Corporate Acquisitions and Firm-level Uncertainty: Domestic Versus Cross-Border Deals*

Ye Bai† Sourafel Girma‡ Alejandro Riaño§

May 19, 2023

Abstract

This paper investigates how the announcement of acquisitions affect the uncertainty that financial markets perceive about acquiring firms. We use data for publicly-listed firms in the UK between 2004 and 2017 and employ a matching estimator combined with difference-in-differences to address the endogenous selection of firms into acquisitions. While acquisition announcements do not result in a significant change in the volatility of stock returns of acquiring firms across our whole sample—this result hides substantial heterogeneity. Our main result is that the impact of acquisitions on uncertainty is crucially shaped by a deal's geographic scope—i.e. whether the takeover involves a target in the same country or abroad. Domestic deals reduce the volatility of acquirers' returns by 5% on average one quarter after the announcement, while acquiring a foreign firm increases volatility by a similar magnitude. The heightened volatility resulting from cross-border transactions is primarily driven by acquisitions in industries characterized by high investment irreversibility and foreign markets where barriers to investment are higher. Conversely, the volatility reduction following domestic acquisitions is more pronounced in industries with low irreversibility. Additionally, characteristics of the deal itself, such as the relative size of the acquisition, the payment method, and whether the deal achieves majority control of the target, also play important roles in mediating the effect of acquisitions on volatility.

Keywords: Mergers and Acquisitions; Uncertainty; Volatility; Stock Returns; Cross-border acquisitions; Irreversibility; UK.

JEL classification: F23; F36; G32; G34.

*We thank Menzie Chinn (the Editor) and one referee for their constructive comments. We thank Alice Bonaime, Ron Davies, Mihai Ion, Neelam Jain, Andrew Karolyi, Rahul Mukherjee, Joel Stiebale, and seminar participants at De Montfort University and City, University of London for their useful comments which have greatly improved the paper.

†International Business School Suzhou, Xi'an Jiaotong-Liverpool University. ye.bai@xjtlu.edu.cn

‡University of Nottingham, GEP and CFCM. sourafel.girma@nottingham.ac.uk

§City, University of London, GEP, CFCM and CESifo. alejandro.riano@city.ac.uk

1 Introduction

An extensive literature has shown that higher uncertainty is almost always detrimental for firms—depressing investment in physical capital and employment, dampening the responses to policy stimuli and increasing the cost of external finance, risk premia and the probability of default (Froot et al., 1993; Leahy and Whited, 1996; Bulan, 2005; Bloom et al., 2007; Adrian and Rosenberg, 2008; Bloom, 2009; Arellano et al., 2019). At the same time, investment decisions may affect firms' asset prices by changing their exposure to different sources of risk and can, consequently, affect the uncertainty that financial markets perceive about them (Berk et al., 1999; Carlson et al., 2004, 2006; Hackbarth and Morellec, 2008; Fillat and Garetto, 2015; Decker et al., 2016).

In this paper we investigate how corporate acquisitions—one of the largest investments a company will ever undertake—affect the uncertainty perceived about acquiring firms, as proxied by the volatility of their stock returns. Acquisitions have the potential to drastically affect how firms operate by increasing efficiency through the realization of economies of scale, achieving synergies by exploiting assets that are unique to the target, facilitating tax and regulatory arbitrage and allowing a firm to grow faster than internal investment would allow. Nevertheless, their scale and swiftness also render them highly risky endeavors.

Despite the importance of acquisition within aggregate investment, only a handful of papers have explored their relationship with uncertainty. Bhagwat et al. (2016) and Bonaime et al. (2018) investigate how uncertainty affects acquisition activity, while, closer to the spirit of this paper, Duchin and Schmidt (2013) find that uncertainty about the performance of newly merged firms is higher in merger waves when deals are less thoroughly scrutinized by investors. Nevertheless, to the best of our knowledge, this is the first paper to estimate the impact of acquisitions on firm-level volatility and explore the different channels through which this effect is realized.

Although acquisitions can affect the volatility of stock returns of acquiring firms through several channels, crucially, economic theory does not provide unequivocal predictions regarding the direction of the effects. Acquisitions, for instance, could reduce uncertainty for the acquirer by transforming risky options into assets in place or by providing avenues for the acquirer to diversify country- or sector-specific earnings shocks. On the other hand, the opposite effect could arise if acquisitions increase acquirers' exposure to operational leverage, or if international frictions dilute the synergies they intend to achieve. Our objective in this paper is, therefore, to gauge the empirical relevance of different channels that shape the effect of acquisitions on firm-level uncertainty. A key feature of our empirical strategy is that we leverage the well-documented differences between domestic and cross-border deals to identify the channels through which acquisitions affect uncertainty (Doukas and Travlos, 1988; Moeller and Schlingemann, 2005; Gregory and McCorriston, 2005; Chari et al., 2009).

We use data on acquisitions undertaken by publicly listed firms in the UK between 2004 and 2017 to conduct the empirical analysis. The UK has long been one of the most important markets for corporate acquisitions worldwide, and during our period of analysis, it is second only to the United States in terms of the value of acquisitions originating there (Healy and Palepu, 1993;

Gregory and McCorriston, 2005; UNCTAD, 2019). Focusing on listed firms enables us to use the volatility of their stock returns as the measure of uncertainty that financial markets perceive about acquiring firms. Stock returns capture changes in investors' perceptions about the expected future profitability of a firm, and are strongly correlated with uncertainty about 'real' performance outcomes such as total factor productivity and profitability (Leahy and Whited, 1996; Bloom, 2009; Bloom et al., 2018).

We use a matching estimator combined with difference-in-differences to address the endogenous choice of firms to carry out acquisitions. To implement this empirical strategy, we first estimate the probability of a firm announcing domestic and cross-border acquisition in a given quarter on the basis of a broad range of observable pre-treatment characteristics including acquisition experience, firm size, profitability, leverage, liquidity, firm- and industry-level volatility and stock price misvaluation, as suggested by the literature (Harford, 1999; Jovanovic and Rousseau, 2002; Moeller et al., 2004; Moeller and Schlingemann, 2005; Rhodes-Kropf et al., 2005; Garfinkel and Hankins, 2011; Erel et al., 2012; Grullon et al., 2012; Hackbarth and Miao, 2012; Bonaime et al., 2018). We use the estimated probabilities of undertaking each type of acquisition to weight observations in a regression that explains the difference in the volatility of firms' stock returns one quarter after the announcement of an acquisition and one quarter before as a function of indicators of acquisition activity and pre-treatment controls. We carry out an extensive heterogeneity analysis on the basis of deal-, industry- and destination market-specific characteristics to elucidate the factors that mediate the effect of acquisitions on uncertainty.

At first pass, we do not find that the announcement of an acquisition has a discernable impact on the volatility of stock returns of acquirers. This null result across our whole sample, however, hides substantial heterogeneity across different types of acquisitions. Our main result is that the effect of acquisitions on the uncertainty that financial markets perceive about acquiring firms crucially depends on the geographic scope of a deal. More specifically, we find that the volatility of firms undertaking domestic acquisitions falls by 5.5% one quarter after the announcement of the transaction; on the other hand, the announcement of a cross-border deal results in an increase in volatility of a similar magnitude. Our results show that the geographic pattern of firm expansion not only affects the expected gains from takeovers, but, crucially, matter for how the investment in acquiring a target firm affects the uncertainty that financial markets perceive about acquirers.

Turning to the mechanisms that explain these differences, we find that irreversibility, as proxied by the importance of used capital goods, asset redeployability and capital intensity, is a key channel explaining the increase in uncertainty following cross-border acquisitions. We find that not only cross-border acquisitions in high-irreversibility sectors increase the volatility of acquirers' stock returns between 8 to 16% in the first quarter after the announcement of the deal, but this effect remains quantitatively important and highly significant a full year after. This result is consistent with an extensive literature in international trade that highlights the substantial fixed and sunk costs involved in operating abroad. In this context, an acquirer becomes exposed to the higher operational leverage involved in operating a target abroad. If an acquisition is hard to reverse,

acquirers will be more willing to bear losses in order to avoid divesting and having to incur the large set up costs to reestablish a presence abroad in the future (Riaño, 2011; Fillat and Garetto, 2015).

Other mechanisms we investigate do not appear to be as important in explaining the why cross-border acquisitions increase the volatility of acquirers. We find evidence that this effect is stronger when certain frictions such as physical distance, entry barriers and a lack of corporate transparency are higher. Nevertheless, we find that differences in the effect of cross-border deals on volatility along these dimensions are not as large as those that we identify along the degree of irreversibility of a deal. We do not find any evidence suggesting that the impact of diversifying acquisitions on volatility is systematically lower than for horizontal deals, nor that the positive effect of cross-border deals is weakened when target firms are located in countries with business cycles that are less correlated with the UK's.

The leading mechanisms that drive the volatility-reducing effect of domestic deals are harder to isolate. On the one hand, consistent with the transformation of real options to assets in place, this effect is only significant for large deals (Carlson et al., 2004, 2006). On the other hand, if the operational leverage channel is less important for domestic transactions, we would expect the volatility-reduction effect to be stronger in high-irreversibility industries in which the real option features of acquisitions are more salient. However, we find the opposite. We do not find the volatility reduction to be stronger among diversifying deals either.

Lastly, we explore how deal-level features such as method of payment, relative size and whether a deal achieves majority control affect our results. We find that the effect of acquisitions on volatility based on their geographical scope is stronger for large deals and majority transactions. Although the volatility-reducing effect of domestic deals is unaffected by the method of payment, the rise in volatility following cross-border transactions is only present in cash deals, which account for more than 90% of the acquisitions in our data. Cross-border acquisitions paid for with stock or a mix between cash and stock, on the other hand, elicit a large and negative response on the volatility of stock returns of acquirers, consistent with the notion that this method of payment can act as insurance against overpayment from the point of view of the acquirer (Hansen, 1987; Fuller et al., 2002; Mantecon, 2009). It is important to remark, however, that since a deal's attributes are chosen by acquirers and targets to mitigate the risks associated with a transaction, reverse causality could muddle the interpretation of these results.

This paper lies at the intersection of the literature on finance and international economics. It provides further evidence about the central role that the geographic scope of acquisitions plays in determining outcomes in the market for corporate control (Moeller and Schlingemann, 2005; Denis et al., 2002). Our work also adds to the expanding body of research in international trade that explores the impact of various dimensions of globalization on firm-level volatility (e.g. Riaño, 2011; Vannoorenberghe, 2012; Kramarz et al., 2020). In this respect, using stock returns as our underlying measure of firm performance enables us to estimate volatility using high-frequency data and thus capture short-term fluctuations that would be overlooked when using lower-frequency

yearly data for sales, profits or productivity.

Our work is closely rated to Fillat and Garetto (2015), Fillat et al. (2015), and Girma et al. (2016); these papers investigate how firms' international status affects the risk and volatility perceived by investors in these companies. Girma et al. (2016) investigate the impact of changes in the intensive margin of foreign sales, be it through exports or sales by foreign affiliates, on volatility, while Fillat and Garetto (2015) and Fillat et al. (2015) examine how 'greenfield' foreign investment affects multinationals' risk premium. In contrast, our paper leverages the larger change in the *extensive* margin of global engagement brought about by cross-border acquisitions—the most important component of foreign direct investment flows, accounting for between two-thirds to three-quarters of worldwide FDI inflows over the last two decades (UNCTAD, 2019).

Lastly, our paper speaks to the body of work in international trade that investigates the impact of cross-border acquisitions on a wide range of 'real' performance outcomes, including total factor productivity, technology transfer, innovation and wage premia, primarily for acquired targets (see e.g. Girma and Görg, 2007; Arnold and Javorcik, 2009; Guadalupe et al., 2012; Wang and Wang, 2015). We complement this body of work by focusing on the effect of acquisitions in the perception of financial markets about the expected future profitability of acquirers.

The rest of the paper is organized as follows. Section 2 summarizes different theoretical mechanisms through which acquisitions can affect firm-level uncertainty and that we will investigate in the empirical analysis. Section 3 describes the data and provides summary statistics. Section 4 presents our empirical methodology and identification strategy. The results of our empirical analysis are presented in Section 5. Section 6 concludes.

2 Mechanisms through which acquisitions may affect firm-level uncertainty

In this section we discuss potential channels through which acquisitions can shape the uncertainty that financial markets perceive about acquiring firms, emphasizing how differences between domestic and cross-border deals help to elucidate the mechanisms at play.

Our analysis is anchored on production-based models of asset pricing that relate expected returns to firms' investment decisions (e.g. Berk et al., 1999; Carlson et al., 2004, 2006; Hackbarth and Morellec, 2008; Grullon et al., 2012; Fillat and Garetto, 2015). In this class of models, investments such as acquisitions, are characterized as real options, on the basis of three key dimensions: acquirers have some flexibility about the time at which they propose a deal to the target firm; there is uncertainty regarding the benefits and synergies that the takeover will generate; and the investment in the acquisition of the target firm is, to a large extent, irreversible.

As we establish below, different aspects of an acquisition are expected to increase or decrease the uncertainty that financial markets perceive about acquirers, and thus, we organize our discussion around the expected direction of the potential effect.

2.1 Channels that increase uncertainty about the acquirer

2.1.1 Operational leverage

Completing an acquisition is likely to affect the operational leverage of an acquirer, and consequently its stock returns, by exposing it to future commitments in terms of the fixed costs of operation associated with this investment (Carlson et al., 2004, 2006). For instance, in the proximity-concentration trade-off model of horizontal FDI, an acquirer that decides to take over a firm to reach foreign customers directly rather than serving them through exporting, incurs establishment-specific fixed costs to operate the newly acquired target, thus increasing its operational leverage.

If acquisitions are to a large extent irreversible—perhaps because the target's assets are highly specific and therefore hard to redeploy in case of distress, or due to high information gathering costs (Nocke and Yeaple, 2007; Lee and Caves, 1998)—then acquirers are more willing to bear losses in order to avoid divesting and having to incur the large set up costs to reestablish their foreign presence in the future. Thus, greater exposure to higher operational leverage is likely to be associated with a higher volatility of stock returns for acquirers.

This effect is stronger the larger the increase in operational leverage brought about by an acquisition—a dimension along which domestic and cross-border deals notably differ. An extensive body of work in international economics has documented the fact that servicing foreign markets, be it through exporting, setting up new affiliates abroad, or cross-border acquisitions, involves higher fixed costs than serving the domestic market (see Antràs and Yeaple, 2014; Melitz and Redding, 2014, for a review). This literature has also found that the costs associated with setting up operations across borders such as channels of distribution, market intelligence, readaptation of products to comply with foreign specifications are largely sunk (Helpman et al., 2004; Das et al., 2007).[1] These features are parsimoniously captured by models of international trade that incorporate firm heterogeneity, economies of scale and irreversible investment, which are also useful to shed light on the relationship between firms' operation in international markets and their risk premia and volatility.

Riaño (2011) finds that the higher fixed and sunk costs involved in exporting result in exporting firms exhibiting greater sales volatility, even though the latter allows firms to diversify country-specific shocks. Along similar lines, Fillat and Garetto (2015) document a 'pecking order' in terms of firms' risk premia and the operational leverage associated with their operation across different markets. Consistent with the evidence that multinationals incur higher fixed and sunk costs of setting up a foreign presence and operating than exporters, which in turn, incur higher costs than domestic firms—they find that the risk premium of multinationals is greater than that of exporters, which, in turn, is greater than that of domestic firms. Based on this evidence, we would expect that, everything else equal, cross-border acquisitions would increase the volatility of acquirers more

[1] While these stylized facts have first been established in the context of manufacturing firms, there is evidence that high fixed and sunk costs of operation are also highly relevant to characterize the operation of firms in services industries (Breinlich and Criscuolo, 2011; Ariu, 2016), which account for a substantial number of acquisitions in our data (see Table B.2 in Appendix B).

than domestic deals, and, furthermore, we expect this differential to be more apparent in industries characterized by a greater degree of investment irreversibility and economies of scale.

2.1.2 International frictions

Cross border acquisitions have the potential to generate synergistic gains over and above those delivered by domestic deals. They provide acquirers the opportunity to exploit differences in factor prices, arbitrage tax regimes and regulations and access specific assets embodied within the target firm that would otherwise be unattainable.

On the other hand, national borders are associated with a broad range of frictions that significantly impede the successful integration of the acquirer and target firms by, among other things, making it more difficult to exercise investor protection, exacerbating agency problems and increase transaction costs that preclude the efficient transfer of control after an acquisition (Caves, 1996).

There is ample empirical evidence that the same frictions that reduce the volume of international trade between a pair of countries also affect the occurrence of acquisitions across borders (Rossi and Volpin, 2004; Head and Ries, 2008; Erel et al., 2012; Barattieri et al., 2016). The more important these frictions are, the more likely it is that financial markets perceive greater uncertainty about an acquirer's future performance when it takes over a foreign rather than a domestic firm. Davies et al. (2018) find that acquisitions are more responsive to barriers between the origin and destination countries, in terms of differences in institutional quality and geographical and cultural barriers than greenfield foreign direct investment.

2.2 Channels that reduce uncertainty about the acquirer

2.2.1 Converting real options into assets-in-place

When a firm undertakes an acquisition it is, in essence, exercising the call option to merge with the target firm. Because the new assets that the firm acquires are less risky than the underlying option they replace, the decision to carry out an acquisition reduces the acquiring firm's risk by transforming growth options into assets in place (Carlson et al., 2004, 2006). Consistent with this mechanism, Cooper and Priestley (2011) find that firms' risk falls during periods of high investment, while Grullon et al. (2012) show that firms' stock returns are more sensitive to volatility when they have more investment opportunities and subsequently fall when real options are exercised. Thus, we would expect that the conversion of risky real options into assets in place brought about by an acquisition should, everything else equal, lower the uncertainty that financial markets perceive about acquirers. We would also expect this effect to be stronger the larger the acquisition is relative to the value of the acquiring firm.

2.2.2 Diversification

Deals that span different industries or countries can provide diversification benefits provided that the shocks affecting the acquirer and the target are not perfectly correlated. Rowland and Tesar

(2004) find that adding multinationals to a portfolio of domestic firms provides diversification benefits for investors in the U.S., Canada and Germany; similarly, Fillat et al. (2015) find that the risk premium of U.S. multinationals is lower when they have affiliates in countries with business cycles that are less correlated with the US economy.

On the other hand, a substantial body of work has documented that firms operating across different industries and countries exhibit a value discount relative to a portfolio of comparable, single-segment firms (Lang and Stulz, 1994; Berger and Ofek, 1995; Denis et al., 2002). The literature has found that managers often diversify the operation of their firms to pursue private benefits like higher compensation, achieving greater power within the merged firm, and the prestige that accompanies corporate empire-building (see e.g. Morck et al., 1990; Denis et al., 1997). If diversifying deals are more prone to be driven by factors unrelated to profit maximization, these acquisitions could increase uncertainty for investors instead.

2.3 Deal characteristics that affect uncertainty

Once an acquirer has decided to acquire a target, a deal is structured determining the degree of risk sharing between the acquirer and the target—i.e. the extent to which the acquirer assumes the target's liabilities. This is a highly complex process, whose outcomes can significantly shape the uncertainty that financial markets perceive about the transaction. While we do not consider the full extent to which the structuring of a deal affects the volatility of returns for the acquirer, we explore the impact of three of its most important dimensions—the size of the deal relative to the market value of the acquirer, the method of payment and whether an acquisition achieves or not majority control—as there is ample evidence that these characteristics crucially affect the magnitude of abnormal returns realized after the announcement of an acquisition (see e.g. Doukas and Travlos, 1988; Moeller et al., 2004; Gregory and McCorriston, 2005; Chari et al., 2009).

2.3.1 Method of payment

Using stock instead of cash as a method of payment can help to reduce the level of indebtedness necessary for the acquirer to complete a deal and limit the risk of overpaying, as the payoff to the target is contingent on the synergies that the deal produces (Hansen, 1987; Fuller et al., 2002; Mantecon, 2009). To the extent that international frictions make it more difficult to assess the expected benefits of cross-border deals, as discussed in Section 2.1.2 above, it is more likely that acquirers would prefer to use equity rather than cash in the former transactions. On the other hand, targets in cross-border acquisitions are often unwilling to accept foreign equity; this forces acquirers to pay with cash and may limit the positive demonstration effects associated with this method of payment (Travlos, 1987; Moeller and Schlingemann, 2005).

2.3.2 Ownership control

The extent of control that a bidder achieves over a target firm is crucial in shaping the functioning of the combined firm, e.g. determining the scope for transfer of technology, intangible assets and other tacit knowledge such as management practices. The decision to pursue partial control of a target following an acquisition entails both benefits and costs for the acquirer. Mantecon (2009) suggests that partial ownership allows the acquirer to learn about the profitability of the target at a lower cost than a full acquisition would—an advantage that is more valuable in situations characterized by high valuation uncertainty. Alquist et al. (2019) show that, in the context of cross-border acquisitions, keeping the target's owners as partners can reduce the acquirer's costs of operation—particularly in unfamiliar environments or in places characterized by weaker investor protection.

On the other hand, minority control of a target can increase the risk of failure in integrating the management of the acquiring and target firms and limit the ability of the acquirer to monitor and rein in opportunistic behavior by the target's management. This, in turn, weakens the incentive for outside investors to join in co-financing the venture (Antràs et al., 2009). Limits to full ownership imposed on foreign investors, which are more prevalent in emerging markets, provide less protection for the acquirer's shareholders against the risk of expropriation relative to domestically-owned firms (Bris and Cabolis, 2008).

2.3.3 Relative size

We would expect the potential impact of an acquisition on the uncertainty perceived about the bidder to be stronger, the larger the acquisition is compared to the market value of the acquirer. Naturally, the larger the relative size of a deal, the greater its impact on the expected future profitability of the acquirer, and the uncertainty that markets perceive about it. As we have noted in Section 2.2.1 above, we would then expect a larger reduction in uncertainty following the announcement of larger deals.

In summary, the effect of acquisitions on the volatility of stock returns of acquiring firms depends on a broad range of potentially non-mutually exclusive mechanisms. Determining the overall magnitude of the impact on acquiring firms and the most relevant channels through which this is manifested is ultimately an empirical question. We now turn to present the data we use to investigate the hypotheses we develop and discuss our estimation and identification strategy.

3 Data

Our data comes primarily from two sources: Thomson Reuters' SDC Platinum International Mergers and Acquisitions database and Datastream. SDC reports public and private merger and acquisition transactions involving at least a 5% stake in the target company. For each transaction we observe the deal's value, the share of the target firm's equity purchased, the dates of announcement and completion of the deal, and the country and industry of operation of the acquiring and target

firms. Daily stock prices, which we use to construct stock returns and their volatility, as well as other financial variables used in the estimation are obtained from Datastream.

We calculate stock returns as the first difference of the logarithm of a firm's daily stock price. Following an extensive literature in finance and macroeconomics, we measure firm-level uncertainty by means of the realized volatility of stock returns—i.e. the standard deviation of firms' daily stock returns within a given quarter (see e.g. Duffee, 1995; Leahy and Whited, 1996; Andersen et al., 2001; Bloom et al., 2007; Grullon et al., 2012). Variable definitions and additional data sources are described in detail in Appendix A.

Our sample consists of 1,205 firms listed in the London Stock Exchange, observed from the first quarter of 2004 until the third quarter of 2017. We initially identify 2,085 successful acquisition deals made by public firms in the UK accounting for a total of 316.3 billion pounds, or two-thirds of the value of all domestic and outward acquisitions involving UK firms according to the Office of National Statistics.[2] Since our econometric analysis requires information on a wide range of covariates used to estimate the propensity score, our final sample consists of 1,651 acquisitions that account for 88% of the value of all acquisitions carried out by public firms over our period of analysis.

Table 1 presents summary statistics regarding the number of acquisitions during our period of analysis. Cross-border acquisitions—i.e. deals that involve the acquisition of a firm outside the UK—account for 45% of all takeovers in our data and involve primarily target firms in other developed countries, with the United States, Germany, Australia, France, and Canada being the largest destination markets. Among developing countries and emerging markets, Brazil, South Africa, Russia, India and China respectively, attract the largest number of acquisitions (see Table B.1 in Appendix B). Table B.2 in Appendix B reports the sectoral composition of deals in terms of the industry of operation of acquirer and target firms and their domestic and cross-border status. Consistent with the international evidence, a large number of acquisitions occur in service industries such as IT consulting, finance and retail (Barattieri et al., 2016); we also observe large sectoral heterogeneity in terms of the importance of domestic and cross-border acquisitions.

While cross-border deals tend to be larger in absolute terms than those involving domestic firms, consistent with the findings of Moeller and Schlingemann (2005) for U.S. firms, we do not find significant differences between them in terms of their propensity to achieve majority control, whether they constitute a diversifying acquisition (i.e. when the 3-digit industry of the acquirer and target firms differ from each other), or their method of payment. Regardless of the country in which the target firm is located, the majority of transactions achieve control of the target and are paid for with cash, while deals are evenly distributed in terms of being diversifying or horizontal.

Our empirical strategy relies on comparing the volatility of acquirers with that of firms that are similar in terms of a broad range of observable characteristics prior to the announcement of

[2]See Mergers and acquisitions involving UK companies time series, available at: https://www.ons.gov.uk/businessindustryandtrade/changestobusiness/mergersandacquisitions/datasets/mergersandacquisitionsuk

Table 1: Deal Characteristics—by Target Country

	Domestic	Cross-border
Number of deals	910	741
Median transaction size (millions US dollars)	11.00	24.00
Majority (%)	80.54	80.43
Diversifying acquisition (%)	49.78	46.28
Cash acquisition (%)	90.00	94.73

Domestic acquisitions are those in which the target firm is located in the UK, while cross-border acquisitions are those in which the target firm is located in any country other than the UK. Transaction size is denominated in millions of US dollars. Majority indicates the percentage of deals in which the acquiring firm holds 50% or more of the target firm's equity after acquisition and did not previously have control. Diversifying acquisitions are those in which the target firm's three-digit SIC industry code is different from that of the acquiring firm. Cash acquisition indicates the percentage of deals in which the all the value of transaction has been paid in cash.

Table 2: Summary Statistics—by Acquiring Firm Status

Variable	Acquirer Status					
	Never		Domestic-Only		Cross-border	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
(log) Firm volatility	-1.38	0.73	-1.38	0.74	-1.33	0.65
(log) Industry volatility	-1.16	0.33	-1.22	0.44	-1.15	0.46
Stock returns	-0.01	0.27	-0.01	0.28	-0.01	0.29
(log) Market value	4.27	2.44	4.32	2.25	5.19	2.49
Market to book value	2.90	4.50	3.32	6.15	2.83	4.00
Cash flow (Million £)	181.97	1203.62	44.54	131.67	184.91	651.17
Leverage	3.46	40.53	4.77	63.42	3.57	14.34
ROA	-3.19	33.75	-4.48	28.60	-1.76	28.79
(log) Herfindahl index	-3.11	3.53	-3.22	3.33	-3.32	3.48
Misvaluation	4.33	2.31	4.37	2.10	5.26	2.33
Number of firms	842		145		218	
Number of (firm-quarter) observations	27,783		4,969		8,537	

Never-acquirers are firms that do not carry out any acquisition deal throughout our period of study; domestic-only acquirers are firms that acquire at least one firm in the UK but never acquire a firm abroad; cross-border acquirers are firms that have, at least once, acquired another firm abroad. Notice that firms identified as cross-border acquirers may have engaged in domestic acquisitions during our period of study. Firm volatility is measured as the standard deviation of daily stock returns for a firm in a given quarter. Detailed variable definitions are in Appendix A.1.

an acquisition—but that do not engage in acquisitions themselves. To this end, we split the firms in our data in three groups according to their acquisition activities: firms that never engage in acquisitions during our period of study (never-acquirers), firms that only acquire other firms in the UK (only domestic acquirers) and firms that have acquired at least one firm abroad (cross-border acquirers).[3]

[3]Note that most cross-border acquirers have also acquired domestic firms at some point over our period of analysis.

Table 2 presents summary statistics for the firm-level characteristics that we use for the estimation of the probability of engaging in domestic and cross-border acquisitions (i.e. the propensity score) below. We find that while the first two moments of stock returns are very similar across the three groups of firms, cross-border acquirers tend to be larger and more profitable, in terms of market value and ROA respectively, than only-domestic- and never-acquirers (Moeller and Schlingemann, 2005). Both types of acquirers—but particularly cross-border ones—tend to be more overvalued than never-acquirers based on the decomposition of the market-to-book ratio proposed by Rhodes-Kropf et al. (2005).

Given the notable differences in observable characteristics between acquirers and never-acquirers, it is unlikely that the volatility of stock returns of the latter would provide a consistent estimate of the counterfactual level of uncertainty that acquiring firms would have experienced had they not engaged in acquisitions. In the next section we describe the econometric strategy we follow to address the endogeneity of firms' acquisition decision.

4 Econometric Strategy

4.1 Estimation

Our objective is to estimate the average treatment effect of domestic and cross-border acquisitions on the volatility of stock returns of acquiring firms. This entails comparing the realized volatility of stock returns of firms engaged in different types of acquisitions to the volatility that these firms would have experienced had they not done so. Thus, the main empirical challenge we face is to obtain an unbiased estimate of the counterfactual outcome which is, by definition, unobservable.

We employ a matching estimator that utilizes non-acquiring firms that are similar to domestic and cross-border acquirers across a wide range of observable pre-acquisition characteristics to construct counterfactual outcomes for the two types of treated firms. The use of the propensity score intends to remove factors correlated with both the decision to carry out domestic and cross-border acquisitions (the treatments) and the outcome variable (volatility). Our main identifying assumption is, therefore, that firms' selection into carrying out acquisitions is based upon observable characteristics, and therefore, that once we control for the propensity score, the change in potential outcomes, i.e. the observed change in the volatility of stock returns of acquirers after the acquisition and the counterfactual change in volatility they would have experienced had they not engaged in an acquisition, are as good as random. Put it differently, we seek to block 'backdoor paths' of factors that affect both firms' decisions to undertake acquisitions and the volatility of their stock returns. We combine this estimator with a difference-in-differences approach that purges the influence of all observable and unobservable elements of the acquisition decision that are constant over time.

We implement the matching estimator by combining inverse probability weighting with covariate adjustment, thus providing two opportunities to adjust for selection on observables. This 'doubly robust' property implies that the estimator we use delivers unbiased inference of causal effects even

under model misspecification—as long as either the outcome regression or the propensity score models are correctly specified.

We use a multinomial logit model with three outcomes—no acquisition, domestic acquisition and cross-border acquisition—estimated on the pooled data to obtain the propensity score, in which all covariates included in the estimation are lagged 4 quarters in order to allay concerns of reverse causality and 'bad controls'—i.e. the decision to acquire affecting the covariates.[4] The propensity score is the estimated predicted probability that firm i would announce an acquisition of type $j \in \{\text{domestic}, \text{cross-border}\}$ in period t (using no acquisitions as the reference group) conditional on covariates—$\widehat{P}(A_{it} = j|\mathbf{X_{it-4}})$.[5] We then use the estimated propensity score to weight treated observations of acquisition type j by the inverse of the predicted probability of receiving a given treatment, $\widehat{P}_j^{-1}$, while control observations (coming from the group of never-acquirer firms) receive a weight of $(1-\widehat{P}_j)^{-1}$. Doing so gives more importance to acquiring firms for whom the conditional probability of acquiring a firm is not very high, while at the same time giving a greater weight to never-acquirers who are predicted to engage in acquisitions based on the value of their observed characteristics.

Our benchmark estimating equation is:

$$\ln y_{it+1} - \ln y_{it-1} = \alpha + \mathbf{A'_{it}}\boldsymbol{\beta} + \mathbf{X'_{i,t-4}}\boldsymbol{\Gamma} + \mathcal{F}(t) + \varepsilon_{it}, \tag{1}$$

where i indexes firms and $t \in \{2004q1, \ldots, 2017q3\}$ denotes time (quarter-years). The outcome variable is the difference in the logarithm of the volatility of stock returns of firm i over two quarters, $t+1$ and $t-1$, where t indicates the quarter-year at which firm i may have undertaken an acquisition. The main variables of interest are subsumed in the vector of acquisition dummies, $\mathbf{A'_{it}} = (A_{it}^{dom}, A_{it}^{cb})$, in which A_{it}^{j} takes the value 1 when firm i announces an acquisition of type $j \in \{\text{domestic}, \text{cross-border}\}$ in period t and 0 otherwise. The vector $\mathbf{X_{i,t-4}}$ comprises a set of pre-treatment control variables, which are the same ones used in the estimation of the propensity score (lagged by four quarters), and which we discuss in detail below.[6] $\mathcal{F}(t)$ denotes an array of quarter and year fixed effects that control for seasonal and aggregate factors such as merger waves and macroeconomic shocks that affect the acquisition activities of firms and the volatility of their stock returns, and ε_{it} denotes the error term.[7] Note that by making our comparison in

[4]Note that since the propensity score is estimated using the pooled data, firm fixed effects are not included in the estimation of the multinomial logit model. Doing so would result in never-acquirer firms (the control group) being dropped from the estimation.

[5]Notice that we exclude firms that undertake more than one acquisition of the same type within 4 quarters of each other, e.g. a firm acquiring one domestic target in 2012Q1 and another in 2012Q4.

[6]For instance, if a firm announces a domestic acquisition in the third quarter of 2005 (say, in August 15), then $A_{i,2005q3}^{dom} = 1$ and the dependent variable is the difference in the logarithm of the volatility of stock returns of firm i in the fourth quarter of 2005 (i.e. the standard deviation of daily stock returns between October 1st and December 31st, 2005) minus the logarithm of the volatility of stock returns of firm i in the second quarter of 2005 (i.e. the standard deviation of daily stock returns between April 1st and June 30th, 2005); all covariates included in $\mathbf{X'_{i,t-4}}$ correspond to the third quarter of 2004.

[7]Since we include quarter and year fixed effects both in the estimation of the propensity score and the outcome regression (1), we are accounting for cyclical and aggregate shocks both with respect to the acquisition decision and in the behavior of firm-level volatility.

terms of growth rates rather than levels we assume that acquisitions are based on the vector of observable pre-acquisition characteristics and time-invariant unobservables. In order to put our results in context with the extensive literature that examines the behavior of the abnormal stock returns around acquisitions, we also estimate a version of equation (1) using the time-difference in the mean *level* of stock returns as the dependent variable.

The specification (1) can be readily adapted to accommodate heterogeneous effects on volatility for different types of acquisitions, which we use to elucidate the importance of different mechanisms shapingta the relationship between acquisitions and uncertainty. To do so, we include interaction terms between the acquisition treatment dummies, $\mathbf{A'_{it}}$, and discrete covariates $\mathbf{S_i}$, which can vary at the deal-, industry and target country-level. The vector of coefficients $\boldsymbol{\delta}$ measure the difference in the effect of each type of acquisition (domestic and cross-border) within the subset of observations defined by $\mathbf{S_i}$.[8]

$$\ln y_{it+1} - \ln y_{it-1} = \alpha + (\mathbf{A_{it}} \times \mathbf{S_i})'\boldsymbol{\delta} + \mathbf{X'_{i,t-4}}\boldsymbol{\Gamma} + \mathcal{F}(t) + \varepsilon_{it}, \tag{2}$$

4.2 Determinants of Domestic and Cross-Border Acquisitions

We now discuss the estimates obtained from the multinomial logit model we use to estimate the propensity score and the choice of explanatory variables we use to model firms' decisions to engage in domestic and cross-border acquisitions. We include measures of firm size, performance, profitability, leverage, liquidity, valuation, and volatility as determinants of the decision to acquire following the extensive literature on the subject (see e.g. Harford, 1999; Jovanovic and Rousseau, 2002; Moeller et al., 2004; Rhodes-Kropf et al., 2005; Garfinkel and Hankins, 2011; Erel et al., 2012; Grullon et al., 2012; Hackbarth and Miao, 2012; Bonaime et al., 2018).

Table 3 reports marginal effects evaluated at the mean for the propensity score model. It is important to emphasize, however, that the role of propensity score estimation is to achieve a 'balancing score' in the sense of weighting the observations to eliminate biases in estimated treatment effects due to differences in the distribution of the baseline covariates, *not* to provide a causal explanation of the mechanisms determining the incidence of treatment.[9]

The estimates reported in Table 3 suggest that the forces driving the selection of firms into domestic and cross-border acquisitions are quite similar. We find that past acquisition activities, both at home and abroad, are the most important factors explaining subsequent acquisitions. Direct experience results in a higher likelihood of completing a deal of the same type—i.e. having

[8] For instance, when we investigate whether irreversibility affects the impact of acquisitions on volatility, the vector $\boldsymbol{\delta}$ includes 4 treatment effects: the impact of (i) domestic acquisitions occurring in low-irreversibility industries, (ii) domestic acquisitions in high-irreversibility industries, (iii) cross-border acquisitions in low-irreversibility industries and (iv) cross-border acquisitions in high-irreversibility industries.

[9] As Blundell and Dias (2009) note, if we use a model of the propensity score that predicts treatment 'too well' then the distribution of the propensity scores for treated and control firms will not overlap and it will become harder to find suitable non-treated firms to match with treated ones. On the other hand, if the propensity score model has too few covariates, then the conditional independence assumption is less likely to hold.

Table 3: Determinants of Acquisitions

	Type of Acquisition	
	Domestic	Cross-border
	N = 910	N = 741
	(1)	(2)
Past domestic acquisitions	0.1328***	0.0413***
	(0.011)	(0.07)
Past cross-border acquisitions	0.0483***	0.1098***
	(0.009)	(0.010)
Market value	-0.0055***	0.0004
	(0.001)	(0.001)
Market-to-Book value	0.0003	0.0002
	(0.000)	(0.000)
Cash	-5.1E-6***	-1.8E-6***
	(1.9E-6)	(5.7E-7)
ROA	6.5E-5**	-1.9E-5
	(2.8E-5)	(3.0E-5)
Leverage	8.9E-7	-1.2E-5
	(6.7E-6)	(3.6E-5)
Herfindahl index	-0.0032***	-0.0021***
	(0.005)	(0.001)
Firm misvaluation	0.0070***	0.0048***
	(0.001)	(0.001)
Firm Volatility	-0.0055***	0.0018
	(0.001)	(0.001)
Industry volatility	-0.0067***	0.0005
	(0.003)	(0.003)
Stock returns	0.0066**	0.0029
	(0.003)	(0.003)
Year fixed effects	Yes	Yes
Quarter fixed effects	Yes	Yes
Observations	41,289	
Time period	2004q1-2017q3	

Entries on the table are marginal effects evaluated at the mean obtained from estimating a multinomial logit model with three outcomes: no acquisition, domestic, and cross-border acquisition. N on the top of each column denotes the number of each type of acquisitions, domestic and cross-border. Detailed variable definitions are in Appendix A.1. All covariates are lagged 4 quarters. Standard errors in parenthesis. ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

completed a domestic acquisition in the previous year has a higher impact on the probability of completing a domestic deal in period t than having completed a cross-border one, while the converse is true for cross-border acquisitions. These results are consistent with the findings of Fuller et al. (2002) and Stiebale and Trax (2011), who show that firms that engage in acquisitions often do so repeatedly over time. Similarly, Karolyi et al. (2016) report that one in five public acquirers are

'serial acquirers'—i.e. they purchase five or more targets within 3 years—accounting for two-thirds of the cumulative acquisition value around the world.

Consistent with both neoclassical and behavioral theories of acquisitions, we find that firm misvaluation—defined as a systematic difference between a firm's market and 'true' value—has a positive effect on the probability of engaging in both types of acquisitions (Rhodes-Kropf et al., 2005; Dong et al., 2006). Higher market power, proxied by a firm's Herfindahl index of its sales within a 3-digit industry, and cash flow have a negative impact on the probability of both types of acquisitions. The former effect is consistent with Grenadier (2002), who shows that a more competitive environment increases the opportunity cost of waiting, and therefore accelerates the exercise of the option to acquire. While greater liquidity is associated with a higher likelihood to engage in acquisitions, as shown by Harford (1999), the magnitude of the estimated marginal effect associated with cash flow is very close to zero.

We find that higher volatility of stock returns at the firm and industry level, lowers the likelihood of domestic acquisitions, in line with the 'wait-and-see' response of real options to higher uncertainty (Leahy and Whited, 1996; Bulan, 2005; Bloom et al., 2007) and consistent with the findings of Bonaime et al. (2018); this effect is insignificant for cross-border acquisitions. Similarly, past performance, measured in terms of ROA and stock returns, only has a significant impact only for domestic deals.

Table 4 reports standardized differences for the means and variance ratios for the covariates used in the estimation of the propensity score. The results reveal large differences between both types of acquirers and non-acquirers in terms of observable pre-acquisition characteristics in the raw data, thus providing clear evidence of selection into treatment. Reweighting reduces substantially standardized differences and variance ratios get much closer to 1. This indicates that the matching procedure is able to eliminate a substantial amount of bias resulting from differences in the observed covariates.[10] Putting it differently, our matching procedure is successful in finding appropriate non-acquiring firms—in terms of being very similar in their pre-treatment observable characteristics to treated firms—to compare to both types of acquirers.

5 Results

In this section we present our estimates of the average treatment effect of acquisitions on the volatility of stock returns of acquiring firms. We explore the extent to which the estimated treatment effect is heterogeneous across a range of deal-, industry- and target country-level characteristics. Doing so, allows us to shed light on the operative mechanisms through which acquisitions shape the level of uncertainty that financial markets perceive about the acquirer.

[10] The empirical literature considers standardized differences below 10% and variance ratios between 0.5 and 2 after matching to indicate that covariate balancing has been achieved (see Caliendo and Kopeinig, 2008).

Table 4: Balancing Diagnostics

	Domestic versus No Acquisitions				Cross-border versus No Acquisitions			
	Standardised Difference		Variance Ratio		Standardised Difference		Variance Ratio	
	Raw	Weighted	Raw	Weighted	Raw	Weighted	Raw	Weighted
Domestic acquisitions	56.20%	-0.37%	8.601	0.976	28.39%	0.36%	4.175	1.023
Cross-border acquisitions	23.55%	-1.78%	3.949	0.875	61.20%	0.78%	11.357	1.057
Market value	21.67%	7.09%	0.826	0.886	79.31%	-0.45%	1.05	1.128
Market to book value	-2.44%	3.00%	1.12	1.637	6.69%	-9.95%	0.771	0.941
Cash flow	-6.29%	-0.37%	0.179	0.546	19.08%	-3.73%	0.634	0.285
ROA	22.27%	-2.39%	0.286	0.677	21.52%	-4.19%	0.704	1.436
Leverage	1.19%	-1.20%	0.174	0.068	2.32%	0.94%	0.216	0.287
Herfindahl index	-2.58%	-2.03%	0.907	1.006	-15.10%	4.74%	1.067	0.907
Firm misvaluation	28.44%	4.46%	0.774	0.926	82.62%	2.52%	0.995	1.005
Firm volatility	-29.14%	7.56%	0.995	1.043	-14.80%	15.62%	0.647	1.201
Industry volatility	-26.90%	8.56%	1.394	1.451	-16.85%	16.16%	1.406	1.693
Stock returns	12.89%	-5.20%	0.667	0.957	12.59%	1.18%	0.587	0.905

The standardized difference for each covariate X_k included in the estimation of the propensity score presented in Table 3 is given by $SD_k = \frac{\overline{X}_{k,1} - \overline{X}_{k,0}}{\sqrt{(s^2_{k,1} + s^2_{k,0})/2}}$, where $\overline{X}_{k,1}$ and $\overline{X}_{k,0}$ denote the sample mean of covariate X_k in the treatment and control groups respectively; $s^2_{k,1}$ and $s^2_{k,0}$ are the sample variances of covariate X_k in the treatment and control groups respectively. The variance ratio is defined as $VR = s^2_{k,1}/s^2_{k,0}$.

Table 5: Effect of Acquisitions on Stock Returns and their Volatility

Dependent variable:	Mean Returns		Volatility	
Type of acquisition:	(1)	(2)	(3)	(4)
All	0.0048		-0.0036	
	(0.011)		(0.020)	
Domestic		-0.0007		-.0553**
		(0.012)		(0.023)
Cross-border		0.0106		0.056
		(0.018)		(0.032)
Observations	40,297		40,525	

The table reports the coefficients of regressions where the dependent variable is the difference between the log mean stock return one quarter after the announcement of an acquisition and the log mean return one quarter before announcement in columns (1) and (2) and the difference between the log volatility of stock returns one quarter after the announcement of an acquisition and the log volatility one quarter before announcement on treatment (domestic and cross-border acquisitions) dummies. Control variables (all lagged 4 quarters) include domestic and cross-border acquisition dummies, market capitalization, market-to-book value ratio, cash flow, ROA, leverage, sales Herfindahl, acquiring firm's misvaluation, firm- and industry-level volatility of stock returns, mean stock returns and quarter- and year- fixed effects (Definitions of control variables are available in Appendix A.1). Treated observations are weighted by $1/\widehat{P_j}$ and control ones are weighted by $1/(1-\widehat{P_j})$, where $\widehat{P_j}$ denotes the estimated propensity score for acquisition of type j (domestic or cross-border) reported in Table 3. Standard errors in parenthesis ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

5.1 Benchmark Estimates

In order to put our contribution in the context of the extensive literature that examines whether acquisitions create value for shareholders, we first investigate whether the announcement of an acquisition affects the *mean* stock returns of acquirers one quarter after an acquisition has been announced. It is important to note, however, that while the regressions using the level of stock returns are not the same as the most commonly used specifications exploring the evolution of abnormal returns around the announcement of an acquisition, both methods intend to recover the same estimand—i.e. the additional return earned by acquiring firms relative to the counterfactual one they would have achieved had they not carried out the acquisition.

In column (1) of Table 5 we pool together all acquisitions and in column (2) we examine if there are significant differences depending on whether deals are domestic or cross-border. In line with the literature that estimates abnormal returns around acquisition events, we find an insignificant effect of acquisitions on the level of stock returns over the short run, regardless of whether deals span different countries of not (Jensen and Ruback, 1983; Andrade et al., 2001; Doukas and Travlos, 1988; Gregory and McCorriston, 2005).

Turning to the volatility of stock returns, the results reported in columns (3) and (4) show that while the overall impact of acquisitions is close to zero, the effect of acquisition on uncertainty depends crucially on the geographic scope of a deal. More precisely, the announcement of a domestic acquisition significantly reduces the volatility of stock returns by 5.5% in quarter after the announcement, whereas the announcement of a cross-border deal results in a positive impact, albeit

marginally insignificant, of similar magnitude.[11] In Appendix B, we show that the magnitude of the effect of domestic deals decreases slightly over the course of one year after announcement (see Table B.3).

The discussion in Section 2 highlights the fact that there are several, not necessarily mutually-exclusive, mechanisms that could determine the overall magnitude and significance of the estimates we report. While we cannot fully disentangle each channel individually, the heterogeneity analysis that follows sheds light on the relative importance of different plausible mechanisms shaping the effect that acquisitions have on the volatility of stock returns of acquiring firms.

5.2 Irreversibility

We first explore the role of irreversibility in conjunction with the differences in the operational leverage of the acquiring firm that are brought about by domestic and cross-border acquisitions. As our discussion in Section 2 reveals, the real-option characterization of acquisitions can have different implications for their impact on the uncertainty that financial markets perceive about acquirers: the flexibility regarding when to propose a deal and the uncertainty about the expected gains from a deal imply, on one hand, that announcements can reduce the volatility of stock returns as acquirers transform risky options into assets in place; on the other hand, if acquisitions lead to a substantial increase in operational leverage, the opposite result would obtain. We follow Gulen and Ion (2015) and Bonaime et al. (2018) in using three different proxies for the degree of irreversibility of investment at the industry-level: irreversibility, asset redeployability and capital intensity. We now discuss how each of these variables is constructed.

The irreversibility variable intends to approximate the extent to which firms' investment costs are sunk on the basis of their reliance on rented capital, depreciation expenses and sales of physical capital. Investment is likely to be less irreversible when firms tend to rent rather than buy their capital equipment, since the former provides greater flexibility in terms of changing the scale of a firm's operation; when capital depreciates faster; and when firms can rely on a secondary market to divest. Thus, following Bonaime et al. (2018), we add expenditure in rented capital, depreciation and sales of property, plant & equipment (PP&E) scaled over total PP&E lagged one year for each firm in our data. We then calculate each industry's average, and split industries in two groups according to the cross-industry median of the indicator.

The second proxy is based on Kim and Kung (2016)'s measure of asset redeployability, which uses capital flow data collected by the Bureau of Economic Analysis for all economic sectors in the United States to measure the extent to which industries utilize different types of assets. The redeployability score of an industry is higher when a large proportion of firms in a given industry use a particular type of asset (e.g. computer equipment or furniture and fixtures), reflecting both lower asset specificity and the existence of a thick secondary market for the asset. Higher redeployability is associated with lower irreversibility because, everything else equal, the liquidation value of assets is higher and divestment less costly in bad states of the world.

[11] Table B.4 in Appendix B shows that this result is robust to the exclusion of acquisitions in finance-related sectors.

The last measure we consider is capital intensity, measured as the mean of the ratio of PP&E investment to total assets (again, lagged by one year), with the view that firms operating in high capital intensity industries are more affected by indivisibilities and more illiquid secondary markets. We calculate irreversibility and capital intensity for the firms in our data and then aggregate these measures at the 3-digit industry level, while for redeployability we use the industry-level score constructed by Kim and Kung (2016) based on U.S. data; for each industry-level indicator, we divide our sample in two groups according to its median value.

The results reported in Table 6 provide strong support for the hypothesis that higher fixed costs of operating foreign affiliates lead to a substantial increase in uncertainty for acquirers in industries characterized by a high degree of investment irreversibility, regardless of the proxies we use to characterize differences in investment irreversibility across industries. The magnitude of the effect of cross-border deals increases substantially relative to the benchmark estimate reported in column (4) of Table 5; according to the estimates reported in Table 6, a cross-border acquisition increases the volatility of stock returns of acquiring firms between 8 to 16% one quarter after the deal is announced in high irreversibility industries, with the effect being generally stronger when irreversibility is based on the industry of the target firm. Conversely, cross-border acquisitions in low-irreversibility industries do not have a discernable impact on uncertainty. Notably, we also find that while the overall effect of acquisitions on volatility dies out after one quarter, the positive impact of cross-border deals in high-irreversibility industries remains large and highly significant throughout a whole year after the announcement of a deal (see Table B.5 in Appendix B). These results are consistent with the findings of Riaño (2011) and Fillat and Garetto (2015), who show that high fixed and sunk costs associated with establishing presence abroad, be it through exporting or operating foreign affiliates, increase the volatility and risk premium of globally-engaged firms.

The results on domestic acquisitions are harder to interpret through the lens of real options. If domestic acquisitions do not increase the operational leverage of acquirers as much as cross-border deals, we would expect the reduction in uncertainty due to the transformation to assets in place to be stronger in high irreversibility industries in which the real option features of acquisitions are more prominent. Instead we find that the negative effect of domestic acquisitions is only significant in low-irreversibility industries.

One alternative explanation is that the domestic-cross-border split is not fully capturing differences in operational leverage brought about by acquisitions. To explore this possibility, we estimate a regression in which we classify all acquisitions, regardless of the location of the target firm, in terms of the interaction between capital intensity, as a proxy for the level of fixed costs, and the irreversibility variable defined above. The results reported in Table B.6 in Appendix B are not fully consistent with the real options channel either. While acquisitions in industries characterized by high irreversibility and low fixed costs result in a significant reduction in volatility, we find a small and insignificant effect for deals in high-irreversibility and high fixed cost sectors.

We next turn our attention to the diversification channel. It could be the case that the reason

Table 6: Effect of Acquisitions on the Volatility of Stock Returns—Irreversibility

	Irreversibility		Redeployability		Capital Intensity	
	Acquirer	Target	Acquirer	Target	Acquirer	Target
	(1)	(2)	(3)	(4)	(5)	(6)
Domestic × Irreversibility below median	-0.0961***	-0.0779**				
	(0.031)	(0.035)				
Domestic × Irreversibility above median	0.0025	0.0034				
	(0.033)	(0.039)				
Cross-border × Irreversibility below median	0.0168	-0.0219				
	(0.047)	(0.052)				
Cross-border × Irreversibility above median	0.086**	0.1504***				
	(0.043)	(0.042)				
Domestic × Redeployability below median			0.0295	0.0331		
			(0.038)	(0.038)		
Domestic × Redeployability above median			-0.1008***	-0.1004***		
			(0.034)	(0.033)		
Cross-border × Redeployability below median			0.0920*	0.0894**		
			(0.049)	(0.045)		
Cross-border × Redeployability above median			-0.041	0.0344		
			(0.041)	(0.055)		
Domestic × Capital Intensity below median					-0.0785**	-0.0865**
					(0.034)	(0.035)
Domestic × Capital Intensity above median					-0.0327	0.0109
					(0.031)	(0.038)
Cross-border × Capital Intensity below median					0.0271	-0.0126
					(0.049)	(0.048)
Cross-border × Capital Intensity above median					0.0764*	0.1546***
					(0.040)	(0.043)
Observations	40,525		40,525		40,525	

The table reports the coefficients of regressions where the dependent variable is the difference between the log volatility of stock returns one quarter after the announcement of an acquisition and the log volatility one quarter before announcement on treatment (domestic and cross-border acquisitions) dummies interacted with industry-level proxies of irreversibility (see Appendix A.2 for their definition). Control variables (all lagged 4 quarters) include domestic and cross-border acquisition dummies, market capitalization, market-to-book value ratio, cash flow, ROA, leverage, sales Herfindahl, acquiring firm's misvaluation, firm- and industry-level volatility of stock returns, mean stock returns and quarter- and year- fixed effects (Definitions of control variables are available in Appendix A.1). Treated observations are weighted by $1/\widehat{P_j}$ and control ones are weighted by $1/(1-\widehat{P_j})$, where $\widehat{P_j}$ denotes the estimated propensity score for acquisition of type j (domestic or cross-border) reported in Table 3. Standard errors in parenthesis ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

why domestic acquisition result in a reduction in uncertainty is because they help acquirers to diversify industry-specific shocks. Similarly, the higher volatility that acquirers experience after the announcement of a cross-border deal could be due to due to a high degree of comovement between the business cycle of the UK and other developed countries, which tend to attract the largest number of deals in our data.

5.3 Diversification

In this section we investigate the hypothesis that the impact of acquisitions on the volatility of the acquirer is mediated by the opportunities provided by these investments to diversify away industry- and country-specific shocks. We investigate two dimensions of diversification—whether the acquirer and target firms operate in the same industry, and the degree of business cycle correlation between the target firm's country and the UK's.

Table 7: Effect of Acquisitions on the Volatility of Stock Returns—Diversification

	Diversification	
	Industry	Geographic
	(1)	(2)
Domestic ×	-0.0801**	
Horizontal Acquisition	(0.035)	
Domestic ×	-0.0303	
Diversifying Acquisition	(0.029)	
Cross-border ×	0.0231	
Horizontal Acquisition	(0.032)	
Cross-border ×	0.0837	
Diversifying Acquisition	(0.058)	
Domestic		-0.0553**
		(0.023)
Cross-border ×		0.0537
Low Business Cycle Correlation with UK		(0.042)
Cross-border ×		0.0448
High Business Cycle Correlation with UK		(0.049)
Observations	40,525	40,525

The table reports the coefficients of regressions where the dependent variable is the difference between the log volatility of stock returns one quarter after the announcement of an acquisition and the log volatility one quarter before announcement on treatment (domestic and cross-border acquisitions) dummies interacted with industry-level proxies of diversification (see Appendix A.2 for their definition). Control variables (all lagged 4 quarters) include domestic and cross-border acquisition dummies, market capitalization, market-to-book value ratio, cash flow, ROA, leverage, sales Herfindahl, acquiring firm's misvaluation, firm- and industry-level volatility of stock returns, mean stock returns and quarter- and year- fixed effects (Definitions of control variables are available in Appendix A.1). Treated observations are weighted by $1/\widehat{P_j}$ and control ones are weighted by $1/(1-\widehat{P_j})$, where $\widehat{P_j}$ denotes the estimated propensity score for acquisition of type j (domestic or cross-border) reported in Table 3. Standard errors in parenthesis ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

These results are reported in Table 7. In column (1) of Table 7 we compare diversifying and horizontal deals (the former are deals in which the acquirer and target firms operate in different 3-digit industries, while in the latter case, both the bidder and target operate in the same industry), domestically and across borders. In column (2) we turn our focus to cross-border deals and explore if the volatility-enhancing effect that cross-border acquisitions have on volatility is dampened when target firms are located in countries with business cycle that are less correlated with that of the UK. Similar to our analysis of irreversibility in the previous section, we split our sample of cross-border acquisitions in two groups (based on the median correlation between the cyclical component of real GDP of target countries and the UK's) and estimate the average treatment effect of acquisitions on volatility for each.

We do not find support for the hypothesis that diversification effects play a key role in shaping the effect of acquisitions on the volatility of stock returns of acquiring firms. The results in column (1) of Table 7 show that, if anything, diversifying acquisitions have a stronger impact on the volatility of acquirers. We do not find that the impact of cross-border acquisitions on volatility is significantly affected by the scope to diversify away aggregate shocks either. The results presented in column (2) are consistent with the empirical literature that finds that the expansion of firms across borders through multinational activity provides limited diversification benefits (Jacquillat and Solnik, 1978; Senchack and Beedles, 1980).

It is possible that our characterization of a 'diversifying' acquisition is too crude to capture the sectoral interconnections that, as Acemoglu et al. (2012) show, determine whether shocks are diversified away or if they are instead amplified in 'cascade' effects that propagate across a production network. On the other hand, the potential of acquisitions to reduce the volatility of acquirers might be dented if financial markets perceive that diversifying acquisitions are driven by practices unrelated to profit maximization, as discussed in Section 2.2.2.

5.4 International Frictions

We now turn our focus to the role that cross-border frictions play in shaping the effect that acquisitions exert on the volatility of stock returns of acquiring firms. Using a battery of proxies for barriers to international investment flows, we evaluate whether the average treatment effect of cross-border acquisitions differs for deals according to the extent of their exposure to a particular friction. Table 8 presents these results. Every row in the table reports the estimated regression coefficients of the interaction between the cross-border treatment and a different target-country characteristic, noting that we also include all control variables specified in equation (1) and the treatment variable for domestic acquisitions in each regression.

Rossi and Volpin (2004), Head and Ries (2008), Erel et al. (2012), Davies et al. (2018) among others, provide robust evidence that the same frictions that impede international trade of goods and services, such as physical and cultural distance and institutional differences between countries, are also key determinants of cross-border acquisitions. Greater physical and cultural distance between

Table 8: Effect of Acquisitions on the Volatility of Stock Returns—International Frictions

		Below Median	Above Median
	Cross-border ×		
(1)	Physical distance	0.0258	0.0945**
		(0.041)	(0.047)
(2)	Cultural distance	0.0573	0.0291
		(0.040)	(0.045)
(3)	Entry costs	0.0215	0.1145**
		(0.039)	(0.054)
(4)	Risk of expropriation	0.0372	0.0856
		(0.039)	(0.053)
(5)	Corporate transparency	0.0663*	-0.0022
		(0.038)	(0.056)
(6)	Accounting standards	0.0446	0.0658
		(0.037)	(0.060)
(7)	Anti-director rights	0.0372	0.0779
		(0.039)	(0.052)
(8)	Creditor rights	0.0577	0.0429
		(0.046)	(0.045)
(9)	Merger control index	0.056	0.0132
		(0.036)	(0.061)

Each row of the table reports the coefficients of a regression where the dependent variable is the difference between the log volatility of stock returns one quarter after the announcement of an acquisition and the log volatility one quarter before announcement on treatment (domestic and cross-border acquisitions) dummies interacted with target country-level characteristics (see Appendix A.2 for their definition), where target countries have been split in two groups according to the median value of each variable. To save space we do not report the coefficient associated with domestic acquisitions. The number of observations in all regressions is the same, 40,525. Control variables (all lagged 4 quarters) include domestic and cross-border acquisition dummies, market capitalization, market-to-book value ratio, cash flow, ROA, leverage, sales Herfindahl, acquiring firm's misvaluation, firm- and industry-level volatility of stock returns, mean stock returns and quarter- and year- fixed effects (Definitions of control variables are available in Appendix A.1). Treated observations are weighted by $1/\widehat{P_j}$ and control ones are weighted by $1/(1-\widehat{P_j})$, where $\widehat{P_j}$ denotes the estimated propensity score for acquisition of type j (domestic or cross-border) reported in Table 3. Standard errors in parenthesis ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

the acquiring and target firms increase the shareholders' cost of monitoring the managers of the target firm. Informational frictions are more pervasive for teams operating at a distance—they slow communication flows down and stifle their reaction to shocks—thereby lowering the synergy gains from acquisitions (Portes and Rey, 2005; Head and Ries, 2008; Kalnins and Lafontaine, 2013). At the same time, the cost of integrating the target after its acquisition is crucially dependent on the fit between the acquirer and the target alongside administrative and cultural practices and personal characteristics (Kogut and Singh, 1988). Following Karolyi (2016), we define the 'cultural distance' between a target country and the UK as the Euclidean distance between the (country-level) average response for a range of questions regarding individuals' bias towards immigrants and other races, their preferences for autonomy, freedom, income and gender inequality, and their views on the

importance of religion, competition, pride in their country and trust towards other people obtained from the World Values Survey.

The results reported in the first row of Table 8 reveal that the stronger effect of cross-border acquisitions on the volatility of acquirers is only significant for deals in which the physical distance between the target's country and the UK is above the median. In contrast, we do not find evidence of heterogeneity in the effect of cross-border acquisitions on volatility based on the cultural differences between the acquirer and target countries (row 2).[12]

As Davies et al. (2018) lucidly put it, while setting up a foreign affiliate injects the parent firm into the destination, an acquisition brings the destination into the parent. Higher barriers to entry, weak investor protection and lack of corporate transparency can amplify the positive effect that we identify cross-border acquisitions have on the volatility of acquiring firms if they exacerbate the uncertainty involved in the process of integrating the target's assets and capabilities within the parent firm's global activities.

We find that the volatility-enhancing impact of cross-border acquisitions is stronger when target firms are located in countries with high barriers to entry. These might tilt the bargaining power away from the acquirer towards the target, as the latter's insider status becomes more valuable, thereby diluting the expected benefits of the acquisition for the acquirer. Weitzel and Berns (2006) also find that engaging in corruption to get around red tape increases the uncertainty regarding the returns to local investments. The results reported in rows (5)-(8) reveal that the impact of cross-border acquisitions tends to be higher for deals in countries with less transparent accounting standards and weaker protection for minority investors. Nevertheless, we do not find significant differences in the magnitude of the acquisition effect along these dimensions. Similarly, we do not find significant differences in the average treatment effect of cross-border acquisitions according to the easiness to conduct acquisitions in the target country, as proxied by the merger component of the competition law index developed by Bradford and Chilton (2018), for which higher values indicate that the law prohibits more behaviors or requires more extensive remedies.

In summary, while we find some evidence that certain barriers to international capital flows amplify the effect of cross-border acquisitions on the volatility of acquirers, as a whole they do not appear to be the most important mechanism explaining the differential effect of domestic and cross-border acquisitions on the uncertainty perceived by financial markets.

5.5 Deal-level Characteristics

There are several features of the way that an acquisition deal is structured, such as the method of payment, relative size and whether majority control of the target is achieved, that acquirers can use to ameliorate the effect of takeovers on uncertainty. In this section we explore how deal-level characteristics mediate the impact of acquisitions on volatility for domestic and cross-border deals. There is ample evidence that these characteristics crucially affect the magnitude of abnormal

[12] Using other measures of common culture typical from the gravity literature such as having a common language or a colonial relationship yield similar results.

returns following the announcement of an acquisitions.

These results have to be interpreted with care. Because these transaction characteristics are chosen by acquirers and targets potentially with the view to mitigate the uncertainty associated with a deal, it is possible that the identifying assumption of selection-on-observables does not hold due to reverse causality.

Table 9: Effect of Acquisitions on the Volatility of Stock Returns—Heterogeneity by Deal Characteristics

	Method of Payment (1)	Relative Deal Size (2)	Ownership Control (3)
Domestic × Cash	-0.0527**		
	(0.024)		
Domestic × Other	-0.0714		
	(0.084)		
Cross-border × Cash	0.0721**		
	(0.034)		
Cross-border × Other	-0.2239***		
	(0.073)		
Domestic × Small		-0.0077	
		(0.031)	
Domestic × Large		-0.0853***	
		(0.029)	
Cross-border × Small		0.0325	
		(0.040)	
Cross-border × Large		0.0625	
		(0.044)	
Domestic × Minority			-0.0048
			(0.052)
Domestic × Majority			-0.0587**
			(0.026)
Cross-border × Minority			0.0055
			(0.060)
Cross-border × Majority			0.0636*
			(0.037)
Observations	40,525	40,525	40,525

The table reports the coefficients of regressions where the dependent variable is the difference between the log volatility of stock returns one quarter after the announcement of an acquisition and the log volatility one quarter before announcement on treatment (domestic and cross-border acquisitions) dummies interacted with deal-level characteristics (see Appendix A.2 for their definition). Control variables (all lagged 4 quarters) include domestic and cross-border acquisition dummies, market capitalization, market-to-book value ratio, cash flow, ROA, leverage, sales Herfindahl, acquiring firm's misvaluation, firm- and industry-level volatility of stock returns, mean stock returns and quarter- and year- fixed effects (Definitions of control variables are available in Appendix A.1). Treated observations are weighted by $1/\widehat{P_j}$ and control ones are weighted by $1/(1-\widehat{P_j})$, where $\widehat{P_j}$ denotes the estimated propensity score for acquisition of type j (domestic or cross-border) reported in Table 3. Standard errors in parenthesis ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

Table 9 presents our results. The coefficients reported in column (1) show that the impact of cross-border acquisitions on the volatility of acquirers is crucially affected by the method of payment. While cash deals produce a positive and significant increase in volatility post-acquisition (of similar magnitude to the overall effect for cross-border deals reported in column (4) of Table 5), the treatment effect changes sign becoming negative and quite large for acquisitions not fully paid by cash (i.e. using stock or a mix between cash and stock)—a 20% reduction in the volatility of the acquirer's stock return one quarter after the acquisition has been announced. It is important to remark, however, that while paying with equity is preferable from the point of view of the acquirer, targets are often unwilling to accept foreign equity, forcing the acquirer to pay with cash (Moeller and Schlingemann, 2005)—this is a salient feature of our data, with more than nine out ten deals using cash as the method of payment.

In column (2) we examine the role of an acquisition's *relative* size—i.e. the value of the transaction divided by the equity market capitalization of the acquirer at the end of the fiscal year prior to the acquisition announcement. We find that the reduction in volatility following domestic deals is only significant for large deals, consistent with the notion that this effect is stronger the more important the exercise of the real option is vis-à-vis the existing assets in place for the acquirer. We do not find that the effect of cross-border deals is significantly mediated by the relative size of the transaction, however.

Lastly, we study the effect of the level of control achieved by an acquisition. The results presented in column (3) show that acquisitions—whether they are domestic or cross-border—only have a significant impact on the volatility of the acquirer when they achieve majority control of the target. This could reflect the fact that the value of minority acquisitions is substantially smaller than majority ones (Ouimet, 2013), which would limit the impact of the acquisitions on the returns and volatility of the acquirer. Acquiring majority control strengthens the acquirer's incentives to invest more resources in the target and share more proprietary technologies and intangible assets by easing holdup problems—particularly in cross-border acquisitions (Antràs et al., 2009; Chari et al., 2009). Thus, the result that majority-achieving cross-border deals result in an increase in the perceived volatility of acquirers could reflect the fact that these investments are also associated with higher operational leverage for the combined firm.

6 Conclusion

This paper studies the impact that acquisitions have on the volatility of stock returns of acquiring firms. We use data on acquisitions by publicly-listed firms in the UK over the period 2004-2017, and employ a matching estimator combined with differences-in-differences to address the endogenous selection of firms into acquisitions and to control for any time-invariant potential confounders.

While we do not find that the volatility of stock returns changes significantly in response to the announcement of an acquisition across our whole sample, we show that this null result masks substantial heterogeneity. Our main result is that the geographic scope of acquisitions is crucial

in determining their impact on the uncertainty that financial markets perceive about acquiring firms. Domestic acquisitions lower the volatility of returns of acquiring firms one quarter after an announcement is made while cross-border deals produce the opposite effect.

We carry out an extensive heterogeneity analysis to shed light on the role of potential mechanisms that can explain the different response that acquisitions exert on the volatility of stock returns of acquirers depending on the whether they extend a firm's boundaries across countries or not. Our results reveal that when acquisitions exhibit a high degree of irreversibility, the higher fixed costs associated with operating a foreign target increase acquirers' exposure to operational leverage and, consequently, the volatility their stock returns. This result is consistent with workhorse models of firms' global engagement, either through international trade or foreign direct investment, featuring substantial fixed and sunk costs. The increase in volatility brought about by cross-border acquisitions in high irreversibility industries is quantitatively large—between two to three times as large as the effect across all international deals—and remains significant over a whole year after the announcement of an acquisition.

The other channels we investigate are not as important in explaining the increase in volatility produced by cross-border acquisitions. While we find that the effect of cross-border acquisition on volatility tends to be larger for deals in which international frictions are higher, the differences are only significant for certain barriers such as entry costs, lack of corporate transparency and physical distance between the acquirer and target firms. We do not find evidence in support of international diversification mediating the effect of cross-border transactions on volatility.

The mechanisms that drive the reduction in volatility following domestic acquisitions are, on the other hand, harder to pinpoint.

While we find that this effect is stronger for large deals—which is consistent with the transformation of options to assets-in-place hypothesis—the fact that the effect is larger when deals in low-irreversibility industries is not consistent with this channel. The effect does not appear to be driven by the diversification of industry-specific shocks either, as the reduction in volatility is larger when both the acquirer and target firms operate in the same industry.

Lastly, we show that deal-specific characteristics play a critical role in determining the impact of acquisitions on uncertainty. The differential impact of domestic and cross-border deals on the volatility of acquirers is more salient for larger deals relative to the size of the acquiring firm and for transactions that achieve majority control of the target firm. While domestic acquisitions lead to a reduction in volatility regardless of the method of payment, we find that the impact of cross-border transactions is crucially affected by whether acquisitions are paid for entirely by cash or through other methods. Nine out of ten transactions involving foreign firms in our data are paid for by cash leading to the large increase in volatility documented above; in the small minority of cases in which acquisitions are paid for by stock or a mix of stocks and cash, however, the volatility of acquirers falls substantially.

References

Acemoglu, D., V. M. Carvalho, A. Ozdaglar, and A. Tahbaz-Salehi (2012): "The Network Origins of Aggregate Fluctuations," *Econometrica*, 80, 1977–2016.

Adrian, T. and J. Rosenberg (2008): "Stock Returns and Volatility: Pricing the Short-Run and Long-Run Components of Market Risk," *The Journal of Finance*, 63, 2997–3030.

Alquist, R., N. Berman, R. Mukherjee, and L. L. Tesar (2019): "Financial constraints, institutions, and foreign ownership," *Journal of International Economics*, 118, 63–83.

Andersen, T. G., T. Bollerslev, F. X. Diebold, and H. Ebens (2001): "The distribution of realized stock return volatility," *Journal of Financial Economics*, 61, 43–76.

Andrade, G., M. Mitchell, and E. Stafford (2001): "New Evidence and Perspectives on Mergers," *Journal of Economic Perspectives*, 15, 103–120.

Antràs, P., M. Desai, and C. F. Foley (2009): "Multinational Firms, FDI Flows and Imperfect Capital Markets," *Quarterly Journal of Economics*, 124, 1171–1219.

Antràs, P. and S. R. Yeaple (2014): "Multinational Firms and the Structure of International Trade," in *Handbook of International Economics*, ed. by G. Gopinath, E. Helpman, and K. Rogoff, Elsevier, vol. 4, 55–130.

Arellano, C., Y. Bai, and P. J. Kehoe (2019): "Financial Frictions and Fluctuations in Volatility," *Journal of Political Economy*, 127, 2049–2103.

Ariu, A. (2016): "Services versus goods trade: a firm-level comparison," *Review of World Economics (Weltwirtschaftliches Archiv)*, 152, 19–41.

Arnold, J. M. and B. S. Javorcik (2009): "Gifted kids or pushy parents? Foreign direct investment and plant productivity in Indonesia," *Journal of International Economics*, 79, 42–53.

Barattieri, A., I. Borchert, and A. Mattoo (2016): "Cross-border mergers and acquisitions in services: The role of policy and industrial structure," *Canadian Journal of Economics*, 49, 1470–1501.

Berger, P. G. and E. Ofek (1995): "Diversification's effect on firm value," *Journal of Financial Economics*, 37, 39–65.

Berk, J. B., R. C. Green, and V. Naik (1999): "Optimal Investment, Growth Options, and Security Returns," *The Journal of Finance*, 54, 1553–1607.

Bhagwat, V., R. Dam, and J. Harford (2016): "The Real Effects of Uncertainty on Merger Activity," *The Review of Financial Studies*, 29, 3000–3034.

Bloom, N. (2009): "The Impact of Uncertainty Shocks," *Econometrica*, 77, 623–685.

Bloom, N., S. Bond, and J. Van Reenen (2007): "Uncertainty and Investment Dynamics," *Review of Economic Studies*, 74, 391–415.

Bloom, N., M. Floetotto, N. Jaimovich, I. Saporta-Eksten, and S. J. Terry (2018): "Really Uncertain Business Cycles," *Econometrica*, 86, 1031–1065.

Blundell, R. and M. C. Dias (2009): "Alternative Approaches to Evaluation in Empirical Microeconomics," *The Journal of Human Resources*, 44, 565–640.

Bonaime, A., H. Gulen, and M. Ion (2018): "Does policy uncertainty affect mergers and acquisitions?" *Journal of Financial Economics*, 129, 531–558.

Bradford, A. and A. S. Chilton (2018): "Competition Law around the World from 1889 to 2010: The Competition Law Index," *Journal of Competition Law & Economics*, 14, 393–432.

Breinlich, H. and C. Criscuolo (2011): "International trade in services: A portrait of importers and exporters," *Journal of International Economics*, 84, 188–206.

Bris, A. and C. Cabolis (2008): "The Value of Investor Protection: Firm Evidence from Cross-Border Mergers," *Review of Financial Studies*, 21, 605–648.

Bulan, L. T. (2005): "Real options, irreversible investment and firm uncertainty: New evidence from U.S. firms," *Review of Financial Economics*, 14, 255–279.

Caliendo, M. and S. Kopeinig (2008): "Some Practical Guidance for the Implementation of Propensity Score Matching," *Journal of Economic Surveys*, 22, 31–72.

Carlson, M., A. Fisher, and R. Giammarino (2004): "Corporate Investment and Asset Price Dynamics: Implications for the Cross-section of Returns," *The Journal of Finance*, 59, 2577–2603.

——— (2006): "Corporate Investment and Asset Price Dynamics: Implications for SEO Event Studies and Long-Run Performance," *The Journal of Finance*, 61, 1009–1034.

Caves, R. E. (1996): *Multinational Enterprise and Economic Analysis*, New York, NY: Cambridge University Press, 2nd ed.

Chari, A., P. P. Ouimet, and L. L. Tesar (2009): "The Value of Control in Emerging Markets," *Review of Financial Studies*, 23, 1741–1770.

Cooper, I. and R. Priestley (2011): "Real investment and risk dynamics," *Journal of Financial Economics*, 101, 182–205.

Das, S., M. J. Roberts, and J. R. Tybout (2007): "Market Entry Costs, Producer Heterogeneity, and Export Dynamics," *Econometrica*, 75, 837–873.

Davies, R. B., R. Desbordes, and A. Ray (2018): "Greenfield versus merger and acquisition FDI: Same wine, different bottles?" *Canadian Journal of Economics*, 51, 1151–1190.

Decker, R. A., P. N. D'Erasmo, and H. M. Boedo (2016): "Market Exposure and Endogenous Firm Volatility over the Business Cycle," *American Economic Journal: Macroeconomics*, 8, 148–198.

Denis, D. J., D. K. Denis, and A. Sarin (1997): "Agency Problems, Equity Ownership, and Corporate Diversification," *The Journal of Finance*, 52, 135–160.

Denis, D. J., D. K. Denis, and K. Yost (2002): "Global Diversification, Industrial Diversification, and Firm Value," *The Journal of Finance*, 57, 1951–1979.

Dong, M., D. Hirshleifer, S. Richardson, and S. H. Teoh (2006): "Does Investor Misvaluation Drive the Takeover Market?" *The Journal of Finance*, 61, 725–762.

Doukas, J. and N. G. Travlos (1988): "The Effect of Corporate Multinationalism on Shareholders' Wealth: Evidence from International Acquisitions," *The Journal of Finance*, 43, 1161–1175.

Duchin, R. and B. Schmidt (2013): "Riding the merger wave: Uncertainty, reduced monitoring, and bad acquisitions," *Journal of Financial Economics*, 107, 69–88.

Duffee, G. R. (1995): "Stock returns and volatility: A firm-level analysis," *Journal of Financial Economics*, 37, 399–420.

Erel, I., R. C. Liao, and M. S. Weisbach (2012): "Determinants of Cross-Border Mergers and Acquisitions," *The Journal of Finance*, 67, 1045–1082.

Fillat, J. L. and S. Garetto (2015): "Risk, Returns, and Multinational Production," *Quarterly Journal of Economics*, 130, 2027–2073.

Fillat, J. L., S. Garetto, and L. Oldenski (2015): "Diversification, cost structure, and the risk premium of multinational corporations," *Journal of International Economics*, 96, 37–54.

Froot, K. A., D. S. Scharfstein, and J. C. Stein (1993): " Risk Management: Coordinating Corporate Investment and Financing Policies," *The Journal of Finance*, 48, 1629–1658.

Fuller, K., J. Netter, and M. Stegemoller (2002): "What Do Returns to Acquiring Firms Tell Us? Evidence from Firms That Make Many Acquisitions," *The Journal of Finance*, 57, 1763–1793.

Garfinkel, J. A. and K. W. Hankins (2011): "The role of risk management in mergers and merger waves," *Journal of Financial Economics*, 101, 515–532.

Girma, S. and H. Görg (2007): "Evaluating the foreign ownership wage premium using a difference-in-differences matching approach," *Journal of International Economics*, 72, 97–112.

Girma, S., S. P. Lancheros, and A. Riaño (2016): "Global Engagement and Returns Volatility," *Oxford Bulletin of Economics and Statistics*, 78, 814–833.

Gregory, A. and S. McCorriston (2005): "Foreign acquisitions by UK limited companies: short- and long-run performance," *Journal of Empirical Finance*, 12, 99–125.

Grenadier, S. R. (2002): "Option Exercise Games: An Application to the Equilibrium Investment Strategies of Firms," *The Review of Financial Studies*, 15, 691–721.

Grullon, G., E. Lyandres, and A. Zhadanov (2012): "Real Options, Volatility, and Stock Returns," *The Journal of Finance*, 67, 1499–1537.

Guadalupe, M., O. Kuzmina, and C. Thomas (2012): "Innovation and Foreign Ownership," *American Economic Review*, 102, 3594–3627.

Gulen, H. and M. Ion (2015): "Policy Uncertainty and Corporate Investment," *The Review of Financial Studies*, 29, 523–564.

Hackbarth, D. and J. Miao (2012): "The dynamics of mergers and acquisitions in oligopolistic industries," *Journal of Economic Dynamics and Control*, 36, 585–609.

Hackbarth, D. and E. Morellec (2008): "Stock Returns in Mergers and Acquisitions," *The Journal of Finance*, 63, 1213–1252.

Hansen, R. G. (1987): "A Theory for the Choice of Exchange Medium in Mergers and Acquisitions," *The Journal of Business*, 60, 75–95.

Harford, J. (1999): "Corporate Cash Reserves and Acquisitions," *The Journal of Finance*, 54, 1969–1997.

Head, K. and J. Ries (2008): "FDI as an outcome of the market for corporate control: Theory and evidence," *Journal of International Economics*, 74, 2–20.

Healy, P. M. and K. G. Palepu (1993): "International corporate equity acquisitions: who, where and why?" in *Foreign Direct Investment*, ed. by K. A. Froot, University of Chicago Press, 231–254.

Helpman, E., M. J. Melitz, and S. R. Yeaple (2004): "Export Versus FDI with Heterogeneous Firms," *American Economic Review*, 94, 300–316.

Jacquillat, B. and B. Solnik (1978): "Multinationals are Poor Tools for Diversification," *The Journal of Portfolio Management*, 4, 8–12.

Jensen, M. and R. Ruback (1983): "The market for corporate control: The scientific evidence," *Journal of Financial Economics*, 11, 5–50.

Jovanovic, B. and P. L. Rousseau (2002): "The Q-Theory of Mergers," *American Economic Review*, 92, 198–204.

Kalnins, A. and F. Lafontaine (2013): "Too Far Away? The Effect of Distance to Headquarters on Business Establishment Performance," *American Economic Journal: Microeconomics*, 5, 157–179.

Karolyi, G. A. (2015): *Cracking the Emerging Markets Enigma*, London, UK: Oxford University Press.

——— (2016): "The gravity of culture for finance," *Journal of Corporate Finance*, 41, 610–625.

Karolyi, G. A., R. C. Liao, and G. Loureiro (2016): "The Decreasing Returns of Serial Acquirers around the World," Cornell University Working Paper.

Kim, H. and H. Kung (2016): "The Asset Redeployability Channel: How Uncertainty Affects Corporate Investment," *The Review of Financial Studies*, 30, 245–280.

Kogut, B. and H. Singh (1988): "The Effect of National Culture on the Choice of Entry Mode," *Journal of International Business Studies*, 19, 411–432.

Kramarz, F., J. Martin, and I. Mejean (2020): "Volatility in the small and in the large: The lack of diversification in international trade," *Journal of International Economics*, 122, 103276.

La Porta, R., F. López-de-Silanes, A. Shleifer, and R. W. Vishny (1998): "Law and Finance," *Journal of Political Economy*, 106, 1113–1155.

Lang, L. H. P. and R. M. Stulz (1994): "Tobin's q, Corporate Diversification, and Firm Performance," *Journal of Political Economy*, 102, 1248–1280.

Leahy, J. and T. Whited (1996): "The Effect of Uncertainty on Investment: Some Stylized Facts," *Journal of Money, Credit and Banking*, 28, 64–83.

Lee, T.-L. and R. E. Caves (1998): "Uncertain Outcomes of Foreign Investment: Determinants of the Dispersion of Profits After Large Acquisitions," *Journal of International Business Studies*, 29, 563–581.

Mantecon, T. (2009): "Mitigating risks in cross-border acquisitions," *Journal of Banking & Finance*, 33, 640–651.

Mayer, T. and S. Zignano (2011i): "Notes on CEPII's distances measures: The GeoDist database," Document de Travail No 2011-25.

Melitz, M. J. and S. J. Redding (2014): "Heterogeneous Firms and Trade," in *Handbook of International Economics*, ed. by K. R. Elhanan Helpman and G. Gopinath, Elsevier, vol. 4, 1 – 54.

Moeller, S. B. and F. P. Schlingemann (2005): "Global diversification and bidder gains: A comparison between cross-border and domestic acquisitions," *Journal of Banking & Finance*, 29, 533–564.

Moeller, S. B., F. P. Schlingemann, and R. M. Stulz (2004): "Firm size and the gains from acquisitions," *Journal of Financial Economics*, 73, 201–228.

Morck, R., A. Shleifer, and R. Vishny (1990): "Do Managerial Objectives Drive Bad Acquisitions?" *The Journal of Finance*, 45, 31–48.

Nocke, V. and S. Yeaple (2007): "Cross-border mergers and acquisitions vs. greenfield foreign direct investment: The role of firm heterogeneity," *Journal of International Economics*, 72, 336 – 365.

Ouimet, P. P. (2013): "What Motivates Minority Acquisitions? The Trade-Offs between a Partial Equity Stake and Complete Integration," *The Review of Financial Studies*, 26, 1021–1047.

Portes, R. and H. Rey (2005): "The determinants of cross-border equity flows," *Journal of International Economics*, 65, 269–296.

Rhodes-Kropf, M., D. T. Robinson, and S. Viswanathan (2005): "Valuation waves and merger activity: The empirical evidence," *Journal of Financial Economics*, 77, 561–603.

Riaño, A. (2011): "Exports, Investment and Firm-level Sales Volatility," *Review of World Economics (Weltwirtschaftliches Archiv)*, 147, 643–663.

Rossi, S. and P. Volpin (2004): "Cross-country determinants of mergers and acquisitions," *Journal of Financial Economics*, 74, 277–304.

Rowland, P. F. and L. L. Tesar (2004): "Multinationals and the Gains from International Diversification," *Review of Economic Dynamics*, 7, 789–826.

Senchack, A. J. and W. L. Beedles (1980): "Is indirect international diversification desirable?" *The Journal of Portfolio Management*, 6, 49–57.

Stiebale, J. and M. Trax (2011): "The effects of cross-border M&As on the acquirers' domestic performance: firm-level evidence," *Canadian Journal of Economics*, 44, 957–990.

Travlos, N. G. (1987): "Corporate Takeover Bids, Methods of Payment, and Bidding Firms' Stock Returns," *The Journal of Finance*, 42, 943–963.

UNCTAD (2019): *World Investment Report 2019*, New York, NY: United Nations Conference on Trade and Development.

Vannoorenberghe, G. (2012): "Firm-level volatility and exports," *Journal of International Economics*, 86, 57–67.

Wang, J. and X. Wang (2015): "Benefits of foreign ownership: Evidence from foreign direct investment in China," *Journal of International Economics*, 97, 325–338.

Weitzel, U. and S. Berns (2006): "Cross-border takeovers, corruption, and related aspects of governance," *Journal of International Business Studies*, 37, 786–806.

Appendix

A Variable Definitions

A.1 Control variables

These variables, lagged 4 quarters, are the covariates included in the estimation of the multinomial logit model used to obtain the propensity score. They are also included as controls in all the estimates presented in Section 5.

- **Domestic acquisition:** dummy variable equal 1 when a firm has acquired a target firm in the UK in a given quarter-year period and 0 otherwise.
- **Cross-border acquisition:** dummy variable equal 1 when a firm has acquired a target firm abroad (outside the UK) in a given quarter-year period and 0 otherwise.
- **Market value:** sum of a firm's share price multiplied by the number of ordinary shares in issue.
- **Market-to-Book value:** ratio of the market value of a firm's equity divided by its book value (the value of the firm's capital stock in its balance sheet).
- **Cash:** firm's cash from operations divided by the number of shares outstanding.
- **ROA:** return on assets is measured as income before extraordinary items plus interest expenses plus income taxes all divided by total assets.
- **Leverage:** long-term debt plus debt in current liabilities, all divided by total assets.
- **Herfindahl index:** calculated on the basis of the total sales of the listed firms included in our sample within the 3-digit Standard Industry Classification (SIC) industry recorded as their main industry of operation. The Herfindahl index is constructed by summing up the square of each firm's market share within the 3-digit SIC industry for each quarter.
- **Firm volatility:** standard deviation of daily stock returns for a firm in a given quarter.
- **Industry volatility:** market value-weighted average of firm-level volatility (as defined above) within a given 3-digit Standard Industry Classification (SIC) industry in a given quarter.
- **Stock returns:** mean of daily stock returns (log difference between a firm's stock price in two consecutive days) for a firm in a given quarter.
- **Acquirer's misvaluation:** Calculated following Rhodes-Kropf et al. (2005). For each 3-digit SIC industry j and year t in our data we estimate the following regression:

$$\ln M_{it} = \alpha_{0jt} + \alpha_{1jt} \ln B_{it} + \alpha_{2jt} \ln(|NI_{it}|) + \alpha_{3jt} I^{-} \ln(|NI_{it}|) + \alpha_{4jt} \ln \mathrm{LEV}_{it} + \varepsilon_{it}, \quad \text{(A.1)}$$

M_{it} is firm i's observed market value in year t, B_{it} is firm i's book value in year t, $|NI|$ is the absolute value of net income, I^{-} is a dummy taking the value 1 when net income is negative and LEV is the leverage ratio (debt/total assets).

The residual $\widehat{\varepsilon}_{it}$ from (A.1) is interpreted as firm-level mispricing at time t. Misvaluation is therefore defined as:

$$\ln\left(\frac{M}{V}\right)_{it} = \ln M_{it} - \left(\overline{\alpha}_{0j} + \overline{\alpha}_{1j}\ln B_{it} + \overline{\alpha}_{2j}\ln(|NI_{it}|) + \overline{\alpha}_{3j}I^{-}\ln(|NI_{it}|) + \overline{\alpha}_{4j}\ln \mathrm{LEV}_{it}\right), \tag{A.2}$$

where V denotes the (unobservable) true value of firm i and $\overline{\alpha}_{kj} = T^{-1}\sum_t \widehat{\alpha}_{kjt}$ for $k = 0, \ldots, 4$.

A.2 Interaction variables

Irreversibility (Table 6)

- **Irreversibility:** For each firm in our data we add expenditure in rented capital, depreciation, and sales of property, plant & equipment (PP&E) scaled over total PP&E, and lag this ratio one year. We then calculate each industry's average, and split industries in two groups according to the cross-industry median of the indicator. Data comes from Compustat Global - Fundamentals Annual obtained from Wharton Research Data Service.

- **Redeployability:** Redeployability score from Kim and Kung (2016), based on the capital flow table from the Bureau of Economic Analysis for U.S. data. Sourced from https://blogs.cornell.edu/hyunseobkim/asset-redeployability/.

- **Capital intensity:** For each firm in our data we calculate the ratio of PP&E investment to total assets, take the mean and lag this ratio one year. We then calculate each industry's average, and split industries in two groups according to the cross-industry median of the indicator. Data comes from Compustat Global - Fundamentals Annual obtained from Wharton Research Data Service.

Diversification (Table 7)

- **Diversifying Acquisitions:** These are acquisitions in which the 3-digit ISIC industry of the acquirer is different from the 3-digit industry of the target firm. Sourced from Thomson Reuters' SDC Platinum International Mergers and Acquisitions database.

- **Horizontal Acquisitions:** These are acquisitions in which the 3-digit ISIC industry of the acquirer is the same as the 3-digit industry of the target firm. Sourced from Thomson Reuters' SDC Platinum International Mergers and Acquisitions database.

- **Business Cycle Correlation:** We use annual data on real GDP (current international dollars) from 1960 until 2019 from the World Bank's World Development Indicators. We filter the data using the Hodrick-Prescott filter with a smoothing parameter $\lambda = 6$ to obtain the cyclical component of GDP for each country. We split countries in two groups on the basis of the median correlation between each country's cyclical component of real GDP and the UK's.

International Frictions (Table 8)

- **Physical distance:** Geodesic distance calculated following the great circle formula, using the latitude and longitude of the most important cities/agglomerations (in terms of population) in each country constructed by Mayer and Zignano (2011i). Sourced from CEPII's GeoDist database http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=6.

- **Cultural distance:** Following Karolyi (2016), we use data from Wave 6 of the World Value Survey (2010-2014) and construct the Euclidean distance between each target country and the UK, based on the following dimensions: (i) When jobs are scarce, employers should give priority to people of this country over immigrants (strongly agree and agree); (ii) Would not like to have as neighbors: Immigrants/foreign workers; (iii) Would not like to have as neighbors: People of a different race; (iv) How much freedom of choice and control over own life; (v) Men should have more right to a job than women; (vi) Important child qualities: Tolerance and respect for other people; (vii) Important child qualities: Unselfishness; (viii) Income equality should be =1 very equal = 10 large differences in income are needed; (ix) Competition is good/harmful =1 good; =10 harmful; (x) Religion is very important in life; (xi) Most people can be trusted; (xii) Very proud of nationality; (xiii) Willingness to fight for your country.

- **Entry costs:** Euclidean distance between each target country and the UK based on the following dimensions: (i) Entry costs as % GNI per capita; (ii) Number of procedures necessary to open a new business; (iii) number of days necessary to open a new business. Sourced from CEPII's Gravity database `http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=8`.

- **Risk of expropriation:** International Country Risk Guide (ICRG')s assessment of the risk of "outright confiscation" or "forced nationalization". Index takes values between 0 and 10, with lower scores indicating higher risk.

- **Merger control index:** Merger control subindex from the Competition Law Index constructed by Bradford and Chilton (2018). This index is based on the need for pre-merger notifications; post-merger notifications; substantive assessments for economic or public interest reasons; and exemptions or defenses for efficiency, failing firms and public interest that reduce the intensity of the competition regulation.

- **Corporate transparency index:** This index is constructed by Karolyi (2015) as the principal component of 14 variables related to practices of disclosure and accounting (disclosure intensity, governance disclosure for major stockholders, timeliness of disclosure and reporting of consolidation and discretionary reserve), the synchronicity of returns and liquidity in a country, the use of international financial reporting standards and the percentage of shares owned by three largest blockholders among the largest 30 firms in each country. Higher values of the index indicate greater corporate transparency.

- **Accounting standards index:** Index created by examining and rating companies' 1990 annual reports on their inclusion or omission of 90 items. These items fall into 7 categories (general information, income statements, balance sheets, funds flow statement, accounting standards, stock data and special items). From La Porta et al. (1998).

- **Antidirector rights index:** Index aggregating shareholder rights. The index ranges from 0 to 5; the higher number, the more rights shareholders have. From La Porta et al. (1998).

- **Creditor rights:** Index aggregating creditor rights. The index ranges from 0 to 4, the higher number, the more rights creditors have. From La Porta et al. (1998).

Deal-level Characteristics (Table 9)

- **Method of payment:** We group acquisitions in two categories according to the method of payment used: transactions that Thomson Reuters' SDC Platinum International Mergers and Acquisitions database identifies as 'all cash' (cash) and 'other', which group transactions in which the method of payment is recorded as 'all stock' or 'mixed' transactions.

- **Relative size:** Is the value of the transaction divided by the equity market capitalization of the acquirer at the end of the fiscal year prior to the acquisition announcement. We split acquisitions in two groups, small and large, depending on whether a deal's relative size is below or above the median value across all transactions. The value of the transaction is sourced from Thomson Reuters' SDC Platinum International Mergers and Acquisitions database, while market capitalization is obtained from Datastream.

- **Ownership control:** We group acquisitions in two categories: majority and minority. Majority acquisitions are those in which the acquirer purchases 50% or more of the target's equity (without having had control before the acquisition). An acquisition is deemed a minority one otherwise. Sourced from Thomson Reuters' SDC Platinum International Mergers and Acquisitions database.

B Additional Tables

Table B.1: Number of Cross-border Deals per Target Country

Country	# of deals	%	Country	# deals	%
Argentina	3	0.4	Kenya	6	0.81
Australia	43	5.8	Korea, Republic of	1	0.13
Bahamas, The	1	0.13	Latvia	1	0.13
Barbados	4	0.54	Luxembourg	3	0.4
Belgium	12	1.62	Malaysia	2	0.27
Bermuda	2	0.27	Malta	1	0.13
Brazil	17	2.29	Mexico	8	1.08
British Virgin Islands	1	0.13	Morocco	3	0.4
Canada	36	4.86	Netherlands	27	3.64
Chile	5	0.67	New Zealand	5	0.67
China	14	1.89	Nigeria	3	0.4
Colombia	6	0.81	Norway	18	2.43
Congo, DRC	1	0.13	Panama	1	0.13
Croatia	1	0.13	Peru	2	0.27
Cyprus	2	0.27	Poland	7	0.94
Czech Republic	5	0.67	Portugal	4	0.54
Denmark	7	0.94	Romania	5	0.67
Egypt	2	0.27	Russian Federation	12	1.62
Estonia	2	0.27	Singapore	3	0.4
Finland	9	1.21	Slovenia	2	0.27
France	30	4.05	South Africa	17	2.29
Germany	44	5.94	Spain	14	1.89
Gibraltar	1	0.13	Sri Lanka	1	0.13
Guernsey	4	0.54	Sweden	14	1.89
Hong Kong	3	0.4	Switzerland	8	1.08
India	14	1.89	Taiwan	1	0.13
Indonesia	6	0.81	Tanzania	1	0.13
Iraq	2	0.27	Thailand	4	0.54
Ireland	23	3.1	Turkey	12	1.62
Isle of Man	2	0.27	United Arab Emirates	4	0.54
Israel	2	0.27	United States	212	28.61
Italy	19	2.56	Vietnam	4	0.54
Japan	3	0.4	Zambia	1	0.13
Jersey	6	0.81	Zimbabwe	1	0.13
Kazakhstan	1	0.13	**Total**	**741**	**100**

Table B.2: Number of Deals by Acquirer and Target Industry

Industry	Type of Acquisition			
	Domestic		Cross-border	
	Acquirer	Target	Acquirer	Target
Advertising & Marketing	30	35	59	40
Aerospace & Defense	8	7	19	15
Agriculture & Livestock	1	6	2	2
Alternative Energy Sources	1	0	0	1
Alternative Financial Investments	12	6	13	1
Apparel Retailing	0	6	0	4
Asset Management	50	39	19	8
Automobiles & Components	9	9	9	5
Automotive Retailing	39	32	8	8
Banks	1	1	1	0
Biotechnology	6	2	8	8
Broadcasting	7	2	8	3
Brokerage	15	7	4	6
Building/Construction	31	23	4	21
Cable	0	0	0	1
Casinos & Gaming	3	2	4	3
Chemicals	5	4	15	17
Computers & Electronics Retailing	3	4	0	2
Computers & Peripherals	3	4	0	3
Construction Materials	9	3	2	3
Containers & Packaging	4	4	2	5
Credit Institutions	1	1	3	4
Discount and Department Store Retailing	2	1	1	2
E-commerce / B2B	2	3	0	2
Educational Services	0	6	0	2
Electronics	3	9	20	12
Employment Services	30	28	14	11
Food & Beverage Retailing	37	33	6	7
Food and Beverage	15	9	18	12
Healthcare Equipment	7	12	6	9
Healthcare Providers	5	12	0	3
Home Furnishings	0	2	1	3
Home Improvement Retailing	2	2	2	2
Hospitals	1	7	0	1
Hotels and Lodging	1	6	1	1
Household & Personal Products	6	2	8	4
IT Consulting & Services	35	39	21	24
Insurance	5	9	6	9
Internet Software	9	11	9	25
Internet and Catalog Retailing	9	7	0	0
Legal Services	2	4	1	1
Machinery	6	9	24	17
Metals & Mining	18	16	72	67
Motion Pictures / Audio Visual	4	10	1	5
Non Residential	7	33	0	12
Oil & Gas	56	55	40	40
Other Consumer Products	15	23	1	24
Other Energy & Power	0	3	2	3
Other Financials	19	43	7	11
Other High Technology	1	1	11	1
Other Industrials	24	20	0	27
Other Materials	0	2	6	2
Other Media & Entertainment	1	1	0	0
Other Real Estate	13	15	4	1
Other Retailing	16	10	2	3
Paper & Forest Products	0	3	3	4
Petrochemicals	1	0	23	1
Pharmaceuticals	13	12	0	20
Pipelines	0	1	0	2
Power	9	4	13	7
Professional Services	84	100	76	70
Public Administration	0	1	0	1
Publishing	28	16	25	13
REITs	49	7	16	6
Real Estate Management	28	21	15	7
Recreation & Leisure	4	4	5	10
Residential	1	4	0	0
Semiconductors	1	1	0	4
Software	45	41	49	50
Space and Satellites	0	0	0	1
Telecommunications Equipment	2	1	2	6
Telecommunications Services	7	3	16	12
Textiles & Apparel	3	9	6	4
Transportation & Infrastructure	21	25	9	9
Travel Services	0	1	0	1
Water and Waste Management	13	9	1	1
Wireless	10	5	17	8

Table B.3: Effect of Acquisitions on the Volatility of Stock Return Across Different Time Horizons

	Volatility s quarters after announcement			
	+1	+2	+3	+4
	(1)	(2)	(3)	(4)
Domestic	-0.0553**	-0.0285	-0.0416*	-0.0429*
	(0.023)	(0.021)	(0.025)	(0.025)
Cross-border	0.0506	0.0381	0.0253	0.0399
	(0.032)	(0.030)	(0.032)	(0.028)
Observations	40,525	39,950	38,868	37,797

The table reports the coefficients of regressions where the dependent variable is the difference between the log volatility of stock returns in quarter $s \in \{1, 2, 3, 4\}$ after the announcement of an acquisition and the log volatility one quarter before announcement on treatment (domestic and cross-border acquisitions) dummies. Control variables (all lagged 4 quarters) include domestic and cross-border acquisition dummies, market capitalization, market-to-book value ratio, cash flow, ROA, leverage, sales Herfindahl, acquiring firm's misvaluation, firm- and industry-level volatility of stock returns, mean stock returns and quarter- and year-fixed effects (Definitions of control variables are available in Appendix A.1). Treated observations are weighted by $1/\widehat{P_j}$ and control ones are weighted by $1/(1-\widehat{P_j})$, where $\widehat{P_j}$ denotes the estimated propensity score for acquisition of type j (domestic or cross-border) reported in Table 3. Standard errors in parenthesis ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

Table B.4: Effect of Acquisitions on the Volatility of Stock Return—Excluding Acquisitions in Finance-related Sectors

	(1)
Domestic	-0.0541**
	(0.023)
Cross-border	0.0453
	(0.032)
Observations	39,016

The table reports the coefficients of regressions where the dependent variable is the difference between the log volatility of stock returns one quarter after the announcement of an acquisition and the log volatility one quarter before announcement on treatment (domestic and cross-border acquisitions) dummies excluding acquisitions in the following industries: Asset Management, Banks, Brokerage, Credit Institutions, Other Financials, and REITs. Control variables (all lagged 4 quarters) include domestic and cross-border acquisition dummies, market capitalization, market-to-book value ratio, cash flow, ROA, leverage, sales Herfindahl, acquiring firm's misvaluation, firm- and industry-level volatility of stock returns, mean stock returns and quarter- and year- fixed effects (Definitions of control variables are available in Appendix A.1). Treated observations are weighted by $1/\widehat{P_j}$ and control ones are weighted by $1/(1-\widehat{P_j})$, where $\widehat{P_j}$ denotes the estimated propensity score for acquisition of type j (domestic or cross-border) reported in Table 3. Standard errors in parenthesis ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

Table B.5: Effect of Acquisitions on the Volatility of Stock Return by Irreversibility and Across Different Time Horizons

	Volatility s quarters after acquisition			
	+1	+2	+3	+4
	(1)	(2)	(3)	(4)
A) Irreversibility				
Domestic × below median	-0.0779**	-0.0328	-0.0146	-0.0173
	(0.035)	(0.033)	(0.035)	(0.037)
Domestic × above median	0.0034	0.0249	-0.0326	-0.0346
	(0.039)	-0.035	(0.045)	(0.041)
Cross-border × below median	-0.0219	-0.0632	-0.1258***	-0.0987**
	(0.052)	(0.048)	(0.047)	(0.043)
Cross-border × above median	0.1504***	0.1759***	0.2038***	0.1691***
	(0.042)	(0.039)	(0.043)	(0.037)
B) Redeployability				
Domestic × below median	0.0331	0.0875***	0.05	0.0358
	(0.038)	(0.033)	(0.047)	(0.040)
Domestic × above median	-0.1004***	-0.0766***	-0.0652**	-0.0549
	(0.033)	(0.029)	(0.031)	(0.035)
Cross-border × below median	0.0894**	0.0941**	0.0802*	0.0997**
	(0.045)	(0.042)	(0.048)	(0.041)
Cross-border × above median	0.0344	0.0059	-0.0203	-0.0228
	(0.055)	(0.052)	(0.049)	(0.047)
C) Capital Intensity				
Domestic × below median	-0.0865**	-0.0229	-0.0421	-0.0385
	(0.035)	(0.035)	(0.036)	(0.040)
Domestic × above median	0.0109	0.0122	-0.0016	-0.011
	(0.038)	(0.034)	(0.044)	(0.038)
Cross-border × below median	-0.0126	-0.0177	-0.1060**	-0.0792**
	(0.048)	(0.045)	(0.042)	(0.039)
Cross-border × above median	0.1546***	0.1400***	0.2057***	0.1664***
	(0.043)	(0.043)	(0.047)	(0.040)

The table reports the coefficients of regressions where the dependent variable is the difference between the log volatility of stock returns in quarter $s \in \{1, 2, 3, 4\}$ after the announcement of an acquisition and the log volatility one quarter before announcement on treatment (domestic and cross-border acquisitions) dummies interacted with industry-level proxies of irreversibility for the industry of the target firm (see Appendix A.2 for their definition). Each panel reports the results of a separate regression using a different proxy for irreversibility. Control variables (all lagged 4 quarters) include domestic and cross-border acquisition dummies, market capitalization, market-to-book value ratio, cash flow, ROA, leverage, sales Herfindahl, acquiring firm's misvaluation, firm- and industry-level volatility of stock returns, mean stock returns and quarter- and year- fixed effects (Definitions of control variables are available in Appendix A.1). Treated observations are weighted by $1/\widehat{P_j}$ and control ones are weighted by $1/(1-\widehat{P_j})$, where $\widehat{P_j}$ denotes the estimated propensity score for acquisition of type j (domestic or cross-border) reported in Table 3. Standard errors in parenthesis ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

Table B.6: Effect of Acquisitions on the Volatility of Stock Return—Interaction between Irreversibility and Capital Intensity

	(1)
Low capital intensity × Low irreversibility	-0.0542*
	(0.031)
Low capital intensity × High irreversibility	-0.1098***
	(0.041)
High capital intensity × Low irreversibility	-0.0252
	(0.059)
High capital intensity × High irreversibility	0.0179
	(0.030)
Observations	40,525

The table reports the coefficients of regressions where the dependent variable is the difference between the log volatility of stock returns one quarter after the announcement of an acquisition and the log volatility one quarter before announcement on treatment (any acquisition, domestic or cross-border) interacted with industry-level proxies of irreversibility and capital intensity (see Appendix A.2 for their definition). Control variables (all lagged 4 quarters) include domestic and cross-border acquisition dummies, market capitalization, market-to-book value ratio, cash flow, ROA, leverage, sales Herfindahl, acquiring firm's misvaluation, firm- and industry-level volatility of stock returns, mean stock returns and quarter- and year- fixed effects (Definitions of control variables are available in Appendix A.1). Treated observations are weighted by $1/\widehat{P_j}$ and control ones are weighted by $1/(1-\widehat{P_j})$, where $\widehat{P_j}$ denotes the estimated propensity score for acquisition of type j (domestic or cross-border) reported in Table 3. Standard errors in parenthesis ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.