The impact of disruption on takeover and merger activity.

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February 2020

Abstract

This study analyses the effect that disruptive innovations have on the deal activity within the different industrial sectors. This thesis will explore if there is any predictive power in the rate of disruption by relating it to the amount of takeover and restructuring activity and relative deal value. Different stakeholders (such as investors, consultants and management of incumbent firms) could benefit if such a relation would exist. The framework used for this study is tested on a sample of 99 industry-year observations in the three regions, North America, Europe, South & Middle America. Disruption is measured by the creation of a proxy which represents the rate of disruption within a specific industry. The findings indicate that there is a very limited effect of disruption on the number of takeover and restructuring deals, but it does not support any evidence that there is an effect on the relative deal value. As a result, it is recommended that future research complements and expands this framework (especially over-time) and studies the effects for other economies as well.

Keywords: *Disruption; Disruptive innovation; Mergers & Acquisitions; Deal Value*.

ERASMUS UNIVERSITY OF ROTTERDAM
Erasmus School of Economics
Master Thesis Financial Economics

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Date final version: 11th february 2020

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1. Introduction

1.1 Basic question

The leaders of tomorrow's industry are shaping their future today. How will traditional business respond? With the established business models changing at a rapid pace across traditional industries, business may be unable to keep up. They simply do not have the internal capabilities to generate innovation. Increasingly, market-leading companies are turning to M&A to address technology shifts, changes in consumer behaviour, and cross-sector convergence. How M&A fits into a company's strategy and complements organic growth depends very much on the industry the company operates in, its market position and its strategy for value creation. With engaging in mergers and acquisitions companies can make necessary leaps in the competitive marketplace. It can help them to take advantage of the benefits of scale that comes from consolidation or to gain new technology, markets, products and distribution channels.

Another important aspect is that it can help companies respond to unprecedented disruption. This raises the question whether these two are correlated? Does the rate of disruption have any relation to the number of M&A deals done within an industry? Does it have any relation to the relative value of these deals? This research will investigate the rate of disruption within different industries of the U.S. the Europe and the South & Middle America market and try to show that there is a relation with the amount of M&A deals done. The general research question therefore is:

$$Does\ disruption\ have\ an\ (predictive)\ effect\ on\ M\&A\ activity?$$

1.2 Disruption

But what is disruption? Arguably, the main goal of a company is to be profitable. The next goal might be to reach the top of their industry, but this is not always the case. Even the ones that reach the top and serve their customers on the global market might not become market leaders. The "excellent" companies that make it to the top of the industry are scarce. Those companies have a certain competitive advantage that lets them outperform their competitors. However, whilst some of those companies do outperform their peers for years and even decades, this is a rare accomplishment. The difficulty to stay at the top relates to the fact that these incumbent companies have to keep innovating. New entrants threaten and overtake leading incumbents despite the latter's apparently unassailable advantages or resources, brand recognition, and market power. (Christensen, McDonald, Altman, & Palmer, 2018)

The overtaking of leading incumbents by entrants or smaller companies is also known as the disruption of an industry. An example is of an entrant company who became market leader is Apple, who disrupted the computer and telephone business at the beginning of the century. This is one of the

world's most valuable companies at the moment[1], but when they first came on the playing field they were regarded as disruptors.

Furthermore, digitization, globalization, technological advances, and greater reliance on data analytics are accelerating market disruption at a historic pace, making it increasingly difficult for companies to maintain their competitive advantages. Businesses must adapt their processes, systems, and operating models to retain the strategic capabilities that are necessary to have the "right to win".

1.3 M&A

The level of competitiveness of a company is depending on how fast it can absorb knowledge and skills. This is difficult because companies cannot create knowledge and skills for sustainable innovation solely within the organisation. Even when it does happen it takes a long time to implement. One increasingly popular mode of innovating and maintaining competitive advantage are merger and acquisition deals (M&A). Due to constant change and intense competition, firms must constantly keep up with the fast-changing market. These firms need to obtain this knowledge from an external source. M&A is an example of such an external source.

In their paper, (Mitchell & Mulherin, 1996), study industry-level patterns in takeover and restructuring activity during 1980s. They find that interindustry patterns in the rate of takeovers and restructuring are directly related to the economic shocks borne by sample industries. Their concept of an industry shock is any factor, whether expected or unexpected, that alters industry structure. In order to link takeover activity and industry shocks the authors assume that the structure of an industry, including the number and size of firms, is a function of factors such as technology, government policy, and demand and supply conditions. They state that major changes, or shocks, in any of these factors cause shifts in industry structure. Companies can respond to a shock either internally or externally. For example, when a shock like disruptive innovation triggers a decrease in market share a company can react through expansion or takeovers in order to increase their market share again.

(Mitchell & Mulherin, 1996) maintain the hypothesis that the takeover route is often the least-cost method to alter industry structure. The authors see the ongoing changes in the U.S. banking system as an example of takeover activity and industry shocks. Their paper was published in 1996 and in that period recent legislation had removed regulatory hurdles to nationwide banking, and industry members have responded by expanding across state lines and regional boundaries. Analysts predicted that the economies of scale brought about by such expansion will lower operating costs by roughly 33%. The authors state that takeovers are arguably the quickest way to accomplish this expansion, as internal growth would create excess capacity in the relatively mature banking industry. The opposite argument can be made that link takeover activity with negative industry shocks. A shock-driven

[1] See https://www.statista.com/statistics/263264/top-companies-in-the-world-by-market-value/

decline in demand can cause the members of an industry to close unprofitable facilities, but it can also pressure firms to merge the remaining facilities in order to react to the post-shock optimal plant size.

The neoclassical explanation of takeover activity is that mergers are an efficient response to reorganization opportunities that arise as a result of some underlying economic event. The economic shock in question could come from a variety of sources: industry overcapacity, the advent of a new technology, changing regulatory attitudes, or changes in access to capital markets that alter the optimal operating scale of firms. (Rhodes-Kropf, Robinson, & Viswanathan, 2005)

In the paper of Rhodes et al., the general research question is whether valuation errors affect merger activity. The authors try to explain merger intensity predictions by introducing dispersion in the market-to-book ratio as a proxy for reorganization opportunities. This research will follow the same train of thought and similarly use a proxy by using the rate of disruption to explain M&A activity.

1.4 Motivation

Disruption is one of the motives to engage in M&A activity. Studying the effect of an external force such as disruption will contribute to the literature by relating the effect of disruption to M&A activity. At the writing of this thesis it is my understanding that this has not been done before and would therefore be an extension on the theory of disruption literature and may give future research the ability to not solely think about the effects of disruption on profitability but additionally on the immediate effect on the M&A activity of a company.

There has been written a lot about the theory of disruption. The level of current and future disruption determines which strategic action companies need to prioritize. Only those companies that act on their strategy confidently can take advantage of disruption. Companies could benefit from disruptive market sensing. Companies should develop market-sensing capabilities that monitor shifts in disruptive technologies. These companies should ask themselves where their industry is headed in the next five of ten years, what forces are likely to disrupt and reshape their industry or should growth options include investment, partnership, or acquisitions components.

This research is further motivated by the relatively meagre understanding of the dynamics of takeover activity. Prior research finds that takeovers do not occur evenly over time, but instead cluster in distinct waves. As such, the analysis of takeover waves has tended to be ad hoc, with each of the takeover waves in the past century having its own label as discussed in the literature review.

Consistent with this ad hoc characterization, this research will focus on the years 2010-2018 in order to find if there is a distinctly new wave that is driven by strategic, synergistic factors. This period will capture the post financial crises dynamics of the mergers and acquisitions. The data for

merger and acquisition deals is collected from Zephyr, company information from Orbis and Stata is used to run the appropriate tests.

This analysis is organized as follows. *Section 2* will discuss the findings of previous literature. *Section 3* elaborates on which hypotheses were made and the underlying methodology to test these hypotheses. *Section 4* describes the data and presents summary statistics. *Section 5* will show the result of the tests and discuss these. Finally, *Section 6* will conclude and discuss this study and give avenues for future research.

2. Literature Review

2.1 Disruptive innovation

At the basis of the term "disruption" or "disruptive innovation" stands Clayton M. Christensen with his book "The Innovator's Dilemma" (Christensen, 1997). In this book Christensen argues that, very often, it isn't because executives make bad decisions but because they make good decisions that companies fail. These kinds of decisions have been made by those companies over decades and it made them successful. This is one of the reasons that leading firms fail to remain dominant in their respective markets. These apparently well-managed firms were widely lauded by analysts and the business press, and yet each of them overlooked something important that precipitated a decline. (Christensen et al., 2018)

In his research, (Christensen, 1997), indicates that disruptive innovation consists of three principal components. First, that the pace of technological progress outperforms customers' demand for higher-performing technologies. The result is that companies produce product that are more advanced than customers need. This creates a gap at the bottom which can be bridged by new entrants.

Secondly, he makes a difference between sustaining innovations and disruptive innovations. The former are innovations which improve products and services along the dimensions of performance that mainstream customers care about and that markets have historically valued. The latter is rarer. When introduced, these innovations are inferior to existing products on accepted performance dimensions, but they offer new attributes that appeal to different kind of customers. Examples of these attributes are that they are more accessible, convenient or that they are just simply cheaper.

Finally, the last component of his model is that due to existing customers and profit models the incumbents are constrained regarding investments in new innovations. This creates an opportunity for new entrants because they do not have this existing customer base. This results in the unwillingness of incumbents to dive into these smaller markets and introduction of potentially inferior products and services.

There have been numerous studies researching the theory of disruptive innovation in different sectors of industry. Examples of sectors are: semiconductors (Christensen, 2006), computers (Christensen, 1997), retailing (Tedlow & Christensen, 2000), motorcycles and cars, management education and cardiovascular surgery (Christensen, C. M., Raynor, M. and Verlinden, 2001), printing and newspapers (Gilbert, 2005, 2006), management consulting (Christensen, Wang, & van Bever, 2013), cameras (Christensen, 2006), pharmaceuticals (Kapoor & Klueter, 2015), digital video recorders (Ansari, Garud, & Kumaraswamy, 2015), and financial services (Das, 2017).

There have been lively debates around the theory of disruptive innovation. Ranging from the existence and prevalence of disruption, to the way it gets measured and assessed. The issue that has been considered the most prominent is the fact that disruption is a concept that can only be experienced after the fact. Does it allow for ex-ante prediction about whether a particular innovation eventually challenge leading incumbents? (Christensen, 2006; Markides, 2006)

2.1.1 Responding to disruptive innovation

How do companies respond to disruptive innovation? From the early work about the theory of disruption researchers have observed up-market movements by both incumbents and disruptive entrants in various industries. One explanation is that incumbents 'flee' up-market to pursue more profitable customers at higher tiers of the market, and to enhance profitability by replacing lower-margin business with higher-margin business. (Christensen, 1997). The opposite has also been proven by Christensen, explicitly, that incumbents set up an autonomous organizational unit and task it with developing and commercializing the new innovation when a disruptive innovation emerges. This is one of the response strategies that has enjoyed broad empirical support. (Christensen and Raynor, 2003)

There are several additional strategies for dealing with disruption: First, technology strategists who situate their work in the economics of transitions have shown that incumbents may aggressively invest in existing capabilities to extend current performance-improvement trajectories in order to slow or delay the onset of disruption. Second, organizational theorists have argued that incumbents can use organizational ambidexterity to manage conflicts expected to arise from pursuing different types of innovations simultaneously. According to this perspective, exploring (via an emerging business) and exploiting (via an existing business), in parallel, may even help resolve the innovator's dilemma. Third, scholars of entrepreneurship and innovation have shown that incumbents may seek to co-opt disruptive entrants once they start challenging incumbents' market leadership. They may do this by partnering with or licensing start-ups' technology once it reaches a certain threshold. (Christensen et al., 2018)

Especially the first and third strategy relate to M&A activity and can therefore be regarded as an explanation for what this paper is researching. As the level of disruptive innovation is increasing this

could result in incumbents to co-opt with disruptive entrants or to increase their investment in existing capabilities. Respectively, an example of a merger and an acquisition.

2.2 Takeover and merger activity

In general, takeovers and mergers (M&A) are transactions in which the ownership of companies, other business organizations, or their operating units are transferred or consolidated with other entities. M&A transactions enable firms to grow faster than firms relying on organic growth, allow them to penetrate new markets and cross-sell into a new customer base, expand their scope by acquiring a set of complementary products, buy a pipeline of R&D intensive products, patents, or trade secrets, avoid upstream or downstream market foreclosure by suppliers, reduce taxes by means of new subsidiaries situated in tax-friendly countries, realize cost synergies by eliminating surplus facilities and overheads, reduce competition, improve access to capital, etc. (Renneboog & Vansteenkiste, 2019)

2.2.1 M&A waves

Historically, there have been several periods of time in which the number of mergers and acquisitions was significantly higher. This phenomenon is also described as a M&A wave. A M&A wave is normally referred to as a series of aggregate M&A activities with remarkably high volume and value. Considerable research has been conducted on the causes of M&As and it is widely acknowledged that merger waves exists. M&A waves cause major changes in the structure of global capitalism, causing a transition from a business atmosphere composed of agglomerations of small and medium sized local businesses to the current form, with the market dominated by multinational corporations. The waves of mergers and acquisitions are usually caused by a combination of economic, regulatory or technological changes, which are called “shocks”. Since the 1890s there have been 5 major M&A waves, which mostly took place in the U.S. (Martynova & Renneboog, 2008). The *first* wave of mergers and acquisitions occurred between ca. 1890 – 1904. U.S. companies tried to build monopolies in their respective industry. This was mainly done by horizontal integration, meaning that a company acquires another that produces the same type of product. The *second* wave was characterized by the creation of oligopolies and vertical integration between different companies. After the second world war came the *third* wave which was characterized by a trend towards diversification among companies. This wave was followed with a downward period regarding M&A activity. The *fourth* wave distinguished itself by the size and importance of the target companies. Finally, mostly driven by globalization and market deregulation, the *fifth* wave of M&A began in 1992.

Most literature written about merger waves is about the five described above. However, if a simple look is taken at the data of the past two decades, one can see that there is some evidence of two

new mergers waves[2]. The *sixth* merger wave began after the 2001 recession. This happened because the economic growth resurfaced and there was an overflow of dollars into the market. (Cordeiro, 2014) Low interest rates also boosted the rise of private equity (PE) funds, as levered acquisitions became cheaper. The stock market was also booming, which led to large amounts of available capital and an extremely favourable environment for the number of M&A transactions. This wave ended when the "Great Recession" began in 2008.

One could argue that we are currently in the seventh merger wave. Since the world economy came out of the recession in 2009 it has been growing again. In Deloitte's sixth *M&A trends* report (Thomson, Dettmar, & Garay, 2018), they state that tax legislation and a looser regulatory environment helped keep M&A strong in the last couple of years. This, in combination with a relatively strong stock market and cheap financing, was driving M&A activity.

Recent debate about the cause of merger waves has highlighted the fact that merger waves are correlated with high stock market valuations. (Rhodes-Kropf et al., 2005) and (Shleifer & Vishny, 2003) developed models in which merger waves result from managerial timing of market overvaluations of their firms. The authors of these papers argue that bull markets[3] lead groups of bidders with overvalued stock to use the stock to buy real assets of undervalued targets through mergers.

(Mitchell & Mulherin, 1996) argue that there is a more neoclassical explanation and that merger waves result from shocks to an industry's economic, technological, or regulatory environment. (Harford, 2005) also supports this neoclassical explanation of merger waves, namely that these waves occur in response to specific industry shocks that require large scale reallocation of assets. He points out however, that not just these economic shocks are enough to explain the waves. The capital liquidity of the market has to be sufficient to accommodate for asset reallocation. The increase in capital liquidity and reduction in financing constraints that is correlated with high asset values must be present for the shock to propagate a wave. The author further gives the argument that the explanation for merger waves is intuitive: it requires both economic motivation for transactions and relatively low transaction costs to generate a large volume of transactions.

The two competing explanations can thus be broadly categorized into two groups: the neoclassical and behavioural. In this research the neoclassical will be of more significance as disruption can be seen as an economic disturbance that leads to industry (re)organization. When disruption occurs to an industry's environment, a collective reaction of firms inside and outside the industry can be to reallocate the assets within that industry through mergers and partial-firm acquisitions.

[2] See Graph 1 in the Appendix

[3] A market in which share prices are rising, encouraging buying

2.2.2 What drives M&A activity?

The occurrence of a merger is a significant event for companies. Because there is a transfer of ownership and control of assets, there should be an underlying motivation for such an action. Changes in the environment must have occurred to interest the acquiror and possibly also the acquire in the transaction. Else it would have occurred previously.

The environmental changes that motivate takeover and merger activity are subject to a lengthy literature. These changes include economic, financial managerial, judicial and institutional conditions which individually and/or collectively generate the necessary climate for takeover and mergers. (Beckenstein, 1979)

If takeovers and mergers are influenced by external forces, then if these forces are favourable, one would expect strong merger activity. There are, however, implications between takeover & merger activity and the external forces. Firstly, it takes time to complete a merger or a takeover. The year the merger or takeover takes place may be the consequence of motivating forces that existed in a previous year. Secondly, the total effect of the individual external influences is likely to be multiplicative rather than additive due to synergies. These synergies are the concept that the combined value of these companies would be greater than the sum of the separate, individual companies due to the enhanced cost efficiencies of the new business. With mergers, companies combine resources and therefore have a better chance of controlling the market and dominating their industry or industries. It helps boost the company's current performance and helps the company to hold on to a premium position.

Previous research has shown that the larger companies become, the more they rely on M&A to grow. Furthermore, companies are generally more successful with large acquisitions in slower growing, more mature industries. (Rehm, Uhlaner, & West, 2012) Reducing excess industry capacity, which indicates that demand for a product is less than the amount that the business potentially could supply to the market and improving performance could create great value. Moreover, a lengthy integration effort is less disruptive. Faster-growing sectors have shown the opposite. Namely, large deals have been less successful. Why did companies in these sectors underperform? Explanations are that many focused inwardly during the lengthy integration required for larger deals, missing critical product or upgrade cycles. Others attempted to expand complementary businesses, where targets had limited overlap in products and technology.

It is possible to understand M&A performance better by taking a better look at patterns of deal activity. The success of large deals tends to depend more on the industry where they take place, the success of small ones more on the capabilities of the acquiring companies.

2.2.3 Merger theories

Merger motives have triggered far less theoretical efforts than merger consequences. In his paper, (Beckenstein, 1979), gives an overview of various models and theories which investigate merger activity.

First of all are the external force theories. The level of merger activity has been theorised to be related to a variety of external forces. The most prominent is the hypothesis that merger activity is related to *general business conditions*, such as measured by gross domestic product (GDP). One could argue that when the economy grows, so do firms in both number and performance. Consequently, the number of possible mergers increases. Moreover, with economic growth, the assets acquired would be expected to grow over time. Also, the average business firm is experiencing strong performance and is in a better position to make acquisitions.

Another theory states that many mergers are undertaken for capital gains appreciation of the acquiring company's stock. This is regarded as the *promotional gain's theory*. In this theory firms acquire companies with a lower P/E ratio than theirs with the expectation that investors value this acquisition at the higher P/E multiple. *Institutional explanations* also offer explanations for merger activity. Tax incentives, antitrust activity and financial accounting practises are examples of institutional motivation to mergers.

Secondly, (Beckenstein, 1979) elaborates about the internal evaluations theories. One prominent merger theory, introduced by (Gort, 1969), is the *economic disturbance theory*. This theory focuses on discrepancies in valuation between insiders and outsiders to the firm. Economic disturbances are decisive in determining variations in merger rates both among industries and over time. According to this theory, when industry growth is large, the larger are the capacity needs and discovered valuations discrepancies and hence the higher the merger rates.

The next type of internal evaluation theory is the *managerial theory*. Managers of acquiring companies pursue growth maximization. In order to achieve this, they must acquire other firms and internalize the more lucrative investment opportunities. Due to the lower discount rate employed by the mature, growth- oriented firm, an acquisition of the younger, profit-oriented firm can be lucrative to both parties.

Other motivations related to the internal evaluation's theory are *scale economies* and *monopoly power*. These are motivations of horizontal and vertical mergers. (Beckenstein, 1979) points out that unlike the economic disturbance and managerial theories, which are related to changes in economic and stock market conditions and the cost of capital, respectively, there are no logical external indicia which relate to monopoly and scale economy motivations. He gives as explanation that mergers undertaken for such reasons are more likely to occur when the other conditions mentioned above are favourable.

As shown above, engaging in M&A activity can be the result of different motivations. With newer firms releasing new forms of value as a result of technological progress combined with other external changes, they are able to disrupt industries. To combat this disruption, or to keep up with the newer firms, they have to innovate. One way to do this is by investing in or merging with these newer companies. Another way is to invest in even newer firms to outpace the competitors. This results in incumbent firms engaging in more M&A activity. Companies who excel at this are generally the market leaders.

3. Methodology and Hypotheses Development

In this section the hypotheses will be established after which the methodology used to analyse my data will be explained.

3.1 Hypotheses

Hypothesis 01. The average rate of disruption has been increasing in all of the FF industries in the U.S., EU and SMA markets over the time period 2010-2018.

This research uses the industry classification of Fama and French ("FF") to divide the different market regions into industry segments and to assess the impact of the disruption rate in those segments. A full list of the classification and the corresponding SIC codes can be found in Table 4 in the Appendix. The first hypothesis aims to show that the disruption is increasing. The rationale behind this is that due to the increasing technological advances (and the speed with which these become available) it becomes easier for companies to establish themselves as an important market player and therefore disrupt the incumbent firms.

Hypothesis 02. The rate of disruption has been higher in sectors which are heavily dependent on technological innovation (i.e., FF industry 6 -Computer, Software, etc.- and industry 7 -Telephone and TV-).

In their research, (Leinwand & Mainardi, 2017) conclude that the industries undergoing the largest EV shifts were "Internet Software and Service, IT Services, and Biotechnology". The authors argue that reason for these large shifts is due that these sectors are heavily dependent on technological innovation and subject to turbulent change. Following the same logic, it is expected that FF sectors 6 & 7, respectively Computers & Software and Television & TV, are disrupted more.

Hypothesis 03. The rate of disruption is positively correlated with M&A activity.

The third hypothesis examines the general relationship between disruption and aggregate M&A activity in a yearly time series. It assumes the rate of disruption to have explanatory power in relation to the level of takeover and restructuring activity. To do this, a panel data set with number of deals executed as dependent variable is used.

Hypothesis 04. The rate of disruption is positively correlated with deal value. When the rate of disruption is higher in a given year, this will result in a higher overall deal value.

To expand the research the dependent variable for the fourth hypothesis is "relative deal value of M&A deals". This variable is used as the dependent variable instead of the number of deals and is in line with studies like that of (di Giovanni, 2005). The reason why this variable could lead to better results than the "number of M&A deals" among others, is that deal value consists of more information due to showing the magnitude of the deals[4].

Due to the disruption the established business models are changing at a rapid pace. In order to keep up businesses need to turn to disruptive M&A because their internal capability to generate innovation is lacking. There is a catch, however. Disruptive M&A is inherently complex[5]. Disruptive M&A targets are valued and analysed differently, transactions are executed faster, and acquisitions require a wider range of integration models. This would likely have an effect the value of the deals done within an industry.

3.2 Model & Variables description

In this section the model used to test the hypothesis will be explained. Furthermore, the statistics behind the model and the main explanatory and dependent variables are described, and which control variables are used.

3.2.1 Basic model

This study uses a regression analysis to estimate the effect of disruption on takeover and merger activity. A panel data set is used where the dependent variable is the total takeover and restructuring activity in an industry and the explanatory variable is the rate of disruption. This study analyses the effect of disruption across three regions, North America (NA), Europe (EU) and South & Middle America (SMA),and thus in three different models. In order to analyse the effect of disruption on takeover and restructuring activity, and the relative value of these deals, the following models are construed:

$$number\ of\ deals\ completed\ NA_{it} = \alpha_{it} + \beta_1 Disruption\ NA_{it} + \beta'_2 x_{it} + \mu_{it} \quad (3)$$

$$number\ of\ deals\ completed\ EU_{it} = \alpha_{it} + \beta_1 Disruption\ EU_{it} + \beta'_2 x_{it} + \mu_{it} \quad (5)$$

$$number\ of\ deals\ completed\ SMA_{it} = \alpha_{it} + \beta_1 Disruption\ SMA_{it} + \beta'_2 x_{it} + \mu_{it} \quad (6)$$

[4] Lack of deal values for certain M&A's is because firms do not have to announce the deal value.
[5] Source: Deloitte Disruptive M&A, Future of the Deal (Deloitte, 2019)

$$deal\ value\ NA_{it} = \alpha_{it} + \beta_1 Disruption\ NA_{it} + \beta'_2 x_{it} + \mu_{it} \quad (7)$$

$$deal\ value\ EU_{it} = \alpha_{it} + \beta_1 Disruption\ EU_{it} + \beta'_2 x_{it} + \mu_{it} \quad (8)$$

$$deal\ value\ SMA_{it} = \alpha_{it} + \beta_1 Disruption\ SMA_{it} + \beta'_2 x_{it} + \mu_{it} \quad (9)$$

Where i indexes industries, t indexes year, β_1 picks up the effect of disruption, x is a vector of macroeconomic and industry specific characteristics. β'_2 picks up the generic effect of these characteristics. The macroeconomic and industry specific characteristics are also representing its respective regions.

The interpretation of this model is the following. The regression coefficient provides the expected change in the dependent variable (here: M&A activity) for a one-unit increase in the independent variable, the disruption rate in the respective region. A positive coefficient indicates a positive relationship. As disruption increases, the M&A activity increases. Also, M&A activity decreases as disruption decreases. The same holds when deal value is the dependent variable.

To test whether there is a significant difference of the effect of disruption on the M&A activity between the three different regions an additional model is estimated. In this model, a dummy variable is constructed to shows the difference between regions.

$$\gamma_{it} = \alpha_i + \beta_1 * Disruption_{it} + \beta'_2 * Dummy\ region_i * Disruption_{it} + \mu_{it} \quad (10)$$

3.2.2 Extended model

One of the issues with the predictive power of disruption is that disruption is a concept that can only be experienced after the fact. Just generally, it is often the case when longitudinal data is available, that one expects the effects of one variable on another to appear with a delay. That is, this year's amount of deals and deal value may depend on last year's value of disruption rather than on the current value. After the baseline regression the research is expanded by using the lagged (t-1) effect of disruption on the number of deals and deal value. The following models are estimated:

$$number\ of\ deals\ completed\ NA_{it} = \alpha_{it} + \beta_1 Disruption\ NA_{it-1} + \beta'_2 x_{it} + \mu_{it} \quad (11)$$

$$number\ of\ deals\ completed\ EU_{it} = \alpha_{it} + \beta_1 Disruption\ EU_{it-1} + \beta'_2 x_{it} + \mu_{it} \quad (12)$$

$$number\ of\ deals\ completed\ SMA_{it} = \alpha_{it} + \beta_1 Disruption\ SMA_{it-1} + \beta'_2 x_{it} + \mu_{it} \quad (13)$$

$$deal\ value\ NA_{it} = \alpha_{it} + \beta_1 Disruption\ NA_{it-1} + \beta'_2 x_{it} + \mu_{it} \quad (14)$$

$$deal\ value\ EU_{it} = \alpha_{it} + \beta_1 Disruption\ EU_{it-1} + \beta'_2 x_{it} + \mu_{it} \quad (15)$$

$$deal\ value\ SMA_{it} = \alpha_{it} + \beta_1 Disruption\ SMA_{it-1} + \beta'_2 x_{it} + \mu_{it} \quad (16)$$

3.2.3 Statistics

This research will make use of the random effects model. The rationale behind random effects model is that, unlike the fixed effects model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. In this case, the entities are the different industries.

A panel data set involves observations of multiple phenomena obtained over multiple time periods for the same industries. By combining the data in two dimensions this results in more data variation, less collinearity and more degrees of freedom. It is also better in detecting and measuring effects which cannot be observed in either cross-section or time-series data. Panel data allows you to control for variables you cannot observe or measure like cultural factors or difference in business practices across industries; or variables that change over time but not across entities. With panel data variables at different levels of analysis (i.e. industries) suitable for multilevel or hierarchical modelling can be included.

The use of the random effects model results from the fact that differences across industries have some influence on the dependent variable, the number of deals. To check if this arguing is correct, the Hausmann test[6] is performed. From the results of this test the conclusion can be made that the random-effects model is appropriate for the data and model of this research.

3.2.4 Construction of the dependent and explanatory variable

Explanatory variable: Disruption

There is no readily available metric for measuring disruption. To be able to do empirical research about this subject this research follows the proxy introduced by Leinwand & Mainardi (2017). They measured the rate of disruption by looking at the major changes in relative enterprise value (EV) among a sector's 10 leading companies.

$$Relative\ EV\ top\ 10_{it} = \frac{EV\ top\ 10\ firms_{it}}{Total\ EV_{it}} \quad (1)$$

$$Disruption_{it} = \%\ change\ Relative\ EV\ top\ 10_{it} \quad (2)$$

[6] The results of this test can be found in Table 9 in the Appendix

The following example can be used to illustrate how the proxy for disruption is constructed: "Within the FF industry classification Consumer Nondurables[7] of the North America region take the 10 companies with the highest enterprise value in the base year 2010. These companies become the sample for the proxy for measuring disruption in this specific industry. In 2010 the EV share of these 10 companies accounted for 61% of the total EV in that sector. The share of total EV will be tracked of each of the individual companies over the 9-year time span. At the end of 2018 the share of total EV has reduced to 54%. The total market share of the top 10 has thus declined. This could be due to different factors, one of which is the rate of disruption within an industry".

As the average EV share of the top 10 companies in almost every industry classification is above the 50% level[8], the conclusion can be made that the sample of companies is a reasonable representation for each industry. Having a reasonable representation of an industry also means that a realistic measure of disruption is available.

Dependent variable: M&A activity

To analyse the effect of disruption has on M&A activity, the number of deals that are being executed within the different industries have to be identified. There are a couple of deal requirements that have to be met for a deal to be included in the sample:

- Completed deals: deals which have not been completed within the time period will be excluded
- Classification as M&A: deals which have been classified as M&A will be incorporated. To keep the focus on M&A, capital increases, minority stakes, institutional buyouts, management buyouts and buy-ins and share buy backs have been excluded. According to the Zephyr database, mergers are "a one-for-one share swap for shares in the new company and the deal involves a merging of equals". Whenever the swap is not on equal terms, the deal is listed as an acquisition in Zephyr. An acquisition is officially stated as "any deal where the acquirer ends up with 50% or more of the equity of the target" (Zephyr, 2019)
- M&A of "very large companies": the deals to be included should be completed by companies which are specified as "very large companies" within the Orbis database. Very large" is applicable when matching at least one of the following conditions:
  - Operating Revenue ≥ 130 million USD, Total assets ≥ 260 million USD or Employees ≥ 1,000
  - Companies for which 'Operating Revenue', 'Total Assets' and 'Employees' are unknown but have a level of Capital over 6.5 million USD
  - Excluded: Listed Companies with ratios 'Operating Revenue per Employee' or 'Total Assets per Employee' below 130 USD.

[7] See Table 4 in the Appendix for complete list of industry definitions and corresponding SIC codes.
[8] See Graph 2 in the Appendix for complete list of total EV share of the Top 10 companies in 2010.

3.2.5 Control variables

There are several factors that could influence the sample of companies which are used to construct the proxy for disruption. Factors that are considered in the literature as potential determinants of takeover and merger activity are incorporated by x_{it} in *equation (3)* and *(4)*. These control variables are indicators that would isolate the disruption effect further from omitted variable bias correlated with business cycle.

These factors include industry specific characteristics as *asset turnover, employee growth, ROA, sales growth* and *ROE*. The same group of companies which have been used to assess the level of disruption will be used in relation to the industry specific control-variables. This can only be done for the industry specific characteristics. Since economic shocks could have different effects across firms, and further, since different shocks across industries could have different average directional implications, the median absolute change is used in each of the above variables.

Not only industry specific characteristics can have an effect on the amount of takeover and restructuring deals of a firm, exogenous macroeconomic factors should be included in the analysis. One of the most prominent hypotheses is that merger activity is related to general business conditions. This is part of the external force theory of mergers mentioned in the literature review. These general business conditions are represented by a series of calendar *year dummies, inflation*, *gross domestic product (GDP) per capita & GDP per capita growth*. When the economy grows, so do firms in both number and performance. This results in the number of possible takeover and merger increases. Therefore, these variables are included. The year dummies account for unobserved factors that are changing between the years. The data (except for the year dummies) is collected from the World Bank database[9].

[9] https://www.worldbank.org/

4. Data

In this section the construction of the dataset is explained, an overview is given on the composition of the sample and the applied transformations to prepare the dataset for analyses is discussed.

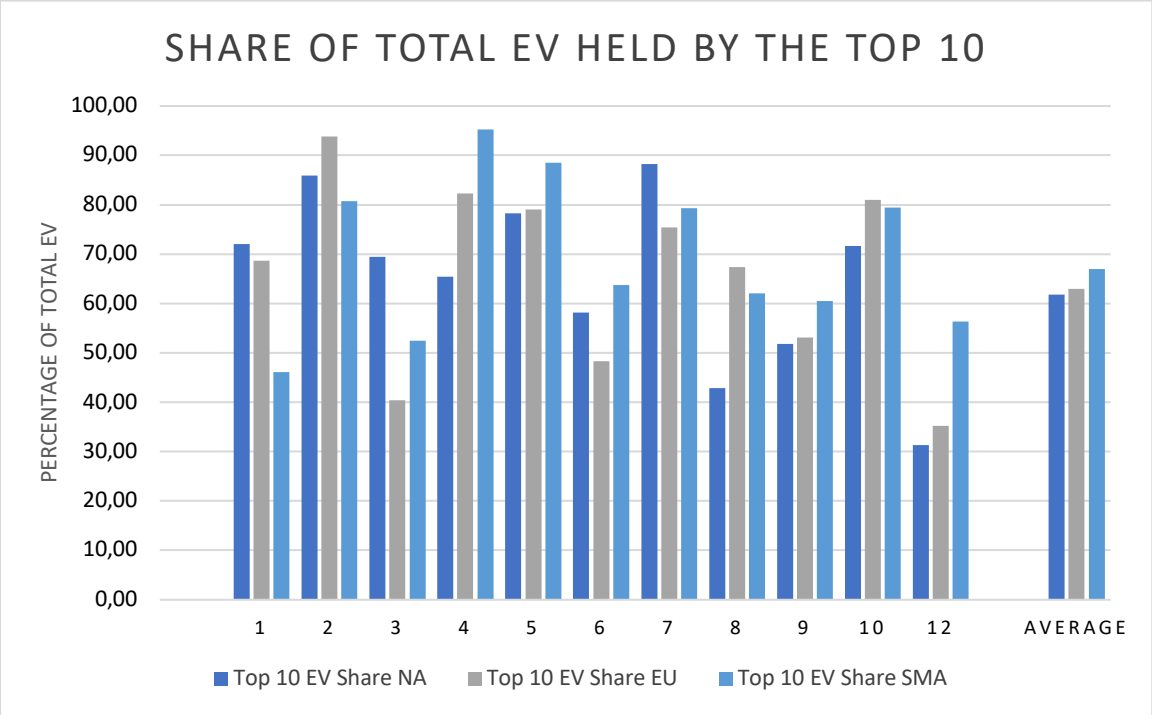
4.1 Dataset construction

The proxy for disruption is constructed by looking at the top 10 largest companies regarding enterprise value in 2010 within each industry. This allows the recognition of major shifts in enterprise value, and with that the identification of major cases of disruption. This construction of the proxy follows the method used by (Leinwand & Mainardi, 2017). The US market is divided into 12 industries following the FF industry classification[10]. The share of total enterprise value (EV) held by each company will be tracked over the time period 2010 till 2018. This time period is chosen so that it will capture the post financial crises dynamics of the mergers and acquisitions.

Company information such as asset turnover, capital expenditure, employee growth, ROA, sales growth and ROE come from the Orbis Insurance Focus database. Orbis is a comprehensive database on detailed reports on public and private insurance companies around the world. The data on M&A deals will come from the Zephyr database. Zephyr is an information solution containing M&A, IPA, and venture capital deals.

Graph 1.

Share of total enterprise value held by the Top 10 by FF industry.



[10] A list of the different industries classifications and there corresponding SIC code can be found in Table 6 of the Appendix

Most of the Top 10 companies have a significant share of the total market in their respective industry, see the graph above. The average of total share held by the Top 10 companies is 61.80%, 62.91% and 67,05% in respectively North America, Europe and South & Middle America.

4.2 Dataset composition and descriptive statistics

Univariate statistics for the average total deals and the main variables used in this paper are shown in Table 1. The statistics are computed based on a panel data set of 99 industry-year observations that represent 11 different industries between 2010 and 2018 in the NA region, the EU region and the SMA region. Total Deals is the total amount of deals that are completed between 01-01-2010 to 31-12-2018 per industry-year. Disruption is the rate of disruption in each industry.

The industry control variables are Asset Turnover, Employee Growth, Sales Growth, ROA, and ROE. Asset Turnover is computed by dividing total sales by the sum of total assets. Employee Growth is the percentage change in employee numbers. ROE is the return on equity, computed as net income divided by the shareholder's equity. ROA is the return on assets computes as net income divided by the total value of assets. Sales Growth is the percentage change in the amount of total sales.

The macroeconomic control variables are inflation, GDP per capita and GDP per capita growth. Inflation is the rate of inflation each year. GDP per capita is the gross domestic product per capita. GDP per capita Growth is the percentage change in the absolute GDP per capita level of each region. Deal Value is the sum of all deal values (in US$) within an industry-year. The number of observations, the overall sample mean, and standard deviation, as well as the minimum and maximum values are presented.

For the main dependent variable, the number of deals, the mean is 120.8, 140.8 and 14.77 for the North America, Europe, and South & Middle America region respectively. The average number of deals completed is significantly less in the emerging market of SMA in comparison with the more developed markets of NA and the EU.

With regard to the dependent variable, disruption, the means are -1.62%, -1.50% and -3.55% for these regions. This shows that in all three regions there has been an average decrease in total share of EV held by the top 10 companies in their respective industry. Also, that this rate of disruption has been higher in the emerging market of South & Middle America.

Table 1.

Descriptive statistics of the three regions, North America, Europe and South & Middle America.

VARIABLES	(1) N	(2) Mean	(3) sd	(4) Min	(5) Max
North America					
Disruption	99	-0.0162	0.0286	-0.165	0.0663
Number of Deals	99	120.8	123.5	12	492
Deal Value	99	7.540e+15	9.985e+15	2.566e+07	4.845e+16
Asset Turnover	99	68.58	38.06	21.75	187.9
Employee Growth	99	0.436	5.834	-17.53	34.29
Sales Growth	99	2.458	7.966	-37.97	24.08
ROE	99	26.38	22.61	-36.47	115.6
ROA	99	6.918	3.582	-10.33	14.24
Inflation	99	1.926e+13	1.712e+12	1.661e+13	2.221e+13
GDP per Capita	99	1.472	0.420	0.750	2.046
GDP per Capita Growth	99	1.743	0.650	0.622	3.034
Europe					
Disruption	99	-0.0150	0.0427	-0.254	0.249
Number of Deals	99	140.8	139.1	19	514
Deal Value	99	1.019e+16	1.521e+16	1.330e+07	6.720e+16
Asset Turnover	99	71.21	29.01	37.63	158.1
Employee Growth	99	0.556	4.484	-16.10	13.92
Sales Growth	99	0.261	10.23	-33.88	28.27
ROE	99	13.79	11.77	-65.73	35.14
ROA	99	5.378	2.909	-2.235	11.84
Inflation	99	1.650	1.496	-0.464	4.130
GDP per Capita	99	14,084	1,186	12,567	16,260
GDP per Capita Growth	99	3.130	1.301	0.974	4.981
South & Middle America					
Disruption	99	-0.0335	0.0699	-0.296	0.0904
Number of Deals	99	14.77	12.85	1	56
Deal Value	99	2.623e+15	5.312e+15	0	2.504e+16
Asset Turnover	99	62.83	26.54	23.51	134.7
Employee Growth	99	11.83	78.03	-93.19	660.9
Sales Growth	99	4.275	13.91	-28.87	81.44
ROE	99	6.363	17.14	-109.3	51.41
ROA	99	3.733	4.545	-10.57	13.39
Inflation	99	5.883e+12	3.736e+11	5.347e+12	6.416e+12
GDP per Capita	99	1.118	1.832	-1.345	4.674
GDP per Capita Growth	99	2.971	1.012	1.650	5.042
Number of industries	11	11	11	11	11

5. Results

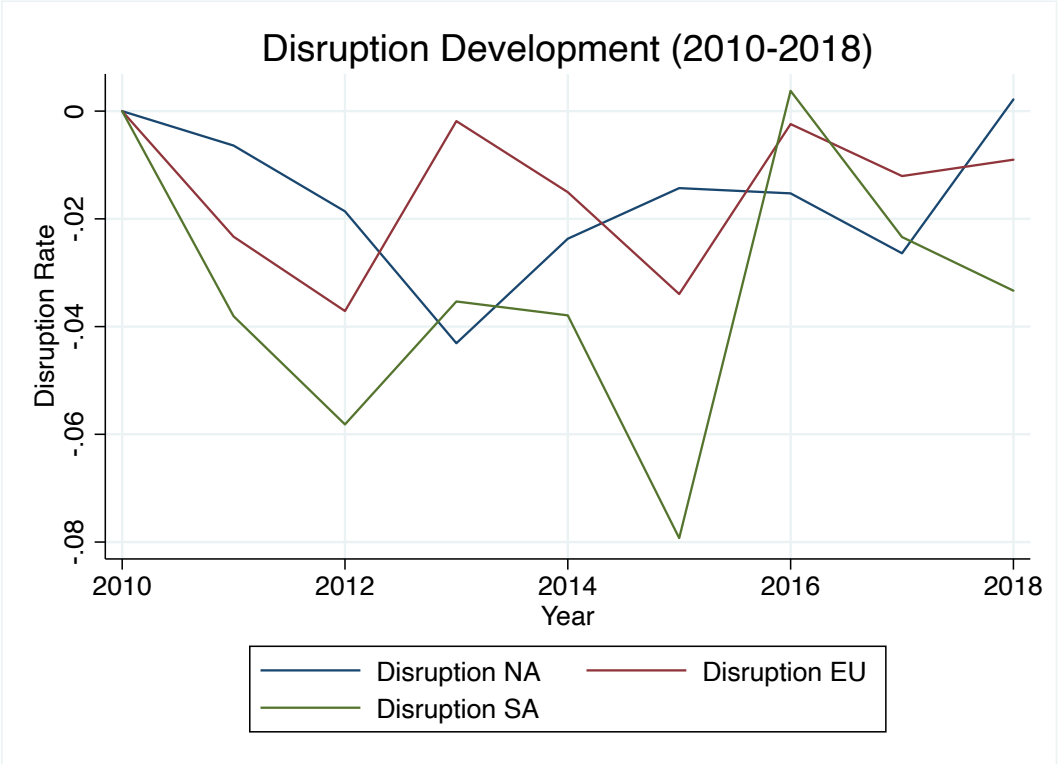
In this section, the empirical results are discussed of the relation between the number of deals and the rate of disruption.

Hypothesis 01. The average rate of disruption has been increasing in all of the FF industries in all three regions over the time period 2010-2018. NOT TRUE

When construction the proxy for disruption and creating the average disruption of the different industries over the years the following can be concluded. In the graph below the mean and median of the rate of disruption of the different industries is displayed. From Graph 2 the conclusion can be made that the rate of disruption does not show a linear increase or decrease.

Graph 2.

Development of the rate of disruption of all FF industries in the three regions.



Hypothesis 02. The rate of disruption has been higher in sectors which are heavily dependent on technological innovation. This goes for the FF industry 6 (Computer, Software, etc.) and industry 7 (Telephone and TV). NOT TRUE

The literature pointed out that large shifts in the EV value could be due to the fact that some sectors are heavily dependent on technological innovation and subject to turbulent change. The sector classifications in the dataset who rely heavily on these technological innovations are FF sector 6 & 7, respectively Computers & Software and Television & TV. The second hypothesis (**H2)** therefore stated that these sectors experienced more disruption. To accept/reject hypothesis 2, a regression was used where the dependent variable is the rate of disruption and the explanatory variables consist of dummy variables for each industry. The results can be seen in Table 2 below. From the results there cannot be concluded that an industry is significantly higher than other industries. Therefore hypothesis 2 is rejected.

Table 2.

Regression with the rate of disruption as the dependent variable and industry dummies as explanatory variables to show which industry heavily influences the rate of disruption.

VARIABLES	(1) Disruption North America	(2) Disruption Europe	(3) Disruption South & Middle America
FF1	-0.00555	0.00940	0.00532
	(0.00508)	(0.0475)	(0.0208)
FF2	0.00199	0.00362	-0.0265
	(0.00648)	(0.00916)	(0.0339)
FF3	-0.00135	0.00503	0.000572
	(0.0101)	(0.00623)	(0.0137)
FF4	0.00432	0.0175	-0.0164
	(0.00810)	(0.0107)	(0.0513)
FF5	-0.0111	-0.000689	-0.00312
	(0.0205)	(0.0120)	(0.0158)
FF6	0.000291	0.00463	0.0344**
	(0.0155)	(0.0114)	(0.0139)
FF7	-0.0114	0.00464	-0.0166
	(0.0123)	(0.0109)	(0.0346)
FF8	0.00829**	0.00844	-1.15e-05
	(0.00423)	(0.00908)	(0.0188)
FF9	0.0152	0.00138	-0.0129
	(0.0103)	(0.00853)	(0.0156)
FF10	-0.00741	0.00234	-0.0252
	(0.00662)	(0.00964)	(0.0195)
FF12	-0.00343	-0.0023	-0.0052
	(0.0033)	(-0.0095)	(-0.002)
Constant	-0.0156***	-0.0201**	-0.0280**
	(0.00466)	(0.00843)	(0.0118)
Observations	99	99	99
Number of years	9	9	9
R-squared	0.4251	0.3348	0.2194
Wald chi2(9)	91.45	216.89	87.43

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Hypothesis 03. The rate of disruption is positively correlated with M&A activity.	NOT TRUE

In Table 3 below the regression results relating the rate of disruption to M&A activity can be found.

Table 3.

Regression result of the normal rate disruption on takeover activity of each of the three regions.

Industry random effects regressions with t-statistics based on robust standard errors clustered at the industry level. In all regressions, year dummies (not shown) are included. See Table 1 for further variable descriptions. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

VARIABLES	(1) Number of Deals	(2) Number of Deals	(3) Number of Deals
Disruption North America	-144.6**		
	(58.90)		
Disruption Europe		-36.71	
		(34.77)	
Disruption South & Middle America			0.461
			(5.836)
Inflation	-0.12	-8.132***	0.43
	(0.15)	(2.439)	(1.2)
GDP per Capita	7.714	0.00171	-1.733
	(37.50)	(0.00611)	(3.459)
GDP per Capita Growth	-34.86	9.937	6.936
	(53.09)	(11.49)	(11.16)
Asset Turnover	0.311	0.411	0.000661
	(0.301)	(0.462)	(0.111)
Employee Growth	0.147	0.758*	-0.00698*
	(0.229)	(0.410)	(0.00361)
Sales Growth	-0.0923	0.168	0.0340
	(0.316)	(0.421)	(0.0688)
ROE	-0.126	-0.113	0.0321
	(0.277)	(0.176)	(0.0412)
ROA	0.863	-0.416	0.0315
	(1.200)	(1.918)	(0.230)
Constant	137.4	68.38	-35.81
	(102.4)	(59.78)	(37.49)
Observations	99	99	99
Number of ff12	11	11	11
R-squared	0.4387	0.3718	0.2299
Wald chi2	261.82	126.96	9.79

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Column 1, 2 and 3 represents the regression of North America, Europe and South & Middle America respectively. The regressions include the standard controls used in the literature. All the models include year dummies and have been adjusted for heteroscedasticity of the standard errors by using robust regressions. Furthermore, the regressions control for asset turnover, employee growth, ROA, sales growth and ROE, inflation, GDP per capita and GDP per capita growth.

The R^2 shows the amount of variance of the takeover activity explained by the model. As this research uses a random effects panel data set, three different values of R^2 are given. These are the within, between and overall R^2. The "between R^2" gives the value of how much the variance between separate panel unites the model accounts for. The "within R^2" gives the values of how much the variance within the panel unites my model accounts for. The "overall R^2"is a weighted average of these two. If there is a factor that accounts for how the dependent variables changes for each of the panel units, in this case the effect of the rate of disruption on the amount of takeover activity, the R^2 within is the most appropriate. The values of the R^2 within are 0.4387, 0.3718 and 0.2299 for column 1, 2 and 3 respectively.

The regressions include both industry specific and macroeconomic control variables. The rate of disruption has a negative effect on the number of deals in column 1 & 2. In Column 3 the rate of disruption almost has no effect. However, this can be related to the number of deals that is completed within this region. This was significantly lower than in the other two regions. Furthermore, the rate of disruption only has a significant effect in the North America region. In both Europe as well as South & Middle America region the effect it is not significantly different from zero. It is also interesting to see that almost none of the control variables have any significant effect on the number of deals done within an industry-year. One would expect that large macro-economic changes in the inflation or the GDP per capita would have some effect on the M&A activity. All these findings are not in line with the third hypothesis, which states that the amount of takeover activity would increase when the rate of disruption would increase.

Contrary to the hypotheses formulated in this paper, there seems to be no effect between the rate of disruption and the amount of deals completed for these models. Moreover, the hypothesis was made that the rate of disruption would have a positive effect on the amount of deals. In all three regressions run the coefficient is negative and therefore the third hypothesis has to be rejected. (**H3**).

Hypothesis 04. The rate of disruption is positively correlated with deal value. When the rate of disruption is higher in a given year, this will result in a higher overall deal value. NOT TRUE

The fourth hypothesis (**H4**) stated that deal value would be positively correlated with the rate of disruption. In the table below the regression results of the tests are shown. The dependent variable is relative deal value. This is measured by looking at the deal value and the enterprise value of the

acquiring company. Of both values the natural logarithm is taken in order to control for a small number of very large deals. Next, the natural logarithm of the deal value is divided by the natural logarithm of the enterprise value of the acquiring firm. From the table it can be seen that the effect of disruption is small in all three subsamples. Moreover, only for the region of Europe the effect of the rate of disruption is significantly different from zero. The values of the R^2 within are 0.1358, 0.1604 and 0.1944 for column 1, 2 and 3 respectively. The variance in M&A activity explained by the model is small. This results in the rejection of the fourth hypothesis.

Table 4.
Regression result of the effect of disruption on the value of deals.

Industry random effects regressions with t-statistics based on robust standard errors clustered at the industry level. In all regressions, year dummies (not shown) are included. See Table 1 for further variable descriptions. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

VARIABLES	(1) Deal Value	(2) Deal Value	(3) Deal Value
Disruption North America	-3.565		
	(16.78)		
Disruption Europe		12.64**	
		(5.942)	
Disruption South & Middle America			5.613
			(7.634)
Inflation	-0.3	-1.763*	0.66
	(0.45)	(1.034)	(0.54)
GDP per Capita	-8.799	-0.000307	7.288
	(20.32)	(0.00265)	(5.736)
GDP per Capita Growth	8.048	-0.673	-25.27
	(31.21)	(3.497)	(18.31)
Asset Turnover	-0.0282	0.0411	0.0230
	(0.0272)	(0.0452)	(0.0250)
Employee Growth	0.0402	0.106	-0.00814
	(0.0987)	(0.213)	(0.0101)
Sales Growth	0.0115	0.0312	-0.127**
	(0.0923)	(0.140)	(0.0538)
ROE	-0.0668	0.114*	0.0156
	(0.0505)	(0.0599)	(0.0472)
ROA	0.670**	-0.396	0.347
	(0.309)	(0.354)	(0.276)
Constant	52.78**	35.45	37.02
	(26.07)	(25.78)	(44.03)
Observations	99	99	99
Number of ff12	11	11	11
R-squared	0.1358	0.1604	0.1944

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

5.2 Additional tests

In order to test the effect of disruption using other methods, additional analysis was carried out. In this additional analysis the effect of disruption was lagged with 1 year. The results of the regressions can be found in the table below.

Table 5.

Lagged effect of disruption

Industry random effects regressions with t-statistics based on robust standard errors clustered at the industry level. In all regressions, year dummies (not shown) are included. See Table 1 for further variable descriptions. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

VARIABLES	(1) Number of Deals	(2) Number of Deals	(3) Number of Deals
Lagged Disruption NA	-115.8**		
	(56.11)		
Lagged Disruption EU		-51.92*	
		(27.67)	
Lagged Disruption SA			4.507
			(5.295)
Inflation	0.17	-7.317***	0.34
	(0.12)	(2.222)	(0.55)
GDP per Capita	32.02	0.000987	-1.842
	(33.54)	(0.00625)	(3.335)
GDP per Capita Growth	-74.60	10.67	7.011
	(47.13)	(11.77)	(10.78)
Asset Turnover	0.207	0.373	0.00397
	(0.322)	(0.468)	(0.110)
Employee Growth	0.102	0.663	-0.00655*
	(0.210)	(0.427)	(0.00352)
Sales Growth	-0.163	0.173	0.0300
	(0.294)	(0.435)	(0.0670)
ROE	-0.0990	-0.153	0.0317
	(0.298)	(0.175)	(0.0377)
ROA	1.222	-0.161	0.0536
	(1.033)	(2.077)	(0.235)
Constant	121.9	76.47	-33.93
	(98.86)	(60.86)	(36.45)
Observations	99	99	99

Number of ff12	11	11	11
R-squared	0.4295	0.3765	0.2303

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

One can argue that the effect of disruption will not have an effect on the number of deals in the same year that disruption happened. This is due to the way disruption is measured in this research. It may be possible that a certain level of disruption happens in one year which results in firm's reaction the following year in order to restore their market share. In order to check whether disruption has an effect on the amount of deals in the next year a regression is run with the lagged (t-1) disruption rate as explanatory variable. The result can be found in Table 5.

Table 4 follows the same structure as Table 3, column 1 gives the regression result for the North America region, column 2 gives the result for the Europe region and column 3 represents the regression of the South & Middle America region. The coefficient of disruption is negative in all the first two regressions, meaning that the rate of disruption has a negative effect on the amount of deals. The values of the R^2 within are 0.4295, 0.3765 and 0.2303 for column 1, 2 and 3 respectively. The third hypothesis (**H3**) is still rejected however, because the effect of the lagged disruption rate is still negative.

6. CONCLUSION AND DISCUSSION

In this section the conclusion and discussion will be made. Next, the limitations of the research will be mentioned including some concessions which had to be made. Lastly, some directions for future research are given and final remarks made.

6.1 Conclusion

In this study the predictive power of disruption is researched by relating it to the takeover and restructuring business. This is done by obtaining the rate of disruption within different industries in three separate regions and comparing it with the total number of deals done in the same industry.

This study contributes to existing literature by studying disruption, which is a phenomenon that has been covered, but never been linked to (the level of) takeover or restructuring activity. This study hopes to give more insight in whether the rate of disruption can be used as a tool to study market phenomena, not just a phenomenon that can be only observed and analysed. Furthermore, it uses a proxy for disruption not used before in this manner or with this purpose.

Hypothesis 1 argued that the rate of disruption has been increasing in all industries over the specified time period in the three global regions. Due to higher increasing technological advances it becomes easier for firms to establish themselves as important market players and disrupt the incumbent firms. After creation of the proxy there could not be found conclusive evidence in support of the hypothesis. The rate of disruption has not been increasing in all industries over the time period within the three regions.

Furthermore, the hypothesis was made that some industries experienced a higher rate of disruption than others. This was also the result found by (Leinwand & Mainardi, 2017) who found that the largest EV shifts were in Internet Software and Services, IT services and Biotechnology. Using the Fama & French industry classifications, the hypothesis was made that FF 6 and 7, respectively Computers & Software and Television and TV, are industries that are heavily dependent on technological innovation and thus would experience more disruption. When looking at the disruption rates of every industry, the observation cannot be made from the data that there is any significant difference between the different industries across the three regions and therefore hypothesis 2 is rejected.

The general research question of this study centres around the question whether the rate of disruption has any predictive power in the amount of M&A deal activity and the relative value of these deals. This is examined by using a panel data set which divides the dataset in industry-year observations. Using this method, the relation between disruption and M&A activity and deal value can be studied.

The third hypothesis stated that the rate of disruption is positively related with the amount of takeover and restructuring activity. This was tested by using the rate of disruption that happened in that year and after that using the lagged (t+1) rate of disruption. In both regressions some significant results were found. However, both regressions show that the effect of disruption has a negative effect on the takeover activity within an industry.

Furthermore, when using the normal rate of disruption, the level of significance disappears when adding more control variables. What is interesting is that when using the lagged effect of disruption, the significance holds and increases when adding more control variables. This could be due to the fact that the rate of disruption does not have an immediate effect on the amount of deals. An industry could be disrupted but the firms within the industry experience the effect later on. This results in firms reacting to disruption that occurred some time ago.

The fourth hypothesis follows the same train of thought but instead of looking at the amount of deals completed it states that the relative deal value would be impacted by the rate of disruption. Specifically, the rate of disruption has a positive effect on relative deal value. The argumentation behind this is that relative deal value could lead to better results than the "amount of M&A deals" because it consists of more information due to showing the magnitude of the deals. However, the results show that this is not the case. The coefficients are for both the normal as the lagged rate positive and not significant at any significance level. Therefore, the fourth hypothesis has to be rejected.

6.2 Limitations

This study has several limitations, which has impacted the results of the study. First and foremost, this study is done with the creation of a proxy. It could be argued that the proxy is not representative for the different industries. The creation of this proxy was done by looking at the enterprise value of the top 10 companies within an industry at the base year of 2010. Future research could create a more dynamic proxy which looks at the top 10 companies of every year, instead of the top 10 of one certain year.

Also, due to some companies merging or have been taken over within my time period some of these companies are excluded and the next highest company is selected. This has an effect on the rate of disruption.

The study in this paper has a cross-sectional design because it allowed for more observations. One drawback of using a cross-sectional design is that the cause-and-effect relationship is generally harder to make.

There are other limitations when looking at the takeover and restructuring activity of an economy. One of which is that no data series includes every merger and acquisition in an economy. All series have a lower limit on the nominal dollar size of the transactions reported. The most obvious

consequence is that the smaller transactions are neglected. This has an effect on the picture the series provide if these smaller transactions are not highly correlated with the larger ones. Also, if the period that was covered was a period of significant inflation, the fixed lower limit on dollar size will artificially inflate the number of recorded transactions over time. This has as result that some transactions will fall below the fixed cut-off point and therefore not be recorded. Furthermore, many merger announcements do not provide specific merger terms or values. Consequently, the reporting services may have to guess whether a transaction should be included in their data series.

Other concessions have been made in the construction of the disruption proxy. Some of the firms that constitute the top 10 of their industry in 2010 are have been bought or merged with in the years thereafter (up to 2018). This results in incomplete data for my proxy. To resolve this, firms for which the enterprise value was not fully available in the time period where replaced with firms whose data was available. The consequence is that for some industries the top 10 consist not of the top 10 largest companies regarding enterprise value in 2010.

6.3 Directions for future research

The difficulty in measuring disruption is that disruption is a concept that can only be experienced after the fact. This has been done in this research as well. Future research could develop a more robust regression technique to study the effect of disruption on the amount of takeover and restructuring activity. The measurement of disruption using a proxy is a relatively new concept and needs to develop itself further. Other ways of measuring disruption should be considered.

Secondly, future research could include capital increases, minority stakes, institutional buyouts, management buyouts and buy-ins and share buy backs instead of solely focusing on mergers and acquisitions. This could give a broader view about the all kinds of transactions that companies do and relating it to disruption.

Furthermore, if data allows it, future research could not only include the largest firms within an industry but try to include as much firms as possible and track their respective market share. This could give a more robust measure of disruption within an industry.

Also, this study used the FF industry classifications. This divides the whole industry in 12 sectors. If a more expansive classification is used the effects of disruption can be related to more specific industries.

6.4 Final remarks

Disruption will always exist. Realising this will enables management teams to understand their position, identify where they are specifically vulnerable and take action. To thrive in a disruption-defined industry, companies must remain in a constant state of reinvention. They need to unceasingly enhance capabilities that support what they do best, apply their strengths in new and different ways and invest in aggressive expansion, which could be achieved using M&A. This paper tried to understand this concept of disruption and tried to find out whether it had implications on the amount of takeover activity and relative deal value. This paper did find some support of the effect of disruption on these M&A characteristics but not with regards to the hypotheses made within this study. This study hints that there could be some predictive power in the rate of disruption. Further work is warranted to improve our insights in these matters.

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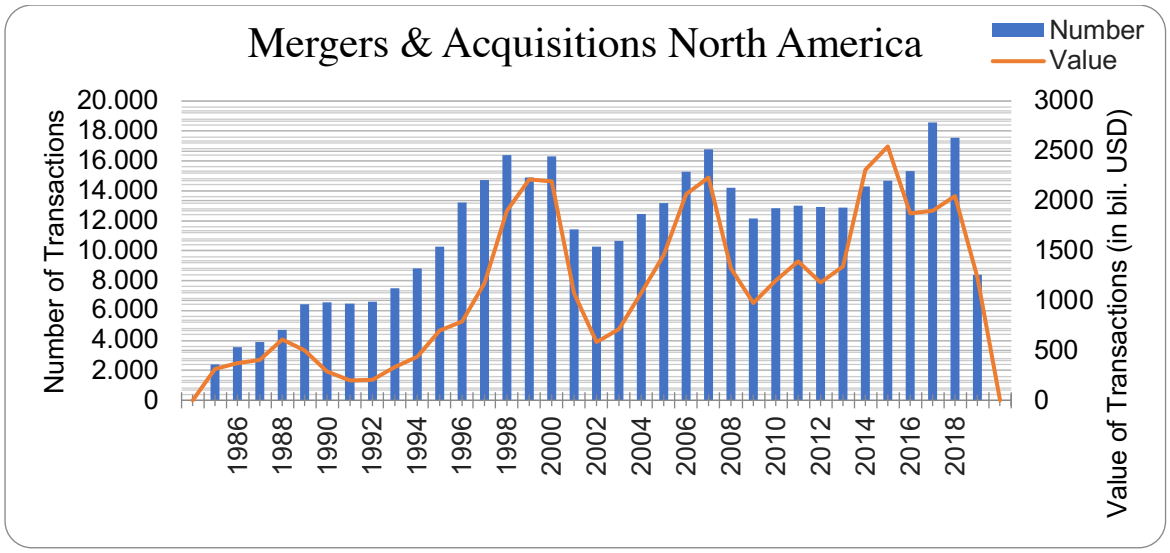
8. APPENDICES

Graph 1.

Mergers & Acquisitions graph of North America.



Source: *Thomson Financial, Institute for Mergers, Acquisitions and Alliances.*

Table 6.

Regression result of the normal rate disruption on takeover activity controlling for industry effects.

VARIABLES	(1) Number of Deals	(2) Number of Deals	(3) Number of Deals
Disruption North America	-144.6**		
	(58.90)		
Disruption Europe		-36.71	
		(34.77)	
Disruption South & Middle America			0.461
			(5.836)
Asset Turnover	0.311	0.411	0.000661
	(0.301)	(0.462)	(0.111)
Employee Growth	0.147	0.758*	-0.00698*
	(0.229)	(0.410)	(0.00361)
Sales Growth	-0.0923	0.168	0.0340
	(0.316)	(0.421)	(0.0688)
ROE	-0.126	-0.113	0.0321
	(0.277)	(0.176)	(0.0412)
ROA	0.863	-0.416	0.0315
	(1.200)	(1.918)	(1.239)
Constant	88.63**	94.37**	13.71
	(43.79)	(43.96)	(10.04)
Observations	99	99	99
Number of ff12	11	11	11

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7.

Regression result of the normal rate disruption on takeover activity after controlling for macroeconomic effects

VARIABLES	(1) Number of Deals	(2) Number of Deals	(3) Number of Deals
Disruption North America	-151.1***		
	(49.23)		
Disruption Europe		-33.36	
		(31.48)	
Disruption South & Middle America			0.826
			(4.809)
Inflation	-0.11	-7.044***	-0.34*
	(0.22)	(2.045)	(0.19)
GDP per Capita	-6.170	-0.00133	-1.704
	(33.43)	(0.00294)	(2.982)
GDP per Capita Growth	-10.10	13.46**	6.981
	(47.64)	(6.729)	(9.151)
Constant	184.7**	123.4**	-37.68
	(88.71)	(51.09)	(36.17)
Observations	99	99	99
Number of ff12	11	11	11

Table 8.

Time effects of the disruption rate.

VARIABLES	(1) Number of Deals	(2) Number of Deals	(3) Number of Deals
Disruption North America	-151.1***		
	(49.23)		
Disruption Europe		-33.36	
		(31.48)	
Disruption South & Middle America			0.826
			(4.809)
Year = 2011	15.58**	15.95**	6.213***
	(6.388)	(7.823)	(2.204)
Year = 2012	11.55	12.49*	0.321
	(7.074)	(7.047)	(2.096)
Year = 2013	-0.421	6.393*	0.0292
	(4.912)	(3.458)	(2.127)
Year = 2014	28.69***	24.77***	-1.150
	(9.727)	(9.479)	(1.663)
Year = 2015	18.48**	33.32***	-2.662
	(8.648)	(11.06)	(2.961)
Year = 2016	0.420	30.01***	-2.549
	(6.461)	(9.081)	(1.812)
Year = 2017	-12.26	35.23**	1.656
	(9.544)	(14.96)	(2.461)
Year = 2018	-22.85**	25.15**	2.028
	(10.18)	(11.29)	(3.270)
Constant	114***	119.9***	14.36***
	(39.03)	(38.28)	(3.475)
Observations	99	99	99
Number of ff12	11	11	11

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9.

Time effects of the lagged disruption rate.

VARIABLES	(1) Number of Deals	(2) Number of Deals	(3) Number of Deals
Lagged Disruption NA	-136.8*** (51.12)		
Lagged Disruption EU		-61.48** (25.66)	
Lagged Disruption SA			5.895 (5.445)
Year = 2011	16.55*** (5.847)	16.73** (7.891)	6.182*** (2.168)
Year = 2012	13.49** (6.726)	12.29* (6.292)	0.497 (2.088)
Year = 2013	3.546 (5.361)	4.173 (3.530)	0.343 (2.142)
Year = 2014	26.38*** (9.285)	25.16*** (9.496)	-0.974 (1.689)
Year = 2015	17.40* (9.329)	33.53*** (11.20)	-2.504 (2.954)
Year = 2016	0.772 (6.219)	28.00*** (8.285)	-2.078 (1.867)
Year = 2017	-10.36 (8.482)	35.49** (15.04)	1.614 (2.457)
Year = 2018	-26.79** (10.96)	24.71** (11.44)	2.138 (3.231)
Constant	114*** (39.03)	119.9*** (38.28)	14.36*** (3.475)
Observations	99	99	99
Number of ff12	11	11	11

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10. *Industry definitions from Fama and French.*

Industry definitions	SIC Codes
(1) Consumer nondurables	0100-0999 2000-2399 2700-2749 2770-2799 3100-3199 3940-3989
(2) Consumer durables	2500-2519 2590-2599 3630-3659 3710-3711 3714-3714 3716-3716 3750-3751 3792-3792 3900-3939 3990-3999
(3) Manufacturing	2520-2589 2600-2699 2750-2769 3000-3099 3200-3569 3580-3629 3700-3709 3712-3713 3715-3715 3717-3749 3752-3791 3793-3799 3830-3839 3860-3899
(4) Energy	1200-1399 2900-2999
(5) Chemicals	2800-2829 2840-2899
(6) Computers, software, etc.	3570-3579 3660-3692 3694-3699 3810-3829 7370-7379
(7) Telephone and TV	4800-4899
(8) Utilities	4900-4949
(9) Wholesale	5000-5999 7200-7299 7600-7699
(10) Medical	2830-2839 3693-3693 3840-3859 8000-8099
(11) Finance	6000-6999
(12) Other	

Table 7.
Companies included in the sample to create proxy.

FF12	Company Name
(1) Consumer nondurables	COCA-COLA COMPANY (THE)
	PEPSICO INC
	PHILIP MORRIS INTERNATIONAL INC.
	MONDELEZ INTERNATIONAL, INC.
	ALTRIA GROUP, INC.
	GENERAL MILLS INC
	TWENTY-FIRST CENTURY FOX, INC.
	KELLOGG COMPANY
	ARCHER DANIELS MIDLAND COMPANY
	CAMPBELL SOUP CO
(2) Consumer durables	FORD MOTOR CO
	HONEYWELL INTERNATIONAL INC
	GENERAL MOTORS COMPANY
	PACCAR INC
	HARLEY DAVIDSON INC
	MAGNA INTERNATIONAL INC
	BORGWARNER INC
	NAVISTAR INTERNATIONAL CORP
	AUTOLIV, INC.
	MASCO CORP
(3) Manufacturing	GENERAL ELECTRIC COMPANY
	CATERPILLAR INC
	UNITED TECHNOLOGIES CORPORATION
	3M COMPANY
	DEERE & CO
	BOEING COMPANY (THE)
	ILLINOIS TOOL WORKS INC
	LOCKHEED MARTIN CORP
	CORNING INC
	NIKE INC
(4) Energy	EXXON MOBIL CORP
	CHEVRON CORPORATION
	CONOCOPHILLIPS
	OCCIDENTAL PETROLEUM CORP
	SUNCOR ENERGY INC.
	CANADIAN NATURAL RESOURCES LIMITED
	APACHE CORP
	HALLIBURTON CO
	DEVON ENERGY CORP
	IMPERIAL OIL LIMITED
(5) Chemicals	PROCTER & GAMBLE CO
	COLGATE PALMOLIVE CO
	PRAXAIR INC
	KIMBERLY CLARK CORP
	AIR PRODUCTS & CHEMICALS INC
	MOSAIC COMPANY (THE)
	PPG INDUSTRIES INC
	AVON PRODUCTS INC

	ECOLAB INC CLOROX CO
(6) Computers, software, etc.	APPLE INC. INTERNATIONAL BUSINESS MACHINES CORP MICROSOFT CORPORATION ORACLE CORP CISCO SYSTEMS INC HP INC. INTEL CORP QUALCOMM INC EMERSON ELECTRIC CO TEXAS INSTRUMENTS INC
(7) Telephone and TV	AT&T INC. VERIZON COMMUNICATIONS INC COMCAST CORPORATION BCE INC VIACOM, INC. ROGERS COMMUNICATIONS INC CENTURYLINK, INC. CBS CORPORATION WINDSTREAM HOLDINGS, INC. TELUS CORPORATION
(8) Utilities	SOUTHERN CO TC ENERGY CORPORATION DOMINION ENERGY, INC. NEXTERA ENERGY, INC. DUKE ENERGY CORPORATION ENTERPRISE PRODUCTS PARTNERS L P EXELON CORPORATION AMERICAN ELECTRIC POWER COMPANY INC PG&E CORP FIRSTENERGY CORPORATION
(9) Wholesale	WALMART INC. MCDONALD'S CORPORATION AMAZON.COM, INC. HOME DEPOT INC CVS HEALTH CORPORATION TARGET CORP LOWE'S COMPANIES, INC. EBAY INC NATIONAL OILWELL VARCO, INC. YUM! BRANDS, INC.
(10) Medical	JOHNSON & JOHNSON PFIZER INC MERCK & CO., INC. ABBOTT LABORATORIES AMGEN INCORPORATED BRISTOL-MYERS SQUIBB COMPANY ELI LILLY AND COMPANY BAXTER INTERNATIONAL INC

	GILEAD SCIENCES INC CELGENE CORP
(12) Other	UNITED PARCEL SERVICE INC FREEPORT-MCMORAN INC. BARRICK GOLD CORPORATION UNION PACIFIC CORP SOUTHERN COPPER CORPORATION TECK RESOURCES LIMITED LAS VEGAS SANDS CORP. THOMSON REUTERS CORPORATION GOLDCORP INC ENBRIDGE INC

Table 11.

Hausman test result.

	----- Coefficients -----			
	(b)	(B)	(b-B)	Sqrt(diag(V_b-V_B))
	fixed	random	difference	S.E.
Disrupt	-8.055645	-8.102722	.0470773	. .2235096

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 0.04

Prob>chi2 = 0.833