Aalto University
School of Business

ECONOMIC POLICY UNCERTAINTY AND THE INFORMATION CONTENT OF EARNINGS ANNOUNCEMENTS:

Empirical evidence from the US in 1985-2018

Master's Thesis
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Spring 2020

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Abstract of master's thesis

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Title of thesis Economic policy uncertainty and the information content of earnings announcements: Empirical evidence from the US in 1985-2018

Degree Master of Science in Economics and Business Administration

Degree programme Accounting

Thesis advisor(s) Henry Jarva

Year of approval 2020 **Number of pages** 71 **Language** English

Abstract

This thesis studies the impact of economic policy uncertainty on the information content of earnings announcements. There is a large body of literature regarding both economic policy uncertainty and the information content of earnings announcements, but the relationship between the two phenomena has not yet been studied. This study gives an overview of the topic with empirical evidence, paving the road for future research.

Economic policy uncertainty (EPU) index by Baker et al. (2013) has been used as a measure of economic policy uncertainty. This recent measure has been found to capture many aspects of economic policy uncertainty, and therefore it has been widely used by academics in many fields. It has been found to have an adverse impact on many areas of economic, including but not limited to decreased GDP growth, M&A activity and capital investments, and increased stock price volatility and equity risk premium.

This thesis continues the research on EPU index by investigating its impact on the information content of earnings announcement in US stock listed companies between 1985-2018. This is done by observing the trading volume of stocks in the earnings announcement window, that includes the daily firm/trading volume observations that are within 16 days of the closest earnings announcement. With this dataset of 17,015,045 observations, two analyses are done. Firstly, a visual illustration is provided by replicating Beaver (1968) methodology but incorporating high/low EPU groups to show the difference. In addition, OSL regressions are run for the whole period and sub-periods of approximately 11 years, to explain the trading volume by the release of the earnings announcement, a proxy for economic policy uncertainty, and the interaction term of the two.

It is found that economic policy uncertainty decreases trading volume during the earnings announcement window. In addition, the magnitude of this effect increases during the release day of an earnings announcement, and one day after that. This shows that the information shock caused by earnings announcement decreases during high economic policy uncertainty, implying a decrease in the information content of earnings announcements. The results regarding the changes in this phenomenon across time are conflicting, and no clear conclusions can be drawn from those.

This thesis provides a starting point for research on the area but is also prone to limitations. The most important one being the lack of control variables, that are suggested to be incorporated as a part of future research. In addition, a qualitative approach could be taken to explain why the information content decreases during the times of high economic policy uncertainty.

Keywords Economic policy uncertainty, EPU, information content of earnings announcement

Table of Contents

List of Figures:

List of Tables:

1. Introduction

This thesis studies the economic policy uncertainty's impact on the information content of earnings announcement by using Baker et al.'s (2013) economic policy uncertainty index. This recent index has been used as a new proxy for economic policy uncertainty by academics in many research areas, and it has been found to be a statistically significant factor of many phenomena, including but not limited to increased stock price volatility (Pastor & Veronesi 2013), decreased M&A activity (Bonaime et al. 2018) and decreased capital investments (Gulen & Ion 2015). The index has also gained market validation and is now used by multiple forecasters in macroeconomic analysis.

The relationship of the information content of earnings announcements and economic policy uncertainty is not yet studied exhaustively by the academics, which is the main motivation of this thesis. It aims to find the impact of economic policy uncertainty on the information content of the earnings announcements, and thus pave the road for future research regarding the topic. The high-level outlay of this thesis goes as follows: introductory chapter, literature review, data description, empirical analysis, limitations and finally the conclusions including suggestions for future research.

1.1. Background and motivation

Research regarding information content of earnings announcements has been active for over five decades, initially being started by Beaver (1968). Lately, the research area has gained some novel contributions by Dechow et al. (2014) showing the increased market response to earnings announcement during the most recent time periods in addition to summing up the research of past decades, and by Beaver et al. (2020) describing the reasons behind these increased market responses.

Simultaneously, in the field of macroeconomics, and more specifically policy uncertainty, Baker et al. (2013) have developed a new index to measure economic policy uncertainty that has initiated a wide range of new research in many areas. The index measures economic policy index by three components, largest of which is the count of news-paper articles

referring to uncertainty in the economic policy context, while the other two components are the sum of scheduled tax code expirations and forecaster disagreement regarding various macroeconomic variables. This new EPU index has been found to capture economic policy uncertainty effectively and has become an important and statistically significant variable in many fields of research.

The EPU index has reported historically high levels of economic policy uncertainty during the past approximately ten years. During the same period, Dechow et al. (2014) found an increased market response to earnings announcements, and this thesis aims to investigate whether the economic policy uncertainty is indeed a significant variable in explaining the market response and thus the information content of earnings announcements.

During the high uncertainty caused by the ongoing global COVID-19 pandemic, the understanding of the complex impact of economic policy uncertainty is crucial, which has also been motivating this thesis. In addition, this thesis intends to bring together the two research areas and serve as a facilitator for future research on the effect of economic policy uncertainty on the already vast research regarding earnings announcements and their information content. The fact that some novelty-value can be added to this already somewhat mature area of research with a long history is another major motivator for this thesis.

1.2. Objectives and limitations

As this thesis is one of the firsts, if not the first, studies combining the two research areas, the results obtained in this study will have major limitations. This thesis aims to give a starting point for other researchers to build on, by investigating the relationship between economic policy uncertainty and information content of earnings announcements. More specifically, this study seeks to answer the three following research questions:

Does economic policy uncertainty have an impact on overall trading volume during the earnings announcement window?

Does economic policy uncertainty have an impact on the magnitude of the trading volume shock caused by the earnings announcements?

How this impact on the trading volume shock has changed over time?

By answering these three fundamental questions regarding economic policy uncertainty, trading volume and the information content of earnings announcements, this thesis' objective is to build a foundation for future research. The results are beneficial not only for academics for the future research, but also for political decision-makers, investors and executives. Political decision-makers can gain new insights regarding the hidden implications of economic policy uncertainty, which helps them to mitigate the adverse effects it causes. The results can also help investors to better understand the information content of earnings announcements, and its time-varying nature. Also, the executives who are in charge of earnings announcements can benefit from the results to determine if they should somehow try to mitigate the effects caused by the economic policy uncertainty, i.e. by providing more detailed management guidance when the level of economic policy uncertainty is high.

As this thesis aims to build an overall picture of the relationship of the two phenomena instead of digging very deeply into details of either phenomenon, there certainly will be limitations to be covered by future research. The thesis does not aim to explain reasons for EPU index's impact on the information content of earnings announcements, or the exact mechanism through which the impact is channeled, and thus the qualitative approach in this study is very limited. In addition, this thesis does not include company- or country-level control variables, that cause the empirical analysis to be prone to omitted variable bias.

1.3. Data and research approach

The data for this thesis was retrieved from three sources: Economic policy uncertainty from EPU index by Baker et al. (2020), daily trading volumes from Wharton Research Data Service's CRSP Daily Stock (2020) database and earnings announcement dates from the same provider's database named CRSP/Compustat Merged (2020) Database – Fundamentals Quarterly. These three data sets were merged, filtered and grouped for empirical analysis. This resulted to the final dataset of 17,015,045 daily trading volume observations from years 1985 to 2018.

The empirical analysis was performed by regression analysis, where daily trading volume was explained by a proxy for economic policy uncertainty, with separate regressions for high EPU index - dummy variable and EPU index raw values as a continuous variable, earnings

announcement event dummy that captured whether the earnings announcement is made during the observed day or one day before that, and the interaction term of the two. These two separate regressions were run to different time periods of approximately 11 years, as well as the sample period as a whole. In addition, the methodology of Beaver (1968) and Dechow et al. (2014) was replicated with the incorporation of high and low EPU groups, to illustrate the difference between the two groups.

Based on this empirical analysis, results with major novelty value were found. Firstly, it was found that the high economic policy uncertainty decreases the trading volume during the earnings announcement window. The magnitude of this effect varied between different periods and was smaller especially during the most recent period. Overall, this shows that during high economic policy uncertainty the impact of factors decreasing trading volume, such as worsening economic conditions exceed the impact of factors increasing the trading volume, such as larger investor disagreement.

Secondly, it was found that higher economic policy uncertainty further decreases the magnitude of the trading volume shock caused by the earnings announcement in periods 1 and 2. In the most recent period, this effect became statistically insignificant. For periods 1 and 2, the decrease is incremental to the above-mentioned overall decrease in trading volume.

Thirdly, the results regarding the change of this impact's size over time were contradictory. When measuring high economic policy uncertainty as a dummy variable, the effect decreased between periods 1 and 2 and became statistically insignificant in period 3. However, when using the EPU index as a continuous variable to proxy policy uncertainty, the effect of the interaction term actually increased between periods 1 and 2, eventually becoming statistically insignificant in period 3.

1.4. Definition of the key concepts

This thesis touches on two separate research fields: information content of earnings announcements and economic policy uncertainty, which are explained in this chapter. After defining the two key concepts, a summary of already existing literature is provided in the following chapter.

1.4.1. The information content of earnings announcements

The earnings announcement is the main information-sharing device for companies in the United States (Dechow et al. 2014). Earnings announcements are required from all publicly listed companies and are published on a quarterly basis. They include a detailed report of the company's performance and contains financial statements, management discussion and other additional information. In addition, Beaver et al. (2020) found that the voluntary disclosures including management guidance, analyst forecasts and financial statement line items with earnings announcements have become more common over time.

Starting from Beaver (1968), the information content of earnings announcements has been measured by the market response to earnings announcements by many authors. A similar measurement is used in this thesis, by proxying market response by trading volume. This method does not necessarily try to capture whether the earnings announcement contained good or bad information for the investors, or how the investors use the information of earnings announcement. The reasoning behind this proxy for market response and thus for information content of earnings announcement is that trading occurs when investors interpret the new information either differently or during varying time periods, whereas the price response would happen when the market as a whole revises the estimation of a company value. (Dechow et al. 2014.)

In this thesis, the earnings announcement window refers to a period of time that includes the observations that are within 16 days of the closest earnings announcement by the company. This definition follows the approach by Dechow et al. (2014). The earnings announcement event in turn refers to a two-day period including the day when earnings announcement is released, and the next day following the announcement. This definition follows the approach by Beaver et al. (2020) with the exception that after-hour earnings announcements are not separated to identify a single event-day, but instead a two-day period is used for all the companies.

1.4.2. Economic policy uncertainty

In this thesis, economic policy uncertainty refers to the level of economic policy uncertainty index by Baker et al. (2013) that consists of three individual components. The value of the overall index, used as a measure of economic policy uncertainty, is the weighted average of those individual components. The three components include newspaper coverage of articles referring to economic policy uncertainty or similar words, the sum of scheduled expirations of federal tax code provisions and the level of forecaster disagreement regarding macroeconomic factors such as government spending and inflation.

The EPU index has been tested in many ways to ensure its credibility and therefore it has been adopted as a robust measure for economic policy uncertainty by both the academics and the market forecasters. Baker et al. (2016) provided another index for economic policy uncertainty that only included the newspaper coverage-based component of their initial index, but they have continued to report the value of the total index and all three components.

Both of these measures for economic policy uncertainty have been widely used by the academics, and they are very highly correlated. The original EPU index with the three individual components has been used in this study to ensure that also economic policy uncertainty shocks with weak press-coverage are captured in the analyses. The fluctuation of trading volume is mainly driven by institutional investors, and thus it is seen to be important to also include the shocks that may not have high press-coverage but can yet be important contributors of economic policy uncertainty as perceived by investment professionals. Such contributors can be scheduled expirations of tax code provisions or certain forecaster disagreements, and thus the index including all three components is used.

1.5. Summary of the previous literature

The two topics covered in this thesis are not collectively studied before, and therefore also the literature review of this thesis is distinctively divided into two sections. Although, when considered appropriate, links between the two research areas has been drawn.

The research regarding the information content of earnings announcements has been active for decades since Beaver (1968) started the research by investigating short-term trading volume and price residual shock that occurs when the earnings announcement of a company

is released. Since then it has been found that no other single event explains a larger portion of the variation in stock returns than earnings announcements, which naturally explains the academics' interest in the topic (Dechow et al. 2014).

The earnings announcement includes a financial statement, and its different items' proportional contribution to the overall information content of the earnings announcement has been studied exhaustively to explain what exactly provides new information to the investors, further translating to either trading volume or price residual shocks. The price residual shock happens when the market as a whole changes expectations of the company value, whereas the shock in trading volume happens when the investors interpret the information of earnings announcement either in different ways or in different time periods (Dechow et al. 2014).

The most recent findings regarding the topic are that the information content of earnings announcements has increased dramatically in the 21st century (Beaver et al. 2018). The reason for this dramatic increase is that management guidance, analyst forecasts and other voluntary disclosures are now more often bundled with the earnings announcement (Beaver et al. 2020).

The research regarding economic policy uncertainty has also been lively for a long time, but the measures of economic policy uncertainty have varied over time. Historically the proxies for economic policy uncertainty have been either election-based – meaning that election years have been considered to be high in terms of uncertainty – or volatility-based where the economic policy uncertainty has been proxied by volatility of other macroeconomic variable(s).

After Baker et al. (2013) published their initial working paper on EPU index, the amount of research regarding economic policy uncertainty has increased dramatically. Another reason for the recent increase in research may have been the Federal Open Market Committee's (2009) and International Monetary Fund's (2012, 2013) suggestions that uncertainty regarding monetary, regulatory and fiscal policy in the US and Europe may have increased the economic decline during the financial crisis in 2008-2009, and slowed the recovery from the crisis.

Previous research regarding the EPU index includes, but is not limited to, the EPU's impact on stock prices and asset valuation, mergers, acquisitions and venture capital, investment decision-making and exchange rate volatility. All these topics are more closely covered in

the chapter three of this thesis, but overall it can be said that economic policy uncertainty has been found to have multiple adverse effects on companies as well as the economies as a whole. The high EPU makes stock prices more volatile and increases the equity premium (Pastor & Veronesi 2013), decreases M&A activity significantly (Bonaime et al. 2018), decreases capital investments (Gulen & Ion 2015) and increases the exchange rate volatility which has multiple adverse effects on the economy as a whole (Braun & Larrain 2005, Krol 2014).

1.6. Structure of the thesis

This thesis consists of a total of eight parts. After this introduction chapter, the second and third chapter will correspondingly cover previous literature regarding the two major research areas this thesis considers: Usefulness of earnings announcements and research on economic policy uncertainty and EPU index in particular.

The fourth chapter summarizes the literature to formulate the hypotheses that are tested in the empirical part of the thesis. The fifth chapter describes the data that is used in the study, as well as its grouping, filtering, new variable construction and finally the descriptive statistics of the sample.

The sixth chapter explains the empirical analysis carried out and its results, including updated replication of Beaver (1968) and Dechow et al. (2014) methodology as well as regression models. The seventh chapter outlines the limitations of this study, and the eighth chapter concludes with practical implications and suggestions for future research.

2. Usefulness of earnings announcements

The first branch of research this thesis concerns is research regarding earnings announcements and their information content to investors. These topics have been covered by extensive literature since Beaver (1968) and Ball & Brown (1968) started examining the topic. No other single event has been found to explain a larger portion of the variation in stock returns, which explains the importance of the topic its interest amongst the academics and the investors. In addition, earnings announcements are the primary device for public

companies to announce their current financial performance to investors and other stakeholders. (Dechow et al. 2014.)

As earnings are either directly or indirectly one of the main determinants of the company value in most of the company valuation approaches, the information content of earnings announcements is a natural area for wide research. The difficulty of studying earnings announcements and their information content is defining and measuring the information content. Beaver (1968) initially used the definition of Theil (1967) defining information as *"a change in expectations about the outcome of an event"*. Therefore, an earnings announcement is assumed to have information content when it leads to a change in investors' evaluation of the correct price for the company's stock.

This investors' evaluation of the correct price cannot be measured directly without knowing the exact expectations of investors. Therefore, the information content to investors has been measured using two dimensions: changes in the trading volume of the stock and the stock price volatility following an earnings announcement. Beaver (1968) was the first to incorporate this methodology for measuring the information content of earnings announcements, but since then it has been widely used in the research area.

In figure 1, Dechow et al.'s (2014) rough replication of Beaver's (1968) empirical results are presented to illustrate the changes in trading volume and stock price residuals during the earnings announcement window. In addition, changes over time are clearly visible in the figures, but will also be covered more closely later in the Chapter 2.3. "Changes in the information content of earnings announcements"**.** A similar empirical methodology will also be used later in this thesis with economic policy uncertainty incorporated into the figure.

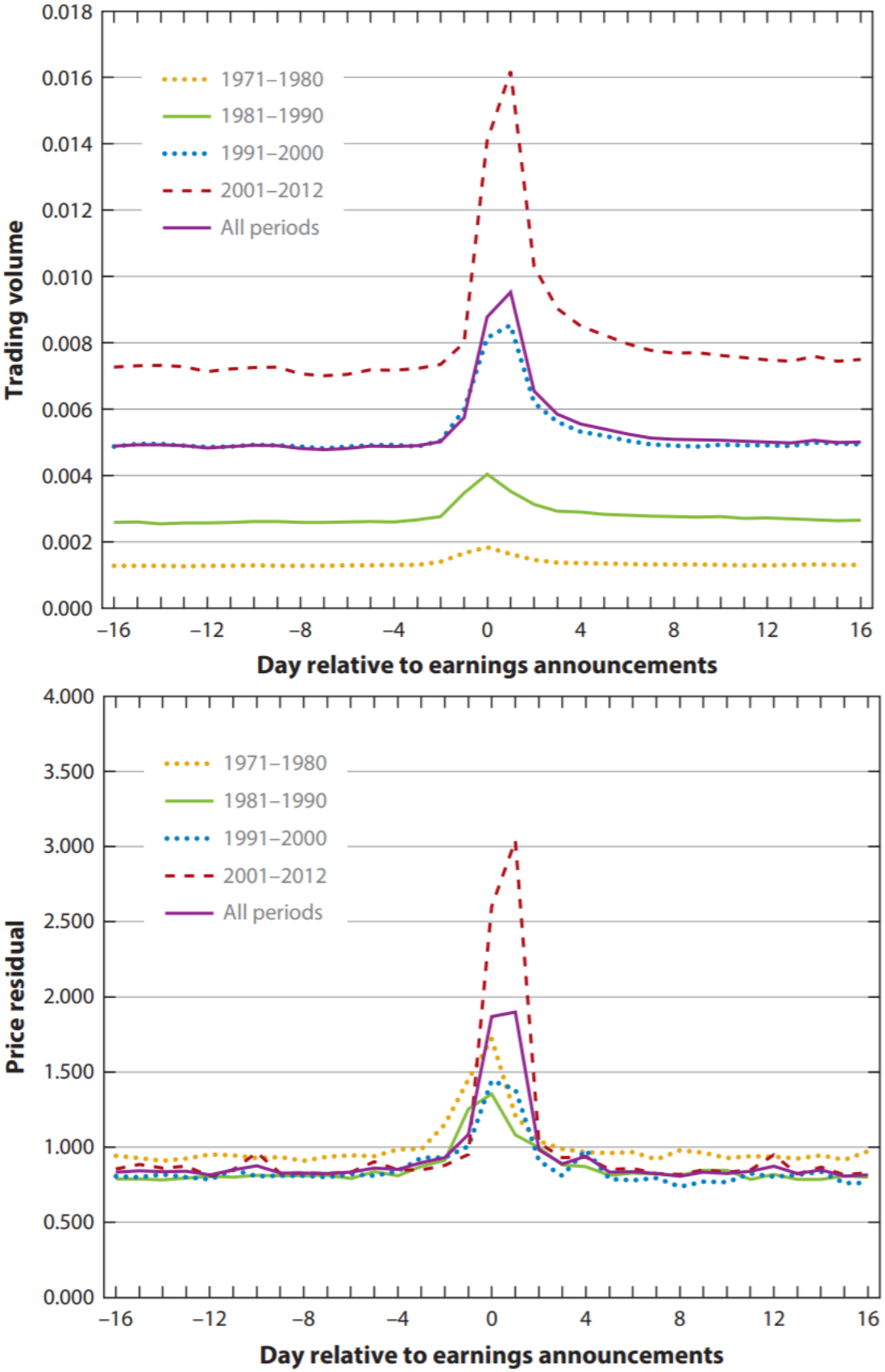

Figure 1 *Analysis of trading volume and stock price residual changes during the earnings announcement window by Dechow et al. (2014).*

The reasoning behind this two-dimensional measurement comes from the economists' consensus that increased trading volume reflects a lack of common consensus regarding the stock price. During an earnings announcement, the new information is most likely the reason for a lack of common consensus. Different investors analyze the announcement for a different period of time, and therefore they make the trading-decision at different times. Therefore, the volume increase may last for some time instead of occurring at the specific point of time right after the earnings announcement is released.

Also, if all the investors would interpret the new information in the same way, there would be a price reaction, but not volume reaction. Therefore, the price residual test measures the changes in the market's expectations as a whole, whereas the volume test measures the changes in the expectations of individual investors. There may also be a situation where there would be a volume reaction, but no price reaction. This would be a situation where individual investors could adjust their expectations, potentially even significantly, but the adjustments would offset each other and there would be no changes in the expectations for the market as a whole. (Beaver 1968.)

In this chapter, a closer view of the literature regarding the usefulness of earnings announcements is presented. The main focus of this review is on trading volume as a proxy for the information content as it is the main topic of interest in this thesis, but certain studies using the stock price volatility as a measure are also covered.

2.1. Usefulness of earnings

Ball and Brown (1968) launched research regarding earnings figure usefulness in their seminar paper where they found a clear relationship between abnormal shareholder returns and unexpectedly high earnings. These results were later replicated by Dechow et al. (2014) with an updated and more comprehensive sample presented in figure 2**.** These results show that the stocks of companies with increasing earnings (positive NI surprise) clearly outperform other groups. In the work of Ball and Brown (1968), there was no attempt to differentiate stock price growth between the actual earnings surprise and the revision of

future cash flow expectations by investors, that may have been caused by the earnings surprise.

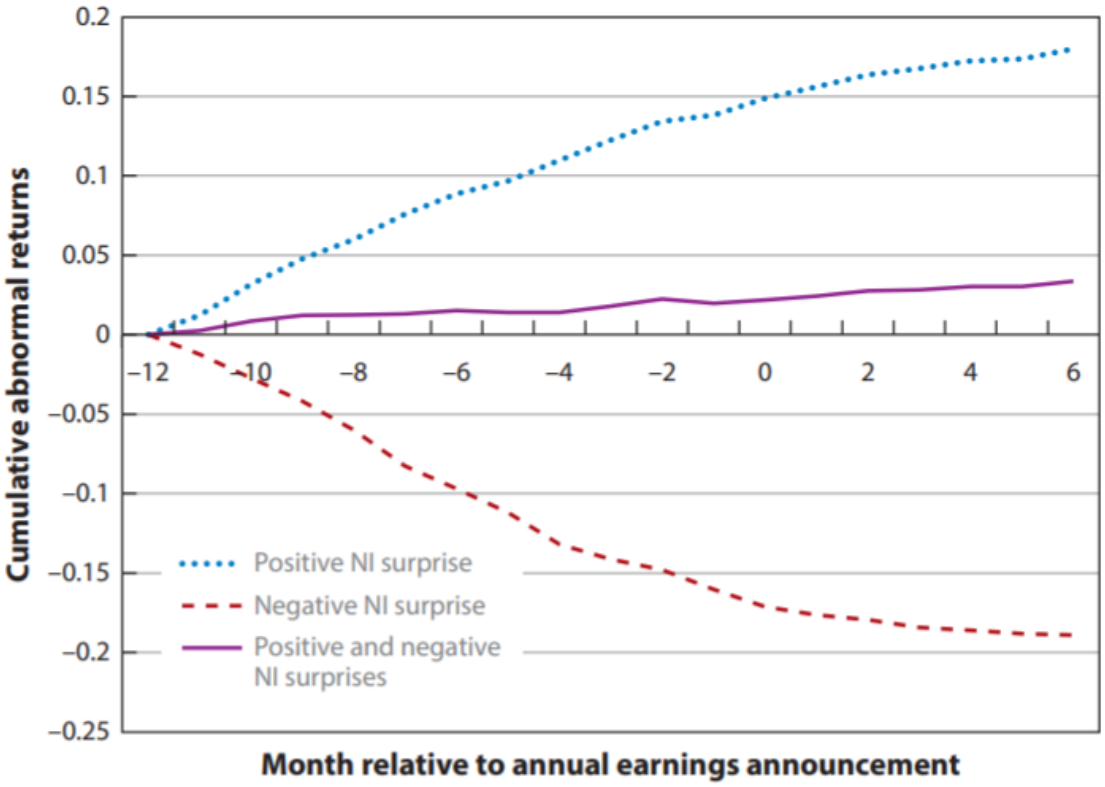

Figure 2 *Plotting of cumulative abnormal returns for positive and negative net income surprise companies by Dechow et al. (2014).*

Kormendi and Lipe (1987) continue the research on the topic by employing a classic proposition of stock price equaling the sum of present values of all expected future benefits acquired by the shareholder. They proxy the expected future benefits to the shareholder by expected future earnings of the company and estimate the market's earnings expectations by a univariate time-series model. The main finding of the study was that the higher persistence the earnings change is expected to have based on their univariate time-series model, the larger the price reaction to that change is.

These findings started a new wave of research on the determinants of the earnings response coefficients. Earnings response coefficient stands for the regression coefficient of stock returns on earnings surprises. In addition to the persistence of earning surprise identified by Kormendi and Lipe (1987), multiple other determinants of earnings response coefficient were found. Other determinants of the earning response coefficient are for example the ratio of market value to book value of equity (Collins & Kothari 1989) and negative net earnings

of the company (Hayn 1995). In addition, the components of net present value calculation of future benefits were found to be important determinants. These components include risk-free rate (Collins & Kothari 1989) and the beta coefficient (Easton & Zmijewski 1989).

2.2. Usefulness of other items of income statements

In addition to earnings, there is a wide range of other determinants affecting the stock price. These include accounting and non-accounting factors ranging from the amount of fixed assets to non-financial indicators such as customer satisfaction (Dechow et al. 2014). These determinants can be divided into three groups: income statement figures, balance sheet figures and other sources of information. The following three sub-chapters will focus on each group one by one.

2.2.1. Income statement figures

The most obvious income statement figure used by the investors is earnings, which was already covered in chapter 2.1. "Usefulness of earnings". In addition to that, there has been a wide range of research regarding the employment of additional components of the income statement to explain stock returns better than just the simplest earnings-based approach. This research was launched by Lipe (1986) in a study dividing income statement items into six different groups, improving forecasting accuracy by modelling each line item group's persistence separately instead of just straight-forward earnings modelling.

The effect of grouping to forecast accuracy was not large, and that might be the reason why such grouping has not received a significant coverage amongst other researchers. An important yet quite intuitive finding of Lipe (1986) was that the income statement item group "other" – including many nonrecurring items – is significantly less persistent than the five other line item groups.

The research on this topic was continued by Fairfield et al. (1996) confirming findings of Lipe (1986) by showing that the income statement items regarding discontinued operations and extraordinary and special items are all less persistent than the other components of earnings. This effect was found to be partially reflected to stock prices by Elliott and Hanna

(1996) and Burgstahler et al. (2002). Asset write-downs and special items were differently priced by investors compared to the other components of earnings, meaning that the investors also understand that those items are not as recurring as the other items.

Many companies have also started reporting an unaudited pro forma earnings figure with their earnings announcement. Pro forma figures exclude many non-recurring items and stock-based compensation expenses, to offer a more transparent view of the continuous operations of the company for the investors. The pro forma figures are also often forecasted by the analysts indicating that there is a clear demand for them amongst the investors. Ultimately Bradshaw and Sloan (2002) and Brown and Sivakumar (2003) found that the pro forma figures are actually more closely related to changes in stock prices than the figures from audited financial statements. (Dechow et al. 2014.)

2.2.2. Balance sheet figures

Another audited financial statement that offers relevant information for investment decisions is the balance sheet. The challenges of valuing companies based on the balance sheet include the depreciation & amortization process, its historical price relying nature and the total ignorance of certain assets, such as internally generated intangible assets. For these reasons, it took years for researchers to actually start considering balance sheet as a value-relevant financial statement with relevant information content for the investors. (Dechow et al. 2014.)

Kick-start for a new kind of thinking was provided by Ohlson (1995) formalizing the role of accounting figures in the valuation-process. As the valuation theory assumes that investors value stocks based on the future dividends, and that the dividends can be calculated based on accounting-based earnings and change of book value of equity, Ohlson (1995) noted that the traditional dividend-based valuation model can also be expressed as a function of future accounting-based earnings and book values.

The resulting model shows that the company value is equal to the sum of the current book value of equity and the discounted value of all residual values, the latter including future earnings and book values. If the residual income is fluctuating and thus complicated to forecast accurately, the firm valuation can also be based on book value. This is the case especially when the assets and liabilities are valued at close to their fair values. (Ohlson 1995.)

Also, other research regarding the topic confirms the role of balance sheet in firm valuation, for example, Collins et al. (1997) found out shortly after the Ohlson's (1995) publication that the incremental value relevance of earnings has decreased and the incremental value relevance of book values has increased offsetting the decrease in earnings. This trend is explained by the increase in nonrecurring expenses to earnings, and many negative earnings in the latter part of their sample period, which obviously makes valuation based on current earnings impossible.

Burgstahler and Dichev (1997) found that the value of a company can be measured as a convex function of earnings and book value where the function depends on the ratio of the two. When the earnings-to-book value is high, earnings explain firm value better, as the company is likely able to maintain current operations in the future. On the other hand, when the earnings-to-book value ratio is low, firms are more likely to need restructuring of their business and thus current book values explain the value of the company better than the current earnings.

Also, Barth et al. (1998) showed that the relative weight of book values in firm valuation increases when the financial health of the company decreases**,** by using a sample of historical bankrupt companies. It is argued that for financially distressed firms, liquidation of assets and shutting down the business is more likely, and that the balance sheet figures are a good proxy for the liquidation value. For financially stable companies the importance of book values decreases and the importance of earnings increases.

Finally, Collins et al. (1999) studied the reasons for better value relevance of book values in loss-making companies. It was found that book values serve a two-dimensional purpose in loss-making company valuation: They are decent proxies for expected future earnings, but also good proxies for abandonment value in those loss-making companies that will shut down their operations and liquidate the assets.

2.2.3. Other sources of information

In addition to accounting-based figures from the income statement and balance sheet, there is a wide range of different information available to investors. Beaver et al. (1980) started this research area by finding that a significant portion of the earnings information is reflected in stock prices months in advance of the actual announcement of changed earnings. They

found that earnings expectations built into stock prices were actually more accurate predictors of earnings than the time-series based earnings expectation models they were researching.

Collins et al. (1987) extended the research further by finding firm size as an important factor of cross-sectional variation to which degree the stock price can be determined based on earnings. It was found that for smaller companies earnings are more important in valuation, and based on this they built an argument that firm size works as a proxy for the amount of information content available for the company and the number of analysts processing that information. Therefore, earnings are important for companies for which there is less other information available, and vice versa, when there is a wider range of information available the importance of earnings decreases.

Lev and Zarowin (1999) researched the reasons why earnings are not sufficient in company valuations. They found that the overall usefulness of accounting information has declined during the 1980s and 1990s. The reason for this decline was the accounting systems' failure to properly capture and reflect the value of innovative activities and new internal innovations within the companies.

Amir and Lev (1996) and Trueman et al. (2001) researched specific industries to find the relevant drivers of companies' value. Amir and Lev (1996) studied the cellular phone industry and found that the main driver of company value was growth in the phoneline subscription base. Both accounting and non-accounting leading indicators of the subscription base growth had a major impact to the companies' price. Trueman et al. (2001) researched the Internet industry instead and found that the website traffic was an important factor of a company's value. This was separated into unique visitors and page views, both of which were found to be important determinants of company's value.

Dechow et al. (2014) also point out that other information is particularly important for early-stage companies. Accounting rules only recognize already triggered sales transactions, but for early-stage companies, there may be very little or no sales. In these cases, investors want to find pieces of information that would be leading indicators for future sales and use those forecasted future sales (and earnings) as a basis of their valuation.

2.3. Changes in the information content of earnings announcements

Beaver et al. (2018) studied the information content of earnings announcements during the period of 1971-2011 measuring information content as the magnitude of stock price changes when earnings announcements were released to price changes during other times. Their overall finding confirms results by previous research that earnings announcements have incremental information content, and thus the price changes of stocks are greater during earnings announcements.

In addition to this overall confirmation of the prior results, Beaver et al.'s (2018) main finding was related to the changes of the information content of earnings announcements over time. By examining the period from 1971 to 2011 they found that the information content of earnings announcements has increased over time. The greatest increase occurred between 2001 and 2011, which was not found by prior research in the area due to shorter study periods.

It was also found that the information content of earnings announcements is significantly larger for profit-making companies and significantly smaller for the companies that are reporting losses. Due to this, the Loss-dummy ended up being one of the most significant variables in their multivariate regression analysis. This suggests that the combined effect of greater persistence of profits than losses and possible greater extent of voluntary disclosures by profit-making companies is larger than the effect of recognition of losses being potentially timelier. (Beaver et al. 2018.)

The positive relationship between information content and company's market capitalization was also found to have changed majorly over time. As already covered, earlier research had found the association, and so did Beaver et al. (2018) at the beginning of their study period. During the last years of the research there surprisingly is a negative association between the two, contrary to what earlier research had found.

After closer analysis of the topic was performed, it was found that the association between analyst forecast coverage and information content exists during the whole sample period, but company size's effect diminishes towards the end of the period. The findings suggest that the company size actually does not affect the information content of earnings announcements, but instead the effect comes from increased analyst coverage to larger

companies. When the analyst coverage is incorporated directly into the analysis, the impact of company size disappears.

Beaver et al. (2019) examined the changing information content of earnings announcements focusing particularly on changes in the 21st century. In this study, the earnings content was measured by both, return and trade volume volatility following Beaver (1968), but using a sample period of 2001-2016.

One major finding of the study was that publishing additional information with earnings announcement has become more common, which has naturally led to increased information content of the announcements. Such additional information includes management guidance, analyst forecasts and disaggregated financial statement line items, each of which has been found to partially explain the increased market response to earnings announcements.

These three types of additional information together explain a significant part of the overall increase in information content, measured by price volatility and change in trading volumes. As voluntary disclosures have become more common, the magnitude of the shock affecting trading volume and stock price has increased, but this alone does not explain the total growth of the market responses.

This finding is contrary to the overall decline in market response to management guidance that is published separately from earnings announcements. There has been an increase in the market response to analyst forecasts during the sample period, but the increase has been remarkably smaller than the increase of market response to earnings announcements.

The study itself does not find exhaustive reasoning for the quick increase of market response to earnings announcements. The three key components – issued management guidance, analyst forecasts and disaggregated financial statement line items – explain the increase to a good extent, yet unexplainable growth in the information content of earnings announcements and thus the market responses to the announcements exists.

Nagar et al. (2019) studied economic policy uncertainty's impact on voluntary disclosures made by management. They found that higher uncertainty is associated with greater bid-ask spreads and smaller price reactions to earnings surprises, and that managers tend to respond to economic policy uncertainty by increasing the amount and information content of their voluntary disclosures. This partly explains the increase in the bid-ask spread.

After Beaver et al. (2018) found the increase in the information content of earnings announcements especially during the 2000s, Shao et al. (2018) studied the importance of earnings announcements in explaining total stock returns using adjusted R^2 measure following Ball and Shivakumar (2008). By using data from 1973 to 2015, they found that the earnings announcements and other disclosures – analyst forecast revisions and recommendations and 8-K filings – grew from explaining roughly 15% of annual returns in the 1990s to explaining 35% of them in the 2010s. The same thing happened solely to the earnings announcements, which used to explain roughly 10% of total market returns before the 2000s, but have explained roughly 20% since 2004.

3. Economic Policy Uncertainty

Another branch of literature this thesis covers very closely is the literature regarding economic policy uncertainty. Following the literature, uncertainty in this context refers to objective uncertainty or risk (Fernández-Villaverde et al. 2015 and Holton 2004). The word uncertainty in this context has two components that are entirely distinct from each other: uncertainty and exposure.

Uncertainty is present when an actor does not know whether a proposition is true or false. Practically this means that individual actors in the market cannot accurately predict the future state of the market environment. For uncertainty to have an impact on actors in the market, they also need to be exposed to it. There is an infinite number of things each actor is uncertain about, but they do not have to care about those uncertain propositions that do not have exposure on them. Therefore, for the uncertainty to affect their decision there must be actual uncertainty, but also a real exposure to the given uncertainty. (Holton 2004.)

This chapter presents the economic policy uncertainty index by Baker et al. (2013) that is used as a measure of economic policy uncertainty in this thesis. The index is constructed based on three individual components, that are presented one by one. After that, previous research on the economic policy uncertainty index is presented. Finally, also other measures of policy uncertainty, including variation-based and election-based measures, are presented briefly.

3.1. Economic policy uncertainty index

Economic policy uncertainty index (EPU index) is a three-component index developed by R. Baker, N. Bloom and J. Davis (2013) to measure the economic policy uncertainty initially in the United States. The index is available for 25 countries and as a global index on website policyuncertainty.com. An overview of the index is provided in this chapter and the three sub-chapters focus on providing more thorough view to each of the index's components.

The first component quantifies newspaper coverage regarding economic policy and uncertainty-related topics. The second component illustrates the quantity and estimated revenue-impact of the US federal tax code provisions set to expire in the coming years. The third component measures disagreement between economic forecasters regarding three policy-related variables, which is then used as a proxy for economic policy uncertainty. The three policy-related variables considered are inflation, purchases of goods and services by the federal government, and purchases of goods and services by state and local governments. (Baker et al. 2013.)

The overall EPU index is then constructed by first normalizing each individual component by its own standard deviation. The EPU index value for each month is then calculated as a weighted average of its components' values. News-based policy uncertainty component had a weighting of 1/2, tax expirations and inflation forecast disagreements both had a weighting of 1/6 and the federal government and state/local government purchase disagreements both had a weighting of 1/12. The weightings used roughly reflect the distribution of quantities of respective sources in newspaper coverage-based component. (Baker et al. 2013.)

As temporary tax provisions were rare or nonexistent in the 1980s, the pre-1991 values of it have been set to its 1991 value in the EPU index. After that adjustment, the overall index has been normalized to 100 from the year 1985 to 2009 resulting in the final EPU index. (Baker et al. 2013.)

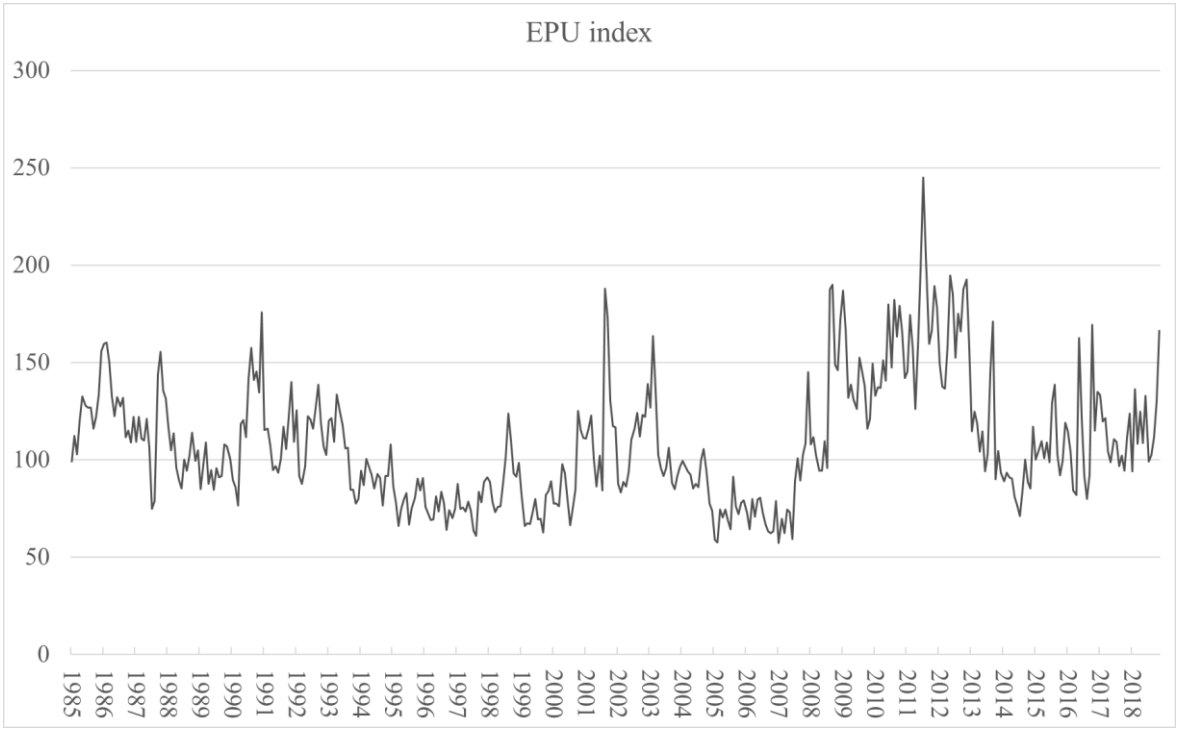

Figure 3 *The overall EPU index including all components, as reported by Baker et al. (2020).*

The EPU index has been reviewed in multiple ways to ensure its applicability as a proxy for the economic policy uncertainty. Firstly, the EPU index was plotted alongside another commonly used measure of uncertainty, the VIX index of 30-days implied volatility on the S&P500 index. The two were found to be closely linked with a correlation of 0.578, but also each one to have independent variation. The VIX index was found to spike significantly more during events that have a strong financial or stock-market connection such as the Asian crisis of 1997, stock-market scandals of early 2002 and right after Lehman's collapse in 2008. (Baker et al. 2013.)

On the other hand, the EPU index spiked relatively more during policy-relevant events such as Gulf Wars, the US presidential elections and debt-ceiling dispute during 2011. The EPU index was also compared to implied volatility indices with longer maturity (up to 10 years) and the correlation between EPU and a given implied volatility index was found to be stronger the longer the maturity of the given index was. The correlation with the 10-year implied volatility index was 0.855, showing that the EPU index seems to be more long-run than short-run focused. (Baker et al. 2013.)

Secondly, the EPU index's news-based component was audited by a human reading of 12,000 articles over the EPU index's time period to ensure the computer-generated approach

in analyzing newspaper releases matches the human-generated results. The founders of the index read hundreds of newspaper articles to develop classification criteria which were then used as an audit template by research assistants in pilot-phase to read and code 2,000 newspaper articles. Based on this pilot the audit template was refined and a training process for new research assistants was established. (Baker et al. 2016.)

For the full-scale audit, new teams of research assistants were recruited and trained. Training included going through the 65-page audit guide developed in pilot-phase, and trial coding of at least 100 articles that were not included in the audit sample, as well as one-on-one meeting to review the trial coding results and extra training and feedback as needed. Also, after the training was completed, one quarter of the articles was assigned to multiple auditors to ensure the audit quality. (Baker et al. 2016.)

Eventually, the trained auditor teams had undergone 12,009 articles from the 1900 to 2012 that were randomly selected based on the desired sample size. The audits resulted in a very high correlation of 0.86-0.93 between human- and computer-generated indices, the exact number depending on the considered time frame. The difference between the two indices cannot be explained by GDP growth rate or the level of EPU. (Baker et al. 2016.)

Thirdly, Political slant in newspaper coverage of EPU was considered, as the audit study did not address the issue of political slant potentially skewing the newspaper coverage of the index. If right- or left-leaning newspapers have higher impact on EPU when respective parties are in power, the political slant might skew the changes in index towards the party currently in power. To address this issue, the 10 newspapers were artificially split into five "Republican" ones and five "Democratic" ones using an index to measure media slant in the US by Gentzkow and Shapiro (2010). Two separate news-based EPU indices were formed based on this grouping, which were found to move very similarly with a correlation of 0.92. This suggests that political slant does not significantly distort the EPU index's newspaper coverage component, and therefore it is not a significant concern for the total index either. (Baker et al. 2016.)

Finally, the EPU index is mapped against uncertainty indicators based on the Beige Book release before each regularly scheduled meeting of the Federal Open Market Committee (FOMC). The Beige Book is a summary of approximately 15,000 words regarding the views and concerns by businesses and other sources expressed to the 12 regional Federal Reserve

Banks in the US. The Beige Book is published eight times a year, before each FOMC's scheduled meeting. (Baker et al. 2016.)

From each Beige Book, the quantity of the word "uncertain" and its variations such as "uncertainty" was taken and normalized by the word count of The Beige Book. Each entry containing "uncertain*" was then read through to judge whether it relates to policy matters, and if so, to what category. The quarterly frequency count per Beige Book highlights many of the same events and overall policy developments as EPU index, with a correlation of 0.54. There are two major findings that came up with this analysis: Firstly, The Beige Book approach seems to be a lagging indicator for policy uncertainty, as for example after the financial crisis The Beige Book uncertainty indicator starts to rise only in the second half of 2009. Secondly, as The Beige Book is published by FOMC it never mentions monetary policy uncertainty contrary to the newspapers. (Baker et al. 2016.)

3.1.1. The count of news articles referring to economic policy uncertainty

The newspaper coverage of economy-, uncertainty- and policy-related topics is the easiest of the three components to extend over time and across countries. For the United States, the component is based on ten leading newspapers: USA Today, Miami Herald, Chicago Tribune, Washington Post, Los Angeles Times, Boston Globe, San Francisco Chronicle, Dallas Morning News, New York Times and Wall Street Journal. Digital copies of each newspaper were gathered starting from January 1985 to obtain the number of articles containing certain word combination referring to economy, policy and uncertainty. (Baker et al. 2016.)

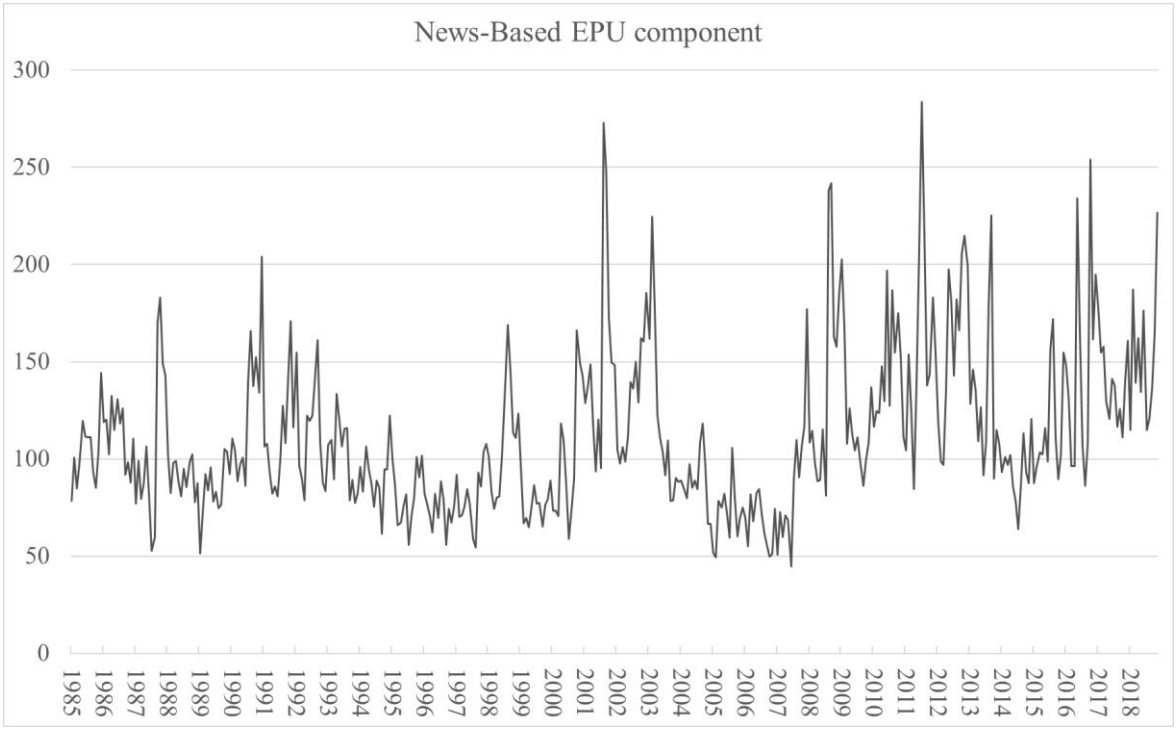

Figure 4 *News coverage-based component of the EPU index.*

Based on the established criteria, to suffice as an article referring to economic policy uncertainty, the article has to contain at least one term from each of the following categories: for uncertainty either "uncertainty" or "uncertain", for economy either "economy" or "economic" and for policy at least one of the following: "Congress", "deficit", "Federal Reserve", "legislation", "regulation" or "White House". In addition, variants of these words, such as plurals and acronyms (i.e. "uncertainties", "regulatory" and "FED") were included. The relevant terms for each category were selected based on the audit study which was explained in detail in chapter 3.1. "Economic policy uncertainty index". (Baker et al. 2016.)

As the quantity of newspaper articles varies significantly across different newspaper and time, the quantities are scaled by the total number of articles in the corresponding newspaper and time-period. After that, each month/newspaper series is standardized between the years 1985 and 2009 to similar standard deviation and then across all the newspapers by months. Finally, the series including all the 10 newspapers is normalized to an average value of 100 between the years 1985 and 2009. (Baker et al. 2016.)

The previous explanation is summarized to step-by-step table below to provide a more easily understandable format (Baker et al. 2016.):

Step no.	Step explanation:
1.	Denote X_{nm} as scaled EPU frequency quantity for newspapers n = 1, 2, … 10 in month m. Denote P as the period used in the standardization and normalization (from 1985 to 2009).
2.	Calculate variance σ^2_n in the interval P for each newspaper n.
3.	Standardize X_{nm} by dividing by standard deviation σ_n for each month m. This results to series Y_{nm} with the same standard deviation during period P for each newspaper n.
4.	Calculate the average between the ten newspapers n of Y_{nm} to create series Z_m for each month m.
5.	Calculate A, the average value of Z_m in the period P.
6.	Finally multiply Z_m by (100/A) for each month m to arrive to normalized newspaper coverage component for the EPU index.
7.	Weight the normalized component by 1/2 to the total index.

Table 1 *Step-by-step summary for calculating news coverage-based component of the EPU index.*

3.1.2. Sum of scheduled expirations of federal tax code provisions

The second component of the EPU index is based on Congressional Budget Office's (CBO) sources listing the quantity of federal tax code provisions expiring in coming years and their estimated revenue-impact. Scheduled tax code expirations pose uncertainty to the political and economic environment as normally decisions regarding a possible extension of the expiration are postponed until the last hours. Such behavior creates uncertainty about future tax legislation and undermines systems stability. (Baker et al. 2013.)

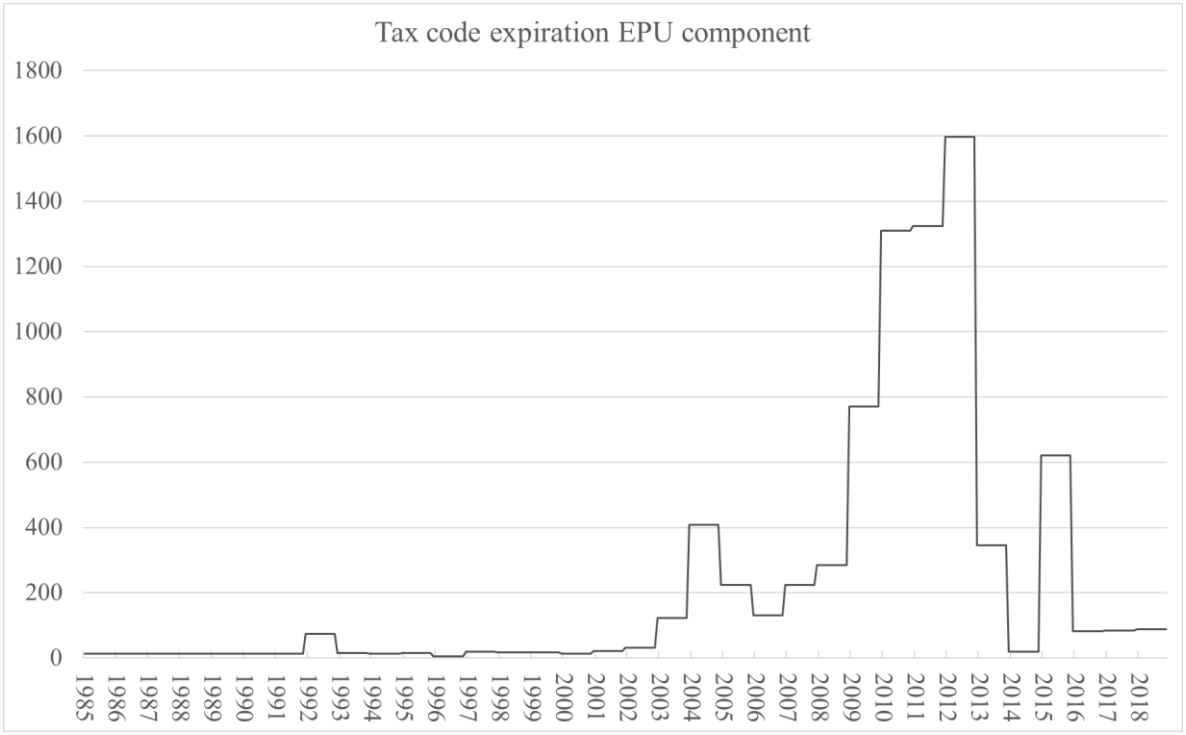

Figure 5 *Tax component of the EPU index quantifying revenue impact of scheduled expirations of federal tax code provisions.*

One example of such a situation is the Bush-era income tax cuts set to expire at the end of 2010. As Democrats and Republicans had different views on whether the tax cuts should be reversed and if so, for which taxpayers, the tax increases were uncertain. Instead of solving the situation well in advance, the Congress ended up finally solving the situation in December 2010, just a few weeks before the tax legislation change would have been brought to practice. (Baker et al. 2013.)

Temporary tax provisions also result in a more difficult interpretation of federal spending and borrowing from CBO's and Office of Management and Budget's (OMB) tax revenue projections, as they have different assumption to scheduled tax expirations and thus lead to different outcomes of federal spending and borrowing. During the past several years, the use of temporary tax provisions has increased and thus the difference between CBO's and OMB's projections has grown. (Baker et al. 2013.)

The data for federal tax code provisions is reported by CBO in January of each year, including information on already scheduled federal tax code provision expirations for the current year and each of the next ten years. The reported data includes a short description of the expiring tax code provision, its estimated revenue impact and its currently scheduled expiration time. From this data, absolute dollar value of the expiring tax provision in each

year of the 10-year horizon is calculated. These figures are then discounted at an annual discount rate of 50% as tax code provisions scheduled to expire in the distant years are not likely to be a significant source of current economic policy uncertainty. The discounted dollar-weighted tax code expirations for each year are then summed to obtain index value for each year. The index's component is then normalized by its own standard deviation prior to 2012 in a similar fashion as previously explained newspaper component. (Baker et al. 2013.)

3.1.3. Disagreements in expert forecasts about future inflation and government purchases

The last component of the EPU index is based on the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters (SPF). Each quarter the participants of SPF receive a request to fill the survey with their forecasts for a wide range of economic variables at different time horizons. Normally around 35 to 50 individual forecasts are obtained for each variable in each quarter. The variables affecting this component of the EPU index are inflation level, purchases of goods and services by the federal government and purchases of goods and services by state and local governments. (Baker et al. 2013.)

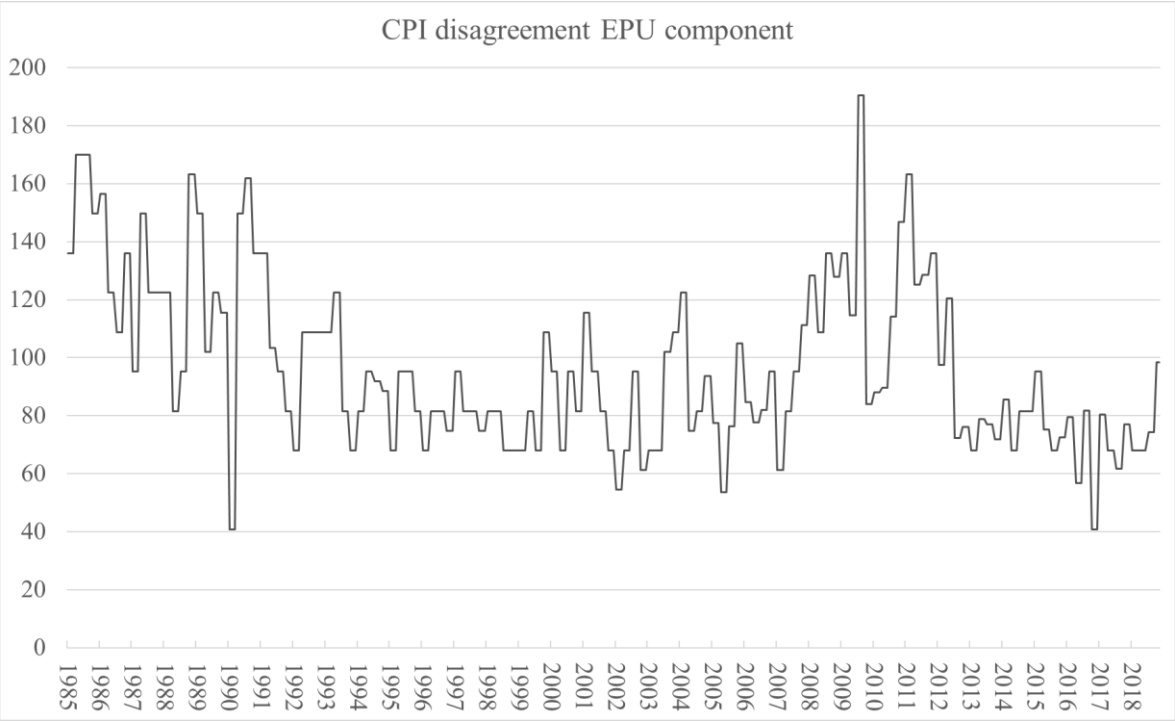

Figure 6 *CPI disagreement component of EPU index quantifies the forecasters' disagreements regarding future inflation levels.*

The proxy for economic policy uncertainty is the difference between individual forecasts. Thus, if the view of the experts filling the survey is similar, there is considered to be little uncertainty, and if there are big deviations between the experts the uncertainty is considered to be high. To measure disagreements regarding inflation forecasts, quarter-on-quarter annualized CPI inflation rates are used for a forecast period of one year. Dispersion is measured by calculating the middle 50% range of CPI inflation rate forecasts. This inflation-based measure has a 1/6 weighting on the total index. (Baker et al. 2013.)

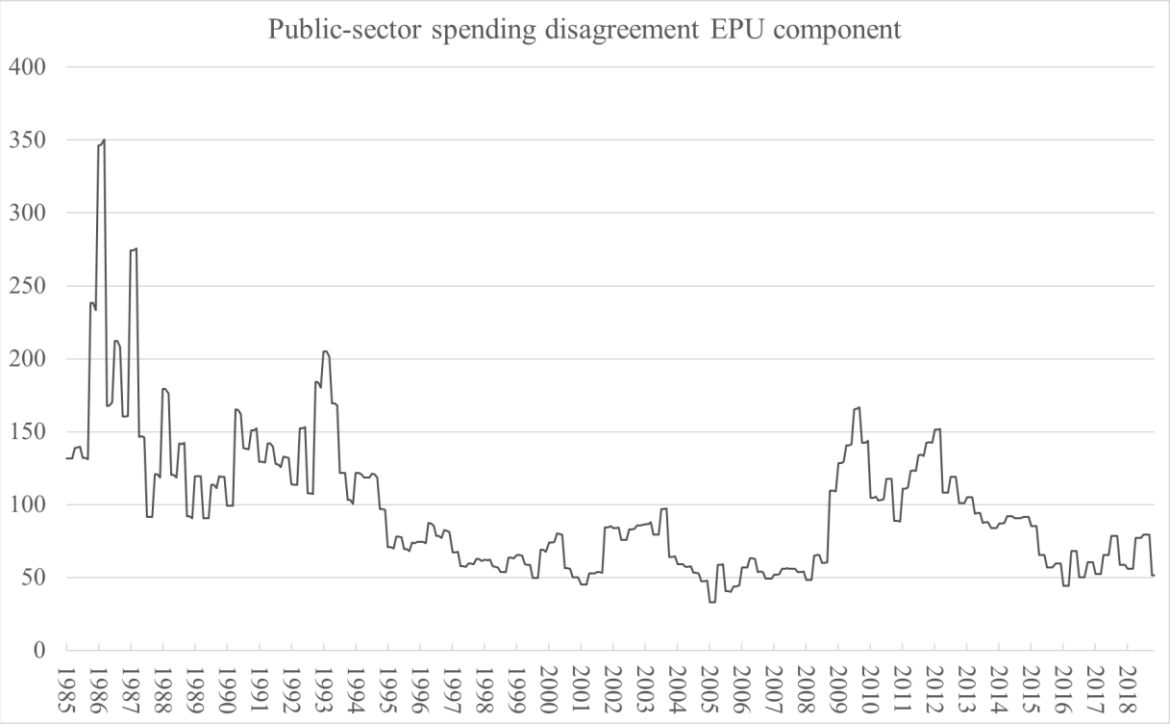

Figure 7 *Public-sector spending disagreement quantifies the forecasters' disagreement in future purchases of goods and services by the federal government and state and local governments.*

For federal government purchases the middle 50% range of one-year forecast is divided by the median one-year forecast, and after that multiplied by a 5-year historical moving average of inflation-adjusted federal purchases to inflation-adjusted gross domestic product ratio. The same methodology is used for state and local government purchases. These two public sector purchase measures are then summed together as the overall measure of forecaster disagreement about future purchases, expressed as a percentage of last five years' average gross domestic product. The combined measure has a weighting of 1/6 to the overall index, giving approximately a weighting of 1/12 to each sub-component. (Baker et al. 2013.)

3.1.4. Previous research on the EPU index

There is vast literature around policy uncertainty and its implications to the economies and individual companies. After the EPU index came out in 2013, it has been used as a new proxy for economic policy uncertainty in numerous studies. This chapter gives an illustrative, not an exhaustive summary of the already existing literature regarding the EPU index and its implications.

Stock prices and asset valuation

Pástor and Veronesi (2013) continued the already existing discussion (i.e. Thorbecke 1997, Rigobon and Sack 2004, Bernanke and Kuttner 2005, Aït-Sahalia et al. 2012 and Pástor and Varonesi 2012) regarding policy uncertainty's effect to stock prices by being the first in the field to use the three-component EPU index as a proxy for economic policy uncertainty. They built a model with seven assumptions regarding stock price changes and policy uncertainty, and empirically tested the model by proxying policy uncertainty with the EPU index. The seven assumptions are: Political uncertainty should be on average higher in the weaker economies, high political uncertainty would make stock prices more volatile and more correlated, policy uncertainty poses a risk premium to stock returns and when the economy is weaker, policy uncertainty should have greater impact on volatility, correlation and risk premium.

In weaker economic conditions the government is more likely to implement new legislation or make other political changes, which is argued to be the reasoning behind the assumption of political uncertainty being higher in such conditions, as there is always uncertainty regarding changing policies. As political uncertainty makes political signals more frequent and impactful, it also causes stock prices to be more volatile. The political signals affect all (or major part of) the firms, and therefore increases the correlation between stocks. Such external shocks are non-diversifiable, and therefore investors require a risk premium. (Pastor and Veronesi 2013.)

In the empirical testing with the EPU index as the proxy for policy uncertainty, support for all seven key assumptions of the model is found. Thus it is empirically proven – on varying significance levels – that the EPU index is higher on weaker economic situations, high EPU makes stock prices more volatile and correlated, high EPU poses a risk premium to stock

returns, and when the economic situation is weaker EPU has even greater impact on volatility, correlation and risk premium. (Pastor and Veronesi 2013.)

Brogaard and Detzel (2015) continue the research on the EPU index's impact on stock markets by focusing strictly on the unconditional relationship between the EPU index and expected returns of stock market. The study is constructed by running multiple regressions with different time periods to estimate logarithmic excess return of the value-weighted index by the EPU index and multiple control variables.

Their finding is, that EPU is positively correlated with volatility of the stock market returns. An increase of one standard deviation to the EPU index simultaneously decreases market returns by 1.31% and increases the future three-month log excess returns by 1.53%. Changes in the EPU index did not affect dividend growth in the period of 1 to 24 months. It was also found that EPU has an impact on equity risk premium, and contrary to Pastor and Veronesi's (2013) emphasis in different economic states, the effect is found to exist in general regardless of the current economic situation. (Brogaard & Detzel 2015.)

Mergers, Acquisitions and Venture Capital

Bonaime et al. (2018) studied political uncertainty's impact on mergers and acquisitions from the 1985 to 2014 in the US. They found that in addition to already identified frictions to capital allocation – such as transaction costs, information asymmetry and behavioral biases – policy uncertainty also poses significant friction to capital markets and thus significantly decreases the M&A activity.

It was found that an increase of one standard deviation to the EPU index decreased merger likelihood by 1.1%. There was also no mean reversion, meaning that these activities were completely lost rather than being simply delayed. The effect was larger for companies with a high amount of irreversible investments or high sensitiveness to policy uncertainty, and weaker for deals that could not be delayed. Target firms were able to negotiate better deal terms for the activities that did occur during the high policy uncertainty levels. (Bonaime et al. 2018.)

Tian and Ye (2018) found similar results regarding venture capital investments. During periods of high policy uncertainty, venture capital investments are significantly decreased. Venture capitals are, however, quick at adjusting their investment-strategy, and thus the

effect decays in approximately three quarters, contrary to the evidence in publicly-traded firms where no evidence of decaying effect was found.

The decrease of investments is higher for target companies that are young, have less tangible assets, are more relied to government spending or are exposed to more severe holdup from entrepreneurs. It was also found that the outcomes of venture capital investments were adversely affected by the high economic policy uncertainty. During the policy uncertainty, venture capitals rely more on stage-financing and reduce the total investment amount to mitigate the adverse effect of high policy uncertainty. (Tian & Ye 2018.)

Investment Decisions

Another research area where the EPU index has already been used is the company-level investments and the EPU index's impact on them. Economic policy uncertainty's impact to investment-levels has been studied for decades using numerous measures for the economic policy uncertainty (i.e. Bernanke 1983, Bertola & Caballero 1994, Abel & Eberly 1996 and Byrne & Davis 2004). Kang et al. (2014) have contributed to this already lively discussion by using the EPU index as a proxy for policy uncertainty, to research its impact on company-level investments. In addition to the total index's impact on investment decisions, all three components' effect has been analyzed separately.

The study covered over 2,700 manufacturing firms located in the US for the time period of 1985-2010 by estimating an error correction model. The different components of the EPU index were found to have different impacts to firm-level investments. The newspaper coverage-based component of the index had a significant negative effect on investment-levels, and it increased the stock price volatility in the long run. The forecaster disagreement regarding federal purchases had significant negative effects to investment-levels in short- and long-run. The tax code expiration component and the forecaster disagreements in inflation levels were instead found to be statistically insignificant. It was also found that none of the components impact the investment-levels of the largest firms of the sample. (Kang et al. 2014.)

Gulen and Ion (2015) continue the research on topic by focusing on cross-sectional heterogeneity to discover whether the impact of economic policy uncertainty is higher for investments of companies with a high level of irreversible investments or high dependence on government spending. For investment irreversibility four different proxies are used: the ratio of fixed assets to total assets, the measure of asset redeployability by Kim and Kung

(2013), whether the firm operates in a durables industry and a measure of sunk costs based on rent expenses, depreciation and sales of fixed assets. For dependence on government spending, the U.S. Bureau of Economic Analysis' input-output tables were used to calculate the share of government purchases from the industry (also taking into account the indirect purchases) to industry's total. (Gulen & Ion 2015.)

The overall finding confirmed the earlier results that economic policy uncertainty has strong negative relationship with capital investments, also after controlling for alternative measures of investment opportunities and macroeconomic uncertainty. Strong evidence was also found suggesting that the negative effect of economic policy uncertainty is stronger for companies with a high degree of irreversible investments. Also, companies that are more dependent on the government spending are significantly more negatively impacted by economic policy uncertainty. (Gulen & Ion 2015.)

Dolinsky and Naranjo (2018) further extend the research to 18 countries around the world instead of just the United States. In addition to EPU's effect on company investments the study also covers its effect to share issuance, payouts and cash holdings. The study is executed by multiple regression models taking into account country- and firm-specific control variables.

The results for investment decisions – but not for all other studied variables – were clear and in line with previous research. For company investments it was found that Gulen and Ion's (2015) results of high policy uncertainty reducing company's investments in the US firms also applied for foreign firms in the 18 studied countries. It was also found that company investments are more sensitive to economic policy uncertainty in the countries that have French legal origin, and thus have on average weaker investor protection.

Regarding new aspects of the study, company's payout policy, share issuance and cash holdings, it was found that during high policy uncertainty companies are more likely to increase their cash holdings and less likely to issue new shares. Regarding payout policies the results were mixed and no conclusions regarding the relationship can yet be drawn. (Dolinsky & Naranjo 2018.)

Exchange rate volatility

In general, volatility in the exchange rate has been found to negatively impact the economy's performance due to increased volatility in profits and net worth of companies which in turn

makes acquiring financing for new investments more difficult, decreasing productivity and thus the economy's GDP growth (Braun & Larrain 2005 and Aghion et al. 2009). The volatile exchange rate can also increase uncertainty about future inflation rates leading to higher interest rates thus decreasing consumption and investments and increase the transaction cost of exporting and importing (Grier & Grier 2006 and Baum & Caglayan 2010). Due to these reasons and other adverse effects of volatile exchange rates factors impacting to exchange rate volatility have been to great interest of researchers.

Krol (2014) was the first to implement EPU index in the discussion of exchange rate volatility, whereas earlier more political event-based measures were used, such as uncertainty regarding elections or new legislation approvement (i.e. Leblang & Bernhard 2006, Bialkowski et al. 2008, Boutchkova et al. 2012 and Julio & Yook 2012). The advantage of the EPU index is its continuing nature which allows it to capture economic policy uncertainty's development over time instead of relying on individual data points occurring at certain time increments.

The research's methodology is to run regression models for exchange rate volatility explained by the EPU index of the United States and the country's own EPU index as well as the growth of industrial production index. The sample includes Mexico, Canada, the euro area, Sweden, the United Kingdom, South Africa, India, South Korea and Japan for years 1990-2012. (Krol 2014.)

The results suggest that an increase in the economic policy uncertainty of home-country and the US significantly increases the exchange rate volatility in many of the countries studied. For emerging countries, only the country's own EPU affected the exchange rate volatility without the US EPU having impact on their exchange rate volatility. As previous research had found exchange rate volatility to negatively impact investments, productivity, consumption, international trade and GDP growth, increase in EPU index can negatively impact the economy's performance through these channels. (Krol 2014.)

In a more recent paper regarding the topic, Kido (2016) studies the effect of the EPU index on various currency exchange rates during the years 2000-2014 using a dynamic conditional correlation GARCH model. The study investigates four high-yielding currencies (Australian dollar, Brazilian real, South Korean won and Mexican peso) and G3 currencies (the US dollar, Euro and Japanese yen).

In the study, it was found that all the four high-yielding currencies correlated negatively with the US economic policy uncertainty, whereas by contrast Japanese yen correlated positively with the US EPU index. The same effect lasted throughout the sample period but was larger during the two US recessions that occurred during the sample period. (Kido 2016.)

3.2. Other measures of policy uncertainty

In addition to the EPU index, there is a wide range of research regarding policy uncertainty that proxies the policy uncertainty by other measures. This chapter provides an overview of the other measures of policy uncertainty including election-based measures and volatility-based measures. It is good to note, that in addition to these measures, there are also numerous less-used ones as the definition of policy uncertainty is not completely settled (i.e. Romer & Romer 2010).

3.2.1. Volatility-based measures

Typically, policy uncertainty has been measured by volatility of certain macroeconomic or other parameters. In such research, the basic assumption has been that the given parameters follow a Brownian motion, meaning a continuous random walk (Karatzas & Shreve 1998). High volatility in the parameters considered has then been linked to a high level of uncertainty, as the prediction of future environment is harder in times of higher variation when the parameter follows a random walk. The incremental change of the value of a parameter is larger during the high volatility times, and thus the uncertainty is considered to be high. (Hassett & Metcalf 1999.)

The exact parameter(s) used varies between studies according to what aspects of policy uncertainty are desired to be captured. Typical parameters include for example tax rates, government spending, productivity, monetary policy shocks and inflation. Born and Pfeifer (2011) is a good example of the volatility-based measuring of policy uncertainty in their study examining business cycle fluctuation caused by the policy uncertainty. Their model of policy uncertainty includes capital and labor tax rate, government spending, monetary policy shocks, total manufacturing productivity and investment-specific technology. These parameters' quarter-level variations together form the model for policy riskiness.

Interestingly, a major finding of theirs is that uncertainty of policy riskiness (measured by their model using the listed explaining parameters) does not play a major role in the business cycle fluctuations.

A similar approach is used by Fernández-Villaverde et al. (2015) in a study where the focus is on fiscal policy shocks. There the input parameters for the riskiness are average capital, labor and consumption tax rates and consolidated public sector spending including federal, state and local government spending. These parameters are then fed into the New Keynesian market model as proxies for fiscal policy uncertainty. Based on their analysis, unexpected changes in the fiscal policy significantly decrease economic activity.

In addition to these two example studies of volatility-based measures, there is a wide range of other studies using very similar methodologies. The exact parameters used for proxying policy uncertainty have not been universally accepted by the academics, and thus interpretation of different studies' results requires a very close examination of the parameters used. The perk of using these macroeconomic factors is their existence, availability, and continuity across time periods.

3.2.2. Election-based measures

Another common measure for policy uncertainty is election-based measurement. This approach basically assumes that during non-election periods the uncertainty stays constant, and it increases during election periods. The reason for this would be that the outcome of the election is unknown. Depending on the winner of the election, major political changes may happen rather quickly. Ceteris paribus is used for the non-election periods, and therefore no changes is assumed to occur during those years, which is the downside of these types of measures. Also, as these measures are not continuous, some statistical tests cannot be used with them.

For example, Çolak et al. (2017) study initial public offering (IPO) activity under political uncertainty that is proxied by gubernatorial elections in the United States. Neighboring states without a gubernatorial election are used as control groups for the states where elections do take place. Basically, the assumption is that there is higher policy uncertainty during the time surrounding the gubernatorial election in the state where the election takes place and normal policy uncertainty in the surrounding states with no election. By using this proxy for political

uncertainty, it is found that there are fewer IPOs in the states during gubernatorial election periods, and that the offer price is lower for the IPOs that do take place and the investors' cost of capital is higher.

Brandon and Youngsuk (2012) use a similar approach with cross-country data and national elections to examine their impact on cross-border flows of capital. The main benefit of the election-based measures is their good availability, which allows for example Brandon and Youngsuk (2012) to use 44 sample countries in their study. In addition, country-level control variables are added to reduce the impact of country-level characteristics on the results. Even then, it is evident that the measure does not capture overall political uncertainty accurately, but instead the possible uncertainty that is caused by the national elections.

4. Summary of the literature and hypothesis formulation

In this chapter, relevant fields of literature will be synthesized to create hypotheses relevant for this thesis' scope. This thesis studies the impact of economic policy uncertainty during the earnings announcement window on stock trading volumes. In the corresponding sub-chapters, literature regarding different areas of the study are covered and hypotheses formed.

Firstly, the overall impact of policy uncertainty on the trading volume will be covered. This will not cover the earning announcement day specifically, but instead the whole earnings announcement window, including 16 days before and after each earnings announcement.

Secondly, policy uncertainty's impact on the trading volume increase that occurs right after earnings announcement is studied. This is the main contribution of this thesis, as even though the information content of earnings announcements and their impact to trading volume shocks is extensively studied by previous research, there are no existing studies that link the phenomena to the level of economic policy uncertainty.

Finally, the study regarding the previous phenomenon is extended to observe the changes in it over time. There is no existing literature regarding exactly this either, but there is voluminous literature regarding changes of other items' information content over time. This existing literature is utilised to formulate the third hypothesis.

4.1. Economic policy uncertainty's impact on trading volume during the earnings announcement window

There has not been a single research extensively studying the impact of economic policy uncertainty on stock trading volumes, but in this chapter relevant pieces of research are synthesized from multiple studies to arrive at a common consensus of the phenomenon for hypothesis formulation. Karpoff (1986) offers a well-structured overview theorizing the drivers of trading volume, and many of the assumptions used in the paper are widely accepted and used by other academics as well. This article is used to identify ways through which economic policy uncertainty could affect trading volume during the earnings announcement window. These identified ways are then explored from economic policy uncertainty related literature to discover their existence and magnitude in this specific context.

Karpoff (1986) identifies two distinct ways of informational events affecting trading volume. Firstly, trading volume increases if investors interpret an informational event differently, and thus disagree regarding its implications for a business. Secondly, trading volume is also affected even if the informational event is interpreted similarly between the investors, if they had divergent expectations before the event. Also, it is found that increased trading costs decrease trading volumes, and that volume increases persist after the informational events rather than being a clear one-off spike.

Based on these identified ways, for economic policy uncertainty to have an impact on trading volume, it should cause at least one of the following: (1) increase/decrease the investor disagreement about informational events, (2) increase/decrease the expectation divergency between the investors, (3) increase/decrease the number of informational events or (4) increase/decrease the trading costs.

One major component of the EPU index is the forecaster disagreement regarding macroeconomic factors such as government spending and inflation levels. Also the newspaper coverage-based component quantifies the number of words that refer to uncertainty, and the tax code expiration based component shows the number of expirations that are planned but normally not considered certain by investors as explained in the corresponding sub-chapter of the component.

These components together should affect the expectations of investors. By definition, uncertainty refers to a situation where stakeholders have difficulties forecasting the future. When there is uncertainty about the future, the forecasting is more difficult and there is a wider range of possible forecast outcomes. With forecasting being more difficult and the range of outcomes wider, the investor disagreement is higher by definition. The same reasoning does apply to both, disagreement regarding a new informational event and an expectation divergence between the investors.

On the other hand, trading volume is found to be counter cyclical by multiple authors, including for example Sarolli (2015). Also, the EPU index is found to be counter cyclical (i.e. Wang 2019), and thus there may be an omitted variable bias. That is, some other variable referring to bad economic conditions, for example declining GDP, would impact trading volume, but is also highly correlated with the EPU index. This also makes a high value of the EPU index to be associated with decreasing trading volume when the analysis is not controlled for such variables.

The EPU index's impact on trading volume is a multi-dimensional phenomenon. Therefore, it is not clear whether a change in one of the four factors cause an increase or decrease in trading volume. This depends on the nature and direction of the change and can also vary between the factors. Therefore, it is very unlikely that a combination of these four factors sums up to zero change in the total trading volume, and it is thus feasible to assume that economic policy uncertainty does have an impact on overall trading volume. Due to a lack of prior research on the topic, the sum of all these factors cannot be reliably assumed to be either positive or negative during high economic policy uncertainty. Therefore, the hypothesis used is the following, two-sided hypothesis:

$H1_1$ = Economic policy uncertainty has an impact on overall trading volume throughout the earnings announcement window.

Which will be tested by using a null hypothesis regarding the same phenomenon that is:

$H1_0$ = Economic policy uncertainty has no impact on the level of trading volume during the earnings announcement window.

4.2. Economic policy uncertainty's impact on the trading volume shock caused by earnings announcements

The existing literature regarding trading volume shocks does not take into consideration macroeconomic factors or the EPU index specifically. Bringing these two research areas together is the major novelty of this thesis.

The trading volume shock that happens when the earnings announcement is released, and one day after that, has been considered to occur due to high information content of earnings announcement (i.e. Beaver 1968 and Dechow et al. 2014). The higher the amount of new information in the announcement, the higher the trading volume increase is.

Therefore, economic policy uncertainty should have an impact on the magnitude of trading volume shock if either of the following applies: (1) information content of earnings announcements is higher during higher EPU periods, leading to an increased trading volume shock, or (2) information content of earning is lower during higher EPU periods, leading to a decreased trading volume shock as the investor can utilize the earnings announcement to a lesser extent in their analysis.

There could be arguments to support either one of these possibilities. For example, when the economic policy uncertainty is high, the actual earnings announcement could be less useful as the macroeconomic factors also play an important part in making the investment decisions. On the other hand, during high uncertainty the earnings announcements could be more useful as they provide clear and standard-compliant financial figures regarding the past performance. These figures could be more useful when the market environment is very uncertain and therefore forecasting the market development is more difficult. Unfortunately, there is no prior research regarding the topic to be used for theorizing which of the two possible direction has a larger total impact in this context. For this reason, a two-sided hypothesis is used. The null hypothesis tested is thus the following:

$H2_0$ = Economic policy uncertainty has no impact on the magnitude of the trading volume shock caused by the earnings announcement.

This null hypothesis is tested with a two-sided test, and therefore the alternative hypothesis is:

$H2_1$ = Economic policy uncertainty has an impact on the magnitude of the trading volume shock caused by the earnings announcement.

4.3. Change of EPU's impact on trading volume shock over time

If the economic policy uncertainty does have an impact on the magnitude of the trading volume shock caused by the earnings announcement, this thesis aims to extend the research by further exploring how the impact of EPU has changed over time. This is another part where this thesis has major novelty-value, as the previous hypothesis was not yet studied by other researchers, naturally this topic has not been either.

Collins et al. (1987) found that the importance of earning is smaller for the companies for which there is less other information available (i.e. small companies). The reason for this is that when there is less information available, investors are forced to use only the information they do have for the decision-making, and thus the importance of this information increases.

This same phenomenon should also apply to macroeconomic factors such as the EPU index: When there is much detailed information available regarding the company, the incremental information content of the EPU index should be smaller, as there most likely is more accurate or better-suiting measures to be used in forecasting of an individual company, depending on for example its industry, countries of operation and so on. Vice versa, when there is a very limited amount of information available, the importance of EPU index should be higher as the investors need to use the data that is available.

Beaver et al. (2018) also note that close analyst-coverage of a company could decrease the relative trading volume shock caused by the earnings announcement, as the analysts could already have incorporated some of the new information in their analyses that are then distributed to other investors. In addition, Barth et al. (2019) find that the investors make their investment-decisions based on more and more sophisticated methods, and the value relevance of the simplest accounting figures, such as earnings, has decreased. This could also apply to macroeconomic factors included in the EPU index, as 50% of the weighting is easily available macroeconomic information, and the other 50% is based on newspaper articles. Therefore, as the amount of data the investors have available and usable for their

investment-decisions has increased, it is expected that the EPU index's impact on the trading volume shock has decreased over time. The tested null hypothesis is therefore:

$H3_0$ = The economic policy uncertainty index's impact on the trading volume shock caused by earnings announcements has not changed over time.

This null hypothesis is tested with a one-sided test, an alternative hypothesis being the following:

$H3_1$ = The economic policy uncertainty index's impact on the trading volume shock caused by earnings announcements has decreased over time.

5. Data, variable construction and descriptive statistics

In this chapter, an explanation of the data and variables used is presented, as well as descriptive statistics regarding the data. This chapter is divided into three parts. Firstly, an explanation of the different data sources and their merging is provided. Secondly, it is explained how the variables used in the empirical analysis are calculated and how the data is grouped. Thirdly, descriptive statistics of the data are presented.

Table 3 summarizes the variables used in this thesis. In the first part of this chapter the first section of the table "Imported variables for data merging" is covered, as well as the three data sources used: CRSP/Compustat merged database, CRSP Daily stock and Economic policy uncertainty index. In the second part of this chapter, the second and third section of the table are covered. Finally, the descriptive statistics of the sample are presented.

	Variable	Formula	Identifier	Source
Imported variables for data merging				
(1)	Date			CRSP Daily stock & Economic policy uncertainty index
(2)	Fiscal quarter		FQTR	CRSP/Compustat merged database & Economic policy uncertainty index
(3)	Fiscal year		FYEARQ	CRSP/Compustat merged database & Economic policy uncertainty index
(4)	Report date of quarterly earnings		RDQ	CRSP/Compustat merged database
(5)	PERMNO			CRSP/Compustat merged database & CRSP Daily stock
Imported and calculated input variables for creation of analysed variables				
(6)	Common shares outstanding		CSHOQ	CRSP/Compustat merged database
(7)	Share Volume		Share Volume	CRSP Daily stock
(8)	Window	(1) - (4)		Calculated
Variables for empirical analysis				
(9)	EPU		Three_ Component_ Index	Economic policy uncertainty index
(10)	Period	1 if (1) < 1.1.1997 and 2 if 1.1.1997 <= (1) < 1.1.2007 and 3 if (1) >= 1.1.2007		Calculated
(11)	Tradvol	(7) / (6)		Calculated
(12)	Event	1 if (8) = 0 or (8) = 1, else 0		Calculated
(13)	High Dummy Total	1 if (9) > median(9), else 0		Calculated
(14)	High Dummy Period	1 if (9) > median(9) for the period, else 0		Calculated
(15)	Event X High Dummy Total	(12) * (13)		Calculated
(16)	Event X High Dummy Period	(12) * (14)		Calculated
(17)	Event X EPU	(12) * (9)		Calculated

Table 2 *List of variables used in the empirical analysis.*

5.1. Gathering and merging data

This chapter provides an overview of the three different data sources used. Also, the variables retrieved from each source are covered, as well as the merging of different data sources into the final dataset. The three data sets used are the economic policy uncertainty index, daily trading volumes data and earnings announcements and financial statement data. These three data sets are each covered separately in the corresponding sub-chapter.

5.1.1. Economic policy uncertainty data

The economic policy uncertainty index by Baker, Bloom and Davis was retrieved online from the corresponding website, where the monthly updated data is available since 1985 for the US (Baker et al. 2020). The data includes, as already covered, three components, but in this thesis, the overall index which is a weighted average of those is used, as covered in the chapter 3.1. "Economic policy uncertainty index".

In addition to the US, the economic policy uncertainty index is available for 23 other major countries, and as a global index. The time span of the index for different countries varies, which is one of the main reasons why this thesis focuses solely on the economic policy uncertainty in the US.

The data is monthly, meaning that for each data entry, year, month and value of EPU index is obtained and it remains constant during the given month. These year and month variables are later used for merging the data with other sources, whereas the EPU index is the main variable of interest in the later analysis. In order to only work with full calendar years and make sure the data is available from all sources, last month of the EPU index used in the research is December 2018, resulting to a total of 408 monthly observations (from January 1985 to December 2018) from the initial 420 monthly observations available (1985-2019).

5.1.2. Daily trading volume data

Daily trading volume data was obtained through the Wharton Research Data Service's CRSP Daily Stock (2020) database. Variables obtained from this database were Share Volume – which measures the number of stocks traded each day – and Common Stocks Outstanding, that simply measures the number of common stocks outstanding for each company and each day. In addition to these, data dates and Permno-company identifiers were later used in merging this data with the earnings announcement date data.

For the time period of 1985-2018, a total of 63,017,383 observations were retrieved from the database. From this dataset, observations with a missing value or an error code for the Share Volume or Common Stocks Outstanding were deleted. This procedure deleted 1,025,858 observations resulting to the final dataset of 61,991,525 observations.

After omitting the missing observations, the first two datasets were merged by months. This resulted in a combined dataset, where the corresponding monthly EPU index value was added as a new variable for each Daily trading volume data observation based on the date of the observation. After this procedure, the dataset still consisted of the same 61,991,525 observations, but each observation now also had an additional variable showing the value of the EPU index during the given month.

5.1.3. Earnings announcement data

The final dataset for earnings announcement dates was obtained through Wharton Research Data Service's CRSP/Compustat Merged (2020) Database – Fundamentals Quarterly. From this database, most of the analyzed variables were obtained, and their identifiers are available in the table 3**.**

Arguably the most important variable available only in this database is the report date of quarterly earnings (RDQ), which shows the date when the quarterly earnings announcement is released. For the years 1985-2018 a total of 898,668 quarterly observation were retrieved from this dataset. From these observations, 160,287 had a missing value for RDQ, and were therefore deleted resulting in a total of 738,381 observations with RDQ available.

This dataset was then merged with the previous combination of the trading volume and EPU data by company identifiers (Permno) and dates, so that each observation of the latter data had to be within sixteen days from that company's closest RDQ. This way only those daily observations for trading volumes and other variables that are close to RDQ and thus relevant for this thesis' scope are analyzed. This procedure thus deleted all the observations from previous data that are more than sixteen days away from the closest earnings announcement, which accounted for a total of 44,976,480 observations. This resulted in a dataset of 17,015,045 firm/day observations that are less than seventeen days away from the closest earnings announcement, including ones either before or after it.

5.2. Constructing variables and grouping the data

After retrieving the initial datasets from the different databases and merging them to the final dataset, the relevant data for the study was available. In this chapter, I cover exhaustively how the data was manipulated to arrive at the dataset that was used to perform the empirical analysis. These procedures are separated into constructing new variables used for the analysis and grouping the data to be able to analyze the results differ between time periods and policy uncertainty levels.

5.2.1. Constructing new variables

As shown in the table 3**,** new variables that are used in the empirical analysis of this thesis were calculated based on the retrieved data. In this chapter, the calculated variables are covered one by one explaining how a given variable is constructed, and what is the reasoning behind it.

Starting from the variable Window, which is calculated as the date of the data less the closest quarterly earnings announcement. Observations more than sixteen days away from the closest earnings announcement were deleted, thus Window gets values in the range [-16;16]. The Window variable is later used in replicating figure 1**,** and incorporating the EPU index to that replication. In addition, the Event variable was calculated based on this variable.

Important variable to show changes in the EPU's impact on trading volume over time is Period, which is more closely covered in the next chapter. Briefly put, Period receives values 1, 2 or 3 depending on the date of the observation. Observations dated before the year 1997 were assigned into Period 1, observations from the year 1997 to 2007 were assigned into Period 2, and observations from 2008 to 2018 to Period 3.

Tradvol variable measures the trading volume of a company's stock. As the number of shares outstanding varies massively between companies, the raw number of stocks traded cannot be used. Instead, the Tradvol variable is a percentual value, dividing the trading volume per day by the total number of stocks outstanding. This way we get a comparable number, that shows how large a percentage of a given company's stocks were traded during a given day. As the Tradvol is scaled with the number of shares outstanding, the company's (reverse)

stock splits do not have an impact on this variable as they would was the raw number of shares traded used.

Event variable is a dummy-variable that receives a value of one when the Window has a value of zero or one, and value of zero on all other values of Window. This Event-dummy captures the announcement day, as, based on the earlier research and i.e. figure 1**,** trading volume increases massively right after the earnings announcement is released, but also returns back to the normal level quickly.

The reason why the Event-dummy includes also Window's value of one, meaning one day after the earnings announcement, is that since 2005 90% of earnings announcements are released during the pre-market and after-market periods (Michaely et al. 2014). For the earnings announcements that are published after market closing, the possible increase in trading volume will naturally occur the next day.

Some studies, such as Beaver et al. (2020) separate the earnings announcements to regular and after-hour earnings announcements, to capture only the relevant increase of the trading volume in the Event variable. Basically, this means that for after-hour earnings announcements the Event day includes only the day following the announcement, as the trading cannot increase in the announcement day given the trading has already closed. In this thesis, the two types of earnings announcements are not separated, and thus the Event variable includes two days for all the announcements.

Other dummy variables used in the analysis are High Dummy Total and High Dummy Period, which refer to the level of EPU index. The grouping of EPU index is more exhaustively covered in the next chapter, but briefly put, the High Dummy Period returns a value of one when the EPU index has a value higher than the given period's median EPU value, and zero when the EPU index is below the median EPU. High Dummy Total does the same thing but covers all the months in the whole period from 1985 to 2018 instead of only a sub-period's months.

The last three variables calculated are the interaction terms of other variables. In the analysis three different interaction terms are used: one between Event and High Dummy Total, another between Event and High Dummy Period, and the last one between Event and EPU. These interaction terms are calculated by multiplying the two variables' values together. The interaction term is used in the regression analyses to increase the understanding of how the two variables jointly explain the changes in the dependent variable. Specifically, in this

thesis' context, it is interesting to see whether the Event adds incremental effect to the proxies of economic policy uncertainty, and this can be seen from the value of the interaction terms.

5.2.2. Grouping different time periods and policy uncertainty levels

Following Ball and Brown (1968) and Dechow et al. (2014), the study period is grouped into periods of approximately ten years to capture the changes in the information content of earnings over time, and policy uncertainty's impact on it. In addition to that, regressions are run to the whole study period as a whole. The level of economic policy uncertainty is also split into two groups (high and low, representing months with higher/lower EPU value than the median of period) in each period. In this chapter the reasoning behind grouping and its practical implications, as well as a summary of the distribution of EPU levels in different years, is presented.

As Beaver (1968) and Dechow et al. (2014) have shown, the information content of earnings varies over time. For this reason, also this thesis takes into account the changes over time, by dividing the whole study period to three shorter periods of approximately ten years and running separate regressions for all three periods in addition to the overall regression for the whole study period.

The total period this thesis studies is from 1985 to 2018, meaning 34 full years. These 34 years are grouped into three shorter periods, period 1 including observations from the 12 years between 1985 and 1996, period 2 including 11 years from 1997 to 2007 and period 3 including 11 years from 2008 to 2018. From the total of 17,015,045 firm/day observations each period included observations as follows: Period 1 included 5,313,167 observations, period 2 included 6,624,309 observations and period 3 included 5,077,569 observations.

In addition to grouping the data by periods, each observation was also grouped by the corresponding month's economic policy uncertainty level compared to other months. This was done by setting dummy variable "High Dummy Period" for each observation so that it retrieves a value of one for observations during the months that have higher than median economic policy uncertainty during the analyzed period. For each observation that had lower than the median EPU level, the High Dummy Period variable received a value of zero. A

similar approach was applied for the High Dummy Total, except the period where the median was calculated, which was the whole study period instead of an individual sub-period.

Summary of the months with a higher than median EPU is shown in the table 4. The left column shows the number of months that have higher than the sub-periods median EPU index in given year. This means that for these months the value of High Dummy Period is one. The right column shows the number of months that have higher than the median EPU index value of the whole study period resulting to the value of one for High Dummy Total variable. Median EPU for period 1 was 105.79, for period 2 it was 85.13 and for period 3 the median was 124.29. For the studied period as a whole (right column) the median EPU index was 102.21. Naturally for each year the number of low EPU months (below period's median) can be calculated as twelve less the number from the table.

Period	Year	No. of high EPU months for given period	No. of high EPU months for the whole time
Period 1	1985	10	11
	1986	12	12
	1987	10	10
	1988	4	6
	1989	3	4
	1990	8	8
	1991	7	8
	1992	9	9
	1993	8	9
	1994	0	0
	1995	1	1
	1996	0	0
Period 2	1997	2	0
	1998	8	2
	1999	1	0
	2000	5	2
	2001	11	8
	2002	11	7
	2003	11	6
	2004	11	1
	2005	1	0
	2006	0	0
	2007	5	2
Period 3	2008	5	8
	2009	10	12
	2010	12	12
	2011	12	12
	2012	12	12
	2013	4	10
	2014	0	0
	2015	2	7
	2016	2	7
	2017	2	8
	2018	5	10

Table 3 *Distribution of the high-EPU months to different years and periods.*

5.3. Descriptive statistics of the final sample

In this chapter, descriptive statistics of the final sample are presented. Table 5 shows this information and the correlation matrix of the analyzed variables. As many of the analyzed variables are either dummy variables or interaction terms including dummy variable(s) it is

evident that the descriptive statistics table is not as informative as it would be with more continuous variables.

	N	Mean	Standard Deviation	Minimum	Q1	Median	Q3	Maximum
Event	17,015,045	0.08	0.27	0	0	0	0	1
EPU	17,015,045	104.49	30.72	57.2	82.28	98.2	121	245.13
High Dummy Total	17,015,045	0.44	0.5	0	0	0	1	1
High Dummy Period	17,015,045	0.47	0.5	0	0	0	1	1
Event X EPU	17,015,045	8.34	29.63	0	0	0	0	245.13
Event X High Dummy Total	17,015,045	0.04	0.18	0	0	0	0	1
Event X High Dummy Period	17,015,045	0.04	0.19	0	0	0	0	1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Event							
(2) EPU	0.00028 0.2546						
(3) High Dummy Total	0.0001 0.6832	0.78417 <.0001					
(4) High Dummy Period	0.00152 <.0001	0.66587 <.0001	0.61662 <.0001				
(5) Event X EPU	0.95586 <.0001	0.08351 <.0001	0.0651 <.0001	0.05666 <.0001			
(6) Event X High Dummy Total	0.65029 <.0001	0.16878 <.0001	0.21463 <.0001	0.13335 <.0001	0.79642 <.0001		
(7) Event X High Dummy Period	0.67297 <.0001	0.13956 <.0001	0.12891 <.0001	0.20999 <.0001	0.7878 <.0001	0.78417 <.0001	

Table 4 *Descriptive statistics and correlation matrix of the final sample*

A major thing worth noting from the descriptive statistics is the median value of EPU variable, which differs from the median value used for High Dummy Total calculation and will therefore be explained more closely to ensure transparency. This table shows the descriptive statistics for all the observations, and therefore the median value shown here is actually the observation-weighted median of the individual months' EPU index values. The median value used for High Dummy Total is calculated by taking the median value of EPU indexes without weighting the months by observation quantities. The practical implication of the medians differing from each other is that there are more observations in the months that have less than median EPU value, and vice versa, less observations in the months that have over the median EPU value.

In the correlation matrix, the correlations between individual variables become visible. Apart from Event variable, all the variables correlate with each other at some level. Event also naturally correlates with its interaction terms, as well as with the High Dummy Period, but with an extremely low correlation coefficient of 0.1%. For other variables than Event, the correlations are not surprising, as EPU and both High Dummy variables are constructed from the same data, and all the interaction terms include Event and one of the economic policy uncertainty proxies.

The reason for the Event having high correlation coefficients (ranging from 65 to 96%) with the interaction terms is that when the Event retrieves the value of zero – which it does in 31 of 33 days in the earnings announcement window – the interaction term also retrieves zero due to the interaction term being the product of the two variables. Partially for the same reason, also all the interaction terms are correlating highly (from 78 to 80%) with each other.

6. Empirical analysis and results

In this chapter, the empirical analysis of the thesis is presented, as well as its results. The chapter is divided into two parts. First, replication of visual presentation of earning announcement's impact to trading volume by Beaver (1968) and later Dechow et al. (2014) (figure 1) is presented. The novelty value of this replication is the incorporation of economic policy uncertainty levels by dividing each time period to high and low EPU observations, thus not only showing the changes over time, but also the policy uncertainty's impact to the trading volume and magnitude of the phenomena.

In the second part of this chapter, the linear regression models explaining trading volumes are presented. There is a total of eight regression models in this thesis. Firstly, the regression models using High Dummy variables as proxies for the economic policy uncertainty are presented for the whole period and the three sub-periods. In the second set of regressions, the High Dummy variables are replaced with the raw values of EPU.

6.1. Extension of the methodology by Beaver (1968) and Dechow et al. (2014)

Beaver (1968) was the first to present trading volume related to days from earnings announcement. Dechow et al. (2014) extended this methodology by dividing the study period into different decades, showing the changes in information content over time. In this thesis the methodology is further extended, to include in addition to time also the level of economic policy uncertainty.

Due to time periods in this study not being decades as in Dechow et al. (2014), the charts without the incorporation of economic policy uncertainty are presented first. This way, the result of the information content of earnings announcements increasing over time by Dechow et al. (2014) is confirmed also for the time periods used in this thesis. As the distribution of trading volumes is naturally skewed to right, the same charts are presented for both median and mean trading volumes.

Starting with figure 8**,** it is evident that the result of Dechow et al. (2014) applies also to the periods used in this study. The increase in trading volumes in approximately one day before earnings announcement to two days after is clear from the figure 8. The overall trading volume and the magnitude of earnings announcements' impact on it is larger during the later periods.

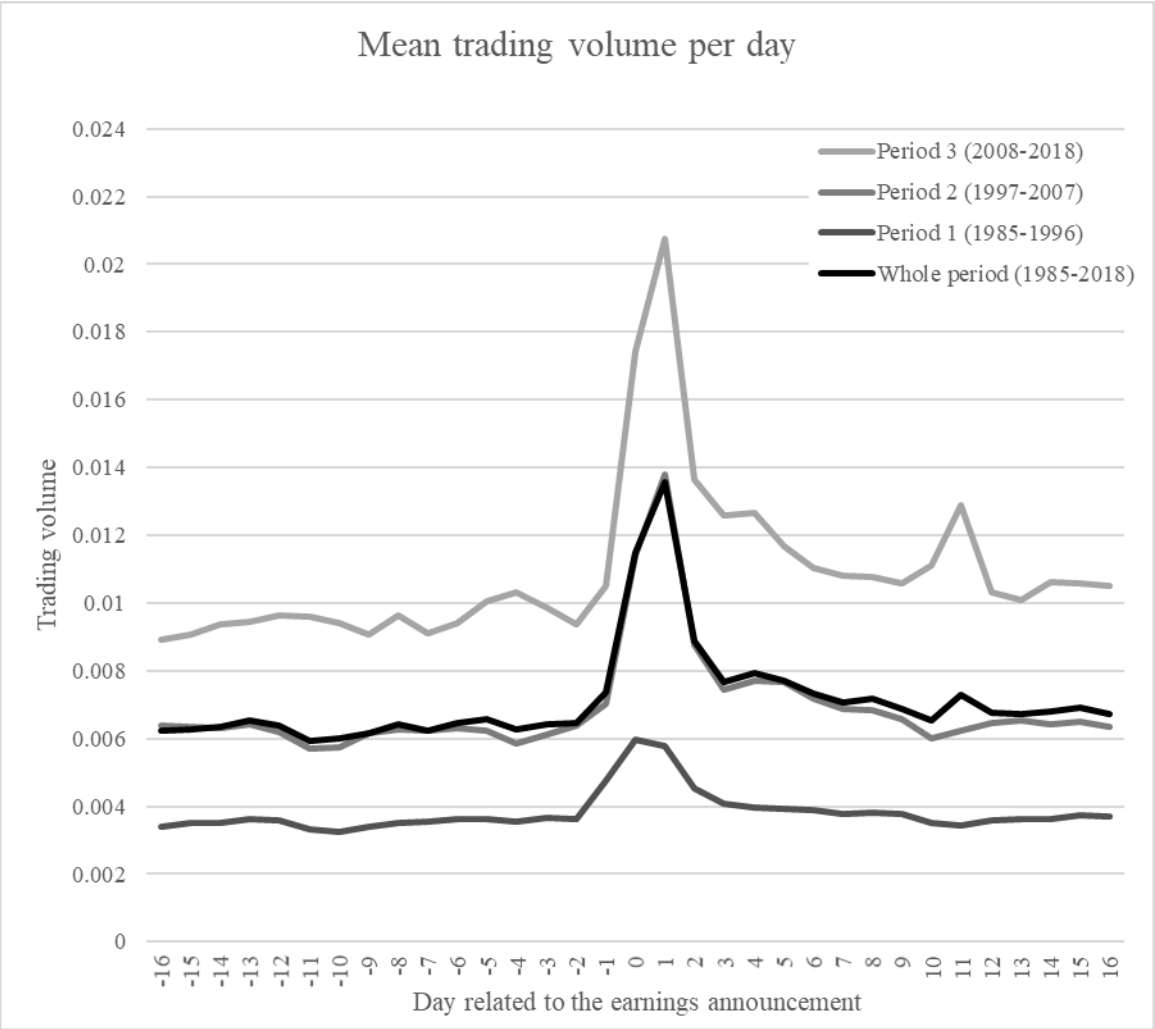

Figure 8 *Mean trading volumes during days close to earnings announcements, replicating methodology of Beaver (1968) and Dechow et al. (2014).*

For period 3, it seems that the increase in trading volume lasts longer than in the two other sub-periods. There is also a minor increase in trading volume approximately eleven days after the earnings announcement, which is surprising, but as this figure measures mean trading volumes it can also be caused by a few outliers with very large trading volumes. It is good to remind here that the measure of trading volume is the proportion of a company's shares being traded during a given day, 0.01 meaning that one percent of all stocks outstanding were traded during that day.

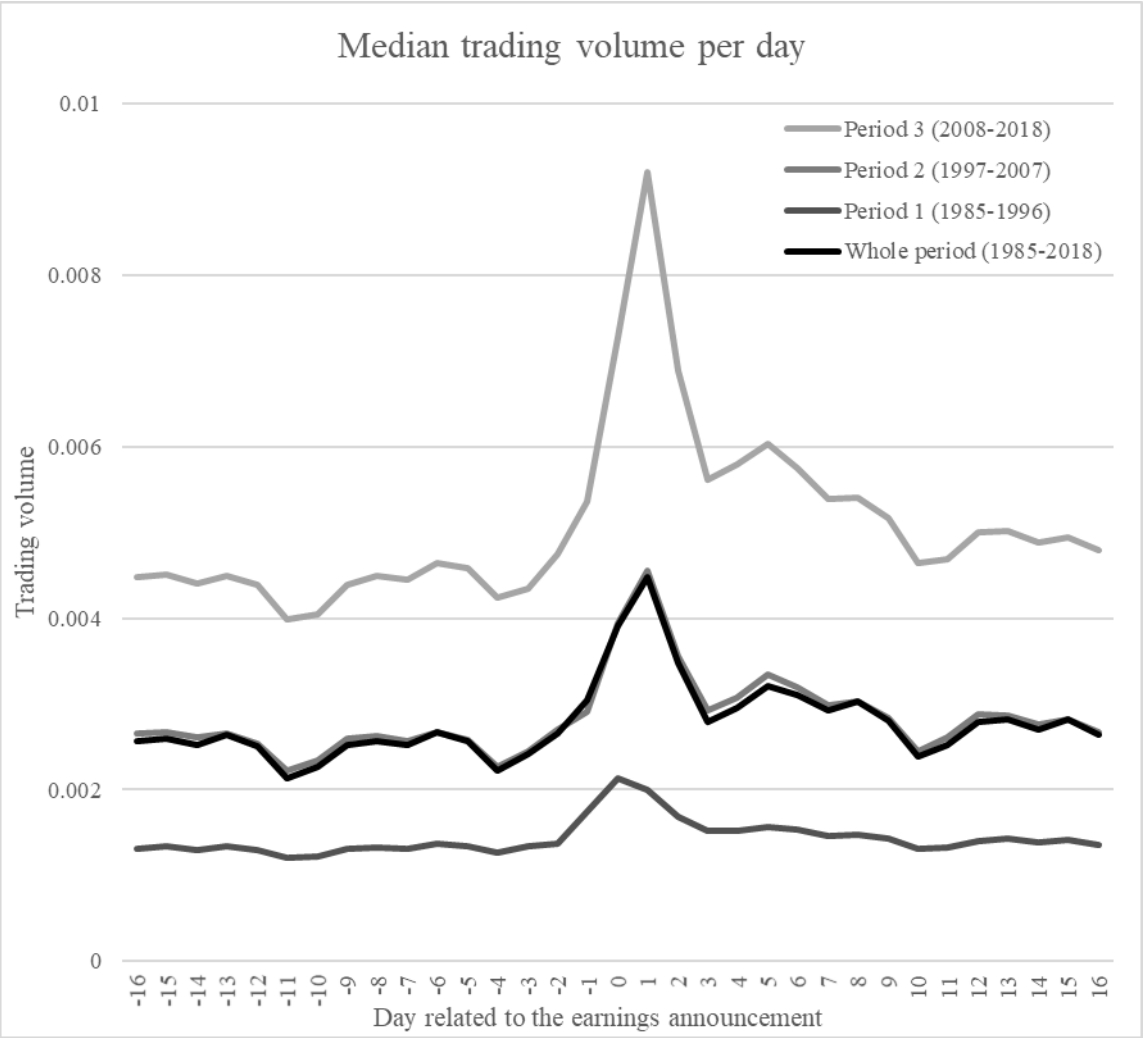

Figure 9 *Median trading volumes during days close to earnings announcement, replicating methodology of Beaver (1968) and Dechow et al. (2014).*

From figure 9 we can see how the phenomenon changes when using the median trading volumes instead of the means. The overall effect stays the same with large increases in trading volume right after earnings announcements, and the effect and trading volumes being larger in the more recent periods.

The trading volumes drop noticeably throughout the period due to right-skewness of the trading volumes. For the whole period, the mean trading volume stays at around 0.3-0.4% of company's stocks and raises to around 0.5% right after the earnings announcement, whereas for the median Figure the corresponding figures were 0.6-0.8% and 1.4%.

Also, the noise visible especially in the mean trading volumes during period 3 in figure 8 diminishes remarkably when the measure is changed to the median trading volumes. Overall, we can conclude that the results of Dechow et al. (2014) hold also in these periods. In the following figures, division to high and low EPU groups will be done.

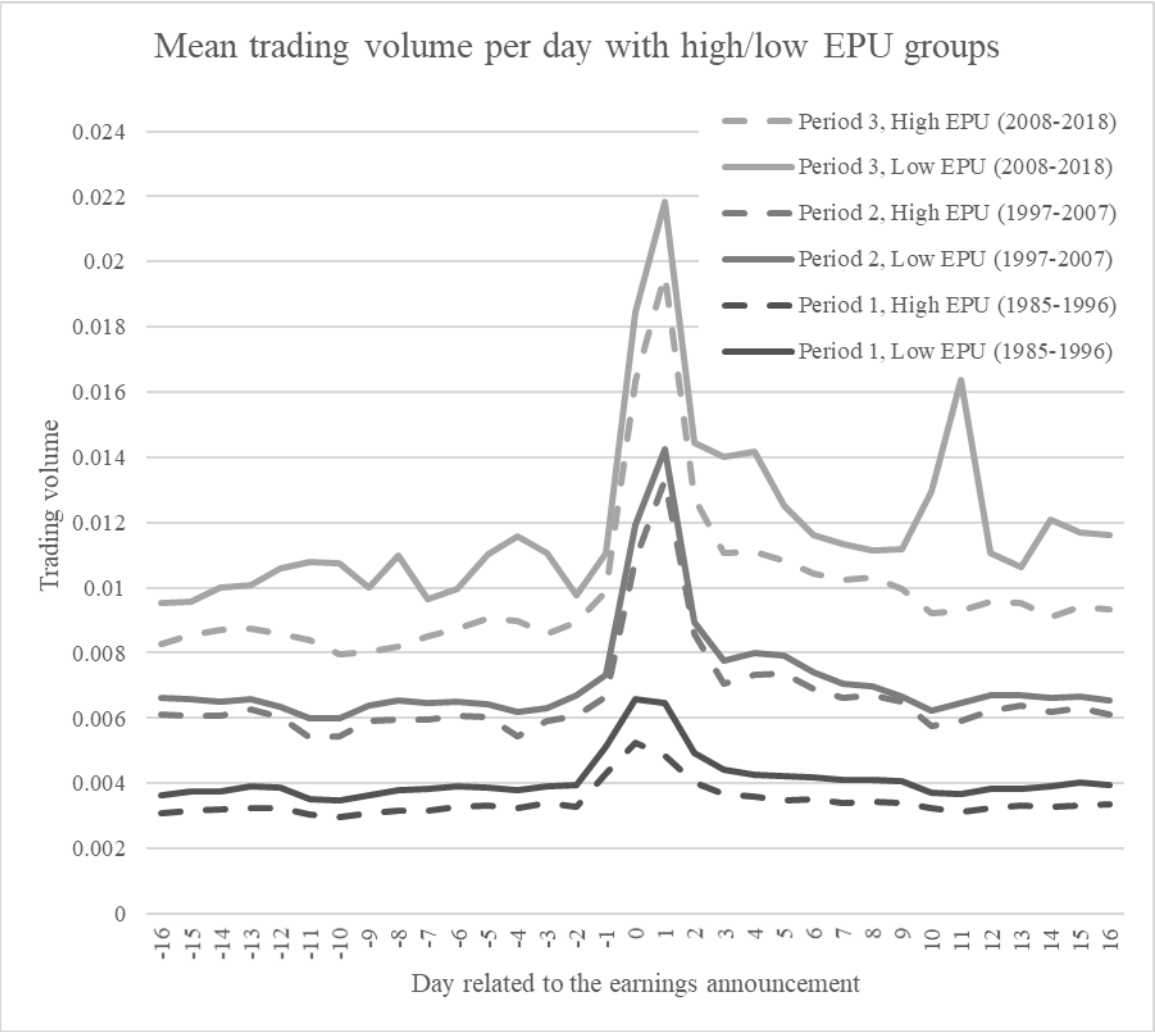

Figure 10 *Extension of Figure 8 where each period has been divided into observations from high and low (below/above median) EPU months.*

Figure 10 presents mean trading volumes in days related to earnings announcements with the time periods used earlier, but also with the high/low EPU groups. It is clear that the phenomenon exists in both high and low EPU groups, but the low EPU groups have overall lower trading volumes. Therefore, we can see that even though the phenomenon persists in different EPU levels, the level of EPU has a significant impact on the stock trading volumes.

Throughout the periods, increased economic policy uncertainty decreases trading volumes, also right after the earnings announcement. An interesting detail is the period 3's noisiness that was also visible in the figure 8. Now after dividing the period to high and low EPU groups, we can see that the noise actually occurred during the low EPU months, and for the high EPU months the trend is very similar to other periods but with higher overall trading volumes.

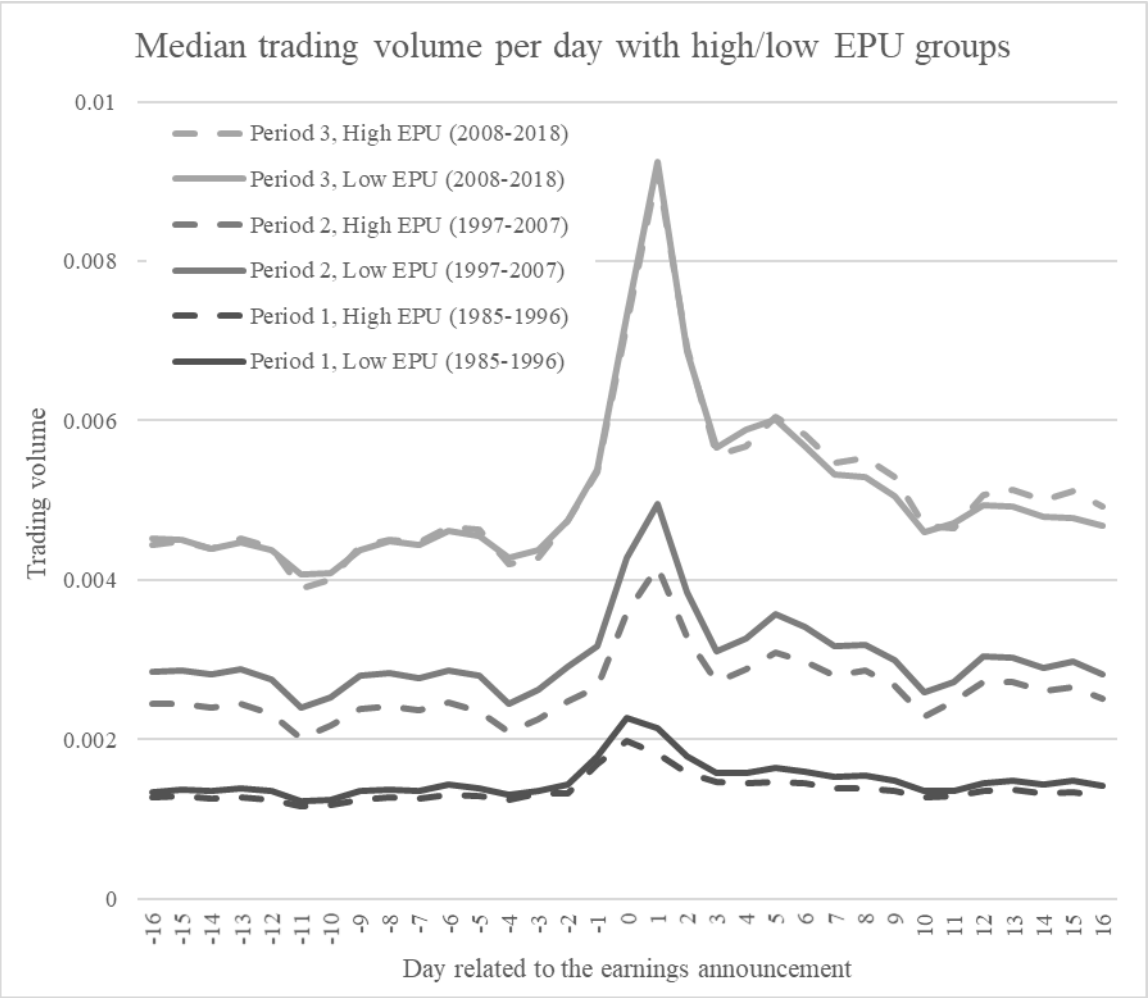

Figure 11 *Extension of Figure 9 where each period has been divided into observations from high and low (below/above median) EPU months.*

The median trading volumes in figure 11 follow the same trend as the mean trading volumes, but the differences between high and low EPU months are smaller, especially in the period 3. Similarly to the figure 10, the noise of the trade volume volatility in period 3 diminishes when using the median volumes compared to the means.

Overall, the result of higher economic policy uncertainty reducing stock trading volumes is clear after these analyses, even though there are significant differences between the time periods and the measure of trading volume used (mean or median). Especially in the period 1, there also seems to be a significantly smaller increase in the trading volume after earnings announcement during high EPU months than the low EPU months. In the periods 2 and 3, the effect diminishes and even though the trading is higher after the earnings announcement during low than high EPU months, the difference is approximately same as during all the other days of the period. This indicates that the difference does not come from the information content of earnings announcement being higher in low EPU months in period 2

and 3, but instead the shareholders are trading less during the earnings announcement window when the level of economic policy uncertainty is high.

The two charts that are split into high and low EPU months show a strong support towards $H1_1$ showing that the overall trading volume increases for months with higher EPU index values compared to the low EPU months. Based on these graphs no conclusions regarding H2 can be made, as there seem to be no clearly visible changes in the magnitude of the trading volume shock. Similarly, no conclusions for H3 can be made for the same reason. Because the results based on this primarily visual illustration are not sufficient to accept any of the hypotheses, the regression tests with probability values and confidence intervals are presented in the next section.

6.2. Regression models

In this chapter, the regression analysis of trading volume is presented. There are two separate regression models used with different proxies for economic policy uncertainty. Both regressions are run for the study period as a whole as well as separately for the three sub-periods to analyze how the impact of economic policy uncertainty on trading volumes has changed over time.

The first regression model uses the High Dummy variables to proxy economic policy uncertainty by dividing all the observations' months into high (above median) or not-high (below median) EPU index. The second regression uses the EPU index as a continuous variable to proxy for economic policy uncertainty, to show more closely how the changes in the EPU index affect trading volume, rather than using only the two groups of EPU index values.

6.2.1. High Dummy as a proxy for economic policy uncertainty

This chapter covers the empirical results for the first set of regressions. This set of regressions includes four separate regressions: one for each of the three sub-periods, and one for the study period as a whole. The regression equation used in this set of regressions is presented in the equation (1) below.

$$TradVol_{id} = \beta_0 + \beta_1 High_m + \beta_2 EA_{id} + \beta_3 High_m \times EA_{id} + \varepsilon_{id} \quad (1)$$

Where:

i = company

d = given trading day

m = the month of given trading day

High = an indicator variable that takes a value of 1 if the monthly EPU index value is above the sample median, and a value of 0 otherwise.

EA = an indicator variable that takes a value of 1 for earnings announcement event days, and a value of 0 otherwise. The earnings announcement event includes the day the earnings announcement is released on, and the day following the announcement.

In the table 6, the summary of the four regressions is presented. The first regression is for the study period from 1985 to 2018 as a whole, and the next three are for the individual sub-periods explained earlier in this thesis. As shown in the equation (1), these regressions use High Dummy as a proxy for increased economic policy uncertainty, whereas the next set of regressions use the raw value of EPU index as a continuous variable to proxy economic policy uncertainty.

	Whole period (1985-2018)	**Period 1 (1985-1996)**	**Period 2 (1997-2007)**	**Period 3 (2008-2018)**
	(1)	**(2)**	**(3)**	**(4)**
Intercept	0.00673***	0.00397***	0.00678***	0.01122***
	(143.77)	(625.57)	(292.68)	(70.02)
High Dummy	0.00012944*	-0.00062831***	-0.00046128***	-0.00187***
	(1.84)	(-65.56)	(-13.85)	(-8.13)
Event	0.00567***	0.00254***	0.00624***	0.00886***
	(34.24)	(111.57)	(76.09)	(15.69)
Event X High Dummy	0.00012944	-0.00081122***	-0.00053684***	-0.00032685
	(0.16)	(-23.58)	(-4.58)	(-0.40)
Adjusted R-Square	0.0001	0.0042	0.0016	0.0001
Number of Observation	17,015,045	5,313,167	6,624,309	5,077,569

Table 5 *Regression models explaining Tradvol by High Dummy, Event and the interaction term of the two in the whole study period and the three sub-periods.*

The Event variable is significant at a confidence interval of $p<0.001$ during the whole study period. In all regressions, the Event increases trading volume significantly, and the increase

is larger in the more recent periods. The coefficient of Event measures the incremental effect of earnings announcement event on trading volume. In period 1, the estimated coefficient of Event is 0.00254 and it is statistically highly significant (t-value=111.57). This implies that during the earnings announcement event, trading volume is approximately 64% higher compared to an average daily trading volume in the earnings announcement window. The estimated coefficient of Event increases to 0.00624 in period 2 and eventually to 0.00886 in period 3, both being statistically significant (t-value=76.09 in period 2 and t-value=15.69 in period 3). This shows that the earnings announcement event increases the daily trading volume by approximately 92% in period 2 and approximately 79% in period 3 compared to the average daily trading volume in the earnings announcement window.

A similar phenomenon is present with the Intercept term, which shows the estimate of trading volume for the observations that do not take place during the High Dummy months nor Event days. The Intercept term shows the increase in overall trading volume, as during the period 1, the value of Intercept term is 0.00397 (t-value=625.57), meaning that approximately 0.4% of the company's shares are traded each day. This increases to approximately 0.7% in period 2 (t-value=292.68) and eventually to 1.1% in period 3 (t-value=70.02). Based on these two terms, it is clear that the overall trading volume has increased over time. In addition, the trading volume has increased in absolute terms right after the earnings announcement, but not relative to the overall trading volumes.

The High Dummy variable is significant at a confidence interval of $p<0.001$ for each of the three sub-periods, but for the whole period at a significance level of only $p<0.05$. For the sub-periods, the High Dummy has negative coefficients showing that high policy uncertainty decreases the trading volume of a stock during the earnings announcement window, which supports the $H1_1$. The result of the whole period is conflicting with these period-specific results, as in that regression the coefficient of High Dummy is positive and thus the high policy uncertainty increases trading volume. This regression has the lowest r-squared, and the most insignificant confidence interval, which may explain the inconsistency. This still poses a need for future research, to explain the reason for the changing sign of the coefficient.

The interaction term of Event and High Dummy variables shows the relationship between the two variables. Analysis of this variable explores if High Dummy's impact to trading volume is incremental during the Event days, or if Event days impact to trading volume is incremental during high EPU months. The interaction term receives statistically significant

results at a confidence interval of $p<0.001$ for periods 1 and 2, but not statistically significant results for period 3 and the whole study period. For periods 1 and 2, the interaction term receives negative values, meaning that the high economic policy uncertainty decreases trading volume during the earnings announcement event days more than explained by Event days and High Dummy months alone. This supports hypothesis $H2_1$ and shows that at least in periods 1 and 2, the economic policy uncertainty has had a significant negative impact on the trading volume shock caused by the earnings announcement.

Therefore, it is evident that the interaction term provides incremental information on the effect that the high policy uncertainty has on trading volume during the earnings announcement event days. It can also be seen that over time the coefficient converges towards zero, as the interaction term's coefficient for period 2 is less negative than for period 1. The same phenomenon occurs also between period 2 and 3, even though the coefficient of period 3 is not statistically significant at desired coefficient levels. This shows that the effect has diminished over time providing support for hypothesis $H3_1$, possibly due to more accurate information being available that reduces the importance of mostly macroeconomic factors covered by the EPU index.

6.2.2. Continuous EPU index as a proxy for economic policy uncertainty

In this chapter, the regressions for the same four periods are run again, but this time using the raw values of the EPU index as a proxy for economic policy uncertainty. Regression used in this set of regressions is presented in the equation (2) below.

$$TradVol_{id} = \beta_0 + \beta_1 EPU_m + \beta_2 EA_{id} + \beta_3 EPU_m \times EA_{id} + \varepsilon_{id} \quad (2)$$

Where:

i = company

d = given trading day

m = the month of given trading day

EPU = value of EPU index in month m

EA = an indicator variable that takes a value of 1 for earnings announcement event days, and a value of 0 otherwise. The earnings announcement event includes the day the earnings announcement is released on, and the day following the announcement.

This analysis provides a broader view of economic policy uncertainty's impact on trading volumes during the earnings announcement window as it takes into account all the changes in the EPU index, rather than focusing purely on the dummy variable that shows only whether the EPU index is above or below the median value.

	Whole period (1985-2018)	**Period 1 (1985-1996)**	**Period 2 (1997-2007)**	**Period 3 (2008-2018)**
	(1)	**(2)**	**(3)**	**(4)**
Intercept	0.00555***	0.00568***	0.00836***	0.01394***
	(44.83)	(263.54)	(118.59)	(30.93)
EPU	0.00001181***	-0.00001933***	-0.00002033***	-0.00002846***
	(10.39)	(-94.23)	(-26.27)	(-8.33)
Event	0.00478***	0.00448***	0.00923***	0.00979***
	(10.93)	(58.03)	(37.17)	(6.20)
Event X EPU	0.00000873*	-0.00002244***	-0.00003664***	-0.00000863
	(2.18)	(-30.5)	(-13.47)	(-0.72)
Adjusted R-Square	0.0001	0.0054	0.0017	0.0001
Number of Observation	17,015,045	5,313,167	6,624,309	5,077,569

Table 6 *Regression models using EPU as a continuous variable. Tradvol is explained by EPU, Event and the interaction term of the two in the whole study period and the three sub-periods.*

In terms of Event variable and Intercept term this regression is very similar to the previous one. Both of these are statistically significant at a confidence interval of $p<0.001$ for all the four time periods used for the regressions. Also in these regressions, coefficients of both of these variables increase when the more recent periods are considered, showing the overall increase in the trading volumes that also applies to earnings announcement window.

The EPU index is also statistically significant at a confidence interval of $p<0.001$ for all four regressions. The coefficient of the EPU index is negative in all the three sub-periods, meaning that an increase in the EPU index and thus economic policy uncertainty decreases the trading volume of stocks. This further supports the abandonment of hypothesis $H1_0$ and thus proves the hypothesis $H1_1$. Similarly to the previous results of the regressions using the High Dummy as a proxy for economic policy uncertainty, in these regressions the whole period's coefficient for the EPU index that proxies economic policy uncertainty is positive. This implies that when the period is modelled as a whole, the increase in the EPU index would actually increase the trading volume.

The interaction term of Event and EPU index is significant at a confidence interval of $p<0.001$ for periods 1 and 2, and at a confidence interval of $p<0.05$ for the whole period. The coefficient of the interaction term is negative for periods 1 and 2, but minorly positive for the whole period. The negative coefficient of periods 1 and 2 means that there is an incremental decrease in the trading volume caused by the EPU index during the earnings announcement event days, in addition to the trading volume decrease that is already found to occur throughout the earnings announcement window. This proves the hypothesis $H2_1$ during periods 1 and 2, but during period 3 the $H2_0$ cannot be abandoned. The effect increases from period 1 to period 2, but becomes statistically insignificant in period 3, which gives mixed results for $H3_1$. The increase between period 1 and period 2 could partly be explained by overall higher EPU values in the period 1 (median of 105.79 compared to period 2's median of 85.13), but the reason cannot reliably be confirmed based on this study's methodology.

7. Limitations

Being one of the first studies combining the EPU index and the earnings announcement information content, this study provides an overview and good starting point for the future research, but also has significant limitations that are outlined in this chapter. In the next chapter, the research is concluded with suggestions for future research, that would tackle many of these limitations.

The main limitation of this study is the lack of macroeconomic and company-specific control variables, which makes the used methodology prone to omitted variable biases. As mentioned earlier, the EPU index is highly counter cyclical, whereas trading volume is found to have a positive relationship with good macroeconomic conditions. Therefore, the results can change significantly when the models are controlled for macroeconomic conditions. On the other hand, it is possible that some of the decrease in trading volume during bad economic conditions is a result of high economic policy uncertainty rather than the actual economic condition.

The lack of control variables also results in low r-squared values in all the regression models. It is important to note that this does not necessarily mean that the effect would be meaningless, as new insights are still provided into the old and already an exhaustive field

of research regarding the information content of earnings announcements. Having models with control variables and thus higher r-squared values would still help in isolating the observed phenomenon more accurately and in removing the omitted variable bias.

In addition to these two limitations, using only US-based stock-listed companies during the time horizon of 33 years limits the generalizability of the results. The sample is vast and can be generalized relatively well to other US-based companies as well, though it is good to note that this study does not take into account the company-specific conditions. The results cannot be generalized to other countries based on this study, as the characteristic of the earnings announcement information content and the exact methodology of the EPU index formulation varies between countries. Also, the effect cannot be generalized to other measures of political uncertainty, as this study only covers the economic policy uncertainty index by Baker et al. (2013).

8. Conclusions

This study has investigated economic policy uncertainty's impact on trading volume during the earnings announcement window, and more specifically on the trading volume shock caused by the releasement of an earnings announcement. This thesis is the first known study to combine the information content of earning announcements and the economic policy uncertainty, and thus provides major novelty value in the two research areas.

For this reason, the hypotheses were formed based on a very limited amount of prior research. Therefore, the null hypotheses are tested with two-sided alternative hypotheses regarding the overall impact of the EPU index on trading volume in the earnings announcement window and the EPU index's impact on the magnitude of the trading volume shock caused by the earnings announcement. This effect was expected to decrease over time, as more accurate data regarding companies has become available, and thus the third hypothesis has been tested one-sidedly.

The data for this thesis was retrieved from three sources: Economic policy uncertainty index from the corresponding website, daily trading volumes from Wharton Research Data Service's CRSP Daily Stock database and earnings announcement dates from the same providers database named CRSP/Compustat Merged Database – Fundamentals Quarterly.

These three data sets were merged, filtered and grouped for the empirical analysis to end up with the final dataset of 17,015,045 daily trading volume observations.

The empirical analysis was performed by regression analysis, where daily trading volume was explained by a proxy for economic policy uncertainty (separate regressions for high dummy variable and EPU as continuous variable), earnings announcement event dummy, and the interaction term of the two. These two separate regressions were run for different time periods as well as the study period as a whole. In addition, the methodology of Beaver (1968) and Dechow et al. (2014) was replicated with the incorporation of the high and low EPU groups, to illustrate the impact of economic policy uncertainty.

Similar limitations are present in both methods. No controls are used in the empirical analysis, and thus these results cam be prone to the omitted variable bias. One potential omitted variable already identified in this thesis is the overall economic condition, in terms of for example GDP growth. During bad economic conditions the overall trading volume decreases, and as the EPU index is highly counter cyclical, some of the EPU index's impact on trading volume can actually be caused by the overall economic conditions.

Regardless of these limitations, results with significant novelty value were found in the empirical analysis. Firstly, it was found that high economic policy uncertainty decreases trading volume during the earnings announcement window. The magnitude of this effect varied between different periods and was smaller especially during the most recent period. Overall, this shows that during high economic policy uncertainty the impact of factors decreasing trading volume, such as the worse economic conditions exceed the impact of factors increasing the trading volume, such as the larger investor disagreement.

Secondly, it was found that higher economic policy uncertainty further decreases the size of the trading volume shock caused by the earnings announcement in periods 1 and 2. In the most recent period, this effect became statistically insignificant. For periods 1 and 2, the decrease is incremental to the overall decrease in trading volume explained in the previous chapter.

Thirdly, the results regarding the development of this impact's magnitude over time were contradictory. When using high economic policy uncertainty as a dummy variable, the effect decreased between periods 1 and 2, and became statistically insignificant in period 3. However, when using the EPU index as a continuous variable to proxy policy uncertainty,

the effect of the interaction term actually increased between periods 1 and 2, eventually becoming statistically insignificant in period 3.

These findings open a new area for research in the context of earnings announcement information content. This study gives the first glimpse to the impact of economic policy uncertainty on the information content of earnings announcement, but more research regarding the topic is still needed. The research could be continued by adding control variables that include company-specific, as well as macroeconomic factors to the methodology used in this study. Also, additional countries to the US could be incorporated into the analysis, as the EPU index is available for approximately twenty other countries as well. In addition, shorter time periods than the periods of approximately 10 years that are used in this study, could be used in the future research. Finally, a more qualitative research approach could be taken to fill the void left by this analysis. The future research could aim at answering questions such as why high economic policy uncertainty decreases the overall trading volume, and why the incremental effect is larger during the earnings announcement event days.

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