of the headquarters[1] reported in SDC using companies' websites, business news, and companies' publications reported in LexisNexis. We then visually identified the perimeter of the headquarters' buildings on Google Maps and geocoded the locations using the *geohash* system. Geohash is a publicly available geocoding system that assigns a string of letters and numbers to geographic locations. This system subdivides space using a hierarchical grid structure with different levels of precision. The more characters are included in the geohash string, the smaller the rectangular cell corresponding to the geohash. In most cases, we find that companies' perimeters are best described by a set of geohashes at the six- or seven-character level of precision. If a firm's headquarters comprise multiple buildings, we recorded a set of geohashes for each of them.

2.3.1.2 Smartphone data

We obtained location tracking data from SafeGraph, a company that aggregates anonymized smartphone-location data from numerous applications on both Apple and Android smartphones. The SafeGraph data cover about 10% of the smartphone users in the United States and consist of "pings," each of which identifies the latitude and longitude of a smartphone at a moment in time. Smartphones are assigned unique and anonymous identifiers. We obtained the SafeGraph data for the period November 2015–November 2017. We then pulled all the pings that appeared in the companies' headquarters during the eight months preceding the

[1]Even though firms can have many secondary locations (e.g., plants, subsidiaries, and branches), companies' headquarters are likely to be central for our analysis, since they represent the center of companies' decision making.

acquisition announcement. Most of the observed visits fall into these eight-month windows. Indeed, as will be described in the results section, most of the interactions occur within the three to four months preceding the acquisition announcement. Because our smartphone data cover the period November 2015–November 2017, the latest acquisition announcements (in December 2017 and January 2018) have a shorter pre-announcement window to observe intercompany visits. As we will describe below, in the regressions we control for differences in data coverage by including period fixed effects.

From this sample, we removed all the pings associated with smartphones that were moving in the proximity of the companies (e.g., passersby). We then assumed that a smartphone belonged to an employee of the company if it appeared in the company's location during a business day (i.e., excluding weekends and national holidays) between 7:00 am and 7:00 pm in the pre-acquisition period. If the "employee" appeared in both the acquirer's and in the target's location, we assigned the person to the company where s/he appeared on the most business days.

Because smartphone data are anonymous, we cannot be certain that a person in a company's headquarters is an actual employee of the company. For instance, people that visited the headquarters of both merging companies in the months preceding the acquisition might be consultants or investment bankers that are hired to perform due diligence activities. Alternatively, they could be common business connections or partners in an alliance (Gulati, 1995). In the concluding section, we discuss how the presence of such people could affect our interpretation of the results.

2.3.2 Regression model and identification strategy

Our objective is to test the effect of pre-announcement face-to-face contacts between the employees of the two merging companies on the abnormal returns on the acquirer's stock at the announcement of the acquisition. The key explanatory variable is the number of days that the acquirer's or the target's employees visited the headquarters of the other company in the eight months preceding the acquisition announcement. Because managers can choose how often to interact with the other company, face-to-face interactions are likely to be endogenous. For instance, during the due diligence process, the acquirer's managers might decide to interact more with the target if they believe the deal has the potential to create greater value. Moreover, companies that share greater complementarities have greater incentives to collaborate even as separate entities, which would result in more intense pre-acquisition interactions. Alternatively, managers of the acquirer could invest more time interacting with the target's employees if they expect the deal to be more problematic. Therefore, the identification of the effect of face-to-face interactions on the acquirer's returns requires an exogenous source of variation in intercompany visits.

To overcome this challenge, we estimate a two-stage least squares regression, where we use the average number of bad weather days in the merging companies' locations in the months preceding the acquisition as an instrument for intercompany visits. Bad weather conditions make mobility between two companies more problematic due to traffic and delays and make any visit less pleasant, especially while walking outdoors (Horanont *et al.*, 2013). Our identification assumption is that weather is exogenous to the acquirer's abnormal returns and affects performance only by reducing employees' mobility between companies. Because weather might partly capture the effect of companies' geographic locations and therefore their industrial composition, we control for either the merging companies' industry pair—defined at the two-digit SIC code level—or their state pair.

The bad weather "treatment" is the weather condition at the acquirer's and at the target's locations. Because weather conditions in nearby location-pairs are not independent, we cluster standard errors at the state-pair level (where state pair *(x,y)* includes both the case where the acquirer's state is x and the target's state is y, and the case where the acquirer's state is y and the target's state is x).

2.3.3 Measures

2.3.3.1 Dependent variable: Cumulative abnormal returns

The stock market reaction to the acquisition announcement is measured as the cumulative abnormal returns (CAR) on the acquirer's stock over a three-day window centered on the deal announcement (date $t = 0$) (Brown and Warner, 1985). First, we estimate on the 240-day pre-acquisition period $t \in$ [-260, -20] the market model $r_{it} = \alpha_i + \beta_i \; r_{mt} + \varepsilon_{it}$ (Fama *et al.*, 1969), where r_{it} is the stock return of firm i on day t, r_{mt} is the daily market return on the CRSP value-weighted index, α_i and β_i are parameters specific to the company, and ε_{it} is the error term. Abnormal returns are then calculated as the residuals $\widehat{\varepsilon}_{it} = r_{it} - \widehat{r}_{it}$, where $\widehat{r}_{it} = \widehat{\alpha}_i + \widehat{\beta}_i \; r_{mt}$ are the predicted returns, and $\widehat{\alpha}_i$ and $\widehat{\beta}_i$ are the estimated coefficients. Finally, the cumulative abnormal returns are calculated by summing the daily abnormal returns $\widehat{\varepsilon}_{it}$ over a three-trading day window surrounding the announcement date ([-1, 1]). In the appendix, we report the results using some alternative event windows. Cumulative abnormal returns are expressed in percentages.

2.3.3.2 Number of intercompany visits

Our key explanatory variable is the number of days in which the acquirer's or the target's employees visited the other company's headquarters between 7:00 am and 7:00 pm of a business day in the eight months preceding the acquisition announcement. Similar results are found if we just consider the acquirer employees' visits to the target or the target employees' visits to the acquirer.

2.3.3.3 Bad weather days

The instrument for the number of intercompany visits is the number of days with bad weather in either the acquirer's or the target's location in the eight months before the announcement, expressed in logarithmic form. Weather conditions have been shown to significantly affect human behavior, including the choice of daily activities (Horanont *et al.*,

2013) and psychological attitudes (Hirshleifer and Shumway, 2003; Saunders, 1993). The source of weather data is the NOAA Global Historical Climatology Network Daily (GHCN-Daily) data set (Menne *et al.*, 2012a). GHCN-Daily contains daily weather measurements from land-based stations that are subject to a common suite of quality assurance reviews (Durre *et al.*, 2010; Menne *et al.*, 2012b). We measure weather in a firm's location using the climatological data from the weather station with the closest geographical coordinates to the firm's zip code, where zip code coordinates are obtained from the 2017 U.S. Census Gazetteer Files. As bad weather, we consider days with precipitation of at least 0.01 inches, maximum temperature below the freezing point (32°F),[2] and maximum temperature above 90°F. These precipitation and temperature thresholds are used in other summary data sets derived from the GHCN-Daily, such as the Global Summary of the Month (GSOM) and Global Summary of the Year (GSOY) data sets provided by the NOAA National Centers for Environmental Information (Lawrimore, 2016). However, results do not substantially change by using alternative thresholds (e.g., 0.05 or 0.1 inches for precipitation, or by adding or removing 3°F from the temperature thresholds).

2.3.3.4 Travel time

An important determinant of intercompany visits is likely to be the transportation time required to move between the two companies' headquarters. Indeed, the opportunity cost of intercompany visits should increase with the geographic distance between companies, as managers spend more time traveling and less time on more productive activities. Distance is a well-known determinant of social interactions, and its effects has been studied in a variety of fields (e.g., Gimpel *et al.*, 2008; Golledge, 2002).

To control for distance, for each acquirer-target pair, we calculate the average transportation time (in hours) required to travel from the acquirer to the target company's zip code during the eight months before the acquisition. To calculate the travel time between the

[2] We consider the maximum temperature rather than the minimum because the minimum is normally reached during night hours, which is not when intercompany visits would take place. However, results are substantially unchanged by using the minimum below 32°F as alternative threshold for freezing days.

companies, we follow Giroud (2013) and assume that managers choose the route and means of transport—by car or air—that minimize transportation time. Transportation time by car is calculated using MS MapPoint.[3] Transportation time by air is calculated by minimizing the sum of three components: (i) the driving time from the acquirer company to the origin airport, (ii) the flight time—considering both direct and indirect flights—to the destination airport, and (iii) the driving time from the destination airport to the target company. The fastest flight route between origin and destination airports is calculated using monthly data on flight duration (ramp-to-ramp time) from the T-100 Domestic Segment Database provided by the Bureau of Transportation Statistics.[4] The econometric models are estimated by considering the logarithm of transportation time.

2.3.3.5 Other control variables and fixed effects

We control for different deal or firm-specific characteristics that could correlate with intercompany visits and the acquirer's returns. For instance, the industry similarity of the two merging companies might affect their level of information asymmetry and synergistic complementarities (Capron and Shen, 2007; Chatterjee, 1986; Coff, 1999). We control for this factor with the dummy *unrelated*, which indicates whether the acquirer and the target have different primary two-digit SIC codes. Because the presence of board interlocks might provide additional informational benefits that could affect the acquirer's returns (Cai and Sevilir, 2012), we include the dummy *board interlock*, indicating whether the two companies share a common director. Data on boards of directors are obtained from Capital IQ Professional. Knowledge-intensive sectors might trigger more intense interactions for knowledge transfer (Dyer and Singh, 1998). Hence, we include the variable *high-tech*, which is a dummy indicating whether the acquirer's or the target's primary four-digit SIC code is a high-tech sector, as defined by the American Electronics Association (Walcott, 2000). Because larger

[3] For firms located in the same zip code, we assumed that the driving time is two minutes.

[4] As Giroud (2013), we assume that one hour is spent at the origin and destination airports combined and—for indirect flights—each layover takes one hour (but results do not substantially change by making alternative assumptions).

transactions could impose greater risks on the acquirer (Hansen, 1987) and increase managers' incentive to perform due diligence on the target, we include the variable *target relative size*, which is the ratio of the deal value to the sum of the deal value and the acquirer's market capitalization, computed at the end of the fiscal year before the announcement. Since public targets are less informationally opaque than private targets and their acquisition process is typically more competitive (Capron and Shen, 2007), we control for the target's public status with the dummy *public target*. We also control for the acquirer's financial characteristics, measured at the end of the fiscal year before the announcement. *Acquirer Tobin's Q* is the ratio of the sum of the acquirer's market value of equity and book value of debt divided by the book value of assets. *Log(acquirer assets)* is the logarithm of the acquirer's total assets. *Acquirer ROE* is the acquirer's return on equity. *Acquirer leverage* is the acquirer's ratio of total debt to total assets. Moreover, to control for the size of the smartphone-users base of the two companies, we include the average number of smartphones that appear during business hours in the acquirer's and the target's locations (*average number smartphones*). Because the smartphone data are available up to November 2017, the acquisition announcements in the last two months have a shorter pre-announcement period over which to observe intercompany visits. We control for this difference in data coverage with the dummy *after 11/2017*, indicating whether the announcement is after the end of the smartphone-data coverage window.

To control for the unobservable heterogeneity of industries, we include the acquirers' industry fixed effects, where industries are defined at the two-digit SIC code level. As described above, in the most restrictive specifications, we also control for industry-pair or state fixed effects, where industry or state pair *(x,y)* includes the cases where the acquirer is in x and the target is in y, and vice versa. Finally, because the coverage of the data collected by SafeGraph increases over time, all the models are estimated with quarter-year fixed effects.

2.4 Results

Table 2.1 presents the descriptive statistics of the variables introduced in the previous section. Our sample includes 225 acquisition announcements. On average, the acquirers earned about 1.19% at the deal announcement.

Table 2.1: Descriptive statistics and correlation matrix.

		Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)
(1)	CAR[-1, 1] (%)	1.19	12.45	-94.54	100					
(2)	Number of visits	4.34	14.05	0	108	0.23				
(3)	Log(bad weather days)	4.95	0.29	3.69	5.34	-0.22	-0.37			
(4)	Log(travel time)	1.14	1.02	-3.40	2.41	-0.08	-0.48	0.47		
(5)	Unrelated	0.34	0.47	0	1	0.05	0.04	0.08	0.05	
(6)	Board interlock	0.06	0.24	0	1	-0.04	-0.07	0.07	-0.01	-0.03
(7)	High-tech acquirer	0.28	0.45	0	1	-0.08	0.03	-0.25	-0.04	-0.06
(8)	Target relative size	0.22	0.20	0.01	0.92	0.09	0.22	-0.02	-0.07	0.06
(9)	Public target	0.44	0.50	0	1	-0.13	-0.10	-0.06	-0.02	-0.16
(10)	Acquirer Tobin's Q	2.00	1.09	0.59	9.03	0.03	-0.01	-0.31	-0.06	-0.08
(11)	Log(acquirer assets)	7.83	2.06	2.54	12.91	-0.16	-0.05	0.03	-0.02	-0.17
(12)	Acquirer ROE	0.09	0.47	-2.33	3.18	-0.14	-0.10	0.08	0.04	-0.06
(13)	Acquirer leverage	0.53	0.21	0.00	0.98	-0.05	-0.09	0.22	0.11	-0.03
(14)	Avg. num. smartphones	67.40	144.78	1.15	1093.65	-0.12	0.31	0.03	0.04	0.00
(15)	After 11/2017	0.12	0.33	0	1	-0.02	0.01	-0.09	0.08	-0.09

		(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(7)	High-tech acquirer	0.01								
(8)	Target relative size	0.09	-0.03							
(9)	Public target	0.25	0.13	0.09						
(10)	Acquirer Tobin's Q	0.13	0.13	-0.28	0.03					
(11)	Log(acquirer assets)	0.00	0.05	-0.35	0.42	-0.14				
(12)	Acquirer ROE	0.06	-0.04	-0.09	0.16	0.04	0.30			
(13)	Acquirer leverage	0.01	0.05	-0.03	0.17	-0.21	0.43	0.30		
(14)	Avg. num. smartphones	-0.09	0.00	0.10	-0.03	-0.04	0.12	-0.01	0.05	
(15)	After 11/2017	0.02	-0.01	-0.01	0.06	0.15	0.08	0.02	0.03	0.04

Table 2.2 provides the descriptive statistics for the number of intercompany visits. Using the methodology described in the previous section, we observe at least one intercompany visit for 95 transactions (about 42% of the sample). Seventy-four acquirers visited their target, and 66 targets visited their acquirer. Among the transactions with at least one intercompany visit, on average, we observe one smartphone per visit and about 10 intercompany visits. The bottom of the table shows how the number of visits observed in a calendar month preceding the announcement changes as we move closer to the announcement month. Because the coverage of the smartphone data increases over time, we adjust the monthly number of visits

by the average in that calendar month. For instance, for an announcement in February 2017, the adjusted number of visits in January 2017 (month -1) is the difference between the number of visits in January 2017 and the average number of visits observed in January 2017. As the table indicates, visits are more likely to occur in the months that are closer to the announcement, and they typically happen in the three or four months preceding the announcement. Similar patterns are observed in the subsamples of acquirers' visits to the target and targets' visits to the acquirer.

Table 2.2: Intercompany visits descriptive statistics.

	Intercompany visits (acquirer's or target's visits)		**Acquirer's visits to the target**		**Target's visits to the acquirer**	
Observations with at least 1 visit	95		74		66	
For the subsample with at least 1 visit:						
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Number of people per visit	1.07	0.02	1.04	0.01	1.03	0.01
Number of visits	10.27	2.07	7.54	1.53	8.12	1.76
Adjusted number of visits by month: (month of M&A announcement = 0)						
-1	0.48	0.31	0.14	0.20	0.53	0.29
-2	0.41	0.33	0.34	0.26	0.35	0.30
-3	0.36	0.35	0.36	0.30	0.36	0.31
-4	0.21	0.30	0.30	0.25	0.03	0.25
-5	0.09	0.27	0.05	0.20	0.05	0.23
-6	-0.15	0.25	-0.12	0.17	-0.12	0.24
-7	-0.3	0.20	-0.18	0.17	-0.33	0.14
-8	-0.49	0.16	-0.35	0.13	-0.43	0.14

Notes. The columns with intercompany visits include observations with either visits of the acquirer's employees to the target's HQ or visits of the target's employees to the acquirer's HQ. Adjusted number of visits by month is the difference between the number of visits in a calendar month and the average number of visits observed in that calendar month (e.g., for an announcement in February 2017, the adjusted number of visits in January 2017 (month -1) is the difference between the number of visits in January 2017 and the average number of visits observed in January 2017).

Figure 2.1 plots the geographic distribution of acquirer-target pairs, distinguishing by whether we capture intercompany visits during the pre-announcement period (Figure 2.1(a)) or we do not (Figure 2.1(b)). Dots indicate the geographic coordinates of companies and ties link acquirers to the corresponding target. From the maps, we can notice that deals with intercompany visits are not concentrated in a particular geographic area but are spread throughout the country. Moreover, visits occur not only in local transactions, but also in deals where merging companies are distant from each other.

Panel A in Table 2.3 provides the descriptive statistics for the number of days with bad weather in either the acquirer's or the target's location in the eight months before the acquisition announcement, distinguishing by days with precipitation, maximum temperature $\leq 32°F$, and maximum temperature $\geq 90°F$. On average, approximately 60% of the days in the eight months preceding an announcement had bad weather in either the acquirer's or the target's location, and the most frequent bad weather condition is precipitation.

Panel B compares the probability of observing an intercompany visit during a business day with versus without bad weather conditions in either the acquirer's or the target's location in the eight months before the announcement. In each case, bad weather reduces the probability of a visit, and the difference is statistically significant at the 1% level.

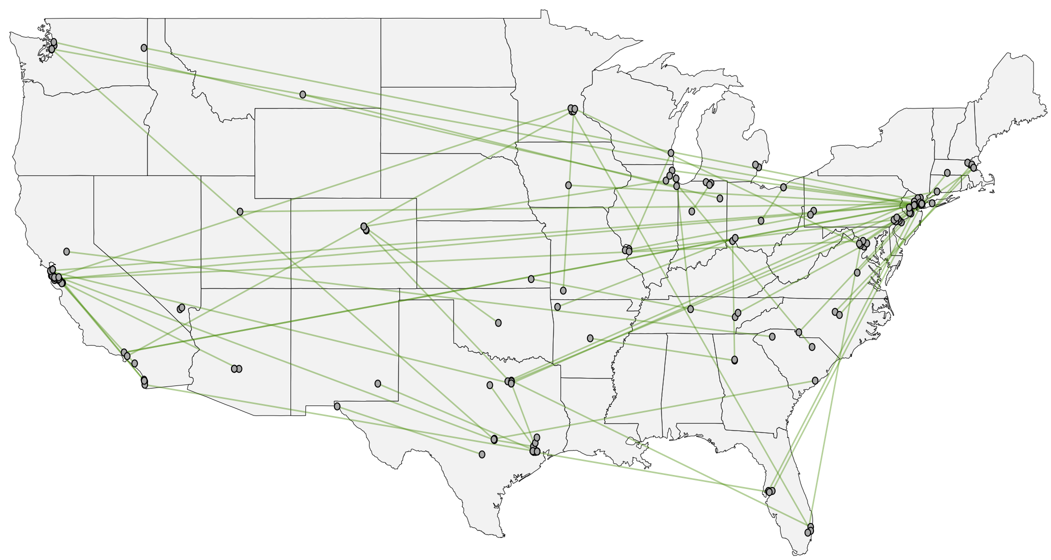
Table 2.3: Bad weather days.

Panel A. **Number of days with:**		Mean	S.D.	Min	Max
(a)	Precipitation ($\geq$ 0.01 inches)	114.83	32.70	22	201
(b)	Max temperature $\leq 32°F$	11.06	17.13	0	146
(c)	Max temperature $\geq 90°F$	46.37	39.66	0	168
(a, b, or c)	Bad weather	146.88	33.93	40	209

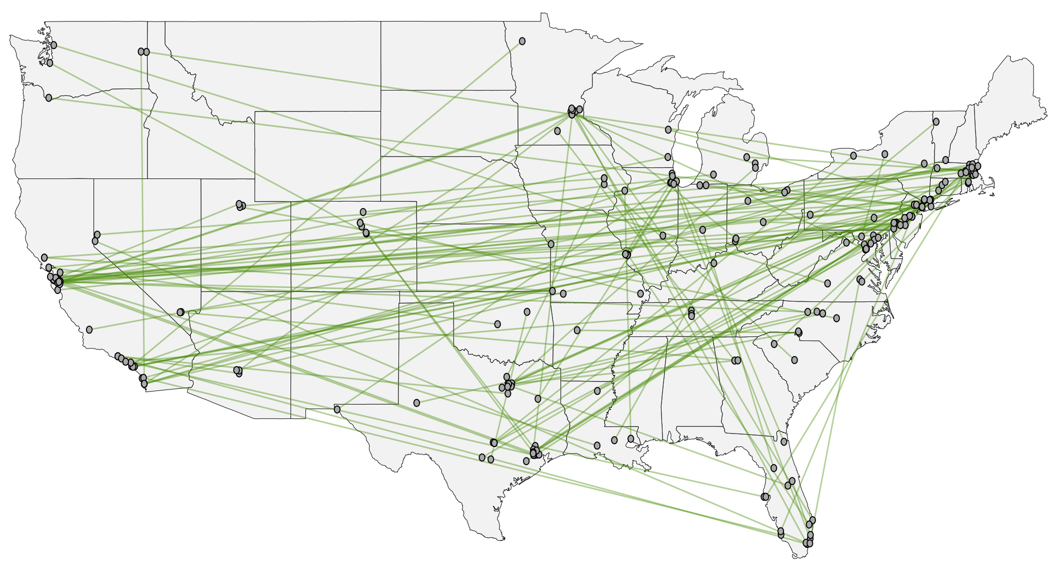
Panel B. **Probability of a visit on a day with vs. without (a), (b), (c), or either:**		With	Without	Difference	t-statistic of the difference
(a)	Precipitation ($\geq$ 0.01 inches)	0.02	0.04	-0.02	11.25
		(0.00)	(0.00)	(0.00)	
(b)	Max temperature $\leq 32°F$	0.01	0.03	-0.02	3.80
		(0.00)	(0.00)	(0.00)	
(c)	Max temperature $\geq 90°F$	0.02	0.03	-0.01	3.89
		(0.00)	(0.00)	(0.00)	
(a, b, or c)	Bad weather	0.02	0.04	-0.02	12.00
		(0.00)	(0.00)	(0.00)	

Notes. Panel A provides the descriptive statistics for the number of days with bad weather in either the acquirer's or the target's location in the 8 months before the acquisition announcement. Panel B compares the probability of observing an intercompany visit during a business day with vs. without bad weather (in either the acquirer's or the target's location) in the 8 months before the announcement. Standard errors are in parentheses.

Figure 2.1: The geographical distribution of pre-announcement face-to-face interactions.



(a): Deals with observed pre-acquisition visits.



(b): Deals with no observed pre-acquisition visits.

Notes. Dots indicate the geographic coordinates of merging companies and ties link acquirers to the corresponding target. Figure 2.1(a) includes the deals for which we observe intercompany visits during the pre-acquisition announcement period. Figure 2.1(b) shows the deals for which we do not observe any interaction.

Table 2.4 describes how the average frequency of intercompany visits and acquirer's returns change in the three tertiles for the total number of bad weather days. The average number of visits and the percentage of deals with at least one visit drop when moving from the first to the third tertile of bad weather days. Similarly, the average acquirer's CAR and the percentage of deals with positive abnormal returns are the highest in the first tertile of bad weather days and progressively decrease moving to the second and third tertiles. These descriptive results suggest that merging companies in bad weather conditions interact less with each other and their merger announcement is associated with lower acquirer's returns compared with companies with more favorable weather conditions.

Table 2.4: Bad weather days tertiles, number of visits, and acquirers' CAR.

Bad weather days in:	1st tertile		2nd tertile		3rd tertile	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Number of visits	7.90	2.39	3.79	1.18	1.11	0.46
% with $\geq$ 1 visit	53.25	5.72	44.74	5.74	27.78	5.32
CAR[-1, 1] (%)	3.19	1.61	1.69	1.07	-1.50	1.55
% with CAR[-1, 1] $>$ 0	67.53	5.37	61.84	5.61	50.00	5.93

Notes. The first tertile includes observations with less than or equal to 140 bad weather days, the second tertile observations with more than 140 and less than or equal to 163 bad weather days, and the third tertile observations with more than 163 bad weather days.

Table 2.5 presents the first-stage regressions, where the dependent variable is the number of intercompany visits. Columns (1), (2), and (3) report the models with announcement quarter-year and acquirer's industry fixed effect, with only the controls, only *log(bad weather days)*, and both the controls and *log(bad weather days)*, respectively. Column (4) replaces the acquirer's industry fixed effects with the acquirer's and the target's industry-pair fixed effects. Finally, column (5) replaces the industry-pair fixed effects with state-pair fixed effects.

As expected, bad weather conditions significantly reduce face-to-face interactions between the two companies. Specifically, the most restrictive specifications, with industry-pair fixed effects (column (4)) and with state-pair fixed effects (column (5)), indicate that a 1% increase in the number of bad weather days reduces the number of intercompany visits by about 0.12 and 0.18, respectively.

Another important determinant of face-to-face contacts is the travel time between the two companies. This finding confirms that distance reduces the acquirer's managers' ability to obtain information about the target via face-to-face contacts (see also Chakrabarti and Mitchell, 2013, 2016).

Table 2.6 presents the estimates from the instrumental variable regressions, where the dependent variable is the acquirer's CAR at the announcement. Column (1) reports, for comparison, the estimates from an OLS model with only the controls, while columns (2)–(5) present the second-stage regressions with or without controls, where the *number of visits* is instrumented with *log(bad weather days)*. As in Table 2.5, columns (1)–(3) report the models with quarter-year and acquirer's industry fixed effects, column (4) includes the industry-pair fixed effects, and column (5) replaces the industry-pair fixed effects with state-pair fixed effects.

Confirming our hypothesis, face-to-face contacts in the pre-announcement period positively affect the acquirer's abnormal returns. Specifically, controlling for industry pairs (column (4)) or state pairs (column (5)), the regressions indicate that an additional day of visits increases the acquirer's cumulative abnormal returns by about 0.81–1.31 percentage points. Hence, the order of magnitude indicates that a one standard deviation increase in the number of visits corresponds to approximately a 0.9–1.5 standard deviation increase in the acquirer's returns.

Being highly correlated with intercompany visits, *log(travel time)* gains statistical significance in some of the regressions (columns (3) and (4)), while it is not significant when included without *number of visits* (column (1)). On the contrary, the statistical significance of intercompany visits persists also in the model without the control variables (columns (2)), suggesting that our inference is not inflated by the presence of a collinear variable. In the appendix, we report additional robustness regressions excluding *log(travel time)* or including alternative functional forms for the travel time control. Overall, the estimates suggest that

Table 2.5: First-stage regressions.

	(1)	(2)	(3)	(4)	(5)
	Number of visits				
Log(bad weather days)		-17.17***	-7.81***	-11.92**	-17.80**
		(3.40)	(2.75)	(5.01)	(6.89)
Log(travel time)	-5.49***		-4.40***	-4.95***	-7.27***
	(1.45)		(1.10)	(1.18)	(1.83)
Unrelated	0.92		1.10		-0.41
	(2.33)		(2.36)		(2.40)
Board interlock	-1.49		0.02	0.16	5.48
	(2.00)		(2.10)	(2.92)	(5.09)
High-tech acquirer	1.74		1.10	2.46	0.44
	(1.65)		(1.79)	(2.15)	(3.16)
Target relative size	9.20		7.80	8.31	22.82*
	(7.77)		(7.35)	(8.20)	(13.05)
Public target	-2.12		-2.30	-3.71	-6.73*
	(2.01)		(2.19)	(2.52)	(3.97)
Acquirer Tobin's Q	0.45		-0.09	-0.50	-0.43
	(0.72)		(0.68)	(1.08)	(1.04)
Log(acquirer assets)	0.26		0.09	0.22	-0.46
	(0.33)		(0.32)	(0.50)	(0.65)
Acquirer ROE	-2.08		-1.84	-1.09	-2.52
	(2.26)		(2.12)	(2.04)	(4.05)
Acquirer leverage	-4.15		-2.38	-5.73	7.03
	(4.66)		(4.38)	(6.39)	(6.65)
Avg. num. smartphones	0.03***		0.03***	0.02**	0.05***
	(0.01)		(0.01)	(0.01)	(0.01)
After 11/2017	-1.66		-1.40	2.89	-10.63**
	(4.50)		(4.16)	(3.94)	(4.97)
Fixed effects:					
Quarter-year	Yes	Yes	Yes	Yes	Yes
Acquirer industry	Yes	Yes	Yes	-	-
Industry pair	-	-	-	Yes	-
State pair	-	-	-	-	Yes
Instrument F statistic		25.45	8.08	5.66	6.67
p-value		0.00	0.01	0.02	0.01
Within R^2	0.35	0.16	0.37	0.39	0.50
Non-singleton observations	216	216	216	183	126

Notes. Standard errors are clustered by pairs of states where the two firms are located (state pair *(x,y)* includes both the case where the acquirer's state is x and the target's state is y, and vice versa). Standard errors are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Industry fixed effects are defined at the 2-digit SIC level. Industry or state pair *(x,y)* includes the cases where the acquirer is in x and the target is in y, and vice versa.

while proximity is a significant facilitator of intercompany visits, the latter are a much more important predictor of M&A performance. In other words, only deals for which interactions occur perform better, irrespective of the geographical distance between merging companies. In the appendix, we also report other robustness regressions using alternative event windows to compute the acquirer's abnormal returns.

For comparison, in Table 2.7 we report the OLS regressions for the effect of intercompany visits on the acquirer's abnormal returns. Column (1) includes the announcement quarter-year fixed effects, the acquirer's industry fixed effects, and the controls; column (2) adds the *number of visits* variable; and columns (3) and (4) include the model with industry-pair or state-pair fixed effects, respectively. Finally, columns (5) and (6) add the interaction of *number of visits* with the dummy *unrelated* in the models with industry-pair and state-pair fixed effects, respectively.

The estimates from models (2)–(4) indicate that while the effect of visits is still significantly positive, its magnitude is smaller compared with the instrumental variable regressions. Hence, when the number of visits varies endogenously, its coefficient is smaller. This pattern could suggest that the acquirers' managers interact more with targets that are more problematic or that impose greater risks. Because such deals result in lower returns, the OLS regressions might underestimate the effect of face-to-face interactions.

Columns (5) and (6) also indicate that the positive effect of intercompany visits is significantly stronger in unrelated acquisitions. Hence, the informational benefits of face-to-face interactions appear to be stronger in contexts where the acquirer lacks the industrial expertise to evaluate the target and is therefore exposed to greater information asymmetry problems. However, because we do not have enough statistical power to test this interaction effect in the instrumental variable regressions, we cannot rule out endogeneity concerns about this result.

We conducted several robustness checks. First, if an acquirer and a target have a preexisting relationship such as being alliance partners, such a relationship can drive both the number of visits and higher returns from acquisition (Porrini, 2004; Zaheer *et al.*, 2010). Us-

Table 2.6: Instrumental variable regressions.

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
	CAR[-1, 1] (%)				
Number of visits		0.44***	1.07***	0.81**	1.31**
		(0.08)	(0.40)	(0.35)	(0.63)
Log(travel time)	-0.92		4.97*	4.74**	9.63
	(0.99)		(2.54)	(2.33)	(6.27)
Unrelated	1.64		0.65	0.00	0.89
	(1.62)		(1.93)	(0.00)	(3.67)
Board interlock	-1.73		-0.12	2.60	-4.11
	(4.09)		(3.92)	(4.15)	(7.03)
High-tech acquirer	-1.93		-3.80	-5.66**	-5.19
	(1.84)		(2.50)	(2.32)	(3.79)
Target relative size	16.49**		6.61	12.19	-24.81
	(8.30)		(6.95)	(7.56)	(23.10)
Public target	-3.64**		-1.36	-1.16	4.52
	(1.50)		(2.48)	(2.86)	(6.95)
Acquirer Tobin's Q	0.77		0.29	0.46	-2.22
	(1.12)		(1.35)	(1.35)	(2.48)
Log(acquirer assets)	0.05		-0.23	-0.17	-0.90
	(0.49)		(0.61)	(0.72)	(1.04)
Acquirer ROE	-1.99		0.24	-5.27**	-0.09
	(1.77)		(2.48)	(2.22)	(4.77)
Acquirer leverage	-1.57		2.88	5.42	6.02
	(5.20)		(6.69)	(7.49)	(14.47)
Avg. num. smartphones	-0.00		-0.03**	-0.02**	-0.06*
	(0.01)		(0.01)	(0.01)	(0.03)
After 11/2017	-4.03		-2.25	-5.15	12.32
	(4.62)		(5.29)	(5.47)	(11.75)
Fixed effects:					
Quarter-year	Yes	Yes	Yes	Yes	Yes
Acquirer industry	Yes	Yes	Yes	-	-
Industry pair	-	-	-	Yes	-
State pair	-	-	-	-	Yes
Non-singleton observations	216	216	216	183	126

Notes. In columns (2)–(5), *number of visits* is instrumented with *log(bad weather days)*. Standard errors are clustered by pairs of states where the two firms are located (state pair *(x,y)* includes both the case where the acquirer's state is x and the target's state is y, and vice versa). Standard errors are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Industry fixed effects are defined at the 2-digit SIC level. Industry or state pair *(x,y)* includes the cases where the acquirer is in x and the target is in y, and vice versa.

ing SDC data on alliances announced from 1990, we found that only seven acquisition deals involved companies with a prior alliance. The inclusion of a control variable for the presence of prior alliances does not affect our results. Second, a horizontal merger between companies that share the same customers or suppliers could induce greater returns due to an increase in the bargaining power of the merged entity vis-à-vis its clients or suppliers (Fee and Thomas, 2004; Shahrur, 2005). To test for this possibility, we run the same regressions reported in the text, but excluding horizontal acquisitions, defined as deals where the merging companies share the same primary four-digit SIC code (see also Fee and Thomas (2004) and Shahrur (2005)). Our results continue to hold in this restricted sample of non-horizontal acquisitions. Finally, our results do not substantially change by using the acquirer's visits to the target or the target's visits to the acquirer as alternative measure for interactions.

2.5 Discussion and conclusion

Information asymmetries make M&As risky (Capron and Shen, 2007; Coff, 1999; Ragozzino and Reuer, 2011), reducing firms' ability to gain from these transactions (Haleblian *et al.*, 2009). In this paper, we find that face-to-face contacts with the target's employees before the acquisition are a powerful channel for information transfer, which helps to increase the acquirer's returns. Because interactions between two companies can be driven by expectations of future acquisition returns, we inferred the effect of intercompany visits using bad weather conditions in the two companies' locations as a source of exogenous variation in mobility.

The results indicate that the positive effect of face-to-face interactions is economically meaningful: a one standard deviation increase in the number of visits corresponds to approximately a 0.9–1.5 standard deviation increase in the acquirer's returns. Previous studies using alternative proxies for information availability also found sizable effects, suggesting that a better pre-acquisition information flow is an important determinant of the acquisition performance. For instance, Cai and Sevilir (2012) show that acquirers' returns are 2.4 percentage points higher if the acquirer and the target share a common director. Moreover,

Table 2.7: OLS regressions.

	(1)	(2)	(3)	(4)	(5)	(6)
			CAR[-1, 1] (%)			
Number of visits		0.29**	0.26**	0.46***	0.00	0.21
		(0.11)	(0.12)	(0.16)	(0.08)	(0.21)
Num. of vis. × Unrelated					0.49**	0.49**
					(0.23)	(0.22)
Log(travel time)	-0.92	0.67	1.13	2.21	0.43	1.65
	(0.99)	(0.56)	(0.76)	(1.40)	(0.75)	(1.35)
Unrelated	1.64	1.38		0.93		-1.55
	(1.62)	(1.33)		(2.41)		(3.17)
Board interlock	-1.73	-1.29	1.69	-0.85	1.66	0.53
	(4.09)	(3.88)	(4.30)	(6.99)	(4.26)	(6.42)
High-tech acquirer	-1.93	-2.43	-3.60**	-4.83	-3.88**	-4.32
	(1.84)	(1.86)	(1.74)	(3.24)	(1.80)	(3.16)
Target relative size	16.49**	13.82**	17.95***	-4.84	15.20**	-9.09
	(8.30)	(6.17)	(6.58)	(19.07)	(5.82)	(17.35)
Public target	-3.64**	-3.03*	-3.32**	-0.91	-2.77*	-0.62
	(1.50)	(1.63)	(1.67)	(3.92)	(1.63)	(3.90)
Acquirer Tobin's Q	0.77	0.64	0.59	-2.20	0.56	-1.91
	(1.12)	(1.16)	(0.94)	(1.86)	(0.80)	(1.59)
Log(acquirer assets)	0.05	-0.02	0.16	-1.53	-0.08	-1.70
	(0.49)	(0.51)	(0.53)	(1.03)	(0.51)	(1.04)
Acquirer ROE	-1.99	-1.38	-5.77***	-1.55	-5.87***	0.15
	(1.77)	(1.66)	(1.67)	(2.67)	(1.56)	(2.81)
Acquirer leverage	-1.57	-0.37	0.37	12.75	3.31	16.12
	(5.20)	(4.87)	(5.87)	(16.08)	(4.14)	(15.06)
Avg. num. smartphones	-0.00	-0.01	-0.01	-0.02	0.00	-0.01
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
After 11/2017	-4.03	-3.55	-3.23	5.41	-1.75	5.03
	(4.62)	(4.19)	(4.74)	(10.94)	(4.10)	(11.23)
Fixed effects:						
Quarter-year	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer industry	Yes	Yes	-	-	-	-
Industry pair	-	-	Yes	-	Yes	-
State pair	-	-	-	Yes	-	Yes
Within R^2	0.15	0.22	0.28	0.24	0.36	0.30
Non-singleton observations	216	216	183	126	183	126

Notes. Standard errors are clustered by pairs of states where the two firms are located (state pair *(x,y)* includes both the case where the acquirer's state is x and the target's state is y, and vice versa). Standard errors are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Industry fixed effects are defined at the 2-digit SIC level. Industry or state pair *(x,y)* includes the cases where the acquirer is in x and the target is in y, and vice versa.

Uysal *et al.* (2008) indicate that acquirers' returns in local transactions are more than twice the returns in non-local transactions.

Our study shows that intercompany visits provide an informational advantage to acquirers, which translates into higher announcement returns. We argue that the private information gathered through company visits can benefit acquirers by reducing the probability of picking a bad deal (Capron and Shen, 2007; Ragozzino and Reuer, 2011), providing an advantage in a competitive bidding process (Barney, 1988; Cai and Sevilir, 2012; Capron and Pistre, 2002), reducing the transaction costs of the acquisition (Cai and Sevilir, 2012; Coff, 1999; Reuer and Ragozzino, 2008), and providing insights into how to optimally structure the integration process and maximize the value of synergies (Datta, 1991; Larsson and Finkelstein, 1999; Wulf and Singh, 2011; Zaheer *et al.*, 2010). While our data does not allow us to empirically test the relative importance of each channel, these mechanisms are not mutually exclusive, and each one can contribute to provide informational advantages to the acquirer.

As Cullinan *et al.* (2004: 104) argue, "In the wake of so many disappointing mergers and acquisitions, [...] there are few better ways of spending managers' time and investors' money than in a careful and creative analysis of an acquisition candidate." Overall, our analysis stresses the importance of face-to-face interactions to support decision making in M&As. While information and communication technologies have greatly enhanced our ability to transfer information across remote locations, face-to-face interactions still appear to be a superior channel for information exchange. As discussed, the specific features of face-to-face interaction—which facilitate the transfer of non-codifiable knowledge, monitoring, and socialization—underpin its lasting superiority as a form of communication (Storper and Venables, 2004).

An important novelty of this study is our ability to quantify temporary human capital movements across organizational boundaries. The results show that the information flow derived from such interactions can provide great economic value. These temporary interactions were unobservable in previous studies, which inferred information flow through alternative measures, such as patent citations (Jaffe *et al.*, 1993), geographical distance (Bernstein *et al.*, 2016; Chakrabarti and Mitchell, 2013, 2016; Giroud, 2013; Kang and Kim, 2008; Mingo, 2013; Ragozzino and Reuer, 2011; Uysal *et al.*, 2008), board interlocks (Cai and Sevilir, 2012), strategic alliances (Gulati, 1995; Lin *et al.*, 2009; Yang *et al.*, 2011; Zaheer *et al.*, 2010), and workers' job changes (Agarwal *et al.*, 2004; Song *et al.*, 2003).

Our study also contributes to the literature on geography and M&As (e.g., Chakrabarti and Mitchell, 2013, 2016; Ragozzino and Reuer, 2011) by documenting the mechanism through which distance can affect returns to M&As. Our results indicate that while geographical proximity is an important facilitator of face-to-face interactions, proximity per se does not affect acquirers' abnormal return. Hence, in our setting, geography matters only to the extent to which it facilitates human capital movements and decreases the costs of transferring knowledge.

It is worth mentioning an important limitation of this study. Because the smartphone data are anonymous, we cannot be certain that the smartphones that we identify in our sample belong to employees. For instance, people who visited the headquarters of both merging companies in the months preceding the acquisition might be external agents, such as consultants or investment bankers, that are hired to perform due diligence activities. However, if hiring such external agents is part of managers' effort to gather information about the target company and design the integration process, our interpretation of the results should not change substantially.

Alternatively, such people could be common business connections. These ties could be an additional channel for knowledge transfer between the two companies. For instance, Gulati (1995, 1998) shows that the presence of a common alliance partner facilitates the creation of a new alliance between two previously unconnected firms, by referring valuable information about the specific capabilities and reliability of potential partners. In the context of M&As, such common connections could provide additional insights about the other party in a merger. As discussed earlier, the presence of common clients or suppliers could also benefit merging firms by increasing their bargaining power vis-à-vis their clients or suppliers

(Fee and Thomas, 2004; Shahrur, 2005). However, our results are robust to the exclusion of horizontal mergers, which suggests that an increase in bargaining power is not the main driver of our results.

Despite these limitations, our results have implications for the study of strategic management. Our study demonstrates the usefulness of measuring knowledge flows between companies and analyzing the economic impact of such knowledge flows on these companies. Hence, future studies on intercompany relationships may benefit from using these novel measures of knowledge transfer. Our study also presents a new perspective regarding the role of geographic proximity. Our results suggest it is face-to-face interactions, not geographical proximity per se, that facilitate knowledge flows. Therefore, in the study of agglomeration, it may be beneficial to decompose the role of geographic proximity into the underlying factors that create the benefits of agglomeration.

2.6 Appendix

2.6.1 Robustness regressions for the instrumental variable regressions

Because the number of intercompany visits is highly correlated with the transportation time between the two companies' headquarters, in Table 2.8 we test the robustness of the instrumental variable regressions by omitting the travel time control or including it with alternative functional forms. Columns (1)–(3) present the models with quarter-year fixed effects, industry-pair fixed effects, and the other controls, while columns (4)–(6) replace the industry-pair fixed effects with state-pair fixed effects. Columns (1) and (4) omit the travel time control, columns (2) and (5) include the travel time control—expressed in hours—in a quadratic form, and columns (3) and (6) include the control in a cubic form. As the table shows, the results described in the main text hold also in these alternative regressions, and the magnitude of the coefficients is comparable to the previous estimates. Similar results hold by replacing the travel time control with the geodesic distance—expressed in miles—between the geographic coordinates of the merging companies' headquarters.

In Table 2.9, we report the regressions with alternative event windows to compute the acquirer's cumulative abnormal returns: a two-day window [-1, 0] (columns (1) and (2)), a two-day window [0, 1] (columns (3) and (4)), and a 11-day window [0, 10] (columns (5) and (6)). Odd-numbered columns report the models with industry-pair fixed effects, and even-numbered columns the models with state-pair fixed effects. The regressions with these alternative event windows confirm the results reported in the main text.

Table 2.8: Instrumental variable regressions without the travel time control or with alternative functional forms.

	(1)	(2)	(3)	(4)	(5)	(6)
			CAR[-1, 1] (%)			
Number of visits	0.35**	0.77***	0.78***	0.73***	1.14***	1.26**
	(0.16)	(0.27)	(0.28)	(0.24)	(0.41)	(0.59)
Travel time (hours)		5.60***	10.34**		8.73**	14.33
		(2.09)	(4.68)		(4.04)	(12.41)
Travel time^2		-0.50**	-1.78*		-0.62**	-2.29
		(0.19)	(0.96)		(0.30)	(2.92)
Travel time^3			0.09			0.11
			(0.06)			(0.17)
Unrelated	0.00	0.00	0.00	0.24	-0.07	0.40
	(0.00)	(0.00)	(0.00)	(3.00)	(3.56)	(3.63)
Board interlock	1.57	2.79	2.86	-0.38	-2.60	-4.60
	(4.62)	(4.07)	(3.97)	(7.14)	(7.60)	(7.27)
High-tech acquirer	-4.16**	-5.14**	-4.77**	-5.96*	-5.62	-6.01
	(1.97)	(2.19)	(2.18)	(3.18)	(3.86)	(4.12)
Target relative size	15.34**	11.17	10.48	-9.56	-21.09	-24.26
	(6.61)	(7.12)	(7.01)	(18.34)	(18.57)	(21.86)
Public target	-2.62	-1.59	-1.70	2.19	3.38	4.96
	(1.86)	(2.49)	(2.46)	(3.93)	(5.58)	(7.65)
Acquirer Tobin's Q	0.21	0.19	0.35	-2.66	-2.72	-2.57
	(1.05)	(1.35)	(1.34)	(1.94)	(2.35)	(2.51)
Log(acquirer assets)	-0.11	-0.12	-0.04	-1.51	-1.25	-1.07
	(0.60)	(0.69)	(0.65)	(1.03)	(1.10)	(1.04)
Acquirer ROE	-5.08***	-5.09**	-5.28**	-0.41	-0.34	0.66
	(1.77)	(2.17)	(2.17)	(3.40)	(4.13)	(5.48)
Acquirer leverage	1.58	4.49	4.32	9.30	8.27	6.13
	(5.96)	(7.84)	(7.95)	(15.31)	(16.54)	(17.04)
Avg. num. smartphones	-0.01	-0.02**	-0.02**	-0.04**	-0.06**	-0.06*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)
After 11/2017	-2.22	-3.41	-3.46	10.92	13.14	13.99
	(4.81)	(4.90)	(4.75)	(12.75)	(11.74)	(11.74)
Fixed effects:						
Quarter-year	Yes	Yes	Yes	Yes	Yes	Yes
Industry pair	Yes	Yes	Yes	-	-	-
State pair	-	-	-	Yes	Yes	Yes
Non-singleton observations	183	183	183	126	126	126

Notes. Number of visits is instrumented with *log(bad weather days)*. Standard errors are clustered by pairs of states where the two firms are located (state pair *(x,y)* includes both the case where the acquirer's state is x and the target's state is y, and vice versa). Standard errors are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Industry fixed effects are defined at the 2-digit SIC level. Industry or state pair *(x,y)* includes the cases where the acquirer is in x and the target is in y, and vice versa.

Table 2.9: Instrumental variable regressions with alternative event windows for CAR.

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR[-1, 0] (%)		CAR[0, 1] (%)		CAR[0, 10] (%)	
Number of visits	0.72**	1.35**	1.01**	1.24**	1.00**	1.13**
	(0.32)	(0.52)	(0.41)	(0.48)	(0.48)	(0.49)
Log(travel time)	3.83*	8.86	6.04**	8.79**	6.63*	9.20**
	(2.14)	(5.26)	(2.76)	(3.96)	(3.56)	(3.98)
Unrelated	0.00	1.44	0.00	0.07	0.00	0.69
	(0.00)	(3.25)	(0.00)	(3.10)	(0.00)	(3.64)
Board interlock	-2.00	-6.07	3.02	-4.59	4.52	-10.05
	(3.12)	(5.52)	(4.20)	(6.36)	(4.88)	(7.04)
High-tech acquirer	-6.90***	-4.32	-7.04***	-7.45**	-6.11**	-5.32
	(2.27)	(3.25)	(2.37)	(3.58)	(2.84)	(3.38)
Target relative size	8.65	-16.46	12.23	-15.45	12.25	-14.39
	(6.36)	(19.93)	(9.32)	(14.89)	(10.31)	(15.67)
Public target	0.15	4.66	-0.85	2.31	0.52	2.10
	(2.22)	(5.87)	(3.55)	(4.98)	(4.33)	(4.84)
Acquirer Tobin's Q	0.32	-2.06	0.23	-2.32	-0.23	-3.50
	(1.04)	(2.09)	(1.48)	(2.51)	(1.61)	(2.25)
Log(acquirer assets)	-0.10	-0.58	-0.27	-0.35	-1.02	-0.01
	(0.59)	(1.13)	(0.83)	(1.05)	(0.98)	(1.04)
Acquirer ROE	-4.80**	-0.94	-4.45*	1.16	-4.72	-2.24
	(2.05)	(4.45)	(2.60)	(4.90)	(3.17)	(5.06)
Acquirer leverage	0.49	-0.62	6.11	-6.33	8.13	-11.87
	(7.19)	(14.21)	(8.50)	(9.45)	(10.59)	(12.11)
Avg. num. smartphones	-0.02**	-0.07**	-0.03**	-0.05**	-0.02*	-0.06**
	(0.01)	(0.03)	(0.01)	(0.02)	(0.01)	(0.02)
After 11/2017	-6.22	9.77	-4.45	8.05	-4.99	12.55
	(3.97)	(10.02)	(5.88)	(6.62)	(6.84)	(9.30)
Fixed effects:						
Quarter-year	Yes	Yes	Yes	Yes	Yes	Yes
Industry pair	Yes	-	Yes	-	Yes	-
State pair	-	Yes	-	Yes	-	Yes
Non-singleton observations	183	126	183	126	183	126

Notes. Number of visits is instrumented with *log(bad weather days)*. Standard errors are clustered by pairs of states where the two firms are located (state pair *(x,y)* includes both the case where the acquirer's state is x and the target's state is y, and vice versa). Standard errors are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Industry fixed effects are defined at the 2-digit SIC level. Industry or state pair *(x,y)* includes the cases where the acquirer is in x and the target is in y, and vice versa.

CHAPTER 3

Sell or Partner? Travel Time, Asymmetric Information, and the Seller's Dilemma in Mergers and Acquisitions

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When a company is acquired, the seller can choose to retain partial ownership of the merged company by accepting payment in stock. This paper shows that this choice is influenced by the seller's ex ante ability to assess the acquirer's value and ex post cost of performing governance activities. Proxying for the seller's information asymmetry with the time required to travel between the merging companies' headquarters, I find that the percentage of stock included in the payment falls with travel time, an effect that is stronger when the seller has more bargaining power. Moreover, greater travel time increases the likelihood that the seller accepts an overvalued stock offer and reduces the chances that the target's CEO sits on the acquirer's board after the acquisition.

3.1 Introduction

Mergers and acquisitions (M&As) are important means that firms can use to expand their scale and scope (Haspeslagh and Jemison, 1991; Hitt *et al.*, 2001). The strategic management literature provides insights on how firms decide to acquire other firms (Capron and Mitchell, 2012; Lee and Lieberman, 2009; Villalonga and McGahan, 2005; Wang and Zajac, 2007) and how they can obtain superior returns from acquisitions (Barney, 1988; Capron and Pistre, 2002; Capron and Shen, 2007; Chatterjee, 1986, 1992; Zaheer *et al.*, 2010). However, while great attention has been devoted to the acquirers' side of M&As, the dilemmas faced by the sellers have rarely been studied. This research gap is nontrivial, considering that every time companies grow through acquisitions, there must be sellers that believe their best strategy is to cede control of the target to the bidding company.

In this paper, I bring attention to the perspective of the seller on one important issue: the decision to retain partial ownership of the merged company. This decision is reflected in the choice of the method of payment, which could be cash, stock, or some combination of the two. When a takeover is paid entirely with cash, the target's shareholders transfer the totality of their ownership rights to the acquirer. If instead the medium of exchange includes equity, stocks of the target are exchanged with stocks of the acquirer, and the target's shareholders become partial owners of the combined entity. The objective of this study is to investigate how the seller's information asymmetry with respect to the acquirer can affect the choice of the method of payment.

Building upon the management literature on geography, I use the geographical proximity between merging firms as a measure of their ability to access information about each other. Spatial proximity enables frequent face-to-face interaction, which is often essential to transfer soft information about a firm's key resources and operations (Baum and Sorenson, 2003; Baum *et al.*, 2000; Sorenson and Stuart, 2001). Such informational advantages are especially valuable in relationships that require assessing a firm's value (Chakrabarti and Mitchell, 2013, 2016; Ragozzino and Reuer, 2011) and monitoring its behavior (Bernstein *et al.*, 2016; Kang and Kim, 2008; Lerner, 1995).

Alternative hypotheses can be made on how information asymmetry could affect the choice of the method of payment, depending on whether one considers the information asymmetry only on the buyer's side of the deal or on both the buyer's and the seller's side. Assuming that only the information asymmetry of the acquirer matters, theoretical models show that when it is costly for the acquirer to observe the true value of the target, the acquirer has incentive to pay for the acquisition with stocks (Fishman, 1989; Hansen, 1987). Because securities have the desirable feature that they make the value of the payment contingent upon the value created through the transaction, stock payments reduce the acquirer's risk of overpaying for the target. The strategy literature has typically considered only the buyer's informational dilemmas and argued that stock payments are more likely in contexts where the target's value is harder to appraise (Coff, 1999; Reuer and Ragozzino, 2008; Reuer *et al.*, 2004).

If instead we assume that the seller's informational dilemmas also matter, alternative predictions can be made. In this study, I argue that the seller's preference on whether to retain partial ownership of the combined entity will be affected by (i) how much the seller trusts that the current value of the acquirer's equity reflects the company's true value, and (ii) the seller's ability to monitor and perform governance activities on the acquirer after the transaction. Considering the first aspect, a well-known example of the risk faced by the seller is America Online's (AOL) stock-financed acquisition of Time Warner, which was announced in January 2000, right before the burst of the dot.com bubble. Despite the considerable premium paid by AOL and the reduction in its stock price at the announcement, the common view is that the acquisition was an excellent deal for AOL, as its equity was overvalued at the time of the announcement and lost more than half of its value over the following two years (Rhodes-Kropf and Viswanathan, 2004; Savor and Lu, 2009). Indeed, studies in finance predict that if bidders have private information about the valuation of their own stocks, they have an incentive to pay for an acquisition with stocks when they know their equity is overvalued, creating an adverse selection risk on the target's side of the deal (Brown and Ryngaert, 1991; Eckbo *et al.*, 1990; Fishman, 1989; Hansen, 1987; Shleifer and Vishny, 2003). Second, if the ex ante information asymmetry is not resolved after the transaction, the acquirer might also be hard to monitor ex post. Because the ability to perform governance activities is often a precondition for corporate ownership and investment (Giroud, 2013; Kang and Kim, 2008; Lerner, 1995), high ex post monitoring costs could also reduce the seller's willingness to become blockholder of the acquirer.

Therefore, while an exclusive focus on the buyer's incentives would lead one to expect a positive relationship between the level of information asymmetry and the propensity to use stock payments, a theory that considers also the seller's perspective would predict an opposite pattern. In this study, I proxy for the level of information asymmetry by using the transportation time between the headquarters of the merging companies and test which prediction finds empirical support in a sample of domestic acquisitions in the Unites States during the period 1993–2014. Arguably, a reduction in travel time increases managers' ability to visit the other party's headquarters, interact with its employees, and obtain valuable information about the company. The results confirm that the seller's perspective matters and strongly support the hypothesis that transportation time increases their reluctance to accept stock considerations. I also find that the negative effect of travel time on the propensity to use stock considerations becomes stronger when the seller has more bargaining power, as proxied by the number of competing bidders. Finally, to further examine how travel time affects seller's incentives, I provide evidence that proximity reduces the chances that the seller is paid with overvalued equity, and increases the seller's ability to perform governance activities on the acquirer, as proxied by the probability that the target's CEO sits on the acquirer's board after the acquisition.

This study contributes to the literature in several ways. First, it brings attention to the seller's perspective in M&As. With the exception of the literature on entrepreneurship and innovation (Gans *et al.*, 2002; Gans and Stern, 2003; Graebner, 2009; Graebner and Eisenhardt, 2004), the seller's side of acquisitions has received limited attention (see also Cuypers *et al.*, 2017). Sellers' decisions are equally important strategic issues as the buyers' decisions and should therefore be informed by research. Moreover, as this paper shows, a theory that focuses exclusively on acquirers can be incomplete and lead to misleading empirical predictions.

Second, it contributes to the literature on M&A, information economics, and governance (e.g., Balakrishnan and Koza, 1993; Reuer *et al.*, 2013) by providing insights on how the ownership of the combined entity is split between the acquirer's and the target's owners. Given the importance of governance for firms' performance (Hillman and Dalziel, 2003), knowing how governance structures arise in the first place is particularly valuable.

Finally, this paper adds to the body of literature on M&A and geography (Chakrabarti and Mitchell, 2013, 2016; Ragozzino and Reuer, 2011) by showing a previously unknown channel through which geography can affect how deals are structured. While previous studies provide evidence of the acquirer's home bias, this paper shows that there is a proximity bias also on the seller's side of M&As. Taken together, the previous evidence and the findings of this study suggest that the evolution of corporate ownership follows the spatial distribution of firms: acquirers tend to buy local firms and sellers retain partial ownership if the group's headquarters are located nearby.

3.2 Theory and hypotheses

3.2.1 Geographical proximity and information access

Different studies argue that geographical proximity facilitates access to information and monitoring. Proximity facilitates face-to-face interaction and the transfer of soft information about a firm's key resources, such as its human capital, brands, technologies, and relationships with suppliers and customers (Baum *et al.*, 2000; Chakrabarti and Mitchell, 2013, 2016; Ragozzino and Reuer, 2011; Sorenson and Stuart, 2001). Studying the financial industry, Coval and Moskowitz (1999) show that investment managers exhibit a strong preference for locally headquartered firms: "Local investors can talk to employees, managers, and suppliers of the firm; they may obtain important information from the local media; and they may have close personal ties with local executives all of which may provide them with an information advantage in local stocks" (Coval and Moskowitz, 1999: 2046). Giroud (2013) finds that manufacturing firms invest more in plants that are located closer to their headquarters and that the higher monitoring potential of close headquarters increases plant-level productivity. Geographic proximity also facilitates active involvement in corporate governance activities. Lerner (1995) shows that venture capitalists are more likely to serve on the boards of local firms, where monitoring is easier. Similarly, Kang and Kim (2008) indicate that block acquirers that are geographically close to the target company are more likely to engage in post-acquisition target governance activities. Such informational and monitoring advantages have been shown to induce a home bias in the market for corporate control as well. In particular, studies find that acquirers have a strong and persistent preference for geographically close targets (Chakrabarti and Mitchell, 2013; Kang and Kim, 2008) and that these informational advantages can translate into better acquisition performance (Uysal *et al.*, 2008).

3.2.2 Geographical proximity and method of payment in M&A

Researchers revealed different factors that can influence the choice of the method of payment in M&A (Amihud *et al.*, 1990; Datta *et al.*, 1992; Faccio and Masulis, 2005; Ismail and Krause, 2010; Martin, 1996; Martynova and Renneboog, 2009). The acquirer's willingness to pay with cash depends on the size of its cash reserves, its debt capacity,[1] and its desire to leave the existing corporate governance structure unaffected. The seller's preference is instead affected by the relative importance the seller attaches to the liquidity of cash, the prospects of future earnings of the bidder's stocks (Faccio and Masulis, 2005), the tax benefits of stock offers (Datta *et al.*, 1992; Hayn, 1989), or the desire to maintain partial control over the combined entity (Ghosh and Ruland, 1998). Different theoretical and empirical studies analyze how the choice of the medium of exchange can vary as a function of the informational distance between merging companies. Alternative predictions can be made by looking at the information asymmetry only on the bidder's side or on both the bidder's and the seller's side of the deal. Below I describe these two perspectives in turn and derive the hypotheses on how geographical proximity can affect the choice of the method of payment.

3.2.2.1 Acquirer's information asymmetry

If critical information about a potential target is not easily accessible, the acquirer can face an adverse selection problem (Akerlof, 1970) and risk to pay more than the correct value for the

[1] More in general, the choice of the method of payment is in part governed by the same forces that govern the choice of a firm's capital structure. For instance, "pecking order" models suggest that when making financing decisions, firms prefer internal sources of capital to external financing, and debt to equity when they use external financing (Myers, 1984).

target. Theoretical models predict that the use of stock payments can provide a mechanism to partly solve the acquirer's informational dilemmas (Fishman, 1989; Hansen, 1987). Securities have the desirable feature that they make the value of the payment contingent upon the value created through the transaction and therefore allow the acquirer to partly transfer the overpayment risk to the seller. Since the value of the combined entity's stock captures the performance of the target, a high-quality seller will have incentive to accept a stock payment. Building on this hypothesis, different empirical studies assume a positive relation between the acquirer's information asymmetry and the probability of a stock payment. Coff (1999) argues that the valuation of knowledge-related assets involves more uncertainty than the valuation of tangible assets and shows that stock payments are more likely in knowledge-intensive industries than in other industries. Studying a sample of new ventures, Reuer and Ragozzino (2008) indicate that both prior alliances between merging firms and targets' initial public offering (IPO) offer a way for acquirers to obtain more information about the targets and hence reduce the need for stock financing in acquisitions. Reuer *et al.* (2004) analyze international mergers and acquisitions and find that firms lacking international and domestic acquisition experience turn to performance-contingent payouts when buying targets in high-tech or service industries.

Following this stream of literature and considering only the acquirer's informational problems, we could predict that the longer it takes for the acquirer's managers to travel to the target's headquarters, the higher will be the propensity to pay for the acquisition with stocks. Indeed, an increase in travel time could reduce managers' ability to visit the target, interact with its employees, and obtain valuable soft information about the company. The following hypothesis formalizes this argument.

Hypothesis 1(a): The greater the transportation time required to move between the merging companies' headquarters, the higher the fraction of stock included in the acquisition payment.

3.2.2.2 Two-sided information asymmetry

Alternative predictions can be made by also considering the seller's informational dilemmas. First, the cost to the seller of obtaining ex ante information about the acquirer's value can reduce the seller's willingness to accept a stock offer. Theoretical models predict that if acquirers have private information about their own value, they have incentive to pay for the acquisition with stocks when they know their equity is overvalued and with cash when their equity is undervalued (Brown and Ryngaert, 1991; Hansen, 1987; Rhodes-Kropf and Viswanathan, 2004; Shleifer and Vishny, 2003). In line with this prediction, Martin (1996) and Faccio and Masulis (2005) find that bidders that experience a considerable stock price gain before the transaction are more likely to pay for the acquisition with stocks. Loughran and Vijh (1997) and Savor and Lu (2009) also show that stock acquirers earn negative long-term abnormal returns after the transaction, thus suggesting that the equity involved in stock acquisitions might indeed be overvalued at the time of the takeover. Hence, when the acquirer has private information concerning its own value, the seller should be less willing to accept a stock payment. Because the seller's mistrust implies that the bidder might be required to issue shares at less than their true value, it becomes costlier for the acquirer to pay with equity. Therefore, the equilibrium fraction of stock included in the payment decreases when the seller has access to less information about the acquirer (Eckbo *et al.*, 1990; Fishman, 1989; Hansen, 1987). In line with this idea, Faccio and Masulis (2005) find that in inter-industry and in cross-country deals—where the target is less familiar with the acquirer's business—stock payments are less likely. In our context, we could argue that a target that is located geographically close to the acquirer might be in a better position to appraise soft information about the quality of the acquirer and might therefore be more likely to detect an overvalued stock offer.

Second, because stock payments imply that the seller becomes blockholder of the acquirer, the ex post cost of monitoring the acquirer might also affect the seller's preference. As previously described, different studies have highlighted that geographical distance to a company reduces investors' ability to engage in corporate governance activities (Bernstein *et al.*, 2016; Kang and Kim, 2008; Lerner, 1995). If the location of a target can be considered a good proxy for the location of its largest shareholders,[2] the transportation time between merging companies can negatively affect their ability to monitor and perform governance activities on the acquirer and therefore their willingness to become blockholders.

In conclusion, both the ex ante ability to evaluate the acquirer and the ex post cost of performing governance activities can induce the seller to avoid stock payments as the transportation time between companies increases. The following hypothesis summarizes this intuition.

Hypothesis 1(b): The greater the transportation time required to move between the merging companies' headquarters, the lower the fraction of stock included in the acquisition payment.

The seller's ability to influence the deal structure is a function of the seller's bargaining power vis-à-vis the acquirer. Hence, while all distant targets might be reluctant to accept a stock payment, those that have more bargaining levers might be more likely to obtain cash considerations. The presence of multiple competing bidders can increase the seller's bargaining power, since the seller can play one bidder against another to achieve the preferred deal structure. We can therefore predict that the negative effect of transportation time on the propensity to use stock considerations will be stronger in the presence of a competitive bidding process. Thus:

Hypothesis 2: The larger the number of competing bidders, the more an increase in transportation time between merging companies reduces the fraction of stock included in the acquisition payment.

Additional predictions can be derived to further support the claims that geographical proximity reduces the seller's adverse selection risk and facilitates ex post monitoring. First,

[2] There are different reasons to believe that this is the case. First, the company can be management-owned, in which case the company's position coincides with the primary business location of its main shareholders. Second, as many authors have pointed out, outside investors are likely to be located close to the company, since proximity facilitates monitoring and access to information (Bernstein *et al.*, 2016; Chakrabarti and Mitchell, 2013; Coval and Moskowitz, 1999; Kang and Kim, 2008; Lerner, 1995; Ragozzino and Reuer, 2011).

if distance acts as a barrier to information flow, we should expect that the longer it takes to move from the target to the acquirer, the harder it will be for the target to detect an overvalued stock offer. As Loughran and Vijh (1997) and Savor and Lu (2009) indicate, the stock price of acquirers that pay with equity tends to drop in the years following the acquisition. Such loss might disproportionately affect sellers that are relatively distant from the acquirer and are therefore unable to gather enough information about the prospects of future earnings of the bidder's stock. Hence, we can predict that the long-term abnormal return for a seller that accepts a stock payment and hold onto the acquirer's stocks after the acquisition will decrease as the transportation time between companies increases. Thus, we expect:

> *Hypothesis 3: The greater the transportation time required to move between the merging companies' headquarters, the lower the long-run buy-and-hold abnormal returns for a seller that accepts a stock payment.*

Second, it should be easier for a seller to engage in corporate governance activities and monitor the operations of the acquirer if the latter is relatively close. I use the probability that the target's CEO serves on the board of the acquirer after the transaction as a proxy for the ability of the selling shareholders to perform governance activities on the acquirer. Top executives are the representatives of the selling shareholders' ownership interests and are also likely to be shareholders of the target themselves (and they might even be the dominant shareholder if the firm is management-owned). Moreover, top executives' involvement in the acquirer's governance might be a good proxy for the behavior of other external blockholders, since blockholders are also likely to be located close to the target (Bernstein *et al.*, 2016; Chakrabarti and Mitchell, 2013; Coval and Moskowitz, 1999; Kang and Kim, 2008; Lerner, 1995; Ragozzino and Reuer, 2011).[3] Because active governance requires frequent company visits (Kang and Kim, 2008; Lerner, 1995), it will be costlier for the target's CEO to oversee

[3] The main advantage of using top executives' involvement in the bidder's governance as a proxy for the selling shareholders' involvement is that their affiliation with the target can be assumed even in the absence of detailed ownership data and their geographical location can be easily identified (as long as it can be reasonably approximated with the target's headquarters).

the acquirer's operations if the two companies are distant from each other. Hence, we can expect that the longer it takes to commute between the merging companies' headquarters, the lower is the probability that the target's top executive will become part of the acquirer's governance. Thus:

> *Hypothesis 4: The greater the transportation time required to move between the merging companies' headquarters, the lower the probability that the target's CEO will be a member of the acquirer's board of directors after the acquisition.*

3.3 Methods

3.3.1 Data

Data on M&A transactions are collected from the Thomson SDC Platinum database, acquirers' accounting data from Compustat, and stock market data from CRSP. The data set includes completed U.S. domestic acquisitions of nonfinancial[4] companies[5] by public nonfinancial companies that were announced between 1993 and 2014. I exclude deals where the acquirer already had partial ownership of the target before the acquisition announcement and intra-group consolidations (i.e., acquisitions where the acquirer or its parent has the same six-digit Committee on Uniform Security Identification Procedures—CUSIP—code as the target or the target's parent). As is common in the literature (e.g., Savor and Lu, 2009; Uysal *et al.*, 2008), I exclude the many small and economically insignificant deals in SDC. Specifically, I consider only deals where the target's value is at least $10 million and at least one percent of the market capitalization of the acquirer six months before the acquisition announcement. Finally, to avoid travel time outliers, I exclude transactions in which the bidder or the target is located in Alaska, Hawaii, Puerto Rico, or the Virgin Islands.

[4]Financial companies are defined as companies with primary two-digit standard industrial classification (SIC) codes from 60 to 69.

[5]I consider the "Merger" transaction form in SDC, which excludes acquisitions of assets.

3.3.2 Models

To test Hypothesis 1 and Hypothesis 2, I estimate two-limit tobit models in which the dependent variable measures the percentage of stock included in the acquisition payment.[6] To test Hypothesis 3, I run OLS models for the long-run buy-and-hold abnormal returns on the bidder's stocks, distinguishing by whether the seller received stock payments or only cash. To test Hypothesis 4, I estimate probit models in which the dependent variable is a dummy indicating whether the target's CEO has a seat on the acquirer's board after the acquisition.

3.3.3 Measures

3.3.3.1 Percentage of stock

The first dependent variable is the percentage of stock used in the payment, as reported in the SDC database.

3.3.3.2 Long-run buy-and-hold abnormal returns

Similarly to Savor and Lu (2009), I calculate long-term buy-and-hold abnormal returns ($BHAR$) as the difference between the buy-and-hold return on the acquirer's stocks and the buy-and-hold return for a benchmark portfolio matched on industry, size, and market-to-book ratio (for a discussion of the advantages of this approach, see also Barber and Lyon (1997) and Lyon *et al.* (1999)). Specifically, the buy-and-hold abnormal return for acquirer i is given by:

$$BHAR^{i}_{(-1,t)} = BH^{i}_{(-1,t)} - BH^{matched\_portfolio\_i}_{(-1,t)},$$

where $BH^{i}_{(-1,t)}$ is the buy-and-hold return for firm i over the period starting one trading day before the announcement of the acquisition (day -1) and ending t trading days after the

[6] The same results hold by testing Hypotheses 1 and 2 with logit models in which the dependent variable is a dummy variable indicating whether the acquisition payment includes stocks.

announcement, and $BH^{matched\_portfolio\_i}_{(-1,t)}$ is the corresponding return for firm i's benchmark portfolio. I exclude from the sample firms that are not present in CRSP for at least 200 trading days of the estimation period and the remaining missing returns are set to zero. The analysis reports results for one year ($t = 250$) and two years ($t = 500$) after the announcement, where returns are expressed as a percentage.

The benchmark portfolio for each acquirer i is obtained as follows. First, I identify in Compustat all the companies with the same two-digit standard industrial classification (SIC) code and market value of equity between 50 percent and 150 percent of the market value of equity of i at the end of the fiscal year before the announcement. I exclude from the portfolio firms that announced an acquisition two years before or two years after the announcement of i's acquisition. Next, I select the 10 firms with the closest market-to-book ratio to i at the end of the fiscal year before the announcement. The final benchmark portfolio is an equally weighted portfolio of these control firms. In particular, each acquirer i will have 10 matched controls or less (if fewer benchmark firms are available).[7] Finally, to account for a few extreme observations, I winsorize returns at the 0.25th and 99.75th percentiles (i.e., 0.5% of the observations).[8]

3.3.3.3 Target's top executive on acquirer's board

For each target in the sample, I verify whether the CEO of the company sat on the acquirer's board of directors in the three years after the transaction was completed. Targets' CEOs before the M&A announcement are identified using Compustat ExecuComp for public companies and S&P Capital IQ for private companies and public companies not present in ExecuComp. For companies not found in either ExecuComp or Capital IQ, information on its top management is obtained using different sources: Marquis Who's Who, LinkedIn, business news, and companies' publications reported in LexisNexis. Finally, bidder's board

[7]As Savor and Lu (2009) argue, the advantage of using a portfolio of multiple firms rather than a single firm is that it is less sensitive to control outliers.

[8]The coefficients estimated in the next section do not substantially change by winsorizing the top and bottom 1%, 0.75%, 0.5%, or none of the observations.

members after the transaction are identified using Compustat ExecuComp, S&P Capital IQ, or the company's proxy statements.

3.3.3.4 Travel time

The key explanatory variable of this study is the number of hours required to travel from the target to the acquiring company. I use the five-digit zip codes of companies' headquarters to identify companies' locations.[9] Even though firms can have many secondary locations (e.g., plants, subsidiaries, and branches), companies' headquarters are likely to be central for our analysis, since they represent the center of companies' decision making. To calculate the travel time between companies, I follow Giroud (2013) and assume that managers choose the route and means of transportation—car or plane—that minimize transportation time. Travel time by car is calculated using MS MapPoint. For firms located in the same zip code, I assume that the driving time is two minutes. Transportation time by flying is calculated by minimizing the sum of three components: (i) the driving time from the target company to the origin airport, (ii) the flight time to the destination airport, and (iii) the driving time from the destination airport to the acquiring company. The flight time between origin and destination airports is measured using data on airline routes from the T-100 Domestic Segment Database provided by the Bureau of Transportation Statistics, which includes monthly data on flight duration (ramp-to-ramp time) for all airline flights that have taken place in the United States. Using these data, I find for each airport pair the fastest route at any point in time (month-year) considering both direct and indirect connections.[10] To account for nonlinear relationships between travel time and the dependent variables (see also Chakrabarti and Mitchell, 2013; Golledge, 2002), travel time is included in the econometric models in logarithmic form.

[9] More precisely, locations are defined by the geographic coordinates of the centroid of the zip code area.

[10] As Giroud (2013), I assume that one hour is spent at the origin and destination airports combined and—for indirect flights—each layover takes one hour.

3.3.3.5 Number of other bidders

To proxy for the relative bargaining power of the seller, I count the number of competing bidders the acquirer has to face. Hence, *Number of other bidders* is given by the total number of bidders minus one.

3.3.3.6 Control variables

I control for product market dissimilarity using the dummy variable *Unrelated*, which equals one if the two companies have different primary three-digit SIC codes and zero otherwise. I control for the relative size of the target with the dummy *Large relative size*, which equals one if the ratio of the value of the deal to the sum of the value of the deal and the acquirer's market capitalization six months before the announcement is in the top quartile of the distribution and zero otherwise. The dummy variable *Target is public* indicates the target's public status. I also include different measures of the bidder's capital structure the year before the announcement of the acquisition. *Acquirer cash > target value* is a dummy indicating whether the bidder's cash and short-term investments are greater than the target's value. *Acquirer M/B* is the ratio of the market value of equity to the book value of equity, winsorized at the 0.25th and 99.75th percentiles. *Log(acquirer assets)* is the logarithm of total assets. *Acquirer leverage* is the ratio of total debt to total assets. *Acquirer dividends* is a dummy indicating whether the bidder distributed dividends. *Acquirer asset tangibility* is the ratio of properties, plants, and equipment to total assets. I control for whether the bidder operates in a high-tech industry with the dummy *Acquirer is high-tech*, which indicates whether the bidder's primary four-digit SIC code is a high-tech sector, as defined by the American Electronics Association (Walcott, 2000). Moreover, the dummy *Acquirer in major metropolis* (*Target in major metropolis*) controls for whether the acquirer (target) is located in one of the 15 most populated core-based statistical areas (CBSAs).[11] Finally, to control for macroeconomic factors and unobservable heterogeneity of industries and geographical areas,

[11]New York, Los Angeles, Chicago, Dallas, Philadelphia, Houston, Washington, Miami, Atlanta, Boston, San Francisco, Detroit, Riverside, Phoenix, and Seattle.

the models include announcement year fixed effects, acquirer's and target's state fixed effects, and acquirer's industry fixed effects, where industries are defined using the Fama-French 49 industries classification.

3.4 Results

Table 3.1 presents the summary statistics and the correlation matrix for the variables included in the models. Fifty-two percent of the transactions involve a public target, and 47 percent are unrelated acquisitions. Table 3.2 provides details on the distribution of the method of payment in the sample. Fifty-five percent of the acquisition payments include stock considerations: 30 percent are paid entirely with stocks, and about 25 percent include a mix of stock and cash. Among mixed-payment transactions, the average percentage of stock included in the payment is 51 percent.

Table 3.1: Descriptive statistics and correlation matrix.

		Mean	St. dev.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1)	% of stock	42.52	44.49	0.00	100.00							
(2)	BHAR [-1,+250] (%)	-1.78	57.57	-206.47	375.70	-0.08						
(3)	BHAR [-1,+500] (%)	-6.54	88.94	-386.28	633.52	-0.07	0.64					
(4)	Board seat	0.09	0.28	0.00	1.00	0.18	0.01	0.00				
(5)	Log(time)	1.00	1.28	-3.66	2.36	-0.13	-0.03	-0.01	-0.07			
(6)	Num. of other bidders	0.03	0.20	0.00	3.00	-0.04	0.00	0.00	-0.02	0.03		
(7)	Unrelated	0.47	0.50	0.00	1.00	-0.08	0.01	0.00	-0.04	0.03	0.00	
(8)	Large relative size	0.25	0.43	0.00	1.00	0.15	-0.02	-0.03	0.21	-0.09	0.07	-0.04
(9)	Tar. is public	0.52	0.50	0.00	1.00	0.14	-0.03	-0.03	0.15	-0.03	0.11	-0.06
(10)	Acq. cash > tar. value	0.33	0.47	0.00	1.00	-0.11	-0.01	0.00	-0.13	0.02	-0.05	-0.02
(11)	Acq. M/B	4.10	5.49	0.42	57.15	0.19	-0.03	-0.03	0.01	0.00	-0.02	-0.08
(12)	Log(acq. assets)	6.49	1.86	0.69	13.44	-0.21	0.01	0.04	-0.05	0.01	0.07	0.04
(13)	Acq. leverage	0.45	0.21	0.01	1.00	-0.08	0.04	0.04	-0.02	0.01	0.04	0.06
(14)	Acq. dividends	0.39	0.49	0.00	1.00	-0.13	-0.01	0.03	-0.02	0.06	0.06	0.11
(15)	Acq. asset tangibility	0.24	0.22	0.00	0.96	0.01	0.04	0.02	0.00	-0.08	0.08	-0.03
(16)	Acq. is high-tech	0.40	0.49	0.00	1.00	0.16	-0.04	-0.04	0.01	-0.04	-0.03	-0.15
(17)	Acq. in major metropolis	0.51	0.50	0.00	1.00	0.05	-0.02	0.00	0.02	-0.04	-0.03	-0.03
(18)	Tar. in major metropolis	0.49	0.50	0.00	1.00	0.02	0.00	-0.01	0.03	-0.07	-0.02	0.00

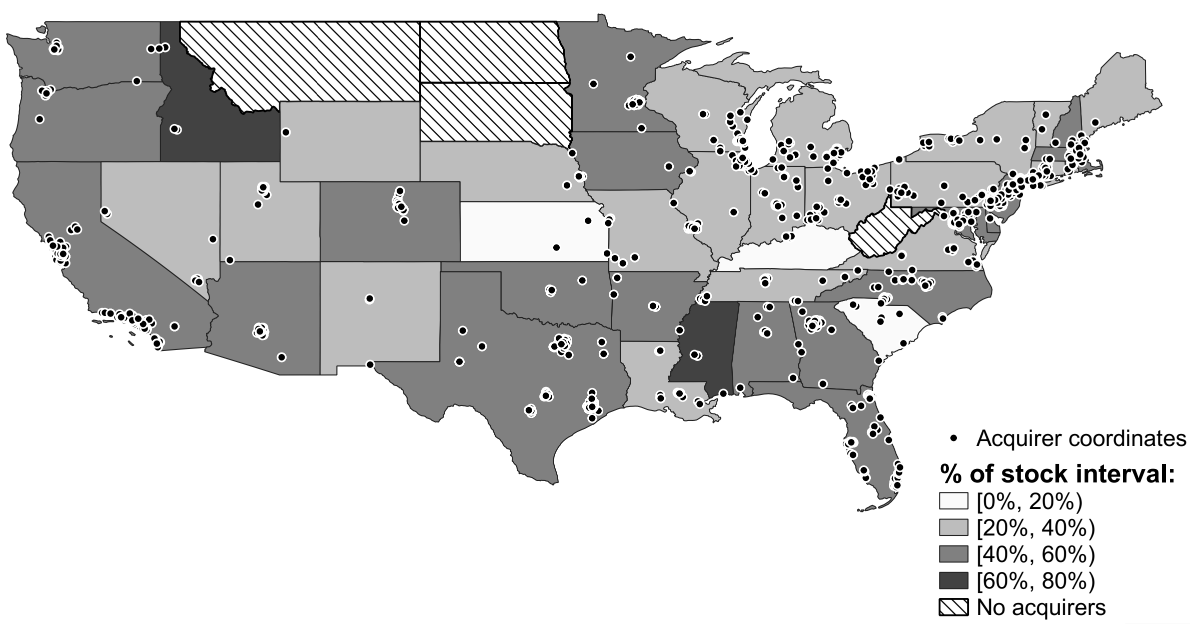
		(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(9)	Tar. is public	0.17									
(10)	Acq. cash > tar. value	-0.37	-0.16								
(11)	Acq. M/B	-0.09	0.00	0.00							
(12)	Log(acq. assets)	-0.16	0.31	0.09	-0.06						
(13)	Acq. leverage	0.13	0.14	-0.20	0.08	0.38					
(14)	Acq. dividends	0.00	0.12	-0.13	-0.08	0.39	0.32				
(15)	Acq. asset tangibility	0.14	0.13	-0.26	-0.12	0.19	0.31	0.27			
(16)	Acq. is high-tech	-0.11	-0.01	0.23	0.16	-0.12	-0.27	-0.25	-0.35		
(17)	Acq. in major metropolis	0.00	-0.01	0.04	0.06	0.00	-0.03	-0.07	-0.09	0.00	
(18)	Tar. in major metropolis	0.04	0.03	-0.01	0.01	0.01	0.01	-0.02	-0.08	0.02	0.15

Table 3.2: Distribution of payment method.

	Observations	% of transactions	% of stock Mean	St. dev.
All transactions	3,543		42.52	44.49
All-stock	1,053	29.72		
Mixed payment	883	24.92	51.37	25.13
All-cash	1,607	45.36		

Figure 3.1 plots the geographic coordinates of acquiring firms and the state-average percentage of stock included in the payment. Acquirers tend to cluster around densely populated areas, and in most cases, the state-average percentage of stock is between 20 and 60 percent, relatively close to the population mean shown in Table 3.2 (42.52%). Hence, the choice of the method of payment does not seem to depend on the specific location of acquirers.

Figure 3.1: Geographic coordinates of acquirers and average percentage of stock included in the payment among acquirers of the same state.



On average, it takes four hours and 10 minutes to move from the target's headquarters to the acquirer's headquarters. Figure 3.2 plots the distribution of travel time for the entire sample, all-cash deals, and deals paid entirely or in part with stocks. Considering all transactions, the figure shows that the distribution is close to bimodal, with many bidders acquiring either local firms or firms in a different city at an intermediate distance. This pattern is consistent with previous studies documenting a home bias in M&A (Chakrabarti and Mitchell, 2013; Kang and Kim, 2008; Ragozzino and Reuer, 2011). The graph also indicates that the distribution of stock-financed deals is shifted to the left (toward local transactions), while the distribution of all-cash deals is shifted to the right (toward distant transactions). Hence, while Figure 3.1 suggests that stock acquirers are equally likely across the country, the method of payment seems to be affected by the *relative* position of merging companies. The pattern is in line with Hypothesis 1(b): distance seems to reduce the probability of a stock payment, which would be expected if sellers become more reluctant to accept stock payments as the distance to the acquirers increases.

Figure 3.2: Distribution of travel time and payment method.

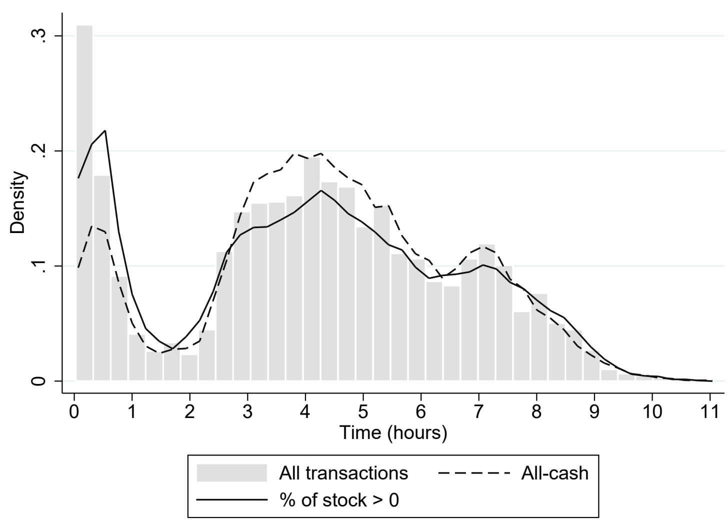
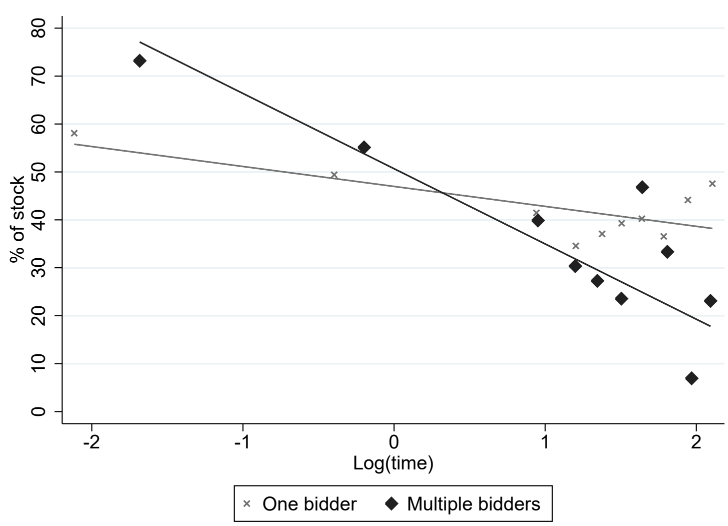


Figure 3.3 shows the relationship between the percentage of stock included in the payment and the logarithm of transportation time, distinguishing by whether the acquisition involved a single bidder or multiple competing bidders. For both types of deals, the graph indicates a clear negative association between travel time and the percentage of stock. This relationship is more negative for acquisitions with a competitive bidding process. This evidence is in line

with Hypothesis 2 and suggests that the more sellers have bargaining power, the more they leverage their bargaining power to avoid stock payments in distant transactions. The effect is also economically meaningful, with the percentage of stock in multiple-bidders transactions dropping by about 50 percentage points between deals with firms located a few minutes from each other and deals with firms located at more than eight hours from each other. A smaller but still significant drop is observed for single-bidder transactions. The figure also indicates that in both cases the relationship appears to be close to log-linear: this pattern is consistent with steep and nonlinear distance-decay curves found in other empirical studies on the effects of geography on economic and social behavior (e.g., Chakrabarti and Mitchell, 2013; Gimpel *et al.*, 2008; Sorenson and Stuart, 2001).

Figure 3.3: Percentage of stock in the acquisition payment and logarithm of transportation time (in hours) between merging companies: single-bidder vs. multiple-bidders deals.



Notes. Dots represent the mean percentage for bins of observations. The size of the bins is constant within each series.

Table 3.3 presents the results of the two-limit tobit models, in which the dependent variable is the percentage of stock included in the payment. Models 1 and 4 include the control variables, Models 2 and 5 introduce *Log(time)*, and Models 3 and 6 add the interaction term between *Log(time)* and *Number of other bidders*. Every specification includes announcement year and acquirer's industry fixed effects, and Models 4–6 also include acquirer's and target's state fixed effects. Standard errors reported in parentheses are clustered by CBSA pair in every regression. The results strongly support Hypothesis 1(b): an increase in the time required to move from one company to the other decreases the fraction of stock included in the payment. The p-value of the coefficient of *Log(time)* is close to zero across all specifications. Considering the marginal effects on the uncensored latent variable, Models 2 and 5 indicate that as the transportation time between companies increases by one percent, the percentage of stock included in the payment drops by about 0.1 percentage points. The coefficient of *Number of other bidders* is negative in every specification, suggesting that it is harder for acquirers to pay with stocks when they face competition from other bidders. In line with Hypothesis 2, Models 3 and 6 show that the interaction of *Number of other bidders* with *Log(time)* is negative and statistically significant (the p-values are 0.01 and 0.02, respectively). Thus, confirming the pattern observed in Figure 3.3, as the sellers' bargaining power increases, the relationship between travel time and the propensity to use stock considerations becomes more aligned with the sellers' preferences.

The table also shows that the percentage of stock is higher for relatively large targets. Since cash is primarily obtained by issuing new debt, relatively large transactions are more likely to be paid with stock because a cash payment would impose significant burdens on the bidder's financial conditions (Faccio and Masulis, 2005). The table also shows that the percentage of stock is higher for public firms. Sellers of private firms tend to prefer cash given the concentrated nature of their portfolio holdings (Faccio and Masulis, 2005). Finally, the percentage of stock increases as the valuations of the bidders—as measured by their market-to-book ratios—increase and decreases if the acquirers are large companies (*Log(acquirer assets)*), since large firms can more easily raise cash through debt markets, and if acquirers have enough cash capacity, as proxied by their cash reserves (*Acquirer cash > target value*), leverage (*Acquirer leverage*), and ability to disburse dividends (*Acquirer dividends*).

Next, we can investigate whether geographical proximity affects the sellers' ability to detect an overvalued stock offer. Table 3.4 shows the one-year and two-years buy-and-hold

Table 3.3: Two-limit tobit models for the percentage of stock included in the payment.

Dependent variable:	% of stock					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Log(time)		-10.10***	-9.62***		-9.23***	-8.78***
		(2.19)	(2.21)		(1.70)	(1.71)
Log(time) × Num. of other b.			-22.45**			-20.43**
			(8.72)			(9.00)
Num. of other bidders	-47.57***	-45.32***	-20.92	-48.14***	-46.26***	-24.56*
	(12.21)	(11.88)	(12.90)	(12.35)	(12.08)	(13.59)
Unrelated	-6.82	-6.61	-6.83	-3.76	-3.64	-3.83
	(5.55)	(5.49)	(5.48)	(5.48)	(5.45)	(5.45)
Large relative size	39.00***	36.53***	36.43***	34.49***	32.57***	32.44***
	(6.52)	(6.57)	(6.54)	(6.30)	(6.31)	(6.29)
Tar. is public	33.57***	33.45***	33.41***	33.86***	33.69***	33.68***
	(5.80)	(5.83)	(5.84)	(5.72)	(5.71)	(5.72)
Acq. cash > tar. value	-23.46***	-23.76***	-23.75***	-28.60***	-28.74***	-28.73***
	(6.66)	(6.72)	(6.70)	(6.49)	(6.52)	(6.51)
Acq. M/B	4.44***	4.43***	4.41***	3.88***	3.91***	3.89***
	(0.85)	(0.83)	(0.83)	(0.77)	(0.76)	(0.76)
Log(acq. assets)	-7.66***	-7.86***	-7.83***	-8.13***	-8.18***	-8.18***
	(1.85)	(1.85)	(1.84)	(1.84)	(1.85)	(1.84)
Acq. leverage	-42.96***	-40.46**	-40.49**	-27.55*	-25.93*	-25.90*
	(16.26)	(16.03)	(16.00)	(15.61)	(15.43)	(15.40)
Acq. dividends	-19.95***	-18.07***	-17.99***	-16.82***	-15.82***	-15.75***
	(6.08)	(5.81)	(5.79)	(5.93)	(5.84)	(5.82)
Acq. asset tangibility	-17.24	-20.04	-19.26	-6.13	-9.21	-8.52
	(17.25)	(17.50)	(17.45)	(17.92)	(17.86)	(17.83)
Acq. is high-tech	24.50**	24.03**	23.38**	18.95*	18.63*	17.92
	(11.25)	(11.20)	(11.25)	(11.21)	(11.19)	(11.25)
Acq. in major metropolis	6.70	5.86	5.97	-2.90	-3.14	-3.26
	(5.66)	(5.09)	(5.08)	(7.05)	(6.74)	(6.69)
Tar. in major metropolis	1.89	0.17	0.35	2.39	1.54	1.61
	(5.69)	(5.11)	(5.10)	(6.57)	(6.25)	(6.21)
Constant	92.88	105.93*	106.04*	78.88	95.70	96.28
	(62.64)	(63.40)	(63.17)	(68.49)	(68.98)	(68.94)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Acq. industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Acq. state fixed effects	-	-	-	Yes	Yes	Yes
Tar. state fixed effects	-	-	-	Yes	Yes	Yes
Pseudo R^2	0.08	0.08	0.08	0.09	0.09	0.09
Observations	3,543	3,543	3,543	3,543	3,543	3,543

Notes. Standard errors are reported in parentheses. Standard errors are clustered by core-based statistical area pair. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

abnormal returns on the acquirers' stocks, distinguishing by acquisition payment. In line with previous studies (Loughran and Vijh, 1997; Savor and Lu, 2009), stock payments tend to lose value in the long run, suggesting that sellers paid with stocks on average receive overvalued equity. The table also shows that the loss is larger for all-stock transactions, while all-cash bidders do not lose value in the long run.

Table 3.4: Buy-and-hold abnormal returns on acquirer's stocks.

	BHAR [-1,+250] (%)		BHAR [-1,+500] (%)	
	Mean	St. err.	Mean	St. err.
All transactions	-1.78	0.97	-6.54	1.49
All-stock	-6.86	2.06	-15.39	3.41
Mixed payment	-4.45	1.83	-8.97	2.77
All-cash	3.02	1.30	0.61	1.87

Notes. $BHAR\ [-1,+250]$ ($[-1,+500]$) is the buy-and-hold abnormal return—expressed as a percentage—on the acquirer's stocks for the period starting one trading day before the announcement and ending one year (two years) after the announcement.

The next two tables report the OLS estimates for the effect of travel time on the buy-and-hold returns on the acquirer's stock, distinguishing by whether the seller received stock (Table 3.5) or was paid only with cash (Table 3.6). Models 1–3 show the OLS estimates for one-year returns ($BHAR\ [-1,+250]$) and Models 4–6 for two-year returns ($BHAR\ [-1,+500]$). Models 2 and 5 in Table 3.5 provide strong support for Hypothesis 3: the long-run returns for a seller that receives a stock payment and holds onto the acquirer's stocks for one or two years decrease as a function of transportation time. In particular, the coefficient estimates indicate that as travel time increases by one percent, the one-year (two-years) returns drop by about 0.02 (0.03) percentage points. Hence, the results suggest that geographically close sellers are less likely to be paid with overvalued stocks. On the contrary, travel time does not have a significant effect on returns in all-cash transactions (Table 3.6).

A possible alternative interpretation of these findings is that distant targets bought with equity are on average riskier and—as a consequence—the value of the combined entity's stocks tends to drop more for stock-financed acquisitions of distant firms. If this is the case, however, we should expect that the negative impact of the target on the acquirer's market value will depend on the relative size of the target (Hansen, 1987). If the target is relatively small compared with the acquirer, its ability to drive down the acquirer's stock price should be mitigated. To test for this possibility, Models 3 and 6 include the interaction between *Log(time)* and *Large relative size*. The interaction shows a positive sign (opposite to what we would expect if distant targets were responsible for the drop in the acquirer's stock value) and is never statistically significant. In other words, targets do not seem to be the main driver of the effect of distance on the long-run returns on the bidder's stocks.

Finally, we can test whether distance affects the probability that the target's CEO sits on the bidder's board after the acquisition. Table 3.7 shows that the target's CEO has a seat on the acquirer's board in about nine percent of the cases, and the frequency is higher in stock-financed transactions (14% in all-stock deals and 13% in mixed payment deals) and lower in all-cash transactions (3%). In other words, the table suggests that merging firms are more likely to integrate their governance structures in stock-financed transactions. Table 3.8 presents the probit model estimates for the effect of transportation time. The results confirm Hypothesis 4: travel time reduces the probability that the target's CEO sits on the acquirer's board after the acquisition. Specifically, the average marginal effects from Models 2 and 3 indicate that a one percent increase in travel time decreases the probability of board membership by 0.01 percentage points.

3.5 Conclusions

The seller's side of M&As has received little attention in the strategy literature. Because M&As are the outcomes of bargaining processes involving acquirers and sellers, an exclusive focus on the acquirer's side of acquisitions can provide only a partial understanding of the market for corporate control. This paper brings attention to this important research gap, while analyzing how ownership of merged companies is allocated between sellers and acquirers through the choice of the method of payment. In particular, this study shows that while a theory focused only on the acquirer's informational dilemmas would lead to predict a positive relationship between merging companies' informational distance and the propensity to use stock considerations, a theory that also considers the seller's informational problems would lead to an opposite prediction. I test these competing hypotheses by looking at how the information asymmetries arising from geographical distance influence the choice of the method of payment. The empirical results indicate that the seller's informational dilemmas are a critical determinant of how ownership of the combined entity is allocated: an increase in travel time between merging companies reduces the fraction of stock included in the payment, and such negative effect becomes stronger when the seller has greater bargaining power. I further hypothesized that an increase in transportation time can both reduce the seller's ability to detect an overvalued stock offer and increase the cost of performing governance on the acquirer after the acquisition. These predictions also find empirical support. On the one hand, greater travel time increases the chances that the seller is paid with equity that drops in value in the years following the acquisition announcement. On the other hand, greater travel time reduces the seller's ability to perform governance activities on the acquirer, as proxied by the probability that the target's CEO sits on the bidder's board after the acquisition.

These findings also have implications for acquirers. In particular, the sellers' reluctance to accept a stock payment from distant bidders implies that only firms that acquire locally will be able to pay with equity, while those that plan to expand geographically through acquisitions will be able to do so mostly by using cash. Therefore, while a firm's financial constraints can limit its ability to engage in acquisitions,[12] such constraints might be less binding if the firm decides to acquire local targets, which could more easily be bought with equity. Moreover, the benefits associated with stock payments—such as their risk-reduction properties (Hansen, 1987) and the lower tax liabilities (Datta *et al.*, 1992; Hayn, 1989)—could disproportionately favor firms that acquire local companies. Hence, this paper provides additional insights on the reasons underlying acquirers' preference for local targets, which has been documented in previous studies (Chakrabarti and Mitchell, 2013).

[12] E.g., see Blonigen and Taylor (2000), Lehto and Lehtoranta (2004), and Huyghebaert and Luypaert (2010).

There are some caveats that are worth mentioning. For instance, a key assumption of this study is that the selling shareholders' representatives during the acquisition negotiation phase (e.g., the target's executives) act in the best interest of the selling shareholders (or are themselves the main owners of the company). If the target's representatives do not have incentive to maximize the long-run returns of selling shareholders, then their inability to adequately assess the bidder's value or to monitor its behavior after the acquisition might have limited effect on the choice of the method of payment. Moreover, I assumed that the seller's ability to perform governance on the acquirer can be proxied by the probability that the target's CEO joins the acquirer's board after the transaction. However, I do not observe whether target's shareholders nominate other directors to represent their interests in the acquirer's governance. While a complete mapping of how firms adjust their governance structures after a merger is beyond the scope of this paper, this is an important topic for future research.

Table 3.5: OLS models for the buy-and-hold abnormal returns on the acquirer's stocks: all-stock and mixed-payment transactions.

Dependent variable:	BHAR [-1, +250] (%)			BHAR [-1, +500] (%)		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Log(time)		-2.24**	-3.49**		-2.77**	-3.98**
		(1.00)	(1.37)		(1.14)	(1.97)
Log(time) × Large rel. size			3.31			3.18
			(2.20)			(4.17)
Num. of other bidders	-3.37	-3.34	-3.40	13.26*	13.29*	13.23*
	(4.97)	(5.04)	(5.04)	(7.54)	(7.55)	(7.63)
Unrelated	-1.31	-1.20	-1.05	0.59	0.73	0.87
	(3.58)	(3.58)	(3.57)	(5.50)	(5.50)	(5.52)
Large relative size	-3.17	-3.58	-6.13	-7.24	-7.75	-10.20
	(3.90)	(3.92)	(4.26)	(5.62)	(5.66)	(7.23)
Tar. is public	-4.96	-4.98	-5.10	-10.09*	-10.11*	-10.24*
	(3.83)	(3.82)	(3.82)	(5.38)	(5.38)	(5.41)
Acq. cash > tar. value	0.33	0.27	0.19	-8.27	-8.34	-8.42
	(3.77)	(3.76)	(3.69)	(6.19)	(6.18)	(6.16)
Acq. M/B	-0.11	-0.10	-0.09	-0.38	-0.37	-0.37
	(0.23)	(0.23)	(0.23)	(0.30)	(0.30)	(0.30)
Log(acq. assets)	0.92	0.88	0.90	1.97	1.92	1.94
	(1.14)	(1.15)	(1.14)	(1.74)	(1.72)	(1.72)
Acq. leverage	3.60	3.93	3.67	20.73	21.13	20.88
	(8.93)	(8.91)	(8.93)	(14.01)	(14.00)	(13.99)
Acq. dividends	-2.36	-1.94	-2.00	6.53	7.05	7.00
	(3.66)	(3.64)	(3.64)	(6.49)	(6.46)	(6.47)
Acq. asset tangibility	6.07	5.40	5.33	5.12	4.29	4.23
	(11.76)	(11.70)	(11.65)	(17.23)	(17.34)	(17.29)
Acq. is high-tech	-7.10	-7.13	-7.47	-21.16**	-21.20**	-21.53**
	(7.73)	(7.67)	(7.67)	(10.74)	(10.68)	(10.67)
Acq. in major metropolis	-5.17	-5.09	-4.80	-12.47*	-12.37*	-12.09*
	(4.49)	(4.48)	(4.51)	(6.76)	(6.74)	(6.78)
Tar. in major metropolis	2.24	2.25	2.41	2.07	2.08	2.24
	(4.22)	(4.19)	(4.20)	(6.39)	(6.36)	(6.36)
Constant	-31.59	-28.12	-25.65	28.47	32.77	35.13
	(26.51)	(25.83)	(25.95)	(38.56)	(37.63)	(37.44)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Acq. industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Acq. state fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Tar. state fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.08	0.09	0.09	0.11	0.11	0.11
Observations	1,936	1,936	1,936	1,936	1,936	1,936

Notes. BHAR $[-1, +250]$ ($[-1, +500]$) is the buy-and-hold abnormal return—expressed as a percentage—on the acquirer's stocks for the period starting one trading day before the announcement and ending one year (two years) after the announcement. Standard errors are reported in parentheses. Standard errors are clustered by core-based statistical area pair. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 3.6: OLS models for the buy-and-hold abnormal returns on the acquirer's stocks: all-cash transactions.

Dependent variable:	BHAR [-1, +250] (%)			BHAR [-1, +500] (%)		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Log(time)		-0.90	-0.75		-0.26	-0.85
		(1.28)	(1.29)		(1.94)	(2.17)
Log(time) × Large rel. size			-0.78			3.04
			(4.16)			(5.28)
Num. of other bidders	-2.04	-1.61	-1.59	-15.60	-15.48	-15.58
	(7.95)	(8.01)	(8.01)	(9.76)	(9.90)	(9.91)
Unrelated	1.81	1.76	1.75	-2.73	-2.74	-2.70
	(3.14)	(3.14)	(3.15)	(4.01)	(4.02)	(4.02)
Large relative size	4.17	4.04	4.92	2.51	2.47	-0.93
	(5.35)	(5.35)	(6.75)	(7.15)	(7.14)	(8.92)
Tar. is public	1.00	0.97	0.98	0.87	0.86	0.82
	(3.58)	(3.58)	(3.59)	(4.94)	(4.95)	(4.95)
Acq. cash > tar. value	-1.01	-1.05	-1.06	-0.36	-0.37	-0.35
	(3.47)	(3.47)	(3.47)	(4.43)	(4.44)	(4.44)
Acq. M/B	-0.51	-0.49	-0.49	-0.32	-0.31	-0.32
	(0.44)	(0.44)	(0.44)	(0.50)	(0.50)	(0.50)
Log(acq. assets)	-1.84	-1.84	-1.84	0.85	0.85	0.84
	(1.53)	(1.54)	(1.54)	(1.91)	(1.91)	(1.90)
Acq. leverage	18.88	18.85	18.78	2.35	2.34	2.61
	(11.64)	(11.65)	(11.64)	(16.30)	(16.31)	(16.23)
Acq. dividends	-3.17	-3.20	-3.22	-2.92	-2.93	-2.85
	(3.43)	(3.44)	(3.42)	(4.77)	(4.77)	(4.77)
Acq. asset tangibility	8.86	8.71	8.70	-3.60	-3.65	-3.61
	(11.06)	(11.06)	(11.06)	(14.48)	(14.44)	(14.45)
Acq. is high-tech	-0.85	-1.01	-0.95	-9.09	-9.13	-9.35
	(7.07)	(7.09)	(7.09)	(11.82)	(11.86)	(11.91)
Acq. in major metropolis	-8.04*	-8.03*	-8.06*	2.19	2.20	2.29
	(4.55)	(4.52)	(4.51)	(6.38)	(6.37)	(6.38)
Tar. in major metropolis	-3.54	-3.69	-3.70	-9.08*	-9.12*	-9.07*
	(3.62)	(3.64)	(3.62)	(5.17)	(5.18)	(5.17)
Constant	-49.30	-47.30	-47.32	16.04	16.61	16.68
	(35.25)	(35.31)	(35.31)	(43.65)	(43.91)	(43.94)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Acq. industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Acq. state fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Tar. state fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.10	0.10	0.10	0.09	0.09	0.09
Observations	1,606	1,606	1,606	1,606	1,606	1,606

Notes. BHAR $[-1,+250]$ ($[-1,+500]$) is the buy-and-hold abnormal return—expressed as a percentage—on the acquirer's stocks for the period starting one trading day before the announcement and ending one year (two years) after the announcement. Standard errors are reported in parentheses. Standard errors are clustered by core-based statistical area pair. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 3.7: Percentage of targets' CEOs that sit on the acquirers' board of directors after the acquisition.

	Board seat (%)	St. err.
All transactions	8.69	0.47
All-stock	13.68	1.06
Mixed payment	13.25	1.14
All-cash	2.92	0.42

Table 3.8: Probit models for the probability that target's CEO sits on the acquirer's board of directors after the acquisition.

Dependent variable:	1 = Board seat 0 = Otherwise		
	Model 1	Model 2	Model 3
Log(time)		-0.06**	-0.05**
		(0.03)	(0.02)
Num. of other bidders	-0.46**	-0.45**	-0.46**
	(0.20)	(0.20)	(0.22)
Unrelated	-0.08	-0.08	-0.03
	(0.07)	(0.07)	(0.08)
Large relative size	0.57***	0.56***	0.60***
	(0.08)	(0.08)	(0.08)
Tar. is public	0.59***	0.59***	0.62***
	(0.07)	(0.07)	(0.07)
Acq. cash > tar. value	-0.46***	-0.47***	-0.49***
	(0.08)	(0.08)	(0.09)
Acq. M/B	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)
Log(acq. assets)	-0.06***	-0.07***	-0.07***
	(0.02)	(0.02)	(0.02)
Acq. leverage	-0.50***	-0.49**	-0.39**
	(0.19)	(0.19)	(0.20)
Acq. dividends	0.03	0.04	0.07
	(0.07)	(0.08)	(0.08)
Acq. asset tangibility	-0.17	-0.18	-0.07
	(0.23)	(0.23)	(0.24)
Acq. is high-tech	-0.12	-0.13	-0.12
	(0.15)	(0.16)	(0.16)
Acq. in major metropolis	0.12*	0.11*	0.11
	(0.06)	(0.06)	(0.09)
Tar. in major metropolis	0.08	0.07	0.05
	(0.07)	(0.07)	(0.09)
Constant	-5.76***	-5.64***	-6.78***
	(0.38)	(0.38)	(0.09)
Year fixed effects	Yes	Yes	Yes
Acq. industry fixed effects	Yes	Yes	Yes
Acq. state fixed effects	-	-	Yes
Tar. state fixed effects	-	-	Yes
Pseudo R^2	0.16	0.17	0.21
Observations	3,543	3,543	3,543

Notes. Standard errors are reported in parentheses. Standard errors are clustered by core-based statistical area pair. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

CHAPTER 4

The Market Value Spillovers of Mergers and Acquisitions: Disentangling Rivalry and Technological Signaling Effects

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Previous studies indicate that rivals of two merging firms experience positive stock market reactions at the merger announcement. The general interpretation of this phenomenon is that the acquisition reveals to the stock market new information about opportunities available to all industry participants, while there is no evidence that rivals could be damaged by the creation of a more efficient competitor. In this paper, I argue that the net spillover effect of a merger on an outsider can be empirically decomposed into a positive opportunity-signaling effect and a negative business-stealing effect. The first element is a function of the similarity between the outsider's technological resources and those of the acquired firm, while the second depends on the proximity between the two firms' product markets.

4.1 Introduction

Mergers and acquisitions (M&As) are important means firms can use to expand their scale and scope (Capron and Mitchell, 2012; Lee and Lieberman, 2009; Villalonga and McGahan, 2005; Wang and Zajac, 2007). The strategic management literature shows how and when combining organizational resources can provide a competitive advantage to merging firms in the form of operational or financial synergies (e.g., Ahuja and Katila, 2001; Barney, 1988; Capron and Pistre, 2002; Chatterjee, 1986). However, while it is argued that synergies arising from an M&A can provide an edge in the competition arena, there is no clear evidence of a negative effect of takeovers on the valuation of the merging firms' competitors. On the contrary, studies that examine the effect of a merger announcement on rival firms' valuation almost unanimously find that competitors experience positive abnormal returns (Cai *et al.*, 2011; Chatterjee, 1986; Clougherty and Duso, 2009, 2011; Eckbo, 1983, 1985, 1992; Eckbo and Wier, 1985; Fee and Thomas, 2004; Gaur *et al.*, 2013; Mitchell and Mulherin, 1996; Shahrur, 2005; Song and Walkling, 2000; Stillman, 1983). While scholars have ruled out the possibility that such gains are due to an increase in industry concentration and market power (Eckbo, 1983, 1985, 1992; Eckbo and Wier, 1985; Fee and Thomas, 2004; Shahrur, 2005; Stillman, 1983), the general interpretation is that rivals benefit because the merger reveals to the stock market new information about opportunities available to all industry participants. For instance, rivals' stock prices could rise if the market infers that the value of certain specialized resources generally owned throughout the industry has increased (perhaps because of significant technological improvements) or that rivals could realize efficiency gains through future mergers of their own.

If a merger is motivated by efficiency reasons, the net impact of its announcement on rivals' valuation should be given by the sum of a positive information effect deriving from news about valuable opportunities and a negative rivalry effect due to the creation of a stronger competitor (Chatterjee, 1986; Eckbo, 1983). Because the net impact is typically positive, there is no clear evidence that mergers have any negative competitive effects. The objective of this paper is to disentangle these two spillover effects and determine their relative importance. I argue that to identify these two channels, we have to characterize outsiders along two dimensions. First, industry participants will be able to take advantage of any opportunity signaled by the merger as long as their *resources* are similar to those of the merging firms. Second, any competitive effects will depend on the extent to which firms compete in the same product *markets* and have to duel to win the same customers. Hence, while positive information effects should be driven by firms' resource similarities, negative rivalry effects should depend on firms' market similarities.

Scholars have shown that because companies can focus similar capabilities to a different extent to different markets (Chen, 1996), a firm's technological resources portfolio does not perfectly predict its position in the product market space (Bloom *et al.*, 2013; Branstetter and Sakakibara, 2002; Silverman, 1999). In this paper, I exploit this empirical variation to identify the positive opportunity signaling effect and negative rivalry effect on outsiders to an M&A. By looking at the abnormal returns to M&A announcements in the U.S. electronics industries from the period 1980–2011, I find that an outsider's returns increase with its technological proximity and decrease with its product market proximity to the firm being acquired. Because the magnitude of the information effect is greater than that of the rivalry effect, outsiders that are identical to the target firm on both dimensions, on average, gain market value at the announcement.

As Haleblian *et al.* (2009, p. 488) note, while the literature on M&As is extensive, very few studies have examined the effects of mergers on outsiders. By addressing this gap, this study contributes to previous research in different ways. First, the lack of evidence of negative business-stealing spillovers on outsiders is particularly puzzling considering the general claim that synergistic M&As can provide an advantage to merging firms (Ahuja and Katila, 2001; Barney, 1988; Capron and Pistre, 2002; Chatterjee, 1986). To address this inconsistency, this paper proposes a method to empirically measure the negative competitive spillovers induced by an M&A announcement.

Moreover, this paper provides new evidence of how a firm's technological similarity to an acquired firm can impact investors' expectations about its future profitability. In particular, the stock market infers that only outsiders that have technological resources sufficiently similar to the firm being acquired are in the position to replicate any advantage revealed upon the M&A announcement. Hence, while previous literature has highlighted that knowledge-based assets are a central component of a firm's value (e.g., Hall *et al.*, 2005, 2007), this study indicates that the market can infer the value of those resources from other firms' M&A decisions.

Finally, it contributes to the broad stream of research on the spillover effects of firms' strategic actions. While there is a considerable body of literature investigating the impact of firms' organic growth decisions, such as R&D investments (Bloom *et al.*, 2013; Branstetter and Sakakibara, 2002; Hall *et al.*, 2010; Jaffe *et al.*, 1993; McGahan and Silverman, 2006), we still have little knowledge of the ramifications of their external growth choices, such as alliances (Oxley *et al.*, 2009) or M&As (Gaur *et al.*, 2013; Valentini, 2016).

4.2 Theory

4.2.1 Previous evidence on the market value spillovers of M&As

Empirical studies on the effect of a merger on the stock market valuation of competing firms typically find that rivals earn significantly positive cumulative abnormal returns (CAR) at the announcement. Table 4.1 provides an overview of these findings. The general explanation for such gains is that the merger conveys information to the stock market about valuable opportunities available to rivals. Eckbo (1983) claims that "since the production technologies of close competitors are (by definition) closely related, the news of a proposed efficient merger can also signal opportunities for the rivals to increase *their* productivity" (p. 244). Similarly, Chatterjee (1986) argues that "the merger announcement may contain 'information' about a process innovation or a technological innovation" (p. 122) that could be replicated by competitors. This "information effect" occurs both in horizontal and non-horizontal mergers. Rivals are defined as companies that operate in the same industry of one or both of the merging firms. Most of the studies document a positive effect on the target's rivals (Chatterjee, 1986; Eckbo, 1983, 1985, 1992; Mitchell and Mulherin, 1996; Song and Walkling, 2000) or, in the case of horizontal M&As, the rivals of both merging firms (Clougherty and Duso, 2009, 2011; Eckbo and Wier, 1985; Fee and Thomas, 2004; Shahrur, 2005; Stillman, 1983), while two more recent studies suggest that also the acquirer's rivals might experience a similar effect (Cai *et al.*, 2011; Gaur *et al.*, 2013).

Rivals' stock prices could rise on a merger announcement if the stock market infers that there is an increase in value of certain resources owned by industry participants, or that rivals could realize efficiency gains through future M&As. While most of the studies are relatively agnostic about the specific mechanism of replication, Song and Walkling (2000) and Cai *et al.* (2011) claim that competitors' returns are related to the probability that they will engage in M&As themselves. Specifically, Song and Walkling (2000) argue that the appearance of a bidder willing to pay a premium over the market price for a target signals to the market that for at least one firm the target's valuation is higher than the target's market price. Hence, target rivals' stock price is adjusted to account for the revised probability of being acquired. Similarly, Cai *et al.* (2011) indicate that the returns of the bidder's rivals around the announcement of an acquisition are related to the probability that they will become bidders themselves.

In horizontal mergers, these gains could also derive from the potential anticompetitive effects of the merger. In particular, the merger could benefit rivals by reducing the costs of enforcing a tacit collusive agreement to limit output and raise product prices and/or lower factor prices. However, such explanation has been rejected by different empirical tests. Stillman (1983), Eckbo (1983), Eckbo and Wier (1985), and Fee and Thomas (2004) find no evidence that the announcement of an antitrust complaint reduces rivals' gains. Eckbo (1985, 1992) shows that rivals' gains are not positively correlated with the change in industry concentration implied by the merger or with the pre-merger level of concentration. Moreover, Fee and Thomas (2004) and Shahrur (2005) provide further evidence inconsistent with the collusion hypothesis by looking at the wealth effects of the merger on suppliers and corporate customers.

Table 4.1: Previous findings.

Study	Countries	Industries	Period	M&A type	Rivals definition	Rivals' returns[a]
Eckbo (1983)	U.S.	Mining and manufacturing	1963–1978	Horizontal and vertical	Same SIC code of target	CAR[-3, 3]: 1.05% (horizontal), 1.52% (vertical)
Stillman (1983)	U.S.	All except financial and regulated	1964–1972	Horizontal	Rivals of acquirer and target, as defined in antitrust cases	AR[0]: 0.40%[b]
Eckbo (1985)	U.S.	Mining and manufacturing	1963–1981	All	Same SIC code of target	Average AR[-3, 3]: 0.58% (horizontal), -0.07% (non-horizontal)
Eckbo and Wier (1985)	U.S.	Mining and manufacturing	1963–1981	Horizontal	Same SIC code of acquirer and target, or as defined in antitrust cases	CAR[-3, 3]: 1.4% (SIC code rivals), 1.2% (rivals defined by antitrust agency)
Chatterjee (1986)	U.S.	All	1969–1972	Related non-horizontal (product extension) and unrelated	Same SIC code of target	CAR[-2, 2]: 1.16% (related non-horizontal), 0.89% (unrelated)
Eckbo (1992)	U.S. and Canada	Mining and manufacturing	1963–1982	All	Same SIC code of target	U.S.: average AR[-20, 10]: 1.26% (horizontal), -0.87% (non-horizontal). Canada: average AR[month 0]: -1.51% (horizontal), 2.42% (non-horizontal)
Mitchell and Mulherin (1996)	U.S.	All except financial and regulated	1982–1989	All	Same Value Line industry of target	CAR[month 0]: 0.5%
Song and Walkling (2000)	U.S.	All except financial and regulated	1982–1991	All	Same Value Line industry of target	CAR[-1, 0]: 0.36%
Fee and Thomas (2004)	U.S.	All except financial and regulated	1980–1997	Horizontal	Same SIC code of acquirer and target	CAR[-1, 1]: 0.24%
Shahrur (2005)	U.S.	All except financial	1987–1999	Horizontal	Same SIC code of acquirer and target	CAR[-2, 2]: 0.39%
Clougherty and Duso (2009, 2011)	Europe	All	1990–2002	Horizontal	Rivals of acquirer and target, as defined in antitrust cases	CAR[-1, 1]: 0.37%
Cai et al. (2011)	U.S.	All except financial and regulated	1985–2009	All	Same SIC code of acquirer	CAR[-20, 1]: 1.88%
Gaur et al. (2013)	China	All	1993–2008	All	Same SIC code of acquirer	CAR[-1, 1]: 0.16%

Notes. [a] CAR[-x, y] indicates the cumulative abnormal returns over the event window starting x days before the announcement and ending y days after. [b] Average abnormal return among the reported deal announcements (pp. 236–238).

4.2.2 Rivalry and opportunity signaling effects

While rivals might benefit from an information effect inducing positive stock market reactions, they might also be harmed by the competitive effects of an acquisition. M&As allow firms to combine their resources and capabilities to improve their competitiveness (Haspeslagh and Jemison, 1991; Hitt *et al.*, 2001). Merging companies can benefit from operational or financial synergies (Barney, 1988; Capron and Pistre, 2002; Chatterjee, 1986). Indeed, studies show that on average, M&As create value for the shareholders of the two merging firms combined (see Haleblian *et al.* 2009 for a review of these findings). Ahuja and Katila (2001) and Bena and Li (2014) also find that M&As can foster the innovation capabilities of merging firms.

Hence, as Eckbo (1983) argues, if a merger is motivated by efficiency reasons, the expected sign of the announcement period abnormal returns of rivals is *unrestricted*. On the one hand, there is an opportunity signaling effect raising rivals' valuation. On the other, rivals will have to face a tougher competitor, which could drive down their expected profitability. Both effects are likely to be stronger for rivals of the target firm. Indeed, the acquisition is more likely to reveal new information about the valuation of the resources of the firm being acquired rather than those of the acquiring firm (Chatterjee, 1986; Eckbo, 1983; Mitchell and Mulherin, 1996; Song and Walkling, 2000). Moreover, because acquirers are typically larger and more mature companies, an acquisition is likely to have a smaller impact on their competitiveness compared with the target company (Chatterjee, 1986).

The total wealth impact on the rivals can be written as the sum of the positive information and negative competitive effects (Chatterjee, 1986):

$$\Delta W_{i,j} = I_{i,j} + R_{i,j}, \tag{4.1}$$

where $\Delta W_{i,j}$ is the net change in the market value of outsider firm i following the announcement of the acquisition of firm j (where i is different from j or j's acquirer), $I_{i,j}$ is the gain from the information effect, and $R_{i,j}$ is the loss from the rivalry effect. As Table 4.1 indicates,

$\Delta W_{i,j}$ is generally found to be positive. Hence, there is no clear evidence of the negative competitive effects of M&As.[1]

To disentangle the rivalry and signaling effects, we need to characterize rival firms along two dimensions. On the one hand, the extent to which the acquired firm and an outsider share the same opportunities depends on the similarity of their resources. Research in the resource-based view framework has highlighted how a firm's ability to compete in its markets, innovate, and adapt to technological change critically relies on the characteristics of its resource base (Barney, 1991; Eisenhardt and Martin, 2000; Peteraf, 1993; Teece *et al.*, 1997; Wernerfelt, 1984). Accordingly, firms may be able to mimic other firms' behavior only when their resource endowments are comparable (Helfat and Lieberman, 2002; Lieberman and Asaba, 2006). It follows that a merger should act as a positive signal only for outsiders that have analogous resources to the acquired company and are therefore expected to replicate any advantage revealed through the announcement. On the other hand, any business-stealing effect depends on the extent to which the outsider and the target operate in the same markets and therefore directly compete to sell their products to the same customers (Bloom *et al.*, 2013; Branstetter and Sakakibara, 2002; Chen, 1996). If the outsider operates in different product markets, a synergy-creating merger should be of little threat to the outsider's profitability.

As long as the same measure is used to characterize resources' and product markets' similarities, the information effect and the competitive effect cannot be empirically separated. Because previous studies relied on a single market-based measure to define rival firms, they were not able to disentangle the two channels. The literature on innovation indicates that when a firm's technological assets are a good proxy for the firm's overall capabilities, we can distinguish these two dimensions. For instance, Silverman (1999) uses patent data to investigate the effects of firms' heterogeneous technological resources on their diversification

[1] Chatterjee (1986) assumes that the information effect is the same across different classes of rivals and uses the relative magnitude of the wealth gain of rivals as an indicator of the competitive effect of the merger. However, the assumption of constant information effects is quite strong, and there is no a priori reason to expect it to hold.

decisions. Because firms can focus similar capabilities to a different extent to different markets, firms' technological resources and product market portfolios do not completely overlap. Indeed, Chen (1996) argues that any two firms are unlikely to have identical degrees of market commonality and of resource similarity with each other. The consequences of this imperfect correspondence have been examined in different studies. For example, studying Japanese government-sponsored research consortia, Branstetter and Sakakibara (2002) show that the increase in research productivity of participating firms is positively related to the extent to which participants have overlapping knowledge bases and negatively related to the extent to which they compete in the same product markets. Similarly, Bloom *et al.* (2013) distinguish between firms' positions in the technology space and in the product market space to study R&D spillovers, and show that firms' performance is simultaneously affected by a positive spillover effect from technology spillovers and a negative business-stealing effect from product market rivals.

Applying similar logic to our context, we can expect that the positive information effect to an outsider will depend on how similar the firm's technological assets are to those of the acquired firm. Instead, the negative competition effect will be related to the extent to which the firm sells its products in the same markets of the acquired firm. Hence, we can rewrite equation 4.1 as:

$$\Delta W_{i,j} = I(\mathit{TechProx}_{i,j}) + R(\mathit{MktProx}_{i,j}), \tag{4.2}$$

where $\mathit{TechProx}_{i,j}$ and $\mathit{MktProx}_{i,j}$ measure, respectively, the technological proximity and the product market proximity between outsider i and target j. The next section introduces a method to empirically estimate the opportunity signaling and rivalry effects.

4.3 Empirical methods

4.3.1 Data

Electronics industries are an ideal context to test equation 4.2. In these industries, technologies are a core element of a firm's capabilities (Hall *et al.*, 2005; Hall and Ziedonis, 2001; Oxley *et al.*, 2009; Walcott, 2000; Ziedonis, 2004). Moreover, companies have a high propensity to patent their technologies—also for negotiating cross-licensing agreements—which provides a way to measure the technological similarity between companies.

M&A data are collected from the Thompson SDC Platinum database. I consider M&A announcements in the period 1980–2011 between public companies present in the CRSP-Compustat database, in which the target has primary Standard Industrial Classification (SIC) code 36 (electronics). Since small acquisitions might have limited competitive effects, I consider deals where the target's value is at least $10 million (see also, e.g., Uysal *et al.* 2008 and Savor and Lu 2009). An outsider i to the acquisition of target j is defined as any company—other than j or j's acquirer—present in CRSP-Compustat and with primary SIC code 36. The advantage of using a relatively broad definition of relevant outsiders to a merger, at the two-digit level, is that it allows us to maximize the presence of firms with partially overlapping patent or product market portfolios with the target. Data on companies' patents are obtained from Kogan *et al.* (2017), who matched companies present in the CRSP database to Google Patents.[2] This match covers all utility patents issued by the U.S. Patent and Trademark Office (USPTO) during the period 1926–2010. Because our hypothesis focuses on firms with technological assets, I consider only outsiders and targets that were assigned at least one patent during the five years preceding the acquisition announcement year. Finally, the breakdown of companies' sales by four-digit SIC codes is obtained from the Compustat Segments (Business Segments) database.

4.3.2 Model

To examine the effect of the announcement of the acquisition of firm j on the abnormal returns of outsider i, I estimate the following model:

$$CAR_{i,j} = \beta^I \, TechProx_{i,j} + \beta^R MktProx_{i,j} + \alpha_j + X_{i,j}\gamma + \epsilon_{i,j}, \tag{4.3}$$

[2] I obtain similar results using patent data from the NBER Patent Data Project (Hall *et al.*, 2001), which cover the period 1976–2006.

where $CAR_{i,j}$ is the cumulative abnormal return on i's stock over a time window surrounding acquisition j's announcement date, α_j is a deal announcement fixed effect, $X_{i,j}$ is a vector of characteristics of firm i at the time of acquisition j, γ is the corresponding vector of coefficients, and $\epsilon_{i,j}$ is the error term. The coefficients β^I and β^R are the estimators of the information effect and rivalry effect defined in equation 4.2. All the regressors are measured at the end of the year before the acquisition is announced. In the most restrictive specification, the model is estimated by substituting $X_{i,j}\gamma$ with a firm $i \times$ year fixed effect, to obtain the estimates of β^I and β^R by controlling for the unobservable characteristics of firm i in the year of acquisition j. Finally, because errors associated with the same announcement date or the same firm might not be independent from each other, coefficients are estimated with robust standard errors two-way-clustered by date and firm (Cameron *et al.*, 2011).

Below I define the empirical variables.

4.3.2.1 Cumulative abnormal returns

The stock market reaction to the acquisition announcement is measured as the cumulative abnormal returns on outsider i's stock over a window of time surrounding the acquisition announcement date ($t = 0$). Specifically, I estimate on the 240-day pre-acquisition period from $t = -260$ to $t = -21$, the market model $r_{it} = \theta_i + \lambda_i r_{mt} + \nu_{it}$ (Fama *et al.*, 1969), where r_{it} is the stock return of firm i on trading day t, r_{mt} is the daily market return on the CRSP value-weighted index, θ_i and λ_i are parameters specific to the company, and ν_{it} is the error term. Abnormal returns are then calculated as the residuals $\hat{\nu}_{it} = r_{it} - \hat{r}_{it}$, where $\hat{r}_{it} = \hat{\theta}_i + \hat{\lambda}_i r_{mt}$ are the predicted returns, and $\hat{\theta}_i$ and $\hat{\lambda}_i$ the estimated coefficients. Finally, the cumulative abnormal returns are calculated by summing the daily abnormal returns $\hat{\nu}_{it}$ over a window of n trading days around the announcement date. I consider a three-day event window starting one trading day before the announcement and ending one day after as the baseline measure (*CAR [-1, 1]*), and I report results with alternative windows as robustness checks. Cumulative abnormal returns are expressed in percentages. To ensure that abnormal returns are not confounded by different acquisition announcements (see also

Oxley *et al.*, 2009), I exclude an outsider's returns if more than one firm with overlapping four-digit SIC codes or three-digit patent classes with the outsider were involved in an M&A announcement (as an acquirer or as a target) within three trading days from each other.

4.3.2.2 Technological proximity

The technological proximity between firm i and target j quantifies the similarity between their patent portfolios at the end of the year before the acquisition announcement. Specifically, following Jaffe (1986), I define technological proximity as:

$$TechProx_{ij} = \frac{T_i T_j'}{\sqrt{T_i T_i'}\sqrt{T_j T_j'}},$$

where T_i (T_j) is the vector representing the distribution of patents issued to firm i (target j) across the 426 three-digit USPTO technological classes. In particular, the c-th element of vector T_i (T_j) measures the fraction of i's (j's) patents that are in technological class c. The distributions are computed considering the patents granted during the five years preceding the acquisition announcement year. This index represents the uncentered correlation between the vectors T_i and T_j, and equals one if firms have identical patent distributions and zero if they have no overlap.

4.3.2.3 Market proximity

A similar index is used to quantify the similarity between i's and j's product market portfolios (Bloom *et al.*, 2013):

$$MktProx_{ij} = \frac{M_i M_j'}{\sqrt{M_i M_i'}\sqrt{M_j M_j'}},$$

where M_i (M_j) is the vector representing the distribution of i's (target j's) cumulative sales across four-digit SIC codes during the five years preceding the acquisition announcement year. Specifically, the s-th element of vector M_i (M_j) represents the fraction of i's (j's) cumulative sales in SIC code s. Also this index varies between one (if the two firms operate in exactly the same product markets) and zero (if they have no overlapping product markets).

4.3.2.4 Control variables

I control for outsider i's financial and technological characteristics at the end of the year before the announcement of acquisition j. *Tobin's Q* is the ratio of the sum of the market value of equity and book value of debt divided by the book value of assets. *Log(assets)* is the logarithm of total assets. *ROE* is the return on equity. *Leverage* is the ratio of total debt to total assets. *Cash* is the ratio of cash and short-term investments to total assets. *Log(patents)* is the logarithm of the total number of patents granted to the firm in the five years before the acquisition announcement. I control for the characteristics of acquisition j with deal fixed effects (α_j in equation 4.3). Finally, to account for the unobservable heterogeneity among industries or firms, I control for firm i's fixed effects. In the most restrictive specification, I also interact the firm fixed effects with year dummies, to control for the unobservable characteristics of firm i in the year of the acquisition.

4.4 Results

The sample includes 873 outsider firms and 200 acquisition announcements, of which about 42.5% involved an acquirer and a target with the same primary four-digit SIC code (horizontal acquisitions). Tables 4.2 and 4.3 show the distribution of outsiders and target companies, respectively, by their primary four-digit industries. Table 4.4 presents the descriptive statistics of the main variables of this study. The average cumulative abnormal returns for outsiders at the acquisition announcement are close to zero. The average technological and market proximities are 0.05 and 0.14, respectively, and their correlation is 0.27. The relatively low correlation between the two measures indicates that a firm's technological resources portfolio does not perfectly predict its position in the product market space. Such imperfect correspondence provides room to empirically disentangle the effects of the two proximity measures (Bloom *et al.*, 2013; Branstetter and Sakakibara, 2002; Silverman, 1999).

Table 4.2: Outsider firms by primary four-digit industry.

Primary SIC	Description	# of outsider firms
3600	Electronic and other electrical equipment, except computer equipment	6
3612	Power, distribution and specialty transformers	10
3613	Switchgear and switchboard apparatus	8
3620	Electrical industrial apparatus	23
3621	Motors and generators	22
3630	Household appliances	15
3634	Electric house wares and fans	23
3640	Electric lighting and wiring equipment	45
3651	Household audio and video equipment	33
3652	Phonograph records, prerecorded audio tapes and disks	6
3661	Telephone and telegraph apparatus	116
3663	Radio and tv broadcasting and communications equipment	122
3669	Communications equipment	34
3670	Electronic components and accessories	22
3672	Printed circuit boards	26
3674	Semiconductors and related devices	230
3677	Electronic coils, transformers and other inductors	2
3678	Electronic connectors	14
3679	Electronic components	62
3690	Miscellaneous electrical machinery, equipment and supplies	47
3695	Magnetic and optical recording media	7
	Total	**873**

Table 4.3: Acquisition announcements by primary four-digit industry.

Primary SIC	Description	# of targets	% of horizontal M&As (acquirer in same prim. SIC)
3600	Electronic and other electrical equip., except computer equip.	3	0.00
3612	Power, distribution and specialty transformers	1	0.00
3613	Switchgear and switchboard apparatus	3	0.00
3620	Electrical industrial apparatus	4	0.00
3621	Motors and generators	8	12.50
3630	Household appliances	5	80.00
3634	Electric house wares and fans	7	14.29
3640	Electric lighting and wiring equipment	7	28.57
3651	Household audio and video equipment	3	33.33
3652	Phonograph records, prerecorded audio tapes and disks	2	0.00
3661	Telephone and telegraph apparatus	29	51.72
3663	Radio and tv broadcasting and communications equipment	24	20.83
3669	Communications equipment	6	50.00
3670	Electronic components and accessories	9	33.33
3672	Printed circuit boards	3	33.33
3674	Semiconductors and related devices	58	75.86
3677	Electronic coils, transformers and other inductors	2	0.00
3678	Electronic connectors	4	25.00
3679	Electronic components	14	28.57
3690	Miscellaneous electrical machinery, equipment and supplies	6	0.00
3695	Magnetic and optical recording media	2	0.00
	Total	**200**	**42.5**

Table 4.4: Descriptive statistics and correlation matrix.

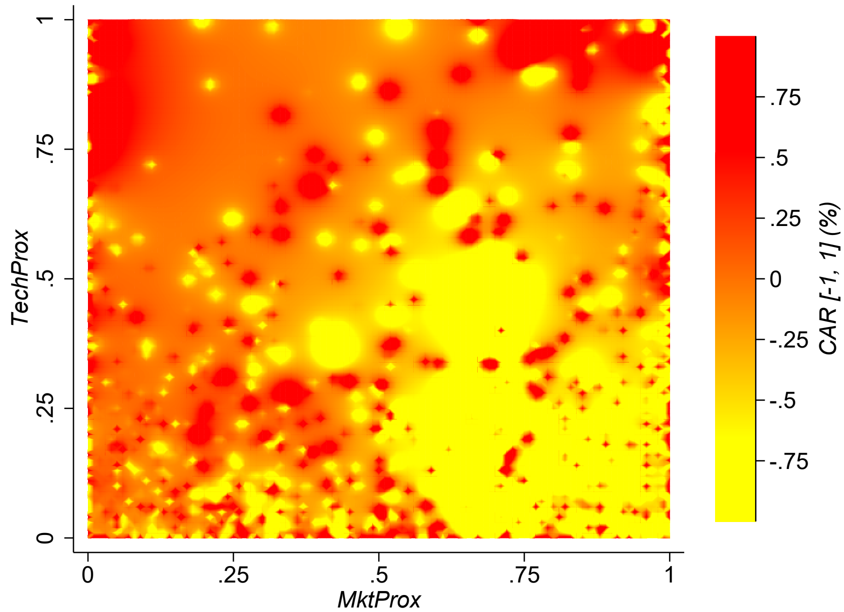
		Mean	S.D.	Min	Max	(1)	(2)
(1)	CAR [-1, 1] (%)	-0.10	7.35	-73.86	186.70		
(2)	TechProx	0.05	0.15	0.00	1.00	0.01	
(3)	MktProx	0.14	0.34	0.00	1.00	-0.02	0.27
(4)	Log(patents)	2.43	1.99	0.00	9.61	0.00	0.18
(5)	Tobin's Q	2.28	2.91	0.26	90.64	-0.02	0.00
(6)	Log(assets)	5.28	2.00	0.06	12.78	0.00	0.13
(7)	ROE	-0.10	0.60	-4.05	0.49	-0.02	0.00
(8)	Leverage	0.38	0.20	0.02	1.00	0.01	-0.02
(9)	Cash	0.25	0.21	-0.01	0.99	-0.01	0.06

		(3)	(4)	(5)	(6)	(7)	(8)
(4)	Log(patents)	0.12					
(5)	Tobin's Q	0.06	-0.02				
(6)	Log(assets)	0.09	0.70	-0.05			
(7)	ROE	-0.02	0.07	-0.04	0.21		
(8)	Leverage	-0.12	0.09	-0.17	0.18	-0.22	
(9)	Cash	0.18	0.01	0.25	-0.06	-0.06	-0.54

Figure 4.1 provides a heatmap showing how the average CAR of outsiders varies in the space defined by *TechProx* and *MktProx*. As expected, CAR is higher the more the outsider is similar to the target in its technological resources, and the less similar it is in its product market portfolio. In particular, CAR tends to be positive for firms that are technologically similar to the target, especially for those with limited product market overlap, and becomes negative for companies that operate in the same product markets but with quite different technological portfolios.

Table 4.5 reports the regression results. Column (1) reports the model with *TechProx* and *MktProx*, without controls. Column (3) adds the control variables, deal fixed effects, and firm fixed effects. Columns (4) and (5) include firm × year fixed effects without and with deal fixed effects, respectively. Finally, columns (6) and (7) include *TechProx* and *MktProx* separately. Each model indicates that technological proximity to the target positively affects an outsider's CAR, while market proximity has a negative effect. The empirical estimates of β^I and β^R in the most restrictive model, with deal and firm × year fixed effects (column (5)), are 1 and -0.5, respectively. Hence, everything else fixed, the market value of an outsider that

Figure 4.1: Technological proximity and product market proximity to the target and average outsiders' CAR.



has identical technologies to the target on average increases by 1% over the three days around the announcement, while the value of an outsider that operates in the same product markets on average decreases by 0.5%. It follows that an outsider that is similar to the target firm on both dimensions will earn about 0.5%. Hence, the information effect outweighs the rivalry effect, and firms that are identical to the target gain from the announcement. Importantly, the estimates provide evidence of negative business-stealing spillovers, which reduce the gains to outsiders. When included separately (columns (6) and (7)), the estimates of the effects of *TechProx* and *MktProx* decrease in magnitude, suggesting that when considered alone, one proximity measure partly takes on the effect of the other.

In Table 4.6, I report the regression results from the most restrictive models, with firm × year fixed effects, using alternative event windows to measure outsiders' CAR. In particular, columns (1)–(2) consider the one-day event window *[0]* (the announcement day), columns (3)–(4) the three-day window *[0, 2]*, columns (5)–(6) the eight-day window *[-3, 4]*, and

Table 4.5: Effects of technological and market proximity to the target on outsiders' CAR.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	CAR [-1, 1] (%)						
TechProx	0.87**		0.84**	1.37***	0.99***	0.74**	
	(0.37)		(0.33)	(0.39)	(0.36)	(0.36)	
MktProx	-0.57**		-0.39**	-0.76**	-0.50**		-0.38*
	(0.25)		(0.20)	(0.31)	(0.22)		(0.22)
Log(patents)		-0.09	-0.10				
		(0.07)	(0.06)				
Tobin's Q		-0.06*	-0.05*				
		(0.03)	(0.03)				
Log(assets)		-0.08	-0.08				
		(0.15)	(0.15)				
ROE		-0.42**	-0.42**				
		(0.17)	(0.18)				
Leverage		-0.21	-0.23				
		(0.40)	(0.40)				
Cash		0.09	0.08				
		(0.41)	(0.41)				
Fixed effects:							
Deal	-	Yes	Yes	-	Yes	Yes	Yes
Firm	-	Yes	Yes	-	-	-	-
Firm × year	-	-	-	Yes	Yes	Yes	Yes
R^2	0.00	0.07	0.07	0.14	0.18	0.18	0.18
Observations	44,924	44,924	44,924	44,924	44,924	44,924	44,924

Notes. Standard errors are two-way-clustered by announcement date and firm (Cameron *et al.*, 2011). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses.

columns (7)–(8) the ten-day window *[-4, 5]*. The regressions for these alternative event windows confirm the pattern described above, highlighting a significantly positive effect of *TechProx* and a significantly negative effect of *MktProx*.

4.4.1 Alternative explanations for the effect of technological proximity

An outsider could also benefit from the acquisition of a firm with similar technologies if the transaction induces an increase in the concentration of those technologies. In particular, by consolidating ownership of some technological resources, a merger could increase the monop-

Table 4.6: Alternative event windows for the outsiders' CAR.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	CAR (%)							
	[0]		[0, 2]		[-3, 4]		[-4, 5]	
TechProx	0.51**	0.40**	1.40***	1.03***	1.48**	1.39***	1.31*	1.44**
	(0.21)	(0.19)	(0.43)	(0.35)	(0.62)	(0.53)	(0.67)	(0.60)
MktProx	-0.37**	-0.23**	-0.76**	-0.51**	-1.09**	-0.94**	-1.04*	-0.83**
	(0.15)	(0.11)	(0.38)	(0.24)	(0.54)	(0.36)	(0.58)	(0.37)
Fixed effects:								
Deal	-	Yes	-	Yes	-	Yes	-	Yes
Firm × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.14	0.17	0.14	0.19	0.14	0.21	0.15	0.21
Observations	44,924	44,924	44,924	44,924	44,924	44,924	44,924	44,924

Notes. Standard errors are two-way-clustered by announcement date and firm (Cameron *et al.*, 2011). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses.

olistic rents provided by those resources (Peteraf, 1993). Such gains are possible when two firms that are technologically similar to the outsider merge, so that ownership in the technological space surrounding the outsider consolidates. Hence, to increase the monopolistic rents, both the acquirer and the target company need to share some technological similarities with the outsider.

To test this alternative mechanism, Table 4.7 adds to the regressions the outsider's technological proximity to the acquirer (*TechProx to acquirer*) and its interaction with the technological proximity to the target (*TechProx*), where the technological proximity to the acquirer is measured using the procedure described in section 4.3.2.2. The regressions indicate that while *TechProx* (to the target) maintains its significance, the interaction of the two proximity measures is never significant. Hence, there is no clear evidence that the positive effect of *TechProx* described in the previous analysis depends on the acquirer's location in the technological space. In other words, technological consolidation around the outsider firm does not appear to be driving the positive market value spillovers captured by *TechProx*.

Table 4.7: Testing the interaction effect of technological proximity to the target and to the acquirer.

	(1)	(2)	(3)	(4)	(5)	(6)
			CAR [-1, 1] (%)			
TechProx	0.93***	0.82*	1.33***	1.13**	1.00***	0.98**
	(0.36)	(0.44)	(0.43)	(0.52)	(0.38)	(0.47)
TechProx to acquirer	-0.28	-0.43	0.13	-0.10	-0.03	-0.05
	(0.44)	(0.59)	(0.63)	(0.84)	(0.44)	(0.59)
TechProx × TechProx to acq.		0.57		0.97		0.08
		(1.28)		(1.46)		(1.30)
MktProx	-0.37*	-0.37*	-0.76**	-0.75**	-0.50**	-0.50**
	(0.19)	(0.19)	(0.31)	(0.31)	(0.22)	(0.22)
Log(patents)	-0.09	-0.09				
	(0.07)	(0.07)				
Tobin's Q	-0.05*	-0.05*				
	(0.03)	(0.03)				
Log(assets)	-0.08	-0.08				
	(0.15)	(0.15)				
ROE	-0.42**	-0.42**				
	(0.18)	(0.18)				
Leverage	-0.23	-0.23				
	(0.40)	(0.40)				
Cash	0.09	0.09				
	(0.41)	(0.41)				
Fixed effects:						
Deal	Yes	Yes	-	-	Yes	Yes
Firm	Yes	Yes	-	-	-	-
Firm × year	-	-	Yes	Yes	Yes	Yes
R^2	0.07	0.07	0.14	0.14	0.18	0.18
Observations	44,924	44,924	44,924	44,924	44,924	44,924

Notes. Standard errors are two-way-clustered by announcement date and firm (Cameron *et al.*, 2011). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses.

4.5 Conclusions

Previous studies systematically find that merging firms' rivals experience positive stock market reactions at the announcement of an acquisition. In this paper, I show that the abnormal returns of an outsider increase the more the firm is technologically similar to the target and decrease the more it competes in the same product markets. Hence, this study provides evidence of negative business-stealing spillovers of M&As, which decrease in magnitude (and eventually switch sign) the more the outsider is expected to replicate any efficiency improvement signaled by the acquisition. These findings complement previous research on the strategic motives of M&As (Ahuja and Katila, 2001; Barney, 1988; Capron and Pistre, 2002; Chatterjee, 1986; Haleblian *et al.*, 2009), by showing that the synergies created by an acquisition represent a real threat to competitors, and negatively affect investors' expectations about the rivals' future profitability.

Moreover, this study provides evidence that the acquisition of a company can affect the valuation of companies with similar technological assets, irrespective of whether they operate in the same markets. Previous literature (e.g., Hall *et al.*, 2005, 2007) showed that the value of a company depends on the size and quality of its knowledge-based assets, as proxied by its stock of R&D investments and patents. This paper contributes to this stream of research by showing that the stock market can infer the value of those resources from other firms' M&A decisions.

More in general, while a broad stream of research describes the spillover effects of internal growth investments (e.g., Bloom *et al.*, 2013; Branstetter and Sakakibara, 2002; Hall *et al.*, 2010; Jaffe *et al.*, 1993; McGahan and Silverman, 2006), only a few studies investigate the spillover effects of firms' external growth investments (see also Oxley *et al.*, 2009). Given the amount of resources firms invest in these activities (Haleblian *et al.*, 2009; Lee and Lieberman, 2009; Villalonga and McGahan, 2005; Wang and Zajac, 2007), understanding the effects of these decisions on outsiders is an important area of research. This paper contributes to this research agenda by disentangling two channels through which an M&A can affect expectations of future profitability of outsiders.

An important caveat is the applicability of this framework to other empirical contexts. While similar mechanisms are likely to affect firms in other industries, the empirical identification of the rivalry and opportunity signaling effects relies on the availability of two distinct measures for a firm's market positioning and for its resources. In the electronics industries, this empirical distinction is made possible by the availability of patent data to proxy for a firm's technological resources. In other empirical settings, where patents cannot be used as a proxy for a firm's strategic resources, other measures need to be developed (e.g., see Chen, 1996), which provides an interesting route for future research.

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