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A cross-country comparison of the influence of industry homogeneity on post-earnings announcement effects

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Abstract

The effects of an earnings announcement on a firm's stock price have been broadly studied. As multiple studies show, a stock price tends to "drift" in the direction of observed unexpected earnings. This "Post-Earnings-Announcement Drift" (PEAD) can be observed after an earnings announcement. According to Shin et al. (2019), industry homogeneity negatively influences a firm's PEAD. This study investigates whether being included in a developed market or a secondary-emerging market differs the influence of industry homogeneity on the magnitude of a firm's PEAD. As the developed market, the S&P500 index was used, and as the secondary-emerging market, the CSI300 index was used. The magnitude of the PEAD was measured by the Cumulative Abnormal Returns (CAR), which is caused by a firm's Standardized Unexpected Earnings (SUE). The industry homogeneity was calculated by finding similarities in the firms' operating expenses. In line with the expectation, this study shows a negative relationship between industry homogeneity and a firm's CAR. However, the study provided no significant results to indicate whether the type of market influences this relationship. For this reason, the magnitude of PEAD is not more negatively related to industry homogeneity in Chinese stock markets than in USA stock markets.

Keywords: Post-Earnings-Announcement Drift, PEAD, cumulative abnormal returns, CAR, developed markets, secondary-emerging markets, China, USA, Industry Homogeneity

Contents

1 Introduction

Fluctuations of stock prices have been broadly studied. As Coombs and Bowen (1971) stated: risk can be perceived as a function of variance and expectations. For a long time, traders are trying to find patterns in the stock fluctuations. After all, betting becomes a lot easier when you know the outcome. However, this carries a problem. When everybody knows the outcome, betting becomes worthless. The ideal scenario for a trader would be that the trader is the only person who knows how to predict a market, without sharing its secret with the rest of the world. The history of studies shows that it is not easy to determine whether stock price fluctuations are predictable, or not.

This study will conduct a cross-country comparison of the influence of industry homogeneity on post-earnings announcement effects. Thus, the studied effect of industry homogeneity on a firm's CAR for multiple days after an earnings announcement will be compared between two countries. One of the discovered post-earnings announcement effects is the phenomenon that the standardized unexpected earnings (SUE) cause the cumulative abnormal returns to drift. This is also referred to as the "Post-Earnings-Announcement Drift" (PEAD). This will be elaborated on in the methodology section.

This study aims to observe whether the influence of industry homogeneity on the magnitude of a firm's PEAD differs between developed countries and secondary-emerging markets. USA firms, which are included in the S&P500 index are used in this study to represent a developed country. Chinese firms, which are included in the CSI300 index are used in this study to represent a secondary-emerging country. This study aims to answer the following research question:

To what extent does the influence of industry homogeneity in the magnitude of PEAD differ between developed stock markets and secondary emerging markets?

To answer this research question, an event study is conducted. A linear regression model is applied with multiple interaction terms. The earnings announcement days are used as the event date. Subsequently, from the event day on, the abnormal returns in the successive 60 trading days are monitored to measure the development of the stock performance after an earnings announcement.

According to Cairney and Young (2006), a comparison of operating expenses shows the most accurate measurement to determine the degree of homogeneity of an industry. Therefore, in this study, the firm's industry homogeneity is annually measured by the similarities in operating expenses between firms that are included in a certain industry. Both positive and negative SUEs are included in the general approach.

With the general approach, the effect of SUE shows no significant results on a firm's PEAD magnitude. Since many prior studies show a significant positive effect of SUE on a firm's cumulative abnormal returns, several robustness analyses are conducted. One of the robustness analyses is the separation between negative and positive standardized unexpected earnings. An additional robustness analysis includes the industry homogeneity measurement of 2020, which will be used to allocate to the firms from 2010 until 2020.

With the approach to use merely the latest industry homogeneity measurements, the model shows significant influences, in contrast to the annually calculated industry homogeneity. When combining positive SUEs with the most recent industry homogeneity approach, multiple significant effects are observed. The results of this study show additional evidence for the negative relationship between industry homogeneity and a firm's PEAD magnitude. However, this study shows no significant difference in the influence of industry homogeneity between developed markets and secondary-emerging markets.

The discovered evidence of the negative relationship between industry homogeneity and a firm's magnitude in PEAD makes this paper a relevant addition to the academic knowledge about the behavior of PEAD. As mentioned before, the behavior of PEAD does not significantly differ between developed and secondary-emerging markets. Although no significant relationship is found, limited research has yet been done on the behavior of the industry homogeneity influence on a firm's PEAD. It is important to thoroughly understand whether this effect is consistently applicable, or whether it needs to meet certain criteria to occur.

It is relevant for any stakeholder to know how this drift behaves in different markets. Shin et al. (2019) conducted a study on the effect of industry homogeneity on the magnitude of a firm's PEAD. They found a significant negative relationship between industry homogeneity and the magnitude of a firm's PEAD. This implies that a higher degree of industry homogeneity results in lower cumulative abnormal returns (CAR), which is in line with the results of this study. A more elaborated theoretical background will be provided in the theoretical framework section.

As mentioned before, an ideal scenario for a trader would be that it is the only person who knows how to predict a market. This study shows more evidence for the fact that markets could be predicted to some degree. This is in line with theories that state the market is inefficient. To find any arbitrage possibilities, every possible way to predict a market must be discovered. Therefore, it is important to conduct studies on firms' abnormal return fluctuations.

As the findings of Shin et al. (2019) about the influence of industry homogeneity are very interesting, it is interesting to investigate whether this effect is different in different markets. As the study of Shin et al. (2019) merely focuses on the Korean market, it is highly relevant to investigate whether this effect is different in countries that have a different degree of development. This study shows that the influence of industry homogeneity on a firm's PEAD does not significantly differ between differently developed markets. This could imply that the degree of influence of industry homogeneity on the magnitude of PEAD is not dependent on how far a market is developed.

First, this paper will discuss the background literature about prior findings. Secondly, chapter 4 describes the applied methodology. Chapter 4 explains the used data and the calculations of the variables. Furthermore, the applied approach will be discussed. Subsequently, the results will be treated in chapter 5. In addition, any performed robustness analyses will be discussed in this chapter. When the results are defined, the outcomes will be evaluated in chapter 6. Any limitations and suggestions for further research will be mentioned in chapter 6. Finally, the concluding findings will be stated in chapter 7, together with the practical implications.

2 Theoretical framework

2.1 Market hypotheses

As mentioned before, it has been broadly studied whether the fluctuations of stock valuations are predictable by determining patterns. One theory is called the 'Efficient Market Hypothesis' (EMH). Fama (1970) states that a market in which prices always "fully reflect" available information is called "efficient", and Malkiel (1989) states that a market is efficient if the price would be unaffected by revealing the information set to all market participants. The stated theory of Fama (1970) resulted in notable reactions.

According to Malkiel (1989), since Roberts (1967) it is customary to classify the 'strength' of the market's efficiency into three forms. In the first place, there is the 'weak form' of the Efficient Market Hypothesis (EMH). This implies that prices fully reflect the information contained in the historical sequence of prices (Malkiel, 1989). The second form is the 'semi-strong' form of EMH. This form implies that current stock prices reflect not only historical price information but also all publicly available information relevant to a company's securities (Malkiel, 1989). Lastly, there is the 'strong form' of EMH. This form implies that all information that is known to any market participant about a company is fully reflected in market prices (Malkiel, 1989).

The weak form of the EMH is also known as 'the random walk theory' (Malkiel, 1989) (firstly mentioned by Pearson (1905)). This theory indicates that the market is never predictable because the stock valuations follow a random pattern. The theory implies that a decline and rise in a stock price is not possible to predict, because the market already includes all of the available information (including the firms' risks and opportunities). Although this theory knows a broad history of development, the random walk theory was tested for the first time by Bachelier (1900). Bachelier (1900) states that it is impossible to expect a mathematically exact forecast, due to the attendance of an infinite number of factors.

In contrast to the theory of an efficient market, the main thoughts of the Capital Asset Pricing Model (CAPM) were formed in the 1960s by Sharpe (1964) (and Sharpe (1963)), Treynor (1962), Lintner (1965), and Mossin (1966). Although the model began to form in the 1960s, the efficient markets theory reached its height of dominance in academic circles around the 1970s (Shiller, 2003). Merton (1973) combined the works of Sharpe (1964), Lintner (1965), and Mossin (1966) to create one inter-temporal capital asset pricing model. In that same year, Malkiel (1973) wrote an extensive book regarding the random walk theory, which made the random walk theory more popular to accept. After the formation of the original CAPM model, multiple extensions to the model were applied.

The belief of markets not being efficient makes studies want to find 'anomalies'. An anomaly can be interpreted as a structural, replicable pattern, that cannot be explained in the framework of existing (mainstream) theory, but can (potentially) be explained economically (Versijp, 2021). It could be exploited to generate excess returns whenever a new anomaly is found (which is not yet discovered by a certain proportion of other investors). The famous paper from Fama (1970) showed a three-factor model where the market risk could be predicted by three market factors. In the first place, the study shows that the size of a firm influences stock returns. This implies that small firms outperform large firms in the long run. Secondly, firms with a high market-to-book ratio tend to outperform firms with a low market-to-book ratio. Lastly, the overall market risk premium was discovered, which is the difference between the expected market returns and the risk-free rate. These findings are a foundation for the hunt for new anomalies that have yet to be discovered.

After conducting two studies, Malkiel (2003) conducted a third study. This study elaborated on the criticism regarding the EMH. Malkiel (2003) states that no anomalies could be exploited to create excess returns after they have been discovered and publicized. Although this is true, one counterargument is the possibility of exploiting an anomaly before it becomes public, by remaining a secret from the concerned investors. According to the findings of Calluzzo et al. (2019), there is an increase in anomaly-based trading when information about the anomalies is readily available through academic publications and the release of necessary accounting data. Lastly, Malkiel (2005) published a fourth study, which reviews the earlier reviewed EMH. This study states clearly that past firm performance is not able to predict future firm performance.

The possible existence of undiscovered anomalies leaves room for discussion on whether markets follow the random walk theory or not. Even though there are reasons to accept the random walk theory, prior studies have also stated counterarguments to show why markets are not efficient. More recent studies show market inefficiency based on behavioral finance. Behavioral finance shows us that markets are not always driven by rational decisions. Traders make decisions, which are influenced by their behavior. For example, traders are likely to have a loss aversion, be overconfident, and overreact to new information. One counterargument arose by Grossman and Stiglitz (1980): A price cannot fully reflect costly information. This argument indicates that information comes with a cost, which can be seen as a form of transaction costs. An example of information costs is that traders could carry the 'home bias'. The home bias indicates the tendency for traders to trade in domestic markets. Hence, trading in a domestic market carries fewer information costs for the trader to understand the respective market.

Barber and Odean (2008) found the effect that individual investors are more likely to buy attention-grabbing stocks than stocks that grab less attention. In this study, a stock is grabbing the attention of certain events: news, unusual trading volume, and extreme returns. Although this study shows active individual trading, it shows that attention-driven buying patterns do not generate superior returns. In line with the attention-driven stock buying behavior, Dellavigna and Pollet (2009) discovered the 'Friday effect'. Dellavigna and Pollet (2009) expected a lower response by investors when the earnings were announced on a Friday, in comparison to other weekdays. Due to this less immediate response to an earnings announcement, a longer drift was expected. They found a 15% lower immediate response and a 70% higher delayed response. An additional finding is the lower trading volume, which is 8% lower around Friday announcements.

The arguments of both theories lead us to the following theory: the Adaptive Market Hypothesis (AMH), which is founded by Lo (2004). This theory combines the EMH with behavioral finance, which implies a changing market with changing profit predictability. With the AMH, 'market efficiency evolves instead of being subject to the conventional view of all-or-nothing efficiency' (Urquhart and McGroarty, 2016). According to Lo (2004), the AMH states that 'investment strategies undergo cycles of profitability and loss in response to changing business conditions, the number of competitors entering and exiting the industry, and the type and magnitude of profit opportunities available'. This implies that trade opportunities shift over time. During certain periods, the market could be efficient, while in other periods the market could carry arbitrage possibilities. The study of Urquhart and McGroarty (2016) found a confirming fluctuation in market return predictability. The study shows that certain market conditions influence market predictability differently in comparison to other market conditions. Additionally, they found that the stocks carry a different manner of predictability in different periods.

2.2 Post-Earnings-Announcement-Drift

In contrast with the EMH of Fama (1970), Ball and Brown (1968) found an anomaly in the long-term performance of 'winning' stocks and 'losing' stocks. This indicates that stocks could be predictable after all, contrasting the EMH. The "Post-Earnings Announcement Drift" (PEAD) is an anomaly that describes the drift of a firm's stock prices tend to continue to drift upward (or downward) for an extended period, following earnings announcements when the quarterly earnings were above (or below) expectations (Fink, 2021). Livnat and Mendenhall (2006) appoint in their definition that the drift is specifically applicable to a stock's cumulative abnormal returns (CAR). Abnormal returns are defined as the difference between the expected returns of a security and the actual returns of that security.

Common reasons for the existence of this drift are limited investor attention and limits to arbitrage. Ball and Brown (1968) found the PEAD for the first time, indicating that positive earnings surprises cause a firm's CAR to drift upwards, and negative earnings surprises cause a firm's CAR to drift downwards. The study of De Bondt and Thaler (1985) confirms this anomaly in the long-term performance of 'winning' stocks and 'losing' stocks. However, according to Fink (2021), the effect was most convincingly demonstrated by Bernard and Thomas (1989) and Bernard and Thomas (1990).

An earnings surprise indicates the difference between a firm's expected earnings and a firm's actual earnings. An earnings surprise could also be referred to as the 'unexpected earnings' The calculation of a firm's earnings surprise is also referred to as a formula, to compute a firm's 'standardized unexpected earnings' (SUE). This is why the anomaly is often called the 'SUE-effect' (Fink, 2021).

Although various studies apply a different event window to calculate a firm's CAR, the methodology of Shin et al. (2019) implies that a firm's CAR is the size-adjusted cumulative abnormal returns over the 45 (or 60) trading days starting from the day after the earnings announcement (day 0) for quarter t. This is in line with the approach from Kovacs (2016), where the post-earnings-announcement drift shows an increase of the abnormal returns in a 60 trading days window, after a positive information announcement. Shin et al. (2019) expected to find a lower under-reaction to earnings information in homogeneous industries, due to the existence of similar accounting information. In line with their expectations, they observed a negative relationship between the magnitude of PEAD and industry homogeneity at firms listed on the Korean Stock Exchange.

2.3 A comparison of stock markets

The PEAD phenomenon is observed across different countries. However, the study of van Huffel et al. (1996) observed no PEAD in Belgium and the study of Ariff et al. (1997) observed no PEAD in Singapore. According to (Fink, 2021), due to the observed PEAD in multiple other countries, there is little evidence against the notion that PEAD is a global phenomenon. Relevant to this study are the findings of Truong (2011). From 1994 to 2009, the study of Truong (2011) observed the existence of PEAD in China.

Due to the findings of Shin et al. (2019) at firms listed on the Korean Stock Exchange (South Korea), it is relevant to investigate whether this effect applies to other countries and if applicable, to what extent this industry homogeneity effect differs from industry homogeneity effects in other stock markets. Worth mentioning are the characteristics of the South Korean market in the applied sample period. Shin et al. (2019) used data from 2005 to 2015. According to the study of Griffin et al. (2010), a post-earnings drift-based trading strategy yields returns of similar magnitude in developed and emerging markets. Thus, becoming a developed market does not imply a significant difference in the firms' PEAD.

Although this study was conducted by using data from 1994 through 2005, the study of Hung et al. (2015) observed similar results. They found that investor distraction and arbitrage risks affect PEAD in developed markets, whereas transaction costs influence PEAD in emerging markets. Although there are similar magnitudes of PEAD observed in emerging and developed markets, there are differences in the industry homogeneity between these markets. According to Divecha et al. (1992), emerging markets are more homogeneous than developed markets.

According to the FTSE Global Equity Index Series Country Classification, South Korea was classified as a developed market in September 2009. From September 2006, South Korea was classified as an advanced emerging market. This implies that South Korea was not always classified as a developed market during the sample period. Because South Korea was not always classified as a developed market, it is relevant to investigate the relationship between industry homogeneity and the degree of market development. The USA stock market was classified as 'developed' from 2010 until 2020 and the Chinese stock market was classified as 'secondary emerging' from 2010 until 2020. Due to the observed existence of PEAD in the Chinese stock market by Truong (2011) and the existence of PEAD in the USA stock market by (Ball and Brown, 1968), it is relevant to investigate whether an industry homogeneity relationship with PEAD magnitude differs between developed stock markets and secondary emerging stock markets.

2.4 Industry Homogeneity

Multiple studies apply a broad definition of how industry homogeneity. Divecha et al. (1992) and Parrino (1997) used stock returns to determine the industry homogeneity. The study of Parrino (1997) mentions this is a "natural proxy since a firm's stock price reflects the present value of its residual cash flow". The study states that firms that get affected by similar news items tend to experience similar stock price fluctuations. However, other studies define industry homogeneity by comparing firms' accounting measurements. For example, the study of Balsam et al. (2003) studied the relationship between the industry expertise of an auditor and a client's performance. However, a broad understanding of industry homogeneity was adopted to define an 'industry expertise'.

A later study by Cairney and Young (2006) wanted to show what characteristics of industry homogeneity industries were causing the auditors' specialization. They used a firm's change in operating expenses as a proxy for industry homogeneity. This was used since a firm's operating activities impact its cost structure. They state that the impact of a firm's cost structure differs in automated industries from less automated industries, where the changes in operating expenses can show the difference in the way economic forces affect the operating expenses. With a similar change in operating expenses, it is likely to be a homogeneous industry, as the firms similarly react to economic forces.

Cairney and Young (2006) state that it is important that homogeneous firms are included in the same three-digit SIC (SIC3) code industry. This is relevant due to the similar cost structure between firms in the same SIC3 industry. Additionally, Cairney and Young (2006) found that the industry homogeneity (by measuring the change in operating expenses) is significantly associated with levels of auditor specialization. The study of Shin et al. (2019) also defines 'industry homogeneity' as firms in the same three-digit SIC (Standard Industrial Classification) code industry (SIC3), which carry similar changes in operating expenses, which is in line with the definition of Cairney and Young (2006).

2.5 Hypothesis

The existence of PEAD is observed in various countries. Due to the findings of Griffin et al. (2010), no differences in the magnitude of PEAD between secondary emerging markets and developed markets are expected. However, according to the findings of Divecha et al. (1992), differences in the influence of industry homogeneity between emerging markets and developed markets are expected.

As mentioned before, emerging markets are more homogeneous than developed markets. In this study, this implies that more homogeneous industries within a market tend to gain lower abnormal stock returns in the emerging markets than in the developed markets. The study of Shin et al. (2019) suggests that higher industry homogeneity leads to a lower magnitude of a firm's PEAD. Combining these findings, it is expected that emerging markets have higher industry homogeneity, and therefore a lower magnitude in PEAD. In conclusion, this study expects that the relationship between the magnitude of PEAD and industry homogeneity is more negatively related in emerging markets than in developed markets. Thus, the magnitude of PEAD is lower in emerging markets than in developed markets, caused by a higher industry homogeneity.

The USA stock market was classified as 'developed' from 2010 until 2020, and the Chinese stock market was classified as 'secondary-emerging' from 2010 until 2020. Both markets contain a sufficient amount of data. Therefore, these markets will be used in this study to investigate the differences in industry homogeneity influences. To answer the research question, the following hypothesis was adopted:

H0 = The magnitude of PEAD is more negatively related to industry homogeneity in

Chinese stock markets than in USA stock markets.

Ha = The magnitude of PEAD is not more negatively related to industry homogeneity in Chinese stock markets than in USA stock markets.

3 Data

In this section, it will be described how the relevant panel data was retrieved.

Because the Chinese and USA listed markets contain many firms, the largest firms in the Chinese market and the largest firms in the USA market will be compared. These indices will be used in this study to be able to make a fair comparison between the Chinese market and the American market. This does exclude the smaller firms of a listed firm. Therefore, it is important to mention that this study is merely focusing on larger firms. This implies that this study does not apply to smaller listed firms.

China and the USA contain multiple indices. The Chinese data is retrieved from the CSI300 index, which stands for the China Securities Index, including the 300 largest A-share firms on the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE). To elaborate, A-shares indicate stock shares of mainland China-based firms, which trade on both the SSE and the SZSE. The USA data is retrieved from the S&P500, which stands for Standard & Poor's index, including the 500 largest firms on the American capital market.

The data of both indices are retrieved from the Refinitiv Eikon platform, and apart from the Chinese operating expenses, all the data is retrieved from the Refinitiv Eikon platform in USD. The Refinitiv Eikon platform contains multiple databases, which carry time-series data, as well as static data. Worth mentioning is the fact that indices refresh their included firms, as it continuously alters what firms are the largest firms on the markets. To follow the data window of Kovacs (2016) and Shin et al. (2019), the sample includes actively listed firms from 2010 until 2020. The data for Chinese firms from before 2010 is very limited. Therefore, the most recent available data window (which is in line with the studies of Kovacs (2016) and Shin et al. (2019)) applied. In this way, as much as possible available data is retrieved, and the results could still be fairly compared with the study of Shin et al. (2019). The composition of both indices is retrieved on May 30, 2022.

This study will conduct an event study, where a firm's earnings announcement date is considered as the event date. In this study, the earnings announcement date is defined as the EPS quarterly reporting date, which is retrieved from the Worldscope database. The dataset contains firms that carry event dates in each quarter, as including firms that only report their earnings annually could bias the results. Any firm with missing or incorrect variables will be excluded from the sample. Incorrect variables include event dates that occurred more than once at the data retrieval and firms that only have annual EPSs available. The indices were retrieved from a constituent list from the Refinitiv Eikon database, where the firms' ISIN codes were used to retrieve other firms' related data.

3.1 Summary Statistics

The regression analyses will apply winsorized variables to tackle possible heteroscedasticity. The continuous variables are winsorized at a 1% and 99% level, indicating that the largest and smallest 1% of the price to book value will be excluded from the dataset. In table 1, the descriptive statistics of the applied winsorized variables and the dummy variables are stated. Subsequently, the correlation coefficients between the applied variables are observed. Due to the included nominal dummy variables, Spearman's correlation was conducted. This is a nonparametric test that does not need a linear relationship and a normal distribution. In table 2, the correlations between the variables of the observed firms can be found. As can be seen in the table, several variables carry a significant correlation coefficient. However, there is only a moderately significant positive correlation between the USA dummy and a firm's market value. Hence, it can confidently be stated that USA firms have a higher chance of having a higher market value.

Table 1: Descriptive statistics

Variable	*N*	Mean	S.D.	Min.	Max.
Dependent variables					
CAR60	23,952	-.0036	.1433	-.4233	.4104
SUE	23,885	-.1794	2.6859	-9.9777	8.1138
HOGN	30,836	.2216	.2436	-.2751	.8178
lnMV	27,499	9.3651	1.2810	6.0149	12.4304
PtoB	28,470	3.7099	5.4961	-19	33.53
USADum	32,080	.6259	.4839	0	1
FridayDum	32,080	.0885	.2841	0	1
Q1Dum	32,080	.25	.4330	0	1

N number of observations, *S.D.* standard deviation, *Min.* minimum, *Max.* maximum.

Table 2: Correlation coefficients between variables

	CAR60	SUE	HOGN	lnMV	PtoB	USADum	FridayDum	Q1Dum
CAR60	-							
SUE	-.0101	-						
HOGN	.0058	.0380*	-					
lnMV	.0047	-.0048	-.0662*	-				
PtoB	-.0046	.0375*	-.2124*	.0270*	-			
USADum	.0323*	-.0053	.0312*	.3215*	.0350*	-		
FridayDum	-.0160*	-.0098	.0208*	-.0046	-.0485*	-.1599*	-	
Q1Dum	-.0430*	.0946*	.0018	-.0194*	-.0285*	.0082	.0149*	-

*$p < 0.05$. Spearman's correlations were used to retrieve the correlation coefficients.

With $CAR60$ = Cumulative (size-adjusted) abnormal returns for 60 trading days following the earnings announcement date
SUE = Standardised unexpected earnings
$HOGN$ = Industry homogeneity
$ln(MV)$ = Firm size, measured as the logarithm of market value
$PtoB$ = Price-to-book value ratio, measured as market value divided by total equity
$USADum$ = Dummy to indicate whenever the firm is included in a USA index
$FridayDum$ = Dummy to indicate whenever the EPS report date occurred on a Friday
$Q1Dum$ = Dummy to indicate whenever the EPS report date occurred on the first quarter

Figures 1 and 2 show the winsorized observations which are included in the regression analyses. In the appendix, the scatterplots (not winsorized) of the full dataset can be found.

Figure 1: Two-way scatter plot with winsorized CAR60 as the dependent variable and winsorized HOGN as the independent variable

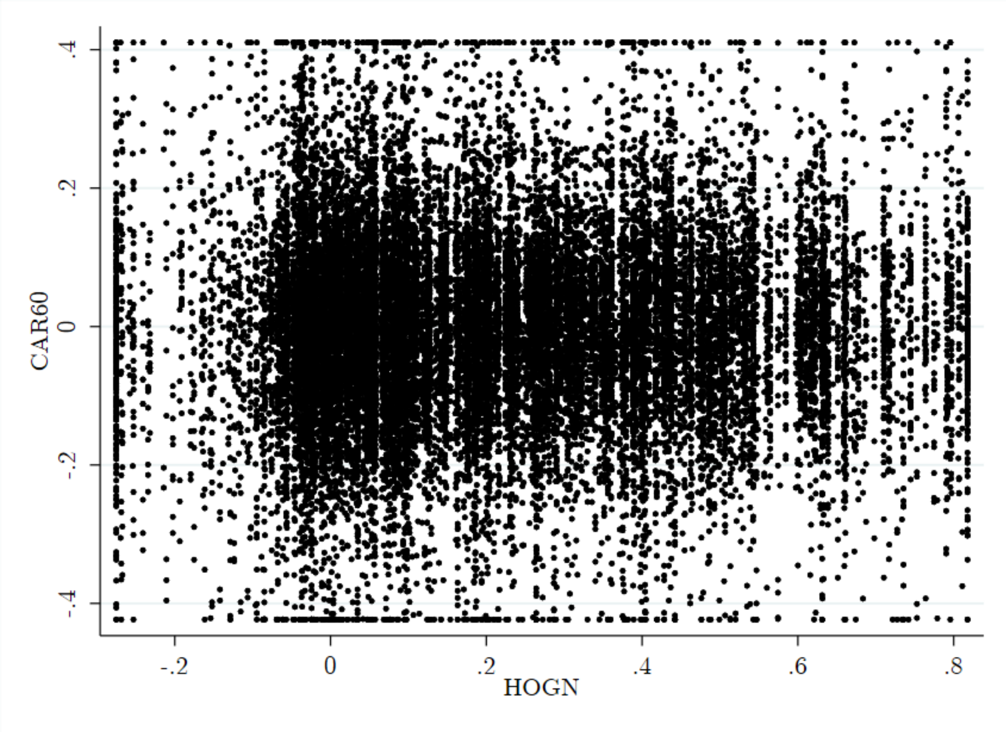
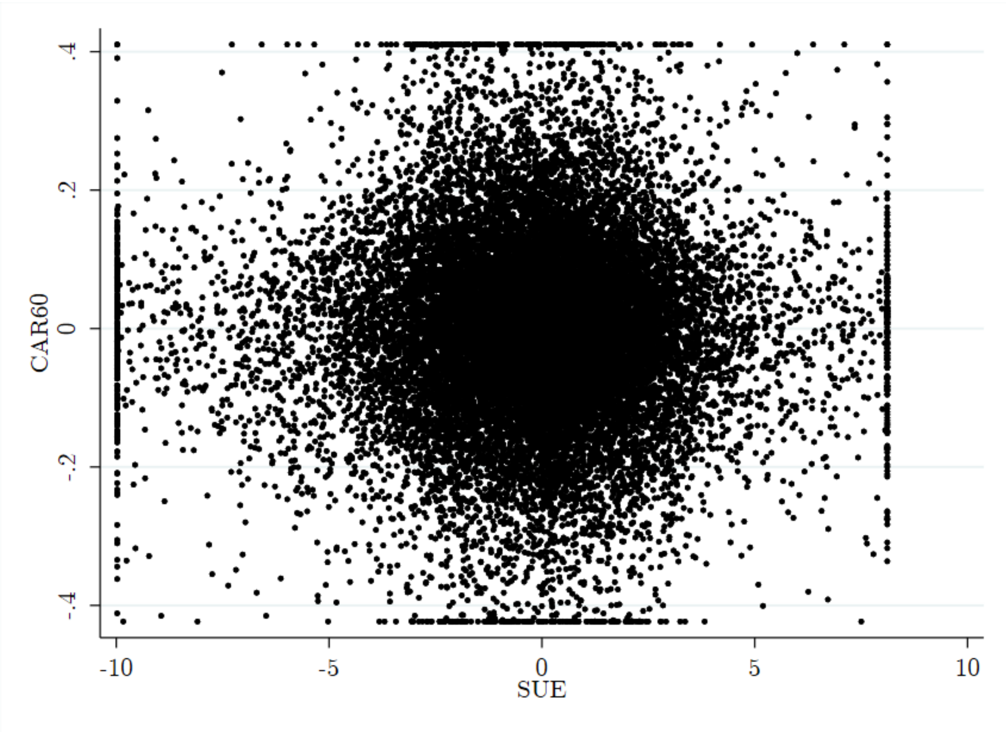


Figure 2: Two-way scatter plot with winsorized CAR60 as the dependent variable and winsorized SUE as the independent variable



4 Methodology

In this section, it will be enlightened how the data was prepared to retrieve the relevant variables.

4.1 Dependent variable

In line with the study of Shin et al. (2019), this study will examine the differences in magnitudes of the post-earnings announcement drift (PEAD) between the USA and China. Where Shin et al. (2019) examined the effects of homogeneity of industries on the PEAD, this paper will focus on the effect of national market development on the PEAD, by comparing the PEAD between the firms of these countries. According to Shin et al. (2019), PEAD is 'the evidence of investors' under-reaction to earnings information due to the lack of resources needed for interpreting earnings news'.

To measure the influence of industry homogeneity on the PEAD, the dependent variable is the firm's CAR, which is the dependent variable in this study. To calculate the firm's CAR, the firm's abnormal returns (AR) must be calculated. AR can be defined as the difference between the firm's actual returns and the normal returns. To calculate a firm's AR, the 'one-factor market model' by Sharpe (1963) is applied. Although there are multiple other models to calculate a firm's AR, the market model is considered the standard approach to calculate a firm's AR. Because the model includes an error term, it is an advantage that the model does not need to solve an optimization (in contrast to other models). Due to limited available data on Chinese firms, solely this model will be used in this study. The average market returns are determined for both the S&P500 index and the CSI300 index separately. In this way, the returns of firms can be compared with the market in which they operate.

The market model calculates the stock return at day t of the evaluation period minus alpha minus the index return at day t multiplied by the stock's beta, adjusted for the overall trend in the market. As Strong (1992) states, the daily estimation period to calculate normal returns can widely vary between different studies. In this study, the estimation period of 100 days is used, from 110 days before the event date until 10 days before the event date. This will provide a fair reflection of the normal market returns, without interfering with the events. The market model can be described as the following formula:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t},$$

where $R_{i,t}$ = the actual stock return of firm i on day t
$R_{m,t}$ = the return of the reference market on day t
α_i = the market's risk-free interest rate of firm i
β_i = the measure of the sensitivity of $R_{i,t}$ on the reference market for firm i
$\varepsilon_{i,t}$ = the error term for firm i on day t, which is not correlated with the market returns

Subsequently, the abnormal returns can be calculated as follows:

$$AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i R_{m,t})$$

The cumulative abnormal returns are calculated by summing the firm's AR during the event window. The CARs are calculated for a period of 45 days after the earnings announcement date, as well as for a period of 60 days after the earnings announcement date, which is in line with the study of Shin et al. (2019). This results in applying the following formula:

$$CAR_{(t_1,t_2)} = \sum_{t=0}^{t=60} AR_{i,t},$$

where t_1 indicates a time window of 45 trading days after the earnings announcement date, and t_2 indicates a time window of 60 trading days after the earnings announcement date. The cumulative abnormal returns are stated in percentage points.

4.2 Independent variables

Industry homogeneity

As mentioned before, Shin et al. (2019) observed a negative relationship between the magnitude of PEAD and industry homogeneity at firms listed on the Korean Stock Exchange. To measure the industry homogeneity, the average correlation in changes in operating expenses of each firm in the same industry and the same index is measured (in line with the study of Cairney and Young (2006)). The study of Cairney and Young (2006) classifies industries by a firm's SIC code. Due to the undesirable possibility of applying different SIC codes to different business segments, this study will sort the firms by their latest value of its Industry Classification Benchmark (ICB) classification. These classifications are retrieved from the Datastream database. The ICB sorts all firms per index in 11 different industries.

Firms with missing data on total operating expenses are excluded from the calculation of the average correlation of the change in total operating expenses per industry. The annual total operating expenses per S&P500 firm are retrieved in 000's USD, from the Worldscope database, from the Eikon Refinitiv platform. The annual total operating expenses per CSI300 are retrieved from the China Stock Market & Accounting Research (CSMAR) database, from the Wharton Research Data Services (WRDS) platform in Chinese Renminbi. For both indices, the total operating expenses are retrieved from the consolidated financial statements.

Relevant to mention is that firms with multiple publicly traded share classes of one firm are included as only one firm in the calculation of the average correlation of the change in total operating expenses per industry. This is determined to counter biased results, as the stocks have a different ISIN identifier while carrying the same total operating expenses, resulting in a correlation of 1.

As mentioned before, the industry homogeneity (HOGN) formula examines the similarity in total operating expenses per industry. To calculate the level of homogeneity, this study calculates the correlation coefficient of the changes in operating expenses of each firm with the other firms in the same industry for five rolling periods and then calculates the average of those coefficients by industry (in line with Shin et al. (2019). In this study, the industry homogeneity of one year is calculated by using a firm's operational expenses for the previous 5 years. This leads to using operational expenses data from 01-01-2006 until 01-01-2020. The following formula calculates the industry homogeneity of one industry in year t:

$$HOGN_t = [\sum_{k=1}^{n} Corr(\Delta OEX_{it}, \Delta OEX_{jt})_k] \times \frac{1}{n},$$

where ΔOEX_t denotes the percentage change in operating expenses for year t. HOGN can take values between -1 and $+1$. n denotes the amount of firms included per industry.

4.3 Control variables

To control for variables that could significantly influence the independent variable, several control variables are included.

The study of Shin et al. (2019) applied a comparison between firms' different levels of unexpected earnings. As mentioned before, unexpected earnings can be interpreted as the difference between expected earnings and actual earnings. In the study of Shin et al. (2019), extremely high unexpected earnings and extremely low unexpected earnings were compared, combined with the homogeneous industry variable. It measured how unexpected earnings at the announcement date affect a firm's CAR. To follow the study of Shin et al. (2019), the formula to calculate the SUE includes the firms' quarterly EPSs, which are retrieved from the Worldscope database.

To calculate the unexpected earnings, the difference between a firm's EPS and the average 12-month forecast estimate of a firm's earnings per share in the same quarter in the previous year is calculated. The average 12-month forecast estimates of a firm's earnings per share are retrieved from the I/B/E/S database. The unexpected earnings are divided by the standard deviation of the unexpected earnings over the prior eight quarters. This leads this study to retrieve the firms' quarterly EPSs from 2007 until 2020. This is the latest annualized rate that may reflect the last financial year or be derived from an aggregation of interim period earnings. Various studies apply different formulas to calculate a firm's SUE. This study applies a time-series model, the following formula to calculate a firm's SUE was used by Shin et al. (2019):

$$SUE_{i,q} = \frac{EPS_{i,q} - EPSforecast_{i,q-4}}{\sigma_{i,q}},$$

where $EPS_{i,q}$ = quarterly earnings per share; $EPSforecast_{i,q-4}$ = average 12-month forecast estimate of a firm's earnings per share in the same quarter in the previous year; and $\sigma_{i,q}$ = standard deviation of unexpected earnings ($EPS_{i,q}$–$EPS_{i,q-4}$) over the prior eight quarters.

According to the study of Shin et al. (2019), a firm's market value significantly influences a firm's CAR. Hence, the market value of each firm per year is included in this study as a control variable as well. This is done by retrieving the firms' market value at the beginning of the year, which is the market value on the 1st of January from 2010 until 2020. This data is retrieved from the Refinitive Worldscope database. The retrieved market value is stated in 000's USD. Due to the expected skewed distribution of a firm's market value, the (natural) logarithmic measure of the market value is applied.

Thirdly, a firm's market-to-book ratio (or: price-to-book ratio) is included as a control variable, as the study of Shin et al. (2019) showed a significant influence on a firm's CAR, which is in line with the three-factor model of Fama and French (1993). The market-to-book ratio is the share price divided by the book value per share. The market-to-book ratio is retrieved from the Refinitive Datastream database. Since the study of Dellavigna and Pollet (2009) discovered a significant influence of a report on Friday on a firm's PEAD, a control for the Friday effect will be included as well. This is done by including a dummy variable (0 = EPS report date occurred on a different working day than Friday, 1 = EPS report date occurred on a Friday).

To study whether the effect of industry homogeneity on the magnitude of PEAD is more pronounced after the first quarterly reporting date than after the remaining quarterly reporting dates, an additional dummy variable is included (0 = EPS report date occurred on a different quarter than the first quarter, 1 = EPS report date occurred on the first quarter of the year). Lastly, fixed effects for the announcement years must be taken into consideration to counter endogeneity problems as well.

4.4 Empirical approach

This study will conduct an event study, where the earnings announcement days are determined as event dates. To be more specific, Ordinary Least Square (OLS) linear regression analyses will be conducted, which examine whether the different countries significantly influence the magnitude of the PEAD.

First, the firms' PEADs will be charted. This will be done by isolating the highest SUE quintile and the lowest SUE quintile from both Chinese and USA firms. In this way, the cumulative abnormal returns will be monitored for 60 cumulative trading days after the firms' earnings announcements. The chart will display an average course of PEADs for all observed CARs with available SUEs per trading day from 2010 until 2020.

Secondly, the regression analyses will be conducted. Two regression analyses will contain both indices from the USA and China without a dummy variable (with and without including control variables). Two additional regression analyses will include the interaction between the USA dummy variable (with and without including control variables). This makes it possible to compare the influences of the variables on a firm's CAR of both indices.

With the HOGN calculated, a regression analysis will be conducted to investigate whether this influences the firms' CARs. To find out whether the index influences this, an interaction term is made between HOGN and the USA dummy (which examines whether firms in China have a lower influence on industry homogeneity than firms in the USA). Because the study of Shin et al. (2019) found a significant influence of an interaction between a firm's standardized unexpected earnings and its industry homogeneity, this 2-way interaction term will be applied in this study as well.

To investigate whether the index of a firm influences this 2-way interaction term, another interaction term (A 3-way interaction) is generated. This results in an interaction between the USA dummy, SUE, and HOGN. This is considered to be the main variable of interest in this study. Additional regression analyses with control variables included are conducted. Also, all the models will include the fixed-year effects. At first, additional control variables and the USA Dummy will be excluded from the model. This results in the following linear regression model:

$CAR_{(t1,t2)} = \beta_0 + \beta_1 SUE + \beta_2 HOGN + \beta_3 SUE \times HOGN + \varepsilon$

Subsequently, the additional control variables will be included in the model. In this way, the effect of control variables on the influence of the independent variables can be measured. This results in the following applied linear regression model:

$CAR_{(t1,t2)} = \beta_0 + \beta_1 SUE + \beta_2 HOGN + \beta_3 SUE \times HOGN + \beta_4 \ln MV + \beta_5 MTB + \beta_6 FridayDum + YearFixedEffects + \varepsilon$

After the analyses of the dataset as a whole, a separation will be made between the USA index and Chinese index. In this way, it can be measured whether the influences of independent variables differ between a USA index and a Chinese index. First, the control variables will be excluded. The following linear regression model will be used:

$CAR_{(t1,t2)} = \beta_0 + \beta_1 USADum + \beta_2 HOGN + \beta_3 SUE + \beta_4 USADum \times HOGN + \beta_5 USADum \times SUE + \beta_6 SUE \times HOGN + \beta_7 USADum \times SUE \times HOGN + YearFixedEffect + \varepsilon$

Lastly, the control variables will be included to be able to measure the effect of control variables on the influence of the independent variables when the USA Dummy is included. This leads to the following linear regression model, which is considered the main regression model of this study:

$CAR_{(t1,t2)} = \beta_0 + \beta_1 USADum + \beta_2 HOGN + \beta_3 SUE + \beta_4 USADum \times HOGN + \beta_5 USADum \times SUE + \beta_6 SUE \times HOGN + \beta_7 USADum \times SUE \times HOGN + \beta_8 \ln MV + \beta_9 MTB + \beta_{10} FridayDum + YearFixedEffect + \varepsilon$

With $CAR_{(t1,t2)}$ = Cumulative (size-adjusted) abnormal returns for 45 or 60 trading days following the earnings announcement date
$USADum$ = Dummy to indicate whenever the firm is included in a USA index
$HOGN$ = Industry homogeneity
SUE = Standardised unexpected earnings
$ln(MV)$ = Firm size, measured as the logarithm of market value
$PtoB$ = Price-to-book value ratio, measured as market value divided by total equity
$FridayDum$ = Dummy to indicate whenever the EPS report date occurred on a Friday
$Q1Dum$ = Dummy to indicate whenever the EPS report date occurred on the first quarter

4.5 Model assumptions

The applied linear regression models make several assumptions. First, it assumes that the regression model follows a homoskedastic course. This implies that the variance is constant across all the observations. However, the model could suffer from heteroskedasticity, implying that the variance changes across the observations. As figures 4 and 5 (not winsorized) show, it is difficult to assume whether this follows a homoskedastic course. These figures can be found in the appendix. To tackle the assumption that the model does not suffer from heteroskedasticity, additional analyses will be conducted where robust standard errors will be applied. Although this tackles a possible heterogeneity issue, it could lead to less precise estimates and wider confidence intervals than when using the valid-model-based standard error (Mansournia et al., 2020). Therefore, even with the use of robust standard errors, it is hard to accurately draw any conclusions about the homogeneity of the regression models.

Any serial correlation between a firm's 45 days CAR and a firm's 60 days CAR is not expected to cause problems, because both models do not interfere. It is expected that the results of the 60 days CAR are similar to the 45 days CAR but more enhanced. Also, there is no case of multicollinearity, as model 2 only shows a moderate relationship between the USA dummy and the (natural) logarithm of a firm's market value.

Another assumption of the model is that the included observations should be independent. This study assumes this is true, although it could be the case that a firm's CAR influences the CAR of another firm in the same industry. However, this study will not investigate whether this effect occurs. Additionally, the model assumes that errors are normally distributed. As figure 4 (not winsorized) shows, it is somewhat skewed to the right. However, this does not differ much from a normally distributed model. Therefore, it is not expected that it would cause any problems. Figure 5 shows an approximately normally distributed data set.

Because ordinal variables were included in the model, Spearman's correlation was conducted. This model needs to meet the least amount of assumptions when compared with other correlation models. This model carries two assumptions. In the first place, the model assumes there are variables included that are on an ordinal or continuous scale. As the regression models carry both forms, this assumption is met. Secondly, this model assumes there is a monotonic relationship between the dependent and the independent variable. This implies that the direction of the relationship remains the same when variables increase in value. As figures 4 and 5 (not winsorized) show, it is hard to interpret whether this assumption is met. However, there are no logical arguments to assume a non-monotonic relationship. Therefore, it is not expected that this will cause problems.

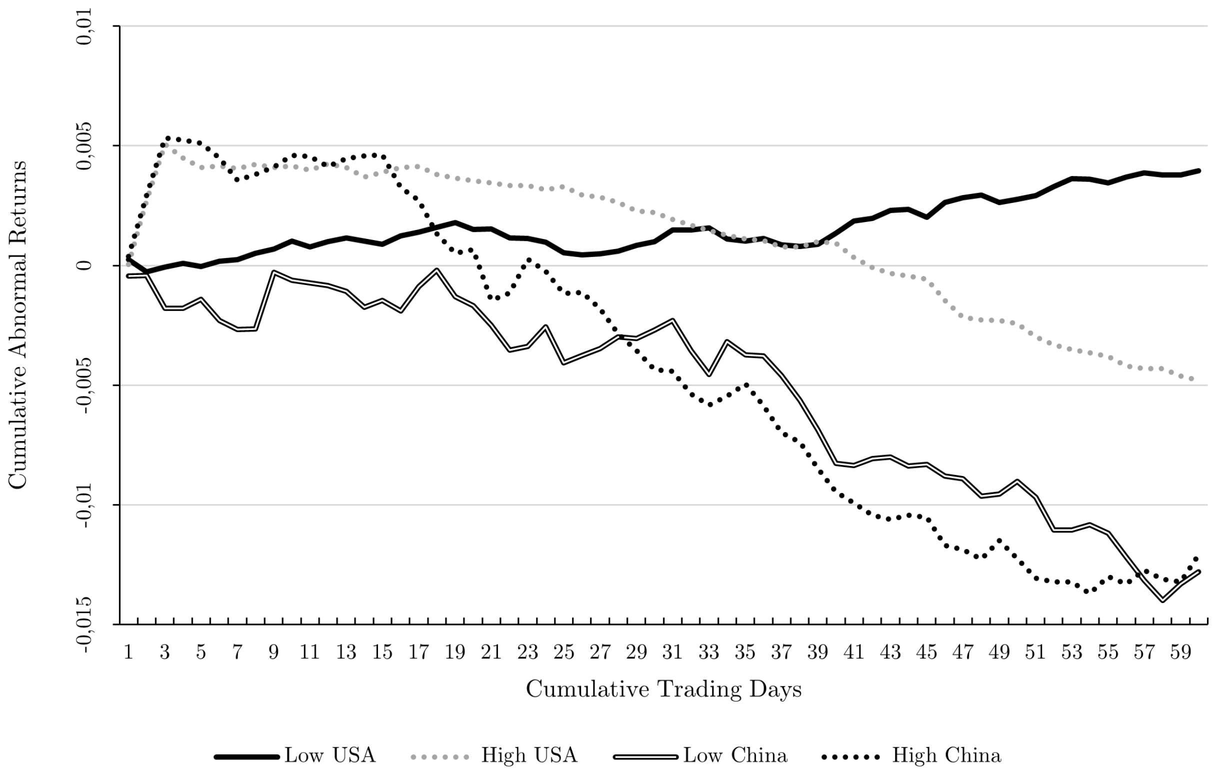
5 Results

In this section, the most relevant results of the main analysis will be treated. First, the observed PEADs will be treated. Subsequently, the outcomes of the regression analyses will be discussed. Lastly, the additional conducted robustness tests will be discussed.

5.1 Event study

In figure 3, the average PEADs for the highest and lowest quintile of SUE can be found. Surprisingly, low SUEs in the USA result in a higher 60 days CAR, and high SUEs in the USA result in a lower 60 days CAR. As for the Chinese firms, low SUEs result in a lower 60 days CAR, as expected. However, the high SUEs result in a lower 60 days CAR as well. Noteworthy are the CARs close after the earnings announcement. Both Chinese and USA firms show that low SUEs result in lower CARs close after the earnings announcement, and high SUEs result in higher CARs close after the earnings announcement. The results of this chart are not in line with the theoretical expectations, as a clear positive relationship between a firm's SUE and a firm's CAR cannot be observed.

Figure 3: Average Post-Earnings-Announcement Drift for USA and Chinese firms



5.2 Regression analyses

Table 3: Linear logistic regressions with the cumulative abnormal returns as dependent variable

	CAR45 as dependent variable			CAR60 as dependent variable		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-.0017	.0056	.0056	-.0032**	-.0101	-.0101
	(.0011)	(.0067)	(.0087)	(.0014)	(.0080)	(.0091)
HOGN	.0019	.0025	.0025	-.0006	-.0003	-.0003
	(.0037)	(.0037)	(.0061)	(.0044)	(.0044)	(.0059)
SUE	.0001	.0002	.0002	-.0005	-.0003	-.0003
	(.0004)	(.0004)	(.0005)	(.0005)	(.0005)	(.0004)
(SUExHOGN)	.0004	.0004	.0004	.0013	.0012	.0012
	(.0014)	(.0014)	(.0016)	(.0016)	(.0016)	(.0025)
lnMV		-.0005	-.0005		.0011	.0011
		(.0007)	(.0009)		(.0008)	(.0009)
PtoB		.0001	.0001		-2.23e-06	-2.23e-06
		(.0001)	(.0002)		(.0002)	(.0003)
FridayDum		-.0054**	-.0054		-.0069**	-.0069*
		(.0025)	(.0031)		(.0030)	(.0035)
Q1Dum		-.0072***	-.0072*		-.0133***	-.0133**
		(.0018)	(.0033)		(.0022)	(.0045)
Observations	21,257	21,233	21,257	21,257	21,233	21,233
R^2 (Overall)	.0000	.0010	.0010	.0000	.0021	.0021
Fixed effects (year)	YES	YES	YES	YES	YES	YES

Coefficient per variable are displayed. For columns 1, 2, 4, and 5: standard errors are stated in parentheses. For columns 3 and 6: robust standard errors are stated in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
(USAdumxHOGN): interaction term between the USA dummy variable and the industry homogeneity variable. *(USAdumxSUE)*: interaction term between the USA dummy variable and the SUE variable. *(SUExHOGN)*: interaction term between the SUE variable and the industry homogeneity variable. *(USADumxSUExHOGN)*: 3-way interaction term between the USA dummy variable, the SUE variable, and the industry homogeneity variable.

In table 3, the results of the basic linear regression can be found. The influences of the variables on a firm's 45 days and 60 days CAR are stated, including both firms from the USA and China. In all models, robust standard errors were applied to counter heteroscedasticity. Per approach, a column is included to indicate the influence of the inclusion of control variables. As can be observed, the control variables do not change the significance of the independent variables. In each model, the independent variables show no significant influence on a firm's CAR. As table 3 shows, the Friday dummy variable has a significant negative influence on a firm's 60 days CAR. However, applying a robust standard error results in results with a low significance (at a 10% level). Also, the Q1 dummy remains significant at the 60 days CAR when robust standard errors were applied. With this approach, the industry homogeneity variable does not significantly influence a firm's 60 days CAR in any way.

In table 4, the main linear regression analysis of this study can be found. Per model, the influence of the inclusion of control variables and the influence of applying robust standard errors are included in the table again. In columns 1 and 2, firms in the USA tend to have on average a significantly higher 45 days CAR than firms in China. However, when applying a robust standard error, the results become insignificant. As can be found in column 2, the market value is significant at a 5% level. Because this is not significant in columns 3-6, it cannot be stated that announcing the earnings on a Friday, results in a higher/lower CAR. As can be observed again, control variables do not change the significance of the independent variables. In both models, the Q1 dummy has a significant negative effect on a firm's 60 days CAR. When applying robust standard errors, the influence is only significant at the 60 days CAR. This implies that earnings announced on an annual report result on average in approximately a decrease of .014 of a firm's 60 days CAR, concerning the remaining quarterly earnings announcements.

Interesting to observe are the insignificant results of industry homogeneity-related variables. No industry homogeneity-related variable tends to significantly influence a firm's 60 days CAR. It can be stated that this approach shows no industry homogeneity which influences a firm's cumulative abnormal returns for both CSI300 and S&P500 firms. Also, apart from the Q1 dummy, the control variables tend to not significantly influence the 60 days CAR of Chinese and USA firms. This is in contrast to the study of Shin et al. (2019), where these variables were all significantly influencing a firm's 45 days and 60 days CARs.

Mentionable are the differences in results between the 45 days CAR and the 60 days CAR. The 45 days model has in general (as expected) a lower explanation power due to a shorter CAR window. In both tables 3 and 4, most of the variables tend to be more significant and carry a higher economical significance. This does not apply to the USA dummy variable and the market value variable. Remarkable is the market value, which has a significant effect when cutting the window from a 60 days CAR to a 45 days CAR when applying no robust standard errors.

Table 4: Linear logistic regressions with the cumulative abnormal returns as dependent variable, including country interaction

	CAR45 as dependent variable			CAR60 as dependent variable		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-.0077***	.0090	.0090	-.0108***	-.0059	-.0059
	(.0022)	(.0068)	(.0095)	(.0026)	(.0080)	(.0092)
USADum	.0073***	.0089***	.0089*	.0091***	.0086***	.0086
	(.0025)	(.0027)	(.0047)	(.0030)	(.0033)	(.0064)
HOGN	.0013	.0031	.0031	-.0010	-.0008	-.0008
	(.0058)	(.0059)	(.0071)	(.0069)	(.0070)	(.0077)
SUE	.0001	.0003	.0003	.0004	.0007	.0007
	(.0008)	(.0009)	(.0011)	(.0010)	(.0010)	(.0014)
(USADumxHOGN)	.0024	.0005	.0005	.0023	.0026	.0026
	(.0076)	(.0076)	(.0088)	(.0090)	(.0090)	(.0111)
(USADumxSUE)	.0002	.0000	.0000	-.0010	-.0011	-.0011
	(.0010)	(.0010)	(.0010)	(.0011)	(.0011)	(.0013)
(SUExHOGN)	.0008	.0009	.0009	.0012	.0011	.0011
	(.0023)	(.0023)	(.0037)	(.0027)	(.0027)	(.0057)
(USADumxSUE	-.0007	-.0008	-.0008	-.0001	.0001	.0001
xHOGN)	(.0029)	(.0029)	(.0040)	(.0034)	(.0034)	(.0057)
lnMV		-.0017**	-.0017		-.0001	-.0001
		(.0007)	(.0011)		(.0009)	(.0011)
PtoB		.0001	.0001		-.0000	-.0000
		(.0001)	(.0002)		(.0002)	(.0003)
FridayDum		-.0036	-.0036		-.0051*	-.0051
		(.0026)	(.0031)		(.0030)	(.0036)
Q1Dum		-.0073***	-.0073*		-.0135***	-.0135**
		(.0018)	(.0033)		(.0022)	(.0045)
Fixed effects (year)	Yes	Yes	YES	YES	YES	YES
Observations	21,257	21,233	21,233	21,257	21,233	21,233
R^2 (Overall)	.0008	.0019	.0019	.0010	.0029	.0029

Coefficient per variable are displayed. For columns 1, 2, 4, and 5: standard errors are stated in parentheses. For columns 3 and 6: robust standard errors are stated in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
(USAdumxHOGN): interaction term between the USA dummy variable and the industry homogeneity variable. *(USAdumxSUE)*: interaction term between the USA dummy variable and the SUE variable. *(SUExHOGN)*: interaction term between the SUE variable and the industry homogeneity variable. *(USADumxSUExHOGN)*: 3-way interaction term between the USA dummy variable, the SUE variable, and the industry homogeneity variable.

5.3 Robustness analyses

To indicate whether the industry homogeneity approach was accurate, three robustness analyses are conducted. In the first analysis, a different approach to indicate industry homogeneity is applied. In the second analysis, only positive standardized unexpected earnings are included in the applied dataset. The third analysis includes merely the negative standardized unexpected earnings in the dataset. In both the second and the third analysis, the industry homogeneity approach from table 5 is used.

The analysis of table 5 provides interesting outcomes. This analysis applies the most recent industry homogeneity measurement. This implies that the fixed firm's industry homogeneity from 2020 is used, which is calculated by taking the average correlation of a firm's operating expenses from 01-01-2016 until 01-01-2020 between other firms in the same industry. These years are used because the most data is available, as the indices keep refreshing the included firms. Table 9 illustrates the number of firms per industry with this approach. This can be found in the appendix.

Table 5: Linear logistic regressions with the cumulative abnormal returns as dependent variable, including the most recent homogeneity measurement

	CAR45 as dependent variable			CAR60 as dependent variable		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-.0111***	.0095	.0095	-.0157***	-.0055	-.0055
	(.0021)	(.0068)	(.0093)	(.0025)	(.0080)	(.0095)
USAdum	.0123***	.0149***	.0149***	.0155***	.0159***	-.0159**
	(.0025)	(.0027)	(.0038)	(.0030)	(.0032)	(.0064)
HOGN	.0161***	.0196***	.0196***	.0209***	.0223***	.0223*
	(.0055)	(.0056)	(.0056)	(.0065)	(.0066)	(.0112)
SUE	-.0006	.0001	.0001	.0009	.0012	.0012
	(.0008)	(.0008)	(.0013)	(.0010)	(.0010)	(.0016)
(USAdumxHOGN)	-.0208***	-.0248***	-.0248**	-.0271***	-.0284***	-.0284*
	(.0073)	(.0074)	(.0077)	(.0086)	(.0088)	(.0128)
(USAdumxSUE)	.0003	.0001	.0001	-.0014	-.0016	-.0016
	(.0009)	(.0010)	(.0012)	(.0011)	(.0011)	(.0016)
(SUExHOGN)	.0008	.0007	.0007	-.0022	-.0023	-.0023
	(.0022)	(.0022)	(.0032)	(.0026)	(.0026)	(.0036)
(USADumxSUE	-.0001	.0001	.0001	.0035	.0036	.0036
xHOGN)	(.0029)	(.0029)	(.0030)	(.0034)	(.0034)	(.0035)
lnMV		-.0022***	-.0022*		-.0007	-.0007
		(.0008)	(.0011)		(.0009)	(.0010)
PtoB		.0001	.0001		.0000	.0000
		(.0001)	(.0002)		(.0002)	(.0003)
FridayDum		-.0034	-.0034		-.0049	-.0049
		(.0025)	(.0031)		(.0030)	(.0036)
Q1Dum		-.0074***	-.0074*		-.0135***	-.0135**
		(.0018)	(.0033)		(.0022)	(.0045)
Fixed effects (year)	YES	YES	YES	YES	YES	YES
Observations	21,279	21,255	21,255	21,279	21,255	21,255
R^2 (Overall)	.0012	.0025	.0025	.0015	.0036	.0036

Coefficient per variable are displayed. For columns 1, 2, 4, and 5: standard errors are stated in parentheses. For columns 3 and 6: robust standard errors are stated in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
(USAdumxHOGN): interaction term between the USA dummy variable and the industry homogeneity variable. *(USAdumxSUE)*: interaction term between the USA dummy variable and the SUE variable. *(SUExHOGN)*: interaction term between the SUE variable and the industry homogeneity variable. *(USADumxSUExHOGN)*: 3-way interaction term between the USA dummy variable, the SUE variable, and the industry homogeneity variable.

In this analysis, a significant positive effect of industry homogeneity on a firm's CAR can be observed. In addition, the interaction between industry homogeneity and the USA dummy tends to have a significant effect on a firm's CAR. This effect becomes insignificant when robust standard errors were applied with the 60 days CAR. Because the interaction between the SUE and the industry homogeneity remains insignificant, no conclusion from this approach can be drawn yet. In general, this approach shows that a more recent measurement of industry homogeneity tends to increase the significance of the regression analysis.

Table 6 uses the industry homogeneity approach from table 5, and includes only the positive SUEs. When focusing on the 60 days CAR, column 5 shows results with a relatively higher significance than the previous approach. In general, this approach shows a significant positive relationship between positive SUEs and a firm's 60 days CAR when no robust standard errors were applied. As column 5 shows, a 1 point higher SUE results on average in an increase of .005 percent points of a firm's 60 days CAR. However, applying robust standard errors will result in an insignificant variable.

This study is mainly interested in the influences of the interaction terms. In line with the theory, a negative significant coefficient of the interaction between the SUE and HOGN variable is observed. This implies that a higher industry homogeneity lowers a firm's 60 days CAR. The research question focuses on the interaction between the influence of SUE and the degree of industry homogeneity and whether the USA dummy influences this coefficient. In contrast to the expectations of the stated hypothesis, the model shows no significant results in the main three-way interaction term between the USA dummy, SUE, and the industry homogeneity. Lastly, it can be observed that when a firm makes an earnings announcement regarding the first quarter of the calendar, a firm's 60 days CAR significantly decreases on average by approximately .010 percentage points. However, the effects become insignificant when applying robust standard errors.

Table 6: Linear logistic regressions with the cumulative abnormal returns as dependent variable, including positive standardized unexpected returns and the most recent homogeneity measurement

	CAR45 as dependent variable			CAR60 as dependent variable		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-.0216***	-.0080	-.0080	-.0289***	-.0242**	-.0242
	(.0044)	(.0099)	(.0123)	(.0053)	(.0118)	(.0179)
USAdum	.0214***	.0231***	.0231***	.0289***	.0293***	.0293***
	(.0051)	(.0053)	(.0064)	(.0061)	(.0063)	(.0088)
HOGN	.0336***	.0381***	.0381**	.0478***	.0508***	.0508*
	(.0112)	(.0114)	(.0159)	(.0134)	(.0135)	(.0250)
SUE	.0025	.0031	.0031	.0044*	.0054**	.0054
	(.0019)	(.0019)	(.0025)	(.0022)	(.0023)	(.0031)
(USAdumxHOGN)	-.0380***	-.0417***	-.0417*	-.0581***	-.0603***	-.0603*
	(.0146)	(.0147)	(.0204)	(.0175)	(.0176)	(.0296)
(USAdumxSUE)	-.0017	-.0018	-.0018	-.0048*	-.0050**	-.0050
	(.0021)	(.0021)	(.0033)	(.0026)	(.0026)	(.0041)
(SUExHOGN)	-.0049	-.0058	-.0058	-.0113**	-.0123**	-.0123
	(.0044)	(.0044)	(.0066)	(.0052)	(.0053)	(.0071)
(USADumxSUE	.0025	.0030	.0030	.0105	.0115	.0115
xHOGN)	(.0062)	(.0062)	(.0088)	(.0074)	(.0074)	(.0101)
lnMV		-.0015	-.0015		-.0004	-.0004
		(.0010)	(.0013)		(.0012)	(.0017)
PtoB		.0002	.0002		.0001	.0001
		(.0002)	(.0003)		(.0002)	(.0003)
FridayDum		-.0035	-.0035		-.0042	-.0042
		(.0036)	(.0040)		(.0042)	(.0035)
Q1Dum		-.0057**	-.0057		-.0099***	-.0099
		(.0026)	(.0047)		(.0031)	(.0064)
Fixed effects (year)	YES	YES	YES	YES	YES	YES
Observations	10,702	10,685	10,685	10,702	10,685	10,685
R^2 (Overall)	.0029	.0038	.0038	.0028	.0040	.0040

Coefficient per variable are displayed. For columns 1, 2, 4, and 5: standard errors are stated in parentheses. For columns 3 and 6: robust standard errors are stated in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
(USAdumxHOGN2020): interaction term between the USA dummy variable and the industry homogeneity variable for 2020. *(USAdumxSUE)*: interaction term between the USA dummy variable and the SUE variable. *(SUExHOGN2020)*: interaction term between the SUE variable and the industry homogeneity variable for 2020. *(USADumxSUExHOGN2020)*: 3-way interaction term between the USA dummy variable, the SUE variable, and the industry homogeneity variable for 2020.

To complement the findings of table 6, an additional robustness analysis was conducted. Table 7 includes merely the negative SUEs. Interesting to observe are the differences between including merely positive SUEs and merely negative SUEs in the model. When focusing on the 60 days CAR, the SUE variable shows an insignificant coefficient. Also, the interaction between the SUE and the industry homogeneity and the three-way variable show no significant results. Lastly, only the Q1 dummy shows significant results. After applying robust standard errors, this remains significant. This implies that when a firm makes an earnings announcement regarding the first quarter of the calendar, a firm's 60 days CAR significantly decreases on average by approximately .018 percentage points.

Table 7: Linear logistic regressions with the cumulative abnormal returns as dependent variable, including negative standardized unexpected returns and the most recent homogeneity measurement

	CAR45 as dependent variable			CAR60 as dependent variable		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-.0013	.0238**	.0238*	-.0052	.0070	.0070
	(.0045)	(.0102)	(.0108)	(.0053)	(.0120)	(.0090)
USAdum	.0029	.0065	.0065	.0045	.0051	.0051
	(.0051)	(.0054)	(.0084)	(.0061)	(.0064)	(.0107)
HOGN	.0124	.0167	.0167	.0172	.0182	.0182
	(.0118)	(.0119)	(.0119)	(.0139)	(.0140)	(.0101)
SUE	.0028*	.0026	.0026*	.0040**	.0034*	.0034*
	(.0017)	(.0017)	(.0013)	(.0020)	(.0020)	(.0015)
(USAdumxHOGN)	-.0037	-.0086	-.0086	-.0051	-.0060	-.0060
	(.0152)	(.0153)	(.0132)	(.0179)	(.0181)	(.0193)
(USAdumxSUE)	-.0027	-.0028	-.0028	-.0047**	-.0047**	-.0047**
	(.0018)	(.0018)	(.0017)	(.0022)	(.0022)	(.0015)
(SUExHOGN)	.0024	.0024	.0024	.0003	-.0003	-.0003
	(.0051)	(.0051)	(.0054)	(.0060)	(.0060)	(.0034)
(USADumxSUE	.0033	.0033	.0033	.0072	.0074	.0074
xHOGN)	(.0060)	(.0060)	(.0050)	(.0071)	(.0071)	(.0041)
lnMV		-.0028**	-.0028*		-.0010	-.0010
		(.0011)	(.0014)		(.0013)	(.0009)
PtoB		.0000	.0000		.0000	.0000
		(.0002)	(.0003)		(.0003)	(.0003)
FridayDum		-.0037	-.0037		-.0064	-.0064
		(.0036)	(.0046)		(.0043)	(.0054)
Q1Dum		-.0090***	-.0090*		-.0177***	-.0177**
		(.0028)	(.0044)		(.0033)	(.0058)
Fixed effects (year)	YES	YES	YES	YES	YES	YES
Observations	10,676	10,668	10,668	10,676	10,668	10,668
R^2 (Overall)	.0015	.0033	.0033	.0021	.0051	.0051

Coefficient per variable are displayed. For columns 1, 2, 4, and 5: standard errors are stated in parentheses. For columns 3 and 6: robust standard errors are stated in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
(USAdumxHOGN2020): interaction term between the USA dummy variable and the industry homogeneity variable for 2020. *(USAdumxSUE)*: interaction term between the USA dummy variable and the SUE variable. *(SUExHOGN2020)*: interaction term between the SUE variable and the industry homogeneity variable for 2020. *(USADumxSUExHOGN2020)*: 3-way interaction term between the USA dummy variable, the SUE variable, and the industry homogeneity variable for 2020.

Table 8 states an additional correlation matrix to indicate the correlation between the included variables of the approach from 6. In this correlation matrix, a low degree of negative significant correlation between the USA dummy variable and industry homogeneity can be found, indicating that USA firms tend to have a lower industry homogeneity according to this approach. In addition, USA firms have a significant negative correlation with the SUE variable. However, this is a low coefficient, which implies that there is not an economically significant difference in SUE between USA firms and Chinese firms.

Table 8: Correlation coefficients between robustness analyses variables

	CAR60	SUE	HOGN2020	lnMV	PtoB	USADum	FridayDum	Q1Dum
CAR60	-							
SUE	.0001	-						
HOGN2020	-.0005	-.0179	-					
lnMV	.0128	-.0138	.0442*	-				
PtoB	-.0050	.0685*	-.1644*	.0284*	-			
USADum	.0380*	-.0502*	-.0110	.2818*	.0153	-		
FridayDum	-.0182	.0029	.0184	-.0124	-.0378*	-.1682*	-	
Q1Dum	-.0305*	.2204*	-.0048	-.0163	-.0208*	.0062	.0162	-

*$p < 0.05$. Spearman's correlations were used to retrieve the correlation coefficients.

6 Discussion

In this section, the outcome of the analysis will be discussed. As the results showed, the original approach did not provide significant results which could be used to answer the main research question. However, the robustness analyses provided meaningful insights. It can be concluded that the outcome of the study is dependent on what industry homogeneity approach was applied.

As stated in the literature review, the main hypothesis was to study whether the magnitude of PEAD is more negatively related to industry homogeneity in China than in the USA. Figure 3 illustrates the firms' average PEADs courses. In contrast to the theoretical expectations, the results show no clear evidence for the expected drift. Therefore, no clear conclusion could be drawn from this figure.

Apart from the SUE variable in table 7, including the control variables results in a higher significance of the coefficients. Also, the 45 days CAR approach provided less significant results than the 60 days CAR approach. In general, the significance of the variables drops when robust standard errors are applied. Comparing table 3 with table 4 shows that including the USA dummy does not significantly change the included variables in table 3. As can be observed in 4, including the USA dummy does not significantly change the included variables in table 3

With the main approach, the industry homogeneity was calculated yearly. This results in no significant coefficients of the variables which are relevant to the stated hypothesis. With the approach of table 6, the analysis showed interesting results, where most of the relevant variables became significant (column 5). In line with the expectations (due to the findings of Griffin et al. (2010)), the correlation matrix in table 8 shows that USA firms are indeed experiencing a lower amount of industry homogeneity than Chinese firms.

Secondly, it was expected that a higher industry homogeneity results in a lower PEAD (due to the findings of Shin et al. (2019)). With the approach of table 4, a significant negative relationship between industry homogeneity and a firm's SUE was found. However, these results become insignificant when applying robust standard errors. Therefore, no conclusions can be drawn, due to the possible attendance of heteroskedasticity. The final expectation was the fact that secondary-emerging countries experience a higher influence of industry homogeneity on a firm's magnitude in PEAD. When focusing on column 5 of table 6, the three-way interaction term between the USA dummy, industry homogeneity, and a firm's SUE shows no significant results. The significance of the results do not change when robust standard errors were applied.

Mentionable is the fact that only the Q1 dummy is significantly lowering a firm's 60 days CAR. This is only a significant effect in table 3, table 4, and table 7. In contrast to the study of Shin et al. (2019), all the control variables were expected to significantly influence a firm's 60 days CAR. The results of tables 6 and table 7 show results that are not in line with the expectations. The interaction term between the industry homogeneity and a firm's SUE shows a significant effect when merely positive SUEs were applied. This is in contrast to the results of Shin et al. (2019), which found a significant effect when merely negative SUEs were applied.

6.1 Limitations

Retrieving the firms' operation expenses resulted in a limitation of this study. The operating expenses were retrieved from the CSMAR platform, whereas the USA operating expenses were retrieved from the Eikon Refinitiv platform. When applying the Eikon Refinitiv platform, the operating expenses differed from the operating expenses which were retrieved from the CSMAR platform. Also, this study applied the EPSs of the Worldscope database. The Datastream database also provided (slightly) different EPSs. This could also influence the results. This could imply that the results are dependent on what databases were used. However, after comparing both platforms, the CSMAR platform showed more accurate results. Therefore, this limitation is not expected to cause complications.

A second limitation of this study is the availability of the data per index. Chinese firms had limited data available regarding their operating expenses. This resulted in a smaller sample size for the measurement of industry homogeneity in the earlier years of the study. This could have caused the insignificant influence of a firm's yearly industry homogeneity. Also, Chinese firms had limited data available regarding their earnings per share, which are used to calculate a firm's SUE. This could have biased the results, as there might be an explanation for why a firm has no early EPS data available.

A third limitation is the choice of indices. Where the study of Shin et al. (2019) used all the listed firms in Korea, this study includes only a selection of firms. This study focuses on the largest listed firms in both countries. However, it could be the case that a higher industry homogeneity influences smaller firms more than larger firms. This could have led to biased results.

A fourth limitation is the continuous refreshment of both the S&P500 index and the CSI300 index. This results in the fact that the formula that calculates the industry homogeneity does not contain the same amount of firms (n) each year. This could result in biased industry homogeneity observations in the early years of the dataset, as there were other firms in the industry that are not included in the current indices.

Lastly, figure 3 shows no clear evidence for the expected PEADs. Although 3 includes merely the highest and lowest quintile of SUEs, the event study could be a limitation of the study. It raises the question of whether the correct data is included. On the other hand, if the data is correctly included, it could indicate that the occurrence of PEAD at large firms is simply not following the theoretical expectations for the period from 2010 until 2020.

6.2 Directions for future research

A logical suggestion for future research is to conduct the same analyses when more data on the CSI300 firms becomes available. In this way, the yearly industry homogeneity can be calculated more accurately, and more SUEs can be calculated to include in the sample.

A second interesting suggestion is the use of different industry classifications. In this study, the ICB classification was adopted. However, it could be analyzed whether the industry classification approach influences the outcomes of the analyses.

The third suggestion for further research is to make a comparison between different countries. Where this study compares a developed country with a secondary-emerging market, it could be interesting to compare a developed country with a frontier country. However, this could be hard to analyze, as frontier countries have limited data.

This study finds significant coefficients when merely positive SUEs were included in the analysis. As mentioned before, this is in contrast with the findings of the study of Shin et al. (2019), where including merely negative SUEs caused significant coefficients. Further research could test a similar approach on a different dataset, to provide more evidence on whether positive or negative SUEs influence a firm's CAR.

It might also be interesting to investigate whether the SUE of firms in an industry gets affected by the SUE of another firm in the respective industry. In this way, further research could provide evidence for the previously mentioned assumption in subsection 4.5, whether the observations are independent. A possible causal relationship between multiple SUEs in a single industry and the magnitude of PEAD is an effect that is worth studying.

Lastly, this study only focuses on the differences in the influences of industry homogeneity between developed and secondary-emerging markets. Further research could investigate whether this influence differs between different similar markets. For example, two emerging markets could be compared.

7 Conclusion

The goal of this study was to find an answer to the following research question: *To what extent does the influence of industry homogeneity in the magnitude of PEAD differ between developed stock markets and secondary emerging markets?* It was expected that the magnitude of PEAD is lower in secondary-emerging markets than in developed markets, caused by a higher industry homogeneity.

To answer this question, multiple linear regression analyses were used. In this study, the measurement for the magnitude of PEAD was a firm's 60 days and 45 days cumulative abnormal returns, where the 60 days CARs showed results with higher significance than 45 days CARs. With an annual industry homogeneity measurement approach, no significant relationship between industry homogeneity and a firm's 60 days CAR was found.

However, the robustness checks found more interesting results. When applying the industry homogeneity from 2020 and including merely positive SUEs, the analysis showed a significant positive effect of a firm's SUE on a firm's 60 days CAR. This implies that a 1 point higher SUE results on average in an increase of .005 percent points of a firm's 60 days CAR. This is not significant when robust standard errors were applied. Therefore, this study makes no concluding statement regarding the effect of SUE on a firm's PEAD magnitude.

The results confirm prior studies, which found a significant negative relationship between SUE and industry homogeneity. This implies that a higher industry homogeneity results in a lower magnitude of PEAD. However, this outcome becomes insignificant when robust standard errors were applied. Therefore, no concluding outcome will be stated again. Finally, no significant effects of the interaction between the USA dummy, SUE, and industry homogeneity were found.

To conclude, the following hypothesis was applied: *The magnitude of PEAD is more negatively related to industry homogeneity in China than in the USA.* This study shows no significant results which could indicate that industry homogeneity influences the PEAD magnitude more in China than in the USA. Therefore, the alternative hypothesis must be accepted: *The magnitude of PEAD is not more negatively related to industry homogeneity in China than in the USA.* As the results of this study show, no significant outcomes were found. This indicates that a higher degree of industry homogeneity does not directly cause a significantly different magnitude of PEAD when comparing developed and secondary-emerging countries. However, it can be concluded that a higher degree of industry homogeneity causes a lower magnitude of PEAD.

7.1 Theoretical contributions and practical implications

As this study found also a negative relationship between the magnitude of PEAD and industry homogeneity, this is in line with prior studies. However, the average course of PEAD was less clearly present than in prior studies. The goal of this study was to provide insight into whether the effect of industry homogeneity on a firm's PEAD magnitude was dependent on what market was analyzed. In this way, the study provides meaningful insights into how the influence of industry homogeneity on a firm's CAR differs from each type of market. To gain insight into the influence of industry homogeneity on a firm's CAR is important to predict the development of a firm's stock price. In this way, stakeholders can improve their anticipation of volatile markets.

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8 Appendix

Figure 4: Two-way scatter plot with CAR60 as the dependent variable and HOGN as the dependent variable

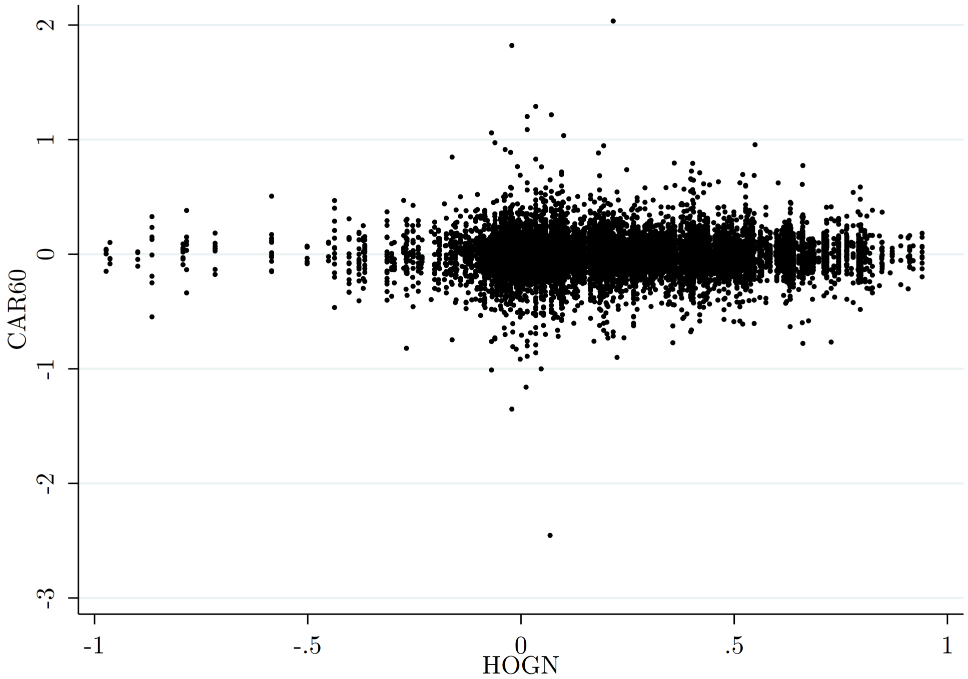

Figure 5: Two-way scatter plot with CAR60 as the dependent variable and SUE as the independent variable

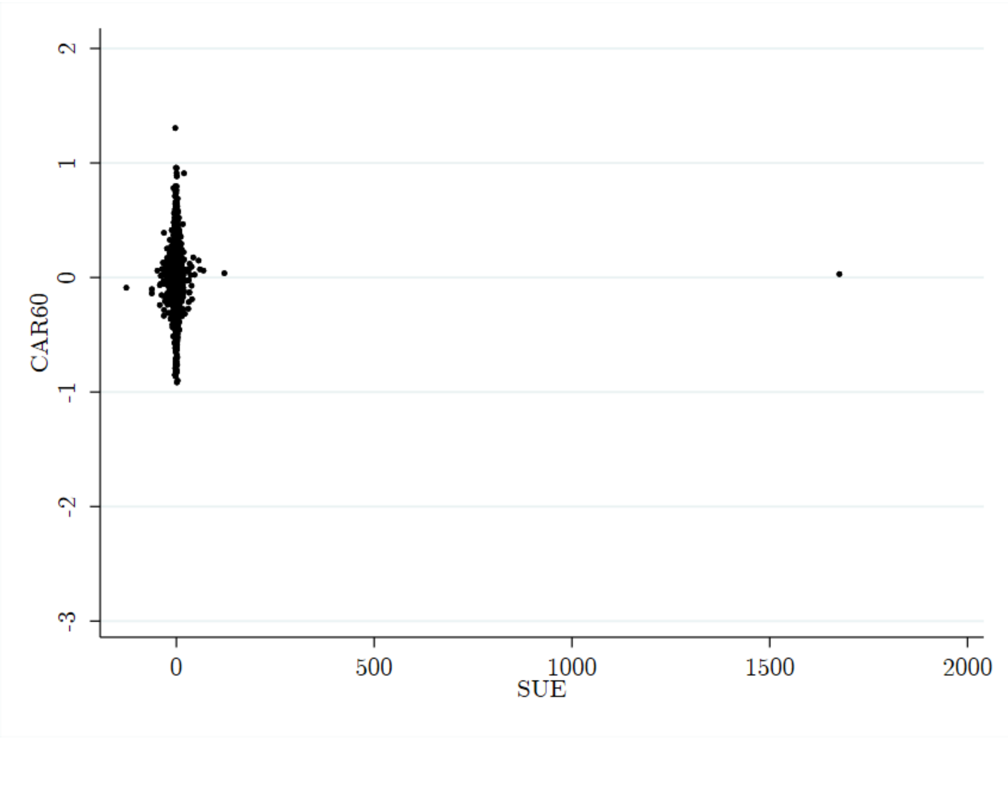

Table 9: Industry homogeneities of 2020

Industry	Amount of firms USA	Amount of firms China	HOGN2020 per industry USA	HOGN2020 per industry China
Aerospace and Defense	10	4	0,286102	-0,263123
Alternative Energy	2	4	0,411668	-0,169409
Automobiles and Parts	7	12	0,526327	0,177043
Banks	19	22	0,218796	0,899560
Beverages	6	10	-0,05574	0,133992
Chemicals	12	15	0,396266	0,060824
Construction and Materials	10	11	0,357548	0,467828
Consumer Services	3	1	0,410342	NA
Electricity	21	8	0,171145	-0,146071
Electronic and Electrical Equipment	14	6	0,364077	0,212757
Finance and Credit Services	4	1	-0,19825	NA
Food Producers	14	12	0,269544	0,069653
Gas, Water and Multi-utilities	8	0	0,255887	NA
General Industrials	16	4	0,235832	0,680911
Health Care Providers	11	4	0,002757	0,311343
Household Goods and Home Construction	6	7	0,326158	0,585251
Industrial Engineering	9	10	0,504873	0,278014
Industrial Materials	2	2	0,920893	NA
Industrial Metals and Mining	3	10	0,711325	0,144206
Industrial Support Services	19	1	0,078927	NA
Industrial Transportation	12	9	0,423818	-0,079141
Investment Banking and Brokerage Services	19	25	0,194638	0,772835
Leisure Goods	6	2	0,029785	NA
Life Insurance	6	4	0,004106	0,392230
Media	10	2	0,397608	-0,341993
Medical Equipment and Services	28	7	0,093588	NA
Non-life Insurance	16	1	0,033692	NA
Oil, Gas and Coal	21	7	0,498003	0,503683
Personal Care, Drug and Grocery Stores	11	5	0,007762	0,232820
Personal Goods	7	0	0,28441	NA
Pharmaceuticals and Biotechnology	20	25	-0,03613	-0,029456
Precious Metals and Mining	1	3	NA	-0,166360
Real Estate Investment and Services	1	7	NA	0,168729
Real Estate Investment Trusts	29	0	0,00029	NA
Retailers	19	4	0,115532	0,446110
Software and Computer Services	32	8	0,00021	-0,062829
Technology Hardware and Equipment	27	32	0,111338	0,109250
Telecommunications Equipment	4	6	0,1	-0,227417
Telecommunications Service Providers	7	3	-0,10017	NA
Tobacco	2	0	-0,14747	NA
Travel and Leisure	24	6	0,369807	0,060176
Waste and Disposal Services	2	0	0,927559	NA
Total	500	300		
Average			0,237572	0,295324

The used data contains operational expenses from 2016 until 2020.