



# Do Cross-Border Stock Exchange Consolidations Affect Cross-Border M&A?

*A study of cross-border stock exchange consolidations' effect on merger volumes and payment methods.*

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Master Thesis, Master of Science in Economics and Business

Administration, Financial Economics

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This thesis was written as a part of the Master of Science in Economics and Business Administration at NHH. Please note that neither the institution nor the examiners are responsible – through the approval of this thesis – for the theories and methods used, or results and conclusions drawn in this work.

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## Abstract

Since the early 2000s, there has been a trend of stock exchanges consolidating across borders with Euronext and Nasdaq being the most prominent examples. We analyse the effect cross-border stock exchange consolidation has on cross-border M&A using a sample of 61,834 cross-border mergers between 1994 and 2017. We find a small decrease in the number of deals between public companies, but do not discover any effect on the average deal size. In addition, we show that transactions with a public acquirer tend to use less stock as consideration post-stock exchange consolidation, which forms an argument that consolidated stock exchanges cause M&A to be perceived as less risky, as stock has inherent risk-sharing properties.

**Keywords:** *Cross-border M&A, stock exchange consolidation, payment method*

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# 1. Introduction

The past 20 years, stock exchanges have been looking outside of their native countries for growth, leading to several cross-border stock exchange mergers or consolidations. As a result, there are now stock exchanges spread over different countries, but with shared ownership. This trend started with the stock exchanges of Paris, Brussels and Amsterdam forming Euronext in 2000. Since then, Euronext has acquired the exchanges of Lisbon, Dublin and Oslo to become the largest stock exchange in Europe by market capitalization. The trend continues as 2020 has seen the Swiss stock exchange operator, SIX, acquire the Spanish exchange, BME, forming the fifth exchange group among developed countries.

How stock exchange consolidation impacts cross-border M&A is an underexplored topic in financial research. With this paper, we therefore set out to investigate the effect cross-border stock exchange consolidation has on cross-border mergers and acquisitions at the firm level. Earlier research on cross-border mergers and acquisitions, like the work of Erel, Liao and Weisbach (2012), examines different determinants of cross-border M&A, such as religion and geography, but does not include any potential effects of stock exchange consolidation.

What incentivises stock exchanges to acquire or merge other stock exchanges? One clear reason behind stock exchange consolidations is listed in the LSE-Borsa Italiana merger announcement (2007) as “the businesses of Borsa Italiana and the London Stock Exchange provides a powerful backdrop for enhanced growth and substantial revenue synergies”. Some benefits for issuers are also claimed in the merger announcement. For instance, an increased “investment and trading activity in issuers’ securities” is expected, “thereby reducing the cost of capital to the combined group’s listed companies.”

Earlier research on stock exchange integration does not study how stock exchange consolidation affects payment methods in cross-border deals. Pownall, Vulcheva and Wang (2014) investigate how global stock exchange mechanisms affect home bias. Hellström, Liu and Sjögren (2018) study how stock exchange mergers affect weak-form information efficiency.

Consequently, we aim to study two topics in this paper: (1) whether stock exchange consolidation affects the volume of cross-border M&A between countries with consolidated

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stock exchanges and (2) whether stock exchange consolidation affects the payment methods for cross-border M&A. To our knowledge, this is the first paper to study the impact of stock exchange consolidation on cross-border M&A.

We collect data from the Thomson Reuters SDC Financial Database and include 61,834 cross-border deals between 1994 and 2017. We build on the methodology of Rossi and Volpin (2004) and Erel et al. (2012) to control for known factors affecting cross-border mergers. Cross-border stock exchange consolidation does not seem to have an effect on the volumes of cross-country M&A in general, nor on the number of transactions or deal values. However, between public companies the number of transactions seems to decrease following an exchange merger. For transactions with a public acquirer, we see a significant decrease in stock as a payment method. When paying in stock, the acquiring firm's shareholders share the risk of the transaction with the target's shareholders. Thus, if the acquiring firm perceives transactions as less risky post consolidation, they would be expected to pay with less stock.

In *Section 2* we provide an overview of the existing literature related to this topic. In *Section 3* we describe and justify our methodology and in *Section 4* we describe the data. *Section 5* includes our results and our interpretation of these. *Section 6* includes our concluding remarks. Our regression outputs are included in the *Appendix*.

## 2. Literature Review

In this chapter, we review research relevant for the objective of our paper. We briefly touch upon research on mergers and acquisitions, while the main focus is on potential determinants of cross-border transactions and research on payment methods. We also mention literature on stock exchange consolidation, as any findings would contribute to expand the understanding of what the consequence of such a consolidation is. Any findings could be factors to consider for antitrust agencies and governments when deciding whether to approve a stock exchange merger.

For a corporate takeover to occur, the acquiring firm must believe that the combined entity of the acquirer and target is worth more than the values of the individual firms. Synergies are the most common justifications to be gained through an acquisition, with economies of scale and scope, the control provided by vertical integration, gaining monopolistic power, gaining expertise, efficiency improvements and diversification benefits being the most commonly cited sources of such. (Berk and Demarzo, 2017)

This applies when stock exchanges are merging as well. Referring to (Pagano 1989; Steil 2001), McAndrews and Stefanadis (2002) say that “stock exchanges have been shown to display economies of scale both in operations and in trading”. They further highlight the establishment of shared trading platforms as an example of operational economies of scale, and heightened market liquidity and reduced market fragmentation as an example of trading economies of scale.

### 2.1 Factors affecting the level of cross-border mergers and acquisitions

The motivation for cross-border and domestic mergers is fundamentally the same. However, cross-border transactions have some characteristics with the potential to affect the level of M&A that are not found in domestic transactions.

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Ahern, Daminelli and Fracassi (2015) argue that national borders are related with factors that are likely to affect both costs and benefits of a transaction. Countries have their own cultural identity – they may speak different languages, different religions might dominate, and countries might have a history of conflict. These are factors that increase the contracting costs associated with merging two companies.

Another factor that could affect cross-border mergers is corporate governance and the level of market development. Using public firms, Rossi and Volpin (2004) and Bris, Brisley and Cabolis (2008) show that firms in countries with higher standards of corporate governance tend to acquire firms in countries with lower corporate governance standards. Chari, Ouimet and Tesar (2009) predict that acquirers from more developed markets benefit from less strong contracting environments when acquiring a firm in an emerging market. They find an “economically large and statistically significant increase in the acquiring firm's stock price” supporting that value is created when acquirers expand the benefits of superior institutions and corporate governance practices to the target firm.

Erel et al. (2012) find in a study of cross-border mergers between 1990 and 2007, that geography, accounting disclosure quality and bilateral trade are factors that increase the likelihood of mergers between two countries. They find that firms from countries with shorter distance between them are more likely to merge. Also, they find that firms from countries with a higher level of trade between them are more likely to merge. They argue that if countries trade, deals are more likely to realise synergies and that firms are more likely to have a common background and culture. Furthermore, they find that taxes appear to affect cross-border mergers, with the acquiring company tending to be from a country with a higher corporate income tax rate.

Another factor that can motivate cross-border mergers is valuation. According to Erel et al. (2012), overall, it is expected that the relative valuation between countries affect cross-border mergers, regardless of the valuation difference occurring due to changes in currency or stock prices, or whether permanent or temporary. They find that acquirers tend to be from high-performing countries – where stock markets and currency have recently increased in value – while firms from weak-performing countries tend to be targets.

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Shleifer and Vishny (2003) show that managers have incentives to buy assets of (relatively) undervalued firms using their inflated stock. Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2004) suggest that overvalued firms can create value for their shareholders by paying for less overvalued firms with their expensive stock. Overvalued stock can be a driver of both domestic and cross-border transactions.

The same logic applies for currency rates. If the currency of a firm appreciates for some exogenous reason, firms in other countries become relatively inexpensive, with the result that potential transactions previously unprofitable can turn profitable with the new exchange rates.

What effect we expect from exchange rates movements depends on whether the movements are expected to be temporary or permanent. With temporary changes, Erel et al. (2012) say “cross-border acquisitions effectively arbitrage these differences, leading to expected profits for the acquirers”. Erel et al. (2012) refer to (Kindleberger, 1969) saying that research also suggests that permanent changes can have effect that could drive mergers and acquisitions, because under foreign control, the cost of capital is lower or expected earnings are higher. Consequently, foreign bidders can bid more aggressively than domestic ones.

## 2.2 Payment method in cross-border M&A

When acquiring a foreign target, the acquirer must decide whether to pay by cash, stock, debt, or a combination of these.

The potential payment methods have different properties; thus the choice of method contains a signalling effect which stakeholders can use to help assess the transaction. As mentioned above, Schleifer and Vishny (2003) show that managers have incentives to use their inflated stock to buy assets. And vice versa, King et al. (2004) argue that management will rather pay the transaction by cash if it believes its stock to be undervalued.

Furthermore, the distribution of risk in a transaction is affected by the choice of payment method. When an acquirer pays for a target by cash, the acquirer is left with all the risk of the transaction. Any gains/losses are carried by the acquirer, while the opposite is the case if the transaction is paid by stock – then the gains/losses are shared by the acquirer and target. Referring to Chang (1998) and Kohers and Ang (2000), Cho and Ahn (2017) argue that the



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choice of payment method therefore contains information for shareholders when trying to assess the possibility of synergies. Rappaport and Sirower (1999) support this, arguing that a confident buyer should pay for an acquisition with cash where it would receive the value themselves. And consequently, that a stock bid can be thought of as the acquirer being less confident that there are synergies to be realised.

As a result, the shareholders of the acquirer will interpret an offer with stock payment negatively, as it signals that managers are not confident about achieving the required level of synergy. (Schijven & Hitt, 2012)

As mentioned, cross-border transactions have additional complexity, such as different cultures and institutions, creating greater information challenges for shareholders than domestic deals. Therefore, Cho and Ahn (2017) argue that the signalling effects of payment method might be more important in cross-border deals.

Huang, Officer and Powell (2016) argue that acquirers are more likely to pay with stock in cross-border deals where the target is in a country with higher governance risk or less transparency. When governance risk is present, it increases the likelihood of overpaying for the target (Hansen, 1987).

The effect stock consolidations have on governance risk for cross-border M&A seems to be underexplored by research, though an effect of stock consolidation on information efficiency has been documented for the OMX Nordic and Baltic consolidation (Hellström et al., 2018). An improvement in accounting quality and value relevance of earnings has been found for (selected) firms on the four first exchanges to be part of Euronext (Paris, Lisbon, Brussels and Amsterdam) (Pownall, Vulcheva & Wang, 2011).

The effects of stock exchange consolidations do not seem to be uniformly distributed across all listed firms. Pownall et al. (2014) document “that the decrease in information costs due to the precommitments to enhanced transparency made the segment firms more attractive to all categories of foreign investors, consistent with the information costs hypothesis.” and “that the integration of the Euronext market was associated with a reduction in home bias for firms listed on the named segments of the Euronext exchange, but not for the nonsegment Euronext firms.”

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For the OMX Nordic and Baltic consolidation, “the merger effects are, however, asymmetrically distributed, indicating, among other, a flight to liquidity effect, i.e. relatively large (small) firms located on relatively large (small) markets experience an improved (reduced) information efficiency.” (Hellström et al., 2018)

A caveat needs to be added: the effects of a stock exchange merger or acquisition on stock exchange integration do not necessarily take place immediately, or at all. A study by Nielsen (2014) looks at a period from 1996-2006 and found, that “the stock markets seem no more integrated than they were at the outset of recent merger activity, suggesting that the levels of cooperation between the Nordic and Baltic exchanges have not been deep enough to produce increased interdependence”.

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### 3. Methodology

We now describe how our econometric model apply to the above-mentioned data. Rossi and Volpin (2004) and Erel et al. (2012) build an econometric model where each observation is the number of transactions between a country pair during their sample period. We build on this approach, but to allow us to consider the aggregate effect of stock exchanges merging, we extend the dataset by making one observation for each country pair during a year. Furthermore, our approach differs in that our pairs of countries are unordered. That is, we aggregate the deals between two countries independent of whether the acquirer is from country A or country B.

We examine cross-border deals between 35 countries classified as advanced economies by the International Monetary Fund in 2016. Consequently, with 24 years of data, there are 14,280 potential observations in our sample (24 years \* 595 country pairs).

**Table 1: Countries included in the analysis**

<i>Countries in our sample</i>				
Canada	United States	Australia	New Zealand	Israel
Japan	Singapore	South Korea	Taiwan	Austria
Belgium	Czechia	Cyprus	Denmark	Estonia
Finland	France	Germany	Greece	Iceland
Ireland	Italy	Latvia	Lithuania	Luxembourg
Malta	Netherlands	Norway	Portugal	Slovakia
Slovenia	Spain	Sweden	Switzerland	United Kingdom

Note that there are years without any transactions between a particular country pair. Moreover, there are transactions in the data from SDC without any information on payment method. As a result, the number of observations is lower than this potential observation count maximum in several regressions.

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### 3.1 Dependent variables

As we look to examine the effect that stock exchange consolidation has on cross-border M&A, we first examine if the consolidation of exchanges affects the number of transactions between the two countries, and further, if it has any effect on the average deal value of the transactions.

To review the number of transactions, we create a variable *deal count* which sums up the number of transactions between a country pair in a year. There are several reasons why we expect stock exchange consolidation to affect transaction count. When stock exchanges merge, countries essentially share financial infrastructure which could contribute to integrate the economies. Exchange consolidation should reduce transaction costs, thus potentially make more transactions economically feasible. We further suspect that similar to a reduction in home bias, a stock exchange merger could increase managers' attention to foreign possibilities, which again could affect the number of transactions positively. A reduction in information costs could also have the same effect.

In addition, we have created a variable for *mean deal value*. We are interested in the mean deal value, as an increase in the total deal value could occur for two reasons: (1) due to an increase in the number of transactions or (2) due to an increase in the average deal size. Since we already review the *deal count*, *mean deal value* isolates any effect due to a change in deal size. As there are registered deals in the data without information on deal value, *mean deal value* is the average deal value for the deals with a reported deal value. What effect we expect on mean deal value is somewhat ambiguous. On the one hand we expect a reduction in risk that could justify paying more, while on the other hand we expect less expensive transactions to occur as the information cost decrease.

We suspect that stock exchange consolidations might cause a change in the payment method of cross-border M&A between firms in the countries with shared-ownership stock exchanges. To investigate any consolidation effect on payment method, we create four variables which act as dependent variables in their respective regressions. These are the stock, cash, other and unknown shares of the total deal value of transactions within a single country pair year. That is, for every year, we take the sum of the deal value of all transactions within a country pair in our dataset, and then calculate how much of this can be attributed to payment in stock, cash, other or unknown respectively.

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The direction of the potential change in payment method is ambiguous, as we suspect factors to pull in different directions. On the one hand, one of the rationales for stock exchange consolidations is to increase liquidity on the combined stock exchange, which could indicate more accurate pricing of firms. Also, we know that investors tend to hold less international equity than diversification theory suggest due to home bias. If exchange consolidations reduce home bias, making equity from the consolidated exchanges' more preferable, shareholders could be more willing to accept payment in stock in cross-border M&A. That is, they could perceive the stock as "less foreign" and could have higher confidence in the valuation of the acquiring company.

On the other hand, stock exchange consolidation could lead to less risk involved in the transaction, thus lowering the incentive to pay in stock, as one would not need to mitigate risk by sharing it with the target.

The dependent variables are all subject to the same statistical analysis. The data is in a longitudinal format, and we use an ordinary least squares (OLS) model to investigate whether there is a causal relationship between two countries having a common consolidated stock exchange and levels of M&A or the transacting firms' choice of payment method.

## 3.2 Independent variables

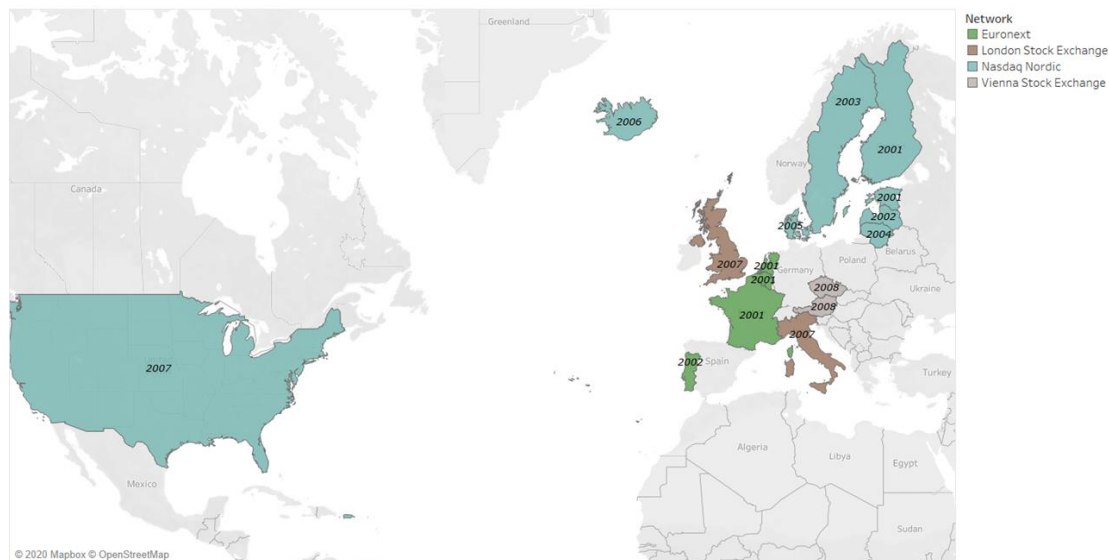
We create a dummy variable set to 1 for deals where the target and acquirer are in countries with consolidated stock exchanges and 0 otherwise. This is the key independent variable in our study, as the objective is to examine any relationship between cross-border stock exchange consolidation and cross-border M&A at the firm level.

As we consider deals completed on a yearly basis, there is an issue of deals being completed before, but still within the same year, the exchanges consolidated. We attempt to control for this by applying the following rule: If the stock exchange consolidation happened in the last six months of the year, we assign 0 to all deals made in this year in the country pair, and 1 if the consolidation happened in the first six months.

**Table 2: Stock Exchange Consolidation Overview**

Countries with same-ownership stock exchanges	Country added to group of same-ownership stock exchanges	Consolidation announced	Consolidation completed
-	France – Belgium – Netherlands	March 2000	September 2001
France – Belgium – Netherlands	Portugal	June 2001	February 2002
France – Belgium – Netherlands – Portugal	United States	June 2006	April 2007 (spin off June 2014)
-	Estonia - Finland	February 2001	April 2001
Estonia – Finland	Latvia	June 2002	June 2002
Estonia – Finland - Latvia	Sweden	May 2003	September 2003
Estonia – Finland – Latvia – Sweden	Lithuania	March 2004	March 2004
Estonia – Finland – Latvia – Sweden - Lithuania	Denmark	November 2004	February 2005
Estonia – Finland – Latvia – Sweden – Lithuania – Denmark	Iceland	September 2006	November 2006
Estonia – Finland – Latvia – Sweden – Lithuania – Denmark - Iceland	United States	May 2007	May 2007
-	Italy – United Kingdom	June 2007	October 2007
-	Austria – Czechia	August 2008	December 2008

*The leftmost column contains the existing stock exchange group, while the country joining the stock exchange group is to the right.*

**Figure 1: Map of Stock Exchange Consolidations per 2017**

*The map shows the extent of the stock exchange networks in our model at the end of 2017. Due to this, Euronext does not include the United States. The year indicates when the country joined the exchange network.*

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Remaining independent variables control for other factors affecting cross-border mergers and acquisitions. We create a dummy variable for each country pair to control for variation in the base level of merger activity between countries (effectively, a country pair fixed effect). It controls for obvious factors such as geographic distance and religion, and less obvious factors such as currency exchange rates and valuation. To control for currency exchange rates, stock market returns and valuation, Erel et al. (2012) create time invariant variables equal to the average yearly difference over their period of interest. As a result, the variables controlling for these factors are constant over the period of the study and is therefore controlled for with our country pair variable. Another approach would have been to include data for these differences each year. However, the effect of doing so is somewhat ambiguous, as within our country pairs, valuation differences likely increase mergers in one direction and reduce them in the other.

Furthermore, we include dummy variables for each year to control for the general level of merger activity (a year fixed effect). This controls for merger waves, as well as other fluctuations due to events like the 2007-2008 financial crisis.

Combined, our dummy variables for year and country pair control for most known potential determinants of cross-border mergers as well as general merger activity. Consequently, any effect captured by the dummy for consolidated exchanges captures the relationship between exchange mergers and firm-level M&A activity.

We believe there are several possible reasons as to why stock exchange mergers would affect firm-level M&A. Pownall et al. (2014) show that exchange mergers mitigate investor home bias and reduce information cost. The same mechanics could affect M&A on firm level and should contribute to increased volumes of mergers. By the same token, if stock exchange consolidations reduce transaction cost, we would expect a positive effect on transaction count. It seems clear that stock exchange consolidation could affect M&A.

The other way, we would not be able to interpret an effect causally if the levels of merger activity would cause the stock exchanges to merge. An example could be that the stock exchange expects the merger activity between two countries to increase anyway, and that mergers lead to increased trading which the stock exchanges benefit from, thus deciding to merge. Slimane (2012) refers to studies that explore the factors behind exchange

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consolidations which are “emphasizing developments in technology, network externalities, and economies of scale and cost reductions”. Also, when reviewing press releases and documents from stock exchange mergers, we have not found any examples of an expected benefit from M&A being a motivation.

As shown in the literature review, payment method varies depending on different factors. Stock, unlike cash, has risk sharing properties, and signals less confidence in synergies than cash. We argue that stock exchange consolidation can reduce governance risk, as well as information costs. This can affect the need to use risk sharing payment methods. Furthermore, we speculate that exchange mergers can increase investors’ willingness to accept foreign stock as payment. In sum, it seems clear that stock exchange consolidation can affect the choice of how to structure the payment of a transaction. Contrarily, it is difficult to imagine that a change in how transactions are paid would affect stock exchanges’ decision to merge.



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## 4. Data

We collect transaction data from the Thomson Reuters SDC Financial Database and include deals announced between 1994 and 2017 and completed by the end of 2017. We choose the year 1994 as the starting point, as the cross-border stock exchange consolidation trend starts in March 2000 with the announcement of the merger of the Amsterdam, Brussels and Amsterdam exchanges. This allows for a period with no consolidated stock exchanges in the data. We use 2017 as the final year in our model, as Euronext acquired the Irish Stock Exchange in March 2018, and there are few available years for study after this acquisition.

Following Erel et al. (2012), we include mergers, buybacks, acquisitions, acquisitions of majority interest, acquisitions of assets and acquisitions of certain assets, and exclude deals involving a government entity as well as deals with either a target or an acquirer within the financial or utilities industry. We further exclude domestic deals, keeping only cross-border deals. We only keep transactions between a selection of countries classified as advanced economies by the IMF in 2016.

For the payment method analysis, we omit observations with missing values for payment method and deal value.

We extract the following variables from SDC: Announcement and effective date of the transaction, name of the target and acquirer, public statuses, four-digit industry codes (SIC), country of the target and country of the acquirer, deal status, deal value, and percent of the deal value paid in stock, cash, other and unknown.

Our main sample (All Acquirers-All Targets) consists of all deals irrespective of the public listing status of the acquirer or target. The main sample is further divided into four subsamples according to the public status of the acquirer-target pair as listed in SDC: Public-Public, Public-Private, Private-Public, or Private-Private. We subject all five samples to the same analysis.

Table 3: Summary Statistics – Deal Count

Statistic	All Acquirers - All Targets				Public Acquirers - Public Targets				Public Acquirers - Private Targets									
	N	Mean	St.Dev.	Median Pctl(75)	Max	N	Mean	St.Dev.	Median Pctl(75)	Max	N	Mean	St.Dev.	Median Pctl(75)	Max			
Deal Count	5,668	10.92	31.938	3	9	472	893	2.287	3.622	1	2	34	3,380	5.977	15.677	2	5	226
Consolidated Exchanges (logical)	14280	0.035	0.183	0	0	1	14280	0.035	0.183	0	0	1	14280	0.035	0.183	0	0	1
Statistic	Private Acquirers - Public Targets				Private Acquirers - Private Targets													
	N	Mean	St.Dev.	Median Pctl(75)	Max	N	Mean	St.Dev.	Median Pctl(75)	Max								
Deal Count	218	1.275	0.852	1	1	7	2,269	3.724	7.234	2	4	96						
Consolidated Exchanges	14280	0.035	0.183	0	0	1	14280	0.035	0.183	0	0	1						

These tables present summary statistics for deal count across the different samples of data.

Table 4: Summary Statistics – Mean Deal Value

Statistic	All Acquirers - All Targets				Public Acquirers - Public Targets				Public Acquirers - Private Targets									
	N	Mean	St.Dev.	Median Pctl(75)	Max	N	Mean	St.Dev.	Median Pctl(75)	Max	N	Mean	St.Dev.	Median Pctl(75)	Max			
Mean Deal Value	3,697	238.81	1114.23	47.507	160.254	50,750	824	1573	5765.96	277.728	1036.23	101,476	2,066	95.73	509.963	18.669	56,016	13,686
Consolidated Exchanges (logical)	3697	0.053	0.224	0	0	1	824	0.051	0.22	0	0	1	2066	0.062	0.241	0	0	1
Statistic	Private Acquirers - Public Targets				Private Acquirers - Private Targets													
	N	Mean	St.Dev.	Median Pctl(75)	Max	N	Mean	St.Dev.	Median Pctl(75)	Max								
Mean deal value	150	280.93	1131.33	37.968	134.884	11,876	548	31.83	209.169	7.99	16.388	4,658						
Consolidated Exchanges (logical)	150	0.047	0.212	0	0	1	548	0.038	0.192	0	0	1						

These tables present summary statistics for mean deal value across the different samples of data.

Table 5: Summary Statistics – Payment Method

Statistic	All Acquirers - All Targets					Public Acquirers - Public Targets					Public Acquirers - Private Targets							
	N	Mean	St.Dev.	Median	Pctl(75)	Max	N	Mean	St.Dev.	Median	Pctl(75)	Max	N	Mean	St.Dev.	Median	Pctl(75)	Max
Deal Value (total)	11,090	333.91	3,776.24	0	0	247,852	14,209	209.6	3,177.38	0	0	245,228	12,954	50.07	437.007	0	0	21,830
% Cash	2,478	0.411	0.416	0.273	0.876	1	822	0.596	0.435	0.81	1	1	2,054	0.36	0.393	0.177	0.724	1
% Other	2,478	0.107	0.246	0	0.058	1	822	0.031	0.106	0	0	1	2,054	0.137	0.27	0	0.125	1
% Stock	2,478	0.131	0.278	0	0.057	1	822	0.223	0.366	0	0.382	1	2,054	0.12	0.258	0	0.07	1
% Unknown	2,478	0.351	0.434	0.046	0.971	1	822	0.15	0.343	0	0	1	2,054	0.383	0.432	0.127	0.969	1
Consolidated exchanges (logical)	11,090	0.028	0.164	0	0	1	14,209	0.035	0.183	0	0	1	12,954	0.033	0.178	0	0	1
Statistic	Private Acquirers - Public Targets					Private Acquirers - Private Targets												
	N	Mean	St.Dev.	Median	Pctl(75)	Max	N	Mean	St.Dev.	Median	Pctl(75)	Max						
Deal Value (total)	14,212	3.493	139.032	0	0	11,876	12,556	2.062	47.614	0	0	4,658						
% Cash	150	0.633	0.464	1	1	1	545	0.229	0.393	0	0.304	1						
% Other	150	0.042	0.159	0	0	1	545	0.106	0.287	0	0	1						
% Stock	150	0.044	0.2	0	0	1	545	0.045	0.185	0	0	1						
% Unknown	150	0.28	0.45	0	1	1	545	0.62	0.465	1	1	1						
Consolidated exchanges (logical)	14,212	0.035	0.184	0	0	1	12,556	0.026	0.16	0	0	1						

*These tables present summary statistics for payment method across the different samples of data.*

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## 5. Results

To analyse the impact of stock exchange consolidation on cross-border deals, we regress the number of completed deals, deal value and payment methods within an observation on the country pair, year and consolidated exchanges variables. The results are shown in tables 6-12 in the appendix.

Table 6 displays the results from the regressions of deal count, that is the number of deals within a country pair in a year. We note that, *ceteris paribus*, the deal count in the Public-Public subcategory is reduced by 0.151. This result is significant at a 1% level. This is an unexpected result, as our initial expectation was that the deal count would be more likely to increase. The average deal count in the Public-Public sample is 0.143. In this context the decrease seems large. We investigate this result further by producing a similar average deal count, but this time with the condition that only country pair years with a non-zero number of deals are included. The impact of stock exchange consolidation seems comparatively smaller when compared to this average of 2.287.

Also in Table 6, we observe that, *ceteris paribus*, the average deal count in the Private-Public subcategory is reduced by 0.027, which seems large compared to the average deal count of 0.019 in Table 3. Again, we produce an average deal count with only observations with at least one deal. We note that the amount of deals is small, but also that the impact of stock exchange consolidation seems comparatively smaller when compared to this average deal count of 1.215.

Table 7 shows the results from the regressions of mean deal value. The results do not suggest that stock exchange consolidation has any significant effect on the average deal value. Considering that we expected stock exchange consolidation to have an ambiguous effect on deal value, these results are unsurprising.

Table 8 through 12, display the results from the regressions of payment method. Each table displays the results of the regressions within each sample.

Table 8 shows the results from the All Acquirers-All Targets sample. We observe that the propensity for using stock as a payment method decreases after the consolidation of a stock

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exchange, as the share of deal value paid for with stock falls with 9.5 percentage points at a 1% significance level.

There may be several explanations behind the decreased propensity for stock as a payment method. If stock exchange consolidations lead to a reduction in the differences in corporate governance risk between the countries with same-ownership stock exchanges, then a reduced propensity for stock as a payment method would be consistent with the finding of Huang et al. (2016). That is, there is a greater use of stock as a method of payment when the target's country has a relatively greater country-level governance risk than the acquirer's. A precondition for this causality is that stock exchange consolidations actually lead to a convergence in country-level corporate governance risk. Some evidence has been found from the Nordic region. Caban-Garcia and He (2011) suggest that earnings comparability for Nordic OMX Exchange countries (marginally) increases compared to Norway (which is not part of OMX Nordic) after the stock exchange consolidation.

We note that the other payment methods are not significant on a 1%, 5% or 10% significance level, and we are therefore unable to draw any conclusions about which payment method(s) partially replace(s) stock. Cash would be an intuitive alternative to consideration in stock, but any change is statistically insignificant from zero.

Table 9 shows the results from a similar model for deals between publicly listed companies, that is, countries where both the target and acquirer are marked as "Public" in SDC. For countries with more than one stock exchange, like NYSE and Nasdaq in the United States, we do not distinguish between where a company is listed. The output seems to suggest that the propensity for using stock for consideration is also lower for deals between publicly listed companies on consolidated exchanges, as the share of deal value paid with stock falls with 12.5 percentage points at a 10% significance level. The number of observations is lower, which might explain the decrease in the significance level compared to table 6.

Table 10 displays the results from a similar model where the acquirer is public and the target is private. Again, the output seems to suggest a lower propensity for using stock as consideration, as the share of deal value paid for with stock falls with 0.080% at a 5% significance level. Any change in the remaining payment methods is statistically insignificant from zero.

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Table 11 displays the results from a similar model where the acquirer is a private firm and the target is public. There are no significant effects observed due to consolidated stock exchanges. Note that the sample size is considerably smaller in this subsample than the others. The small sample is explained by it being rare for a private firm to acquire a public firm, due to reasons such as size and valuation.

Table 12 displays the results for the similar model for deals between firms labelled as “Private” in SDC. In contrast to the other regressions, consolidated exchanges seem to be associated with an increase in propensity for stock as a payment method with 13.4 percentage points at a 5% level. This seems to imply that stock exchange consolidation incentivises listed and unlisted firms differently. However, the number of observations is lower than for Table 8-11. This makes us wary of reaching a definitive conclusion, as the data on Private-Private deals is more limited.

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## 6. Conclusion

The past 20 years, we have seen a trend of stock exchanges consolidating across borders, particularly US and European ones. We present the first investigation of whether this has led to changes in cross-border merger activity. Specifically, we examine the number of cross-border deals in countries where exchanges have consolidated, whether a stock exchange consolidation has an impact on the average value of these deals, and whether this affects the choice of payment method.

The results from our regression on deal count suggest a small decrease in the number of deals between listed firms after stock exchanges consolidate. The results also suggest a small decrease in the number of deals with a private acquirer and a public target when stock exchanges are consolidated. However, we note that this sample is small. For the regression on average deal value, the results do not indicate any effect from stock exchange consolidations that is statistically different from zero.

Our results suggest that stock exchange consolidation has an effect on consideration structure: The propensity for stock as a payment method seems to be negatively affected when the acquirer is a public firm. However, it should be noted that we do not have evidence to suggest which payment method is replacing stock. For deals where both parties are private firms, the regression model suggests that the propensity for stock as a payment method is positively affected, and for these firms as well we do not find evidence for which payment methods stock replaces. However, the data for this subsample is weaker than for the deals with a public acquirer. We do not find a compelling explanation for why the stock exchange consolidation effect for deals between private firms diverges from deals with a public firm, and are therefore wary of concluding that stock exchange consolidations make private acquires more likely to use stock as a payment method.

The data for stock exchange consolidation continues to grow, as the consolidation trend seems to continue. Our sample ends in 2017, and there have been new stock exchange consolidations since then. For instance, The Irish Stock Exchange (now Euronext Dublin) was acquired by Euronext in 2018, and Euronext acquired Oslo Stock Exchange in 2019. Now, a new pan-European group is emerging, as SIX, the stock exchange of Switzerland, has successfully acquired BME, the stock exchange of Spain. With the economies of scale seen among stock

exchanges, we expect it to become increasingly difficult to operate as a small independent exchange, therefore we do not expect this trend to stop. Consequently, more data will be available to explore this topic further in the future. Also, there are stock exchange consolidations which are not in the form of a merger or acquisition of stock exchanges, like the Mercado Integrado Latinoamericano in Latin America (Chile, Colombia, Peru and Mexico) and the SEE link in South-Eastern Europe (Bulgaria, Croatia, Macedonia and more), which could provide an interesting dataset to use for further investigation as the financial markets in the respective countries mature. An expanded dataset could reveal evidence that this paper has been unable to discover.

Stock exchanges constitute important infrastructure in the markets they operate. Understanding the effects of stock exchanges consolidating is important for governments who ultimately decides whether to approve such transactions. This paper only examines some of the potential effects, and further research could be conducted to expand the understanding of stock exchange consolidation. There are other forms of cross-border firm interaction than M&A, such as joint ventures and strategic alliances. It is not inconceivable that stock exchange consolidations could affect these, as they are susceptible to many of the same factors. Our study does not examine joint ventures or strategic alliances. However, this does not indicate that they are not interesting topics to study further.



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## 7. Appendix

The next pages display the regression outputs referred to throughout this paper. There are more than 600 independent variables in the regressions and displaying all of them would not be meaningful. We therefore present regression tables with the constant, as well as the independent variable of interest, Consolidated Exchanges.

**Table 6: Analysis of Deal Count across all samples**

<b>Analysis of the Stock Exchange Consolidation Effect on Deal Count</b>					
	Change in Deal Count - Total Deal Count Within a Country-Pair Year				
	All-All	Public-Public	Public-Private	Private-Public	Private-Private
Consolidated Exchanges	-0.512 (0.372)	-0.151*** (0.040)	-0.019 (0.188)	-0.027** (0.010)	-0.139 (0.110)
Constant	296.657*** (1.134)	10.596*** (0.122)	112.751*** (0.572)	0.778*** (0.032)	41.552*** (0.334)
Observations	14,280	14,280	14,280	14,280	14,280
R <sup>2</sup>	0.934	0.708	0.888	0.366	0.757
Adjusted R <sup>2</sup>	0.931	0.695	0.883	0.337	0.746
Residual Std. Error (df = 13661)	5.449	0.586	2.751	0.153	1.607
F Statistic (df = 618; 13661)	315.126***	53.609***	175.150***	12.756***	68.833***
<i>Note:</i>	* p<0.1; ** p<0.05; *** p<0.01				

**Table 7: Analysis of Mean Deal Value across all samples**

<b>Analysis of the Stock Exchange Consolidation Effect on Deal Value</b>					
Change in Mean Deal Value Within a Country-Pair Year					
	All-All	Public-Public	Public-Private	Private-Public	Private-Private
Consolidated Exchanges	23.504 (126.581)	432.046 (1,227.033)	-2.226 (71.109)	-1,042.710 (916.312)	-21.010 (64.252)
Constant	468.836* (247.679)	3,338.675** (1,683.573)	79.355 (112.884)	1,393.790 (920.133)	63.994 (68.524)
Observations	3,697	824	2,066	150	548
R <sup>2</sup>	0.096	0.277	0.238	0.544	0.494
Adjusted R <sup>2</sup>	-0.027	0.043	0.088	-0.417	0.225
Residual Std. Error	1,129.235 (df = 3254)	5,639.952 (df = 622)	486.910 (df = 1726)	1,346.523 (df = 48)	184.096 (df = 357)
F Statistic	0.779 (df = 442; 3254)	1.185* (df = 201; 622)	1.590*** (df = 339; 1726)	0.566 (df = 101; 48)	1.838*** (df = 190; 357)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

**Table 8: Analysis of Payment Method in the All Acquirers – All Targets sample**

<b>Analysis of the Stock Exchange Consolidation Effect on Payment Methods</b>				
Change in Payment Methods - Total Deal Value Within a Country-Pair Year				
All Acquirers - All Targets				
	% Cash	% Stock	% Other	% Unknown
Consolidated Exchanges	0.047 (0.053)	-0.095*** (0.035)	0.026 (0.027)	0.022 (0.052)
Constant	0.436*** (0.090)	0.247*** (0.060)	0.519*** (0.045)	-0.201** (0.089)
Observations	2,478	2,478	2,478	2,478
R <sup>2</sup>	0.241	0.244	0.445	0.319
Adjusted R <sup>2</sup>	0.107	0.110	0.347	0.198
Residual Std. Error (df = 2103)	0.394	0.262	0.199	0.389
F Statistic (df = 374; 2103)	1.790***	1.817***	4.515***	2.631***

*Note:*

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

**Table 9: Analysis of Payment Method in the Public Acquirers – Public Targets sample**

<b>Analysis of the Stock Exchange Consolidation Effect on Payment Methods</b>				
Change in Payment Methods - Total Deal Value Within a Country-Pair Year Public Acquirer - Public Target				
	% Cash	% Stock	% Other	% Unknown
Consolidated Exchanges	0.093 (0.089)	-0.125* (0.075)	-0.010 (0.022)	0.042 (0.065)
Constant	0.514*** (0.127)	0.139 (0.107)	0.071** (0.031)	0.276*** (0.092)
Observations	822	822	822	822
R <sup>2</sup>	0.324	0.325	0.323	0.430
Adjusted R <sup>2</sup>	0.108	0.109	0.106	0.248
Residual Std. Error (df = 622)	0.411	0.345	0.100	0.297
F Statistic (df = 199; 622)	1.500***	1.504***	1.491***	2.362***

*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

**Table 10: Analysis of Payment Method in the Public Acquirers – Private Targets sample**

<b>Analysis of the Stock Exchange Consolidation Effect on Payment Methods</b>				
	Change in Payment Methods - Total Deal Value Within a Country-Pair Year			
	Public Acquirer - Private Target			
	% Cash	% Stock	% Other	% Unknown
Consolidated Exchanges	0.057 (0.054)	-0.080** (0.035)	0.033 (0.030)	-0.010 (0.057)
Constant	0.471*** (0.091)	0.094 (0.059)	0.078 (0.050)	0.356*** (0.097)
Observations	2,054	2,054	2,054	2,054
R <sup>2</sup>	0.259	0.266	0.522	0.307
Adjusted R <sup>2</sup>	0.116	0.124	0.430	0.173
Residual Std. Error (df = 1721)	0.370	0.241	0.204	0.393
F Statistic (df = 332; 1721)	1.810***	1.877***	5.660***	2.295***

*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01



**Table 11: Analysis of Payment Method in the Private Acquirers – Public Targets sample**

<b>Analysis of the Stock Exchange Consolidation Effect on Payment Methods</b>				
Change in Payment Methods - Total Deal Value Within a Country-Pair Year Private Acquirer - Public Target				
	% Cash	% Stock	% Other	% Unknown
Consolidated Exchanges	-0.401 (0.321)	0.242 (0.170)	0.029 (0.117)	0.130 (0.281)
Constant	1.193*** (0.323)	-0.289* (0.171)	0.138 (0.118)	-0.042 (0.283)
Observations	150	150	150	150
R <sup>2</sup>	0.666	0.494	0.622	0.728
Adjusted R <sup>2</sup>	-0.037	-0.570	-0.175	0.155
Residual Std. Error (df = 48)	0.472	0.250	0.172	0.414
F Statistic (df = 101; 48)	0.947	0.465	0.781	1.271

*Note:*

\*p&lt;0.1; \*\* p&lt;0.05; \*\*\* p&lt;0.01

**Table 12: Analysis of Payment Method in the Private Acquirers – Private Targets sample**

<b>Analysis of the Stock Exchange Consolidation Effect on Payment Methods</b>				
Change in Payment Methods - Total Deal Value Within a Country-Pair				
Year				
Private Acquirer - Private Target				
	% Cash	% Stock	% Other	% Unknown
Consolidated Exchanges	-0.098 (0.131)	0.134** (0.063)	-0.007 (0.051)	-0.029 (0.145)
Constant	-0.037 (0.148)	0.041 (0.072)	0.052 (0.058)	0.944*** (0.164)
Observations	545	545	545	545
R <sup>2</sup>	0.406	0.369	0.829	0.479
Adjusted R <sup>2</sup>	0.094	0.039	0.740	0.206
Residual Std. Error (df = 357)	0.374	0.181	0.146	0.414
F Statistic (df = 187; 357)	1.302**	1.117	9.275***	1.757***

*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01