DETERMINANTS OF POST-ANNOUNCEMENT DRIFT AND MARKET REACTION TO EARNINGS ANNOUNCEMENTS

AYKUT AHLATCIOĞLU

BOĞAZİÇİ UNIVERSITY

2020

DETERMINANTS OF POST-ANNOUNCEMENT DRIFT

AND MARKET REACTION TO EARNINGS ANNOUNCEMENTS

Thesis submitted to the

Institute for Graduate Studies in Social Sciences

in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

in

Management

by

Aykut Ahlatcıoğlu

Boğaziçi University

2020

Determinants of Post-Announcement Drift

and Market Reaction to Earnings Announcements

The thesis of Aykut Ahlatcıoğlu

has been approved by:

Prof. Nesrin Okay Akman ______________________
(Thesis Advisor)

Assoc. Prof. Ulaş Akküçük ______________________

Assoc. Prof. Neslihan Yılmaz ______________________

Prof. Güler Aras ______________________
(External Member)

Assoc. Prof. Cumhur Ekinci ______________________
(External Member)

August 2020

DECLARATION OF ORIGINALITY

I, Aykut Ahlatcıoğlu, certify that

- I am the sole author of this thesis and that I have fully acknowledged and documented in my thesis all sources of ideas and words, including digital resources, which have been produced and published by another person or institution;

- this thesis contains no material that has been submitted or accepted for a degree or a diploma in any other educational institution;

- this is a true copy of the thesis approved by my advisor and thesis committee at Boğaziçi University, including final revisions required by them.

Signature…………………………………….

Date………………………………………

ABSTRACT

Determinants of Post-Announcement Drift

and Market Reaction to Earnings Announcements

The aim of this dissertation is studying the determinants of the post-earnings-announcement drift (PEAD) and the market reaction to earnings announcements. We find strong evidence supportive of the existence of PEAD in the Turkish stock market with significant difference in average cumulative abnormal return between high and low earnings surprise firms in the 60 days following the quarterly earnings announcement. The positive relation between post-announcement abnormal returns and the surprise in earnings remain significant after controlling for an extensive list of explanatory variables. Among these variables, we find firm size has a negative impact on the magnitude of the positive association between surprise and subsequent equity returns. We also analyze the determinants of abnormal volume around earnings announcements. We show volume reaction to positive news is substantially higher than the reaction to negative news. This relation which is robust to the inclusion of a host of control variables is a novel addition to the literature which documents a link between abnormal volume and the magnitude of the surprise rather than the sign of the surprise. We discuss a behavioral explanation for this relation which centers on overconfident noise traders whose attention is grabbed by the positive surprises. Lastly, we study the information value of earnings announcements. We find significantly positive abnormal volume and abnormal absolute return in the three-day window around the earnings announcement which are also trending upwards over time. We take this as evidence that earnings news have information content and that its informativeness has increased through time.

ÖZET

Bilanço Sonrası Getiri Ayrışması

ve Bilanço Açıklanmasına Piyasa Reaksiyonun Belirleyicileri

Bu tezde, bilanço sonrası getiri ayrışması (PEAD) ve bilanço çevresinde piyasa dinamiklerinin belirleyicileri incelenmiştir. Açıklanan çeyreksel bilançosu beklentilere göre pozitif olan hisselerle negatif olan hisseler arasında açıklama sonrası ortalama kümülatif anormal getirilerdeki fark hem ekonomik hem de istatistiksel olarak anlamlı derecede pozitif olup, bu PEAD'nin Türkiye'deki varlığına işaret etmektedir. Bilanço sonrası getirilerle bilanço sürprizi arasındaki ilişkinin literatürde bulunan birçok açıklayıcı değişken kontrol edildiğinde de güçlü olarak kalmaya devam ettiği gözlemlenmiştir. Bu değişkenler arasında bulunan şirket büyüklüğünün, sürpriz ile getiri arasındaki ilişkiyi bir miktar zayıflatıcı rol oynadığı görülmüştür. Ayrica bu tezde, geçmiş bilançolar temelli sürpriz ölçütü kullanılarak şirketler üç gruba ayrıldığında, pozitif sürpriz grubu ile negatif sürpriz grubu arasında ortalama işlem hacmi olarak kayda değer fark olduğu görülmüştür. Bu bulgu, anormal işlem hacmini sürprizin yönünden ziyade sürprizin boyutu ile ilişkilendiren mevcut literatürden farklı bir ilişkiye işaret etmektedir. Sürprizin yönü ile işlem hacmi arasında gözlemlenen bu ilişkiye, hisse senetlerinin kısa vadeli hareketlerini dogru tahmin edeceği ile ilgili irrasyonel bir inanca sahip gürültücü işlemcilerin ilgisinin pozitif sürpriz yapan hisselere yoğunlaşmasının yol açtığı hipotezi de incelenmiştir. Son olarak, bilanço tarihleri çevresinde bulunan pozitif anormal oynaklık ve anormal işlem hacminin zaman içinde arttığı gösterilmiştir. Bu bilanço açıklamalarında ortaya çıkan bilginin yatırımcı gözündeki değerinin arttığına işaret etmektedir.

CURRICULUM VITAE

NAME: Aykut Ahlatcıoğlu

DEGREES AWARDED
PhD in Management, 2020, Boğaziçi University
MA in Economics, 2011, Princeton University
MS in Operations Research, 2008, The Wharton School, University of Pennsylvania
BS in Industrial Engineering, 2006, Boğaziçi University
BS in Civil Engineering, 2006, Boğaziçi University

AREAS OF SPECIAL INTEREST
Information and market efficiency, Financial forecasting, equity portfolio management

PROFESSIONAL EXPERIENCE
Quantitative Researcher, Science Wave Capital, 2018-
Vice President (Equity Research), Ak Investment, 2016-2018
Vice President (Equity Research), Oyak Securities, 2013-2016
Senior Research Associate, DPT Capital, 2011-2013
Teaching Assistant, Princeton University, 2010-2011
Teaching Assistant, The Wharton School, 2007-2008

AWARDS AND HONORS
International Economics Section Fellowship, Princeton University, 2008
OPIM Departmental Fellowship, The Wharton School, 2006
Highest Honors List, Boğaziçi University, 2006

PUBLICATIONS
Journal Articles
Ahlatcıoğlu, A., Okay, N. (accepted). Post-Earnings Announcement Drift: Evidence from Turkey. *Borsa Istanbul Review (SSCI)*.

Guignard, M., & Ahlatcıoğlu, A. (2020). The convex hull heuristic for nonlinear integer programming problems with linear constraints and application to quadratic 0–1 problems. *Journal of Heuristics (SCI).*

Ahlatcıoğlu, A., & Okay, N. (2019). A longitudinal analysis for informativeness of earnings announcements in Borsa Istanbul. *Journal of Capital Markets Studies,(3)*(2).

Ahlatcıoğlu, A., Bussieck, M., Esen, M., Guignard, M., Jagla, J. H., & Meeraus, A. (2012). Combining QCR and CHR for convex quadratic pure 0–1 programming problems with linear constraints. *Annals of operations research (SSCI), 199*(1), 33-49.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my thesis advisor Prof. Nesrin Okay Akman for continuous support and guidance. Her coolheaded approach was instrumental in making sure I get the most out of my studies here while able to keep up with my other professional and personal responsibilities.

I would like to thank the members of my dissertation committee Assoc. Prof. Neslihan Yilmaz, Assoc. Prof. Cumhur Ekinci, Prof. Güler Aras and Assoc. Prof. Ulaş Akküçük for their valuable feedback and contributions. I am grateful to many teachers and professors I have encountered throughout my studies from high school to all the way to graduate school. Among many of these distinguished academics, I would like to especially thank Prof. Monique Guignard who I am fortunate to have as a mentor, coauthor and friend.

Finally, I would like to thank my father Mehmet Ahlatcıoğlu, my mother Yıldız Ahlatcıoğlu and my sisters Beyza Özkök and Esma Özerol for the unconditional love and support they have given me throughout life. My father who is a professor of mathematics was always an inspiration and remains to be the person who I look up to in my life. This list also includes my father-in-law Yunus Nadi Noyan, my mother-in-law Müşerref Noyan and my brother-in-law Özgür Noyan who all are wonderful, caring people and I feel lucky to be part of their family, too. My special thanks go to my beloved wife Esra Noyan Ahlatcıoğlu who is truly a special person and my companion in life. She always was the one to lift my spirits up at times when things did not look very promising while taking much of the responsibility in raising our son Mehmet.

To my family,

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

,

ABBREVIATIONS

CAPM	Capital Asset Pricing Model
EMH	Efficient Market Hypothesis
GICS	Global Industry Classification Standard
IFRS	International Financial Reporting Standards
KAP	Public Disclosure Platform
PEAD	Post-Earnings Announcement Drift
Reg FD	Regulation Fair Disclosure
SEC	Securities and Exchange Commission
U.K.	United Kingdom
U.S.	United States

CHAPTER 1

INTRODUCTION

An anomaly in the finance and accounting literature which survived the test of time in challenging the efficient market hypothesis (EMH) is the post-earnings announcement drift (PEAD). Eugene Fama who developed EMH singles out PEAD as the only anomaly among many he analyzed in (Fama, 1998) as the one which survived robustness checks. PEAD was first documented by (Ball & Brown, 1968) and is characterized by a significantly positive relation between the surprise component in earnings announcements and the subsequent stock returns. In other words, those companies which report earnings which exceed market expectations demonstrate positive abnormal return on average while those which report earnings below market expectations demonstrate negative abnormal return for months after the announcement. PEAD had been the subject of a wide body of literature which primarily focused on the U.S. stock market.

One of the aims of this thesis is to contribute to the understanding of market efficiency by investigating PEAD in a major emerging market. In this regard, to our knowledge this is the first study providing a thorough analysis of the drift and its determinants for Turkey. Also, unlike previous non-U.S. studies, we conduct our study using quarterly earnings announcements with three separate earnings surprise measure and a full battery of explanatory variables. This allows for a better comparison with the research done to explain PEAD in the U.S. market. First, we show that PEAD exists in Borsa Istanbul by finding significant differential in the 60-day post-announcement abnormal return between the top and bottom surprise tertile using any of the three most commonly used surprise measures found in the literature. These measures are standardized unexpected earnings using time-series forecast (SUETF), standardized unexpected earnings using analyst forecast (SUEAF) and earnings announcement reaction (EAR). Using a sample of 6,471 firm-quarter observations in Borsa Istanbul for the 2007-2018 period, we find a drift of 2.9% using SUETF and 2.2% using EAR. For a subsample comprised of 2,398 company-quarter observations with at least one analyst forecast, we find the drift to be 2.9% when surprise is measured using SUEAF. Running a multivariate regression using our full sample, we also provide an extensive analysis on variables documented to have explanatory power with regards to the magnitude of the relation between the degree of surprise and future equity returns. We find that this relation remains both statistically and economically significant even after controlling for a list of control variables commonly used as proxies for firm's information environment, arbitrage risk/cost and limited investor attention. Consistent with the findings of (Foster et al., 1984), we find as firm size decreases, the positive association between surprise and abnormal returns subsequent to the earnings disclosure is strengthened. This finding supports investor underreaction as an explanation for PEAD. Smaller firms are more likely to have less sophisticated investor bases as well as opaquer information environments making the processing of earnings information a more difficult task.

We also demonstrate that multifactor models of (Fama & French, 1993) and (Fama & French, 2015) are not able to explain returns of monthly portfolios which takes long positions in stocks with recent positive surprises and short positions in stocks with negative surprises. Using (Fama & French, 2015) five-factor model, we find the resulting zero-investment portfolio has a monthly excess return of 1.2% when SUETF is used as the surprise measure followed by 0.7% for SUEAF and 0.4% for EAR. As another robustness check, for each quarterly earnings announcement we regress daily returns over the 60 trading-day window against daily factor returns of Fama and French's five-factor model. Regardless of the surprise measure we use, we find the average value of the intercept of these time-series regressions to be significantly positive for firms that fall into the positive surprise quantile Q3 and significantly negative for firms that fall into negative surprise quantile Q1. This indicates that the five-factor model is not able to account for the abnormal patterns in returns following earnings announcement. These findings are consistent with (Bernard & Thomas, 1989) which provided evidence against the argument that PEAD is an artifact of incomplete risk adjustment resulting from model misspecification.

Besides the post-announcement drift, we also analyze the market reaction at earnings announcements and what this reaction could tell about the informational value of these financial disclosures. It has been well known and documented that trading volume increases during earnings announcements. However, as noted in (Lerman & Tan, 2019) there is not yet a unified theoretical framework or empirical evidence that fully explains the wide variation in abnormal volume across firms during earnings announcements. This is important, because how volume varies cross-sectionally and over time has the potential to yield insights on how different market participants perceive public information and revise their expectations that an analysis solely based on price will not be able to. Some announcements cause extremely high volume reaction, while for others realized volume around earnings announcement is not at all different from the non-announcement period. Much of both theoretical as well as empirical work centers on signal strength and differential belief revisions as potential explanations. The signal strength or informativeness captures the intuitive idea that announcements that cause bigger shifts in aggregate expectations should induce a higher trading volume. The empirical studies have used proxies such as the magnitude of the earnings surprise and absolute price change to measure signal strength ((Bamber, 1986), (Bamber, 1987), (Atiase & Bamber, 1994), (Garfinkel & Sokobin, 2006) among others). An earnings announcement could also cause strong volume reaction if it leads market participants to differentially update their expectations. In the theoretical model of (O. Kim & Verrecchia, 1991) which has been empirically evaluated by (Atiase & Bamber, 1994), this occurs because different types of investors possess differing quality of pre-disclosure information. Some investors are more informed than others with regards to the upcoming announcement. This in turn results in a higher belief revision at the announcement by the uninformed type leading trading to occur. Differential belief revisions could also happen, because the public announcement is interpreted differently by different types of investors as in the behavioral model of (Kandel & Pearson, 1995).

We provide evidence on the determinants of trading volume by analyzing quarterly earnings announcement in Borsa Istanbul for the period of 2007-2018. There are very few studies that look at the dynamics of trading volume at earnings announcements for stock markets outside the U.S. ((Truong, 2012), (Park et al., 2014)) and none to our knowledge with a full analysis on its determinants. However, what really differentiates this study from others is that we document a rather striking divergence in volume reaction to earnings announcements based on the degree of surprise. We sort stocks each quarter into three quantiles according to an earnings surprise measure based on past earnings. We observe that the abnormal volume reaction measured as the difference in averages of logarithm of turnover between the earnings announcement window and the non-announcement period is 0.253 for the top surprise quantile Q1 compared to 0.080 for the Q2 quantile and 0.067 for the bad news group Q1. The difference between the top quantile and bottom quantile is statistically significant at 1% level and persists in the post-announcement window. This runs counter to the prior literature which relates trading volume with the absolute value of the earnings surprise. If the prevalent relation was indeed with the absolute value of the surprise, one would have expected a similarly high volume reaction in both bad news and good news quantiles of Q1 and Q3 respectively. This is clearly not the case in our sample. We also look at the evolution of trading volume before earnings announcements. (Chae, 2005) argues that the pre-disclosure information asymmetry which causes high volume at earnings announcements as in models of (O. Kim & Verrecchia, 1991) and (George et al., 1994) should lead to lower volume prior to the announcements as "discretionary liquidity traders" delay their trades until the information asymmetry which works to their disadvantage is resolved. (Park et al., 2014) and (S. Kim & Lim, 2017) builds up on this work and demonstrate that the decline is concentrated on firms that convey bad news at announcements. In our sample, we do not find either an overall decline in trading volume prior to earnings announcements or a significant difference in pre-announcement volume patterns based on the sign of the surprise.

We run a multivariate regression analysis to show that the relation between volume at the earnings announcement and sign of the surprise persists even after controlling for a host of other determinants of trading volume. Importantly, we find that the magnitude of the surprise as proxied by its absolute value do not have incremental power to explain volume reaction once the sign of the surprise is taken into account. Apart from the sign of the surprise, we find that trading volume at earnings announcements is positively associated with the absolute price change and the market-wide trading volume at the same announcement window while negatively correlated with the beta of the firm. On the other hand, firm size which in the literature is found to be inversely related to the average precision of pre-disclosure information and the disagreement at the earnings announcement is found not to be a significant determinant of trading volume. Finally, we do not find evidence that the volume responds to the change in risk profile of the firm as we do not find a significant association between volume and change in beta between pre-announcement and post-announcement periods.

It is not easy to provide an explanation for the huge gap in abnormal volume between positive and negative surprise announcements using the prevailing theoretical frameworks. We control for signal strength or the informativeness of the announcement by including absolute price change as well as absolute magnitude of the surprise. On the other hand, absolute magnitude of surprise and firm size should at least partly proxy for differential interpretation of the announcements and pre-disclosure uncertainty. Admittedly, we do not use analyst-based explanatory variables which are used in the literature to reflect pre-disclosure asymmetry and differential interpretations. However, we think it is hard to argue that analyst-based variables such as forecast dispersion before the announcement or the degree of forecast revisions at the announcement vary enough between positive and negative surprise announcements to explain the huge discrepancy in observed volumes. This is especially true given that analysts are only a subset of market participants and not likely to reflect the full belief heterogeneity across the full investor base.

We offer a potential explanation based on behavioral finance. Our explanation centers on noise traders which tend to trade for reasons unrelated to stock fundamentals. Using a similar argument to (Barber & Odean, 2008), we hypothesize that noise traders' preference of which stocks to trade is driven by which stocks grab their most attention. Surprise earnings announcements are prime candidates for getting attention due to the announcement itself as well as indirectly through increased volume and abnormal price change. In particular, the prevalence of day traders which is not much discussed in the extant literature might play an important role in boosting volume without a similar impact on prices. We think there could be at least two potential explanations for why this mechanism works for positive surprises rather than negative surprises. We think positive surprises could garner more attention as managers are more eager to disclose good news and brokers are more willing to convey good news and issue buy recommendations. The other explanation is that noise traders in general, and day traders in particular are trend-followers and have a tendency to exploit intraday trends in prices of stocks which attracts their attention. However, they are not able to do this for negative surprise firms that gets their attention, because of restrictions on short-selling.

The final part of this thesis looks at the market reaction as a gauge of informativeness of earnings releases. Earnings announcements are the main scheduled and periodic corporate announcement for listed firms in a stock market as they provide a wealth of financial and operational information with regards to the latest fiscal period. As such, an analysis of whether these announcements are valuable in terms of their content is of interest for companies, investors as well as regulatory bodies. (Beaver, 1968) was the first to empirically examine the information content of earnings announcements. From a valuation point of view, an earnings announcement could be considered to have information if it leads to change in market participants expectation for future returns. Accordingly, (Beaver, 1968) used abnormal volatility and abnormal volume at the time of announcement as gauges for information value as the former reflects the resulting change in expectations of the market as a whole while the latter reflects changes in expectation of individual investors. Using the same proxies for information content as (Beaver, 1968), (Landsman & Maydew, 2002) concluded that there is an upward trend in informativeness of quarterly earnings reports in the United States for the 1972-1998 period. The non-US evidence on information content had been scarce and mostly conducted with limited data sets using only annual earnings announcements. Also, the samples used are not recent and accordingly do not reflect the changes in market structure in the last two decades such as the emergence of algorithmic trading.

In this study, we empirically look at whether quarterly earnings announcements have information content and how the informativeness of these announcements has changed over the 2007-2017 using a broad sample comprised of over 12,000 observations coming from 396 companies listed at Borsa Istanbul. As proxies for information content, we use abnormal volume (AVOL) and abnormal absolute return (AAR) around earnings announcements defined similar to (Dellavigna & Pollet, 2009) and (Asthana & Balsam, 2001) respectively.

We find significant information content at earnings announcements for our sample period with average AVOL and average AAR both greater than zero. Comparing annual earnings announcements with interim earnings announcements, we observe a higher abnormal volume, but lower abnormal absolute return at annual announcements. Therefore, our findings do not suggest that annual earnings announcement are more informative than the interim earnings announcements. In line with (Landsman & Maydew, 2002), we find a positive time trend in both AVOL and AAR even after controlling for firm characteristics such as size, book-to-market and beta as well as the magnitude and direction of surprise. This implies that informativeness of earnings has increased at Borsa Istanbul and this is not solely attributable to change in firm composition over time. Our regression analysis also shows that this time trend is more pronounced for growth companies and earnings announcements with a greater magnitude of surprise.

Looking at several drivers of the increase in the information content of earnings announcements over time, (Francis et al., 2002) singled out increase in information released concurrent to earnings announcements such as issuance of operational guidance as the main driver among them. Although we think this could be a plausible explanation for the positive trend in earnings informativeness in Borsa Istanbul, a full-blown analysis similar to (Francis et al., 2002) is beyond the scope of this paper. However, we examined whether the introduction of the Public Disclosure Platform (KAP) have made earnings announcements more valuable for investors as evidenced by a stronger market reaction. The KAP is an online platform similar to EDGAR in the U.S at which companies are required first to disclose all material corporate announcements before other communication channels. KAP which was introduced in June 2009 replaced a paper-based heavily manual process at which companies send relevant information to the Borsa Istanbul through fax (see (Mugaloglu & Erdag, 2011) for more detail). Hence, it could be argued that it helped democratize the information environment by allowing market participants to access material corporate information with no delay and with no cost. To partially mitigate the influence of confounding events, we analyze the impact of KAP on a sub-sample which consist of observations with earnings announcements made between one year before the KAP introduction and one year after the KAP introduction. We find that the AAR is higher in the post-KAP period (June 2009-May 2010) compared to pre-KAP period (June 2008-May 2009), but there is no similar significantly positive change for AVOL. Accordingly, our results are not conclusive on whether a significant change in the information dissemination technology had an influence on the informativeness of earnings announcements.

CHAPTER 2

LITERATURE REVIEW

In this chapter, we present a review of the prior literature starting with PEAD, presenting both US and international evidence on the topic. The second part of the literature review looks at both theoretical as well as empirical studies on trading volume around earnings announcements. The last part of the review is on the information value of earnings announcements with a special emphasis on its evolution over time.

2.1 PEAD: U.S. and international evidence

The abnormal return in the context of PEAD is the difference between the ex-post return of the security following the earnings announcement and its normal return. The normal return can be defined as the expected return of a stock in the hypothetical case where the event did not take place. It can be found using a risk model such as market model, capital asset pricing model (CAPM) or other more sophisticated multi-factor models. (Ball & Brown, 1968) was the first study which empirically looked at the drift phenomenon and showed a positive correlation between change in firms' earnings and stock price change subsequent to the earnings announcement. Their analysis was limited to annual earnings announcements of 261 U.S. firms during the 1957-1965 period. Several other studies following (Ball & Brown, 1968) were able to report similar results. Among these are (Jones & Litzenberger, 1970), (Watts, 1978), (Rendleman et al., 1982).

There were two main competing explanations put forward to explain PEAD. The first explanation focused on the possibility of misestimation or incompleteness of the model used to describe normal return. If a model such as CAPM fails to completely adjust raw returns for risk, observed abnormal return post earnings announcement could be just the compensation for taking the risk that is not reflected in CAPM. The second class of explanation suggests that investors do not fully react to information released at earnings announcement causing a delayed market reaction. This underreaction could be because investors are not able to efficiently process earnings information because of limited attention or other psychological biases. However, it could also be that there is a subset of investors which are not subject to these biases, but they cannot eliminate the underreaction and enforce market efficiency because of high costs or risks involved in conducting the necessary arbitrage trades.

Any explanation that is related to model misestimation/incompleteness will require those firms which post positive earnings surprise become riskier on a dimension not captured by the utilized risk model vis-a-vis those which post negative earnings surprise. (Bernard & Thomas, 1989) used an extensive data set covering quarterly earnings announcements of U.S. firms for the 1974-1986 period. They found that the drift continues to persist even after several risk-correction producers are applied and concluded that the evidence is not supportive of the first class of explanation based on incomplete risk adjustment. Since then, most of the research centered on the delayed market reaction explanation. One exception is (D. Kim & Kim, 2003) which provided a multifactor explanation for PEAD. First, in line with (Bernard & Thomas, 1989) they find that the cumulative arbitrage return over the 60 days subsequent to a quarterly earnings announcement remain significant after adjusting for risk using well-known factor models such as the three-factor model of (Fama & French, 1993) as well as the four-factor model in (Carhart, 1997) which augments momentum to the three-factor model. Then, they propose a four-factor model to explain post-earnings announcement returns as a compensation for risk by adding a novel factor named earnings surprise risk factor to Fama and French's three-factor model.

Support for the investor underreaction explanation came from a series of studies analyzing the cross-sectional variation among companies in the way PEAD manifests itself. (Foster et al., 1984) used a sample comprised of 2,053 firms spanning the period from 1974 to 1981. They were one of the first among many who showed that the magnitude of the drift is negatively correlated with the firm size. In particular, defining the size of a firm as its market capitalization at the beginning of the year that the examining earnings announcement is made, they find that firm size explains 65% of the variation in cumulative abnormal return following earnings announcement, while together with the sign and magnitude of earnings surprise, it is able to explain 85% of the variation. (Bartov et al., 2000) and (Brown & Han, 2000) among others analyzed this relation further and found a negative relation between PEAD and not just size, but also other variables which could serve as proxies for the richness of the information environment and the level of investor sophistication such as percent of shares outstanding owned by institutional investors and number of analysts if any covering the stock. It stands to reason that those firms which are large, whose stocks are held by institutional investors which tend to be more sophisticated than retail investors and whose analyst covering is more extensive have a more transparent information environment and have their earnings news processed more efficiently leading the market reaction to be complete with minimal delay. (Bartov et al., 2000) used the institutional ownership data derived from quarterly 13F filings for the U.S. market. Their key finding is that the relation between PEAD and institutional ownership percentage persists even after accounting for transaction costs and firm size.

(Bernard & Thomas, 1990) examines the hypothesis that PEAD results, because at least some of the investors incorrectly assume earnings follow a seasonal random walk model. Such biased expectation of investors leads market prices to only gradually adjust to earnings surprises as they underestimate the implication of earnings surprises for future earning levels. In particular, they find a positive correlation between abnormal return around the earnings announcement date in quarter t and earnings surprises defined using seasonal random walk model in quarters t-1, t-2 and t-3. (Battalio & Mendenhall, 2005) builds upon (Bernard & Thomas, 1990) and looks at the implications of investor heterogeneity within the context of earnings drift. They use a sample which consists of all Nasdaq stocks whose earnings announcements are recorded on Compustat over the 1993 to 1996 period. Their choice to focus only on Nasdaq stocks is intentional as the Small Order Execution System which was in place at the time makes it very likely that it is the unsophisticated retail investors rather than sophisticated investors which places small trades. They present evidence suggesting that different subsets of investors use different information sets. In particular, investors initiating large trades incorporates analyst forecasts in their decision-making while investors initiating small trades use an information set that is inferior to large traders ignoring the information in analyst forecasts as well as underestimating the time-series autocorrelation of earnings. Under the premise that small trades are primarily initiated by small investors, (Battalio & Mendenhall, 2005) concludes that it is the small unsophisticated investors with biased expectations which cause the drift. Hence, (Battalio & Mendenhall, 2005) is able to isolate the subset of investors which (Bernard & Thomas, 1990) hypothesized to follow seasonal random walk and accordingly cause the earnings drift.

More recently, (Hirshleifer et al., 2009) and (Dellavigna & Pollet, 2009) looked at the behavioral underpinnings of the investor underreaction to earnings information which is hypothesized to be main cause of the drift that follows the earnings release. (Hirshleifer et al., 2009) analyzed quarterly earnings announcements during the 1995-2004 period and found that both the volume and price reaction to earnings news is weaker while the post-announcement drift is higher when there are a greater number of announcements made by other firms on the same day. They find the magnitude of PEAD to be 76% higher without controls and 43% higher with controls on high-news days compared to low-news days. They characterize high-news days as those days which are at the top decile in terms of competing announcements and low-news days as those which are at the bottom decile. In sum, consistent with the limited attention literature in behavioral finance, (Hirshleifer et al., 2009) found that investors underreaction to earnings reports increase when there are a greater number of same-day announcements made by other firms competing for the investors' attention. On the other hand, (Dellavigna & Pollet, 2009) found PEAD is greater for earnings announcements on Fridays when investor inattention is most likely. Their sample is comprised of 228,651 observations spanning the period from 1984 to 2006. Friday announcements are found to cause 15% lower price reaction and 8% lower volume reaction as opposed to 70% higher delayed response.

Another strand of the literature looks at the cross-sectional variation in limits to arbitrage. (Bhushan, 1994) explicitly looked at the relation between drift magnitude and the transaction costs. Looking at the drift phenomenon from the perspective of the informational efficiency framework of (Grossman, 1976) and (Grossman & Stiglitz, 1980), they argue that PEAD could exist in a trading environment where there is investor heterogeneity and transaction costs. These transaction costs could be direct costs such as bid-ask spreads and trading commissions as well as indirect costs which include price pressure effects along with delay in filling the order. They choose stock price as a proxy for the inverse of directs costs while trading volume as a proxy of indirect costs of trading. They find a negative relation between the magnitude of the drift and both of these proxies. They also present evidence that the relation between firm size and drift as well as between analyst following and drift are no longer significant once transaction costs are taken into account. (Battalio & Mendenhall, 2007) provides a more direct test of whether the magnitude of the drift remains significant net of transaction costs by computing the profits generated by using actual earnings announcement times/dates as well as actual bid-ask spreads. They find that an investor could have earned a hedged-portfolio return of at least 14% per year after transaction costs during their sample period of 1993 to 2002.

(Ng et al., 2008) is another paper which looks at the interplay between transaction costs and drift. First, they offer an explanation based on microstructure literature on why trading costs impede informed investors to fully incorporate earnings information into prices at the time of earnings announcement. This is followed by a delayed reaction as informed investors resume trading as value-relevant news makes it profitable to trade again and leads market prices to converge towards fundamental value. In accordance with this theoretical framework, they find immediate reaction to earnings surprises is limited for firms with high transaction costs while PEAD is higher. However, the profits that can be obtained from a PEAD based trading strategy is in fact lower for such firms once transaction costs are netted out.

(Chordia et al., 2009) also uses high-frequency data similar to (Ng et al., 2008) and (Battalio & Mendenhall, 2007). However, unlike these two studies they also include market impact costs and short-sale costs. (Chordia et al., 2009) argues that these costs are likely to be more important costs for informed institutional traders that are looking to exploit PEAD compared to bid-ask and commission costs. They find that a PEAD based monthly hedge return of 2.43% is achievable for the most illiquid stocks, whereas this return is negligibly small at 0.04% for the most liquid stocks. Yet, their transaction cost study indicates that trading costs account for 70-100% of the paper profits of such a strategy for illiquid stocks.

(Mendenhall, 2004) investigates arbitrage risk rather than arbitrage cost as an explanation for delayed reaction to earnings news. They base their argument on the model of (Wurgler & Zhuravskaya, 2002) which envisions a world which consists of two type of investors, arbitrageurs and non-arbitrageurs. The arbitrageurs who in fact hold correct beliefs about the fundamental value of a stock cannot fully exploit the drift because this requires trades that are risky. The risk in this context is arbitrage risk which is defined as the "idiosyncratic volatility of a stock which cannot be offset by holding offsetting positions in other stocks and indices". (Mendenhall, 2004) argues that arbitrageurs face this risk, because they are highly specialized and hold relatively large positions rather than diversified portfolios. They define arbitrage risk as the percentage of stock return variance that cannot be hedged by S&P 500 return. Using a U.S. sample of 52,575 firm-quarter observations for the 1991-2000 period, (Mendenhall, 2004) finds the drift is smaller when the arbitrage risk is lower. In particular, for firms in the highest arbitrage-risk quintile, it is found that the 3-month post-announcement abnormal return spread between the most positive surprise decile and the most negative surprise decile is 10.67% compared to only 2.97% for the firms in the lowest arbitrage-risk quintile.

A critical part of any PEAD study is defining the earnings surprise as the observed drift pattern will inevitably depend on this definition. In the literature, earnings surprise is typically measured as the standardized difference between a proxy for market expectation and actual earning realization. Early studies almost exclusively used some form of a time-series model to define the market expectation and consequently earnings surprise including studies of (Ball & Brown, 1968), (Foster et al., 1984) and (Bartov et al., 2000). However, as analyst forecasts became available for more firms via data services such as IBES, more recent studies also began to use analyst forecasts. (Livnat & Mendenhall, 2006) used an extensive sample of earnings announcements in the U.S. spanning the period 1987-2003 to compare the two most commonly used proxies; the median analyst forecast and the time-series forecast based on past earnings realizations. They find that the drift magnitude based purely on analyst estimates is significantly higher than the drift based on time-series forecast. However, they also find that neither surprise measure subsumes each other and the return differential between firms with most positive surprise and firms with most negative surprise increase when both surprise measures are used. Another surprise measure which was first introduced in (Chan et al., 1996) and studied in depth by (Brandt et al., 2008) is the earnings announcement return (EAR) which ranks stocks according to the immediate stock price reaction around the earnings announcement. (Brandt et al., 2008) using a U.S sample spanning the period 1987-2004 found that a strategy that buys and sell companies based on EAR generates an annual abnormal return of 6.3% compared to 5.6% produced using the traditional time-series forecast based measure. Furthermore, similar to (Livnat & Mendenhall, 2006)'s finding, they documented that a strategy which exploits both EAR and time-series forecast based measure generates an annual abnormal return of around 11%.

The international evidence on PEAD is scarce compared to the evidence for the U.S. Earlier work which utilized limited data sets such as (Ariff et al., 1997), (Van Huffel et al., 1996) and (Hew et al., 1996) do not provide conclusive evidence that PEAD exists in Singapore, Belgium and U.K. markets respectively. More recent studies use comprehensive data sets, but still mostly not directly comparable with the studies on the U.S market which analyze PEAD within a context of quarterly earnings announcements with multiple surprise measures including analyst forecast based surprise measure. Lack of availability of reliable accounting and estimates data in quarterly frequency force most studies to resort to using annual data. However, using only annual data not only reduces number of unique observations, but also makes it challenging to define an effective earnings surprise measure. This is because, most of the information in annual earnings is likely to be priced during earlier interim earnings announcements and the market's surprise reaction if any would be to the fourth quarter results rather than the full year report.

Two multi-country studies which uses annual earnings reports and analyst forecast based measure are (Griffin et al., 2010) and (Hung et al., 2015). (Griffin et al., 2010) found PEAD is only present in 15 of the 38 markets analyzed with PEAD measured as 4.1% (for six months) in developed markets and 4.2% in emerging markets pointing to no statistically significant difference between the two. (Hung et al., 2015) interpreted the 2005 mandatory adoption of International Financial Reporting Standards (IFRS) worldwide as an exogenous information shock and looked at its impact on the drift behavior. They showed that the PEAD existed in 18 out of 30 countries analyzed during the pre-adoption period while this number went down to 13 after the IFRS adoption. The attenuation of the drift primarily comes from countries which adopts IFRS as the average PEAD for the adopting countries decline from 2.4% to 1.1% while for the non-adopting PEAD increased from 2.8% to 4.2%. (Hung et al., 2015) attributed this to improved financial-reporting quality which make stocks easier to value.

(Truong, 2011) tested the PEAD in the Chinese market using quarterly data and found statistically significant drift of 4.1% using a sample of 36,772 observations in the Chinese equity market for the 1994-2009 period. Although this study differentiates itself from previous studies in that it utilizes quarterly earnings announcement data for an extensive look at the drift anomaly and its determinants, it relies exclusively on time-series forecast based measure for this. Due to lack of availability of relevant Chinese estimates data at quarterly frequency, (Truong, 2011) was able to test analyst forecast based PEAD only at annual frequency. He found a hedge strategy of going long the top quintile of earning surprise stocks (based on annual analyst forecasts) and short the bottom quintile of earnings surprise stocks can generate around 9.5% abnormal return for the 1 year period after the earnings information is made public.

2.2 Theory and empirical evidence for volume around earnings announcements

(Beaver, 1968) in his seminal paper which looks at information content of earnings announcements noted that price and volume reactions to an earnings announcement should not be necessarily the same as the former reflects changes in expectations of the market as a whole while the latter reflects the changes in expectations of individual investors. In particular, he argued that volume reaction to an earnings announcement could in fact be a more complete test for informativeness. There could be announcements which do not garner significant price reaction as they do not change the overall market's expectation. However, this does not necessarily imply that such announcements are insignificant. It could be that the expectation of individuals has substantially changed as a result of the information released which could lead them to trade. Indeed, (Bamber & Cheon, 1995) finds that roughly a quarter of earnings announcements in their U.S sample for the 1986-1989 period generate very high trading, but no price change or large price change, but little trading.

(Bamber, 1986) and (Bamber, 1987) are early papers which look at the determinants of trading volume reaction to earnings announcement. In these studies, Bamber finds that trading volume is inversely related to firm size and the absolute value of the earnings surprise. (Bamber, 1987) attributes the negative correlation between firm size and trading volume to the higher availability of pre-disclosure information for larger firms. That is for larger firms it is more likely that information related to quarterly performance is released to the market through alternative sources such as analyst reports prior to the announcement which render the formal earnings release less important. On the other hand, (Bamber, 1987) argues that the positive association between volume reaction and the magnitude of the earnings surprise stems from more surprising announcements being more informative which in turn leads to a wider variety of interpretations or belief dispersion and subsequently higher volume. (Ziebart, 1990) hypothesized that abnormal volume could be driven not by just the extent of pre-disclosure information and the information content or surprise in the announcement, but also change in dispersion of beliefs consistent with trading volume theory of (Karpoff, 1986). In particular, he argued that there is a positive correlation between trading volume at earnings announcements and change in the level of dispersion of beliefs.

Using a sample of 611 earnings announcements for the 1978-1983 period, he found that abnormal volume is positively associated with the absolute change in the mean forecast which proxy for the information content of the announcement as well as change in the dispersion of analyst forecasts which proxy for the change in belief dispersion.

(Atiase & Bamber, 1994) conducted empirical evaluation of (O. Kim & Verrecchia, 1991)'s highly influential analytical model on volume reaction around public announcements. According to (O. Kim & Verrecchia, 1991)'s model, trading volume in the earnings announcement window should be proportional to the degree of differential precision of pre-disclosure information and the contemporaneous absolute price change. In this model differential precision of pre-disclosure information arises because the quality that is the precision of private information investors possess with regards to the upcoming announcement differs among investors. This informational asymmetry causes investors to hold different pre-disclosure expectations which leads to differential belief revision when the announcement is made. That is, relatively more informed investors will have to make smaller belief revisions compared to less informed. Accordingly, this differential belief revision will result in trading after the earning release is made. On the other hand, the other key prediction of (O. Kim & Verrecchia, 1991)'s model that is the positive relation between trading volume and the absolute value of price change is consistent with the early findings in the finance literature that volume in financial markets is positively correlated with the magnitude of price changes (see (Karpoff, 1987) for an extensive review). To test (O. Kim & Verrecchia, 1991)'s model, (Atiase & Bamber, 1994) uses a sample of 5,282 annual earnings announcement for the 1980-1989 period. To proxy for differential precision of investors' pre-disclosure information, they use dispersion and range of EPS forecasts prior to the announcement. Using these two metrics as proxies have two important caveats. First, they reflect divergent expectations of a relatively informed subset of the overall set of market participants. Secondly, divergent expectations could result not only due to high information asymmetry across investors, but also because of the level of average precision of pre-disclosure information or in other words preannouncement uncertainty. (Atiase & Bamber, 1994) argues that they account for the cross-sectional variation in average precision by adding the magnitude of the price change as well as firm size to their multivariate regression analysis. Consistent with the analytical framework of (O. Kim & Verrecchia, 1991), they find that the abnormal volume is positively correlated with both absolute price change around the announcement as well as their two proxies for pre-disclosure information asymmetry. (Utama & Cready, 1997) simplified (O. Kim & Verrecchia, 1991)'s model by assuming there are two types of investors; informed traders having equally high prior precision and remaining traders with equally low precision. They consider institutions to be representative of better-informed traders and asserts that differential precision in pre-disclosure information should peak around 50% institutional ownership. They indeed found that when institutional ownership is low, trading volume increases with institutional ownership, but when institutional ownership is high trading decreases with it. This creates an inverted U-shaped relation between trading volume reaction and institutional ownership.

In the model of (O. Kim & Verrecchia, 1991), differential belief revisions that induce trading are driven by pre-disclosure information asymmetry. Importantly, investors in this model have identical interpretation of the information released at earnings announcements and abnormal volume is proportional to the absolute value of the price change. This implies that abnormal volume should be negligible when the contemporaneous absolute return is close to zero. However, using a quarterly sample of 69,067 observations covering the period between 1981 and 1992, (Kandel & Pearson, 1995) documents that there is significant abnormal volume even for announcements with announcement period returns close to zero. They also construct a measure of differential interpretation defined as the number of pair of analyst forecasts that move in opposite directions and either flip or diverge at the announcement period. Using this measure, they find the average percentage of pairs that either flip or diverge is multiple times higher than the percent recorded in non-announcement periods. To reconcile these findings, (Kandel & Pearson, 1995) deviates from strict investor rationality assumption of (O. Kim & Verrecchia, 1991) and builds a model where investors use different likelihood functions to interpret the public announcement. Accordingly, in their model differential belief revisions that induce trading is driven by differences of opinion. This investor heterogeneity could be caused by differences in information processing as well as differential preferences. (Kandel & Pearson, 1995) does not conduct a direct test of their theory by looking at the relation between trading volume and differential interpretation measures. (Bamber et al., 1999) looks at this relation after controlling for market-wide trading volume, firm size, absolute percentage change in mean forecast (as a proxy for the magnitude of surprise) and the absolute value of return around earnings announcements. Using (Kandel & Pearson, 1995)'s differential interpretation measure based on analyst forecasts, they report that abnormal volume increases with increase in differential interpretation. However, this is restricted to the subsample at which either contemporaneous price return is minimal, or trading is above the non-announcement trading average.

In the literature, there have been also theoretical models which stays in the realm of rational investors paradigm but attempts to explain belief revision induced trading volume at earnings announcements through differential interpretation. Two prominent examples are (Holthausen & Verrecchia, 1990) which introduces differential interpretation by introducing idiosyncratic noise in the public announcement and (O. Kim & Verrecchia, 1997) which assumes investors have private information in conjunction with a public announcement. (O. Kim & Verrecchia, 1997) constructs a model which has the feature that investors employ private information in anticipation of as well as in conjunction with a public announcement. Hence, it is an attempt to incorporate differential preannouncement information as well as differential interpretation in one model. In this general model, they show that when there is only pre-disclosure private information, expected trading volume has a linear relation to absolute price change with a zero intercept. On the other hand, when there is only private information associated with earnings announcement, expected trading volume is independent of the absolute price change.

More recent empirical work takes (O. Kim & Verrecchia, 1997) 's model as an analytical framework to analyze dynamics of trading volume around public announcements. Accordingly, (Ahmed et al., 2003) considers part of volume that is related to absolute price change as related to preannouncement information asymmetry whereas the remaining portion is related to differential interpretation of information at the announcement. They find that in a regression of abnormal trading volume on absolute price change and other control variables, the regression coefficient on absolute price change has declined over time while the intercept term has increased. They take this as evidence that the advent of online trading which led to an increase in the proportion of naive investors has caused a decline in pre-disclosure information asymmetry while increasing differential interpretation. With a similar approach, (Ahmed & Schneible, 2007) analyzes the impact of the Regulation Fair Disclosure (Reg FD) issued by the Securities and Exchange Commission (SEC) in 2000 aimed at preventing firms to make material disclosures to some market participants while excluding others. Comparing the relation between abnormal trading volume and absolute price change in the pre-FD period with post-FD period, they find that this relation got weaker which implies a reduction of differential precision of pre-disclosure information thanks to the new regulation as intended by the SEC.

(Atiase & Gift, 2015) conducts an empirical evaluation of what they consider as four determinants of information induced abnormal volume at earnings announcements. These are heterogenous prior beliefs, differential interpretation of new information, change in consensus and informedness effect. Using a sample of 25,957 quarterly earnings announcements for the 1985-2008 period, they find that all four determinants are significant in explaining abnormal volume after controlling for magnitudes of price reaction around earnings announcements as well as quarterly earnings surprise.

(Barron et al., 2018) found that the magnitude of volume reaction to earnings announcement increased over the 35-year period 1977-2011 and the volume reaction/firm size relation has reversed in a more recent time period (2008-2011) with higher abnormal volume reaction observed at larger firm earnings announcements. They explain both the overall increase in volume reaction and observed reversal in volume reaction/firm size relation by linking it to (O. Kim & Verrecchia, 1991)'s model and suggesting that differential precision of pre-announcement information around earnings announcements increased over time, particularly for large firms. They attributed this increase in pre-disclosure asymmetry particularly for large firms to increased investor diversity which led to greater differences among investors in the motivation and ability to gather private information.

(Lerman & Tan, 2019) divides determinants of trading volume into three categories which are divergence of beliefs upon the arrival of public signal, difference in pre-announcement private information and signal strength. Signal strength refers to informedness which (O. Kim & Verrecchia, 1991) captures with absolute price change. They find significant relation between abnormal volume and contemporaneous analyst revisions, future earnings surprises, the F-score of (Piotroski, 2000) and level of short interest consistent with the signal strength explanation. On the other hand, they observe that proxies they use for belief divergence has a moderate bearing on abnormal volume for only bad and neutral news firms. Finally, they do not find a significant relation between volume and proxies for pre-disclosure information asymmetry for any level of earnings news.

A relatively smaller part of the literature looks at the implication of pre-disclosure information asymmetry on trading volume prior to announcements. (Chae, 2005) found that trading volume decreases cumulatively by more than 15% before scheduled corporate announcements including earnings announcements and attribute this market behavior to information asymmetry. When information asymmetry is high, liquidity providers shy away from trading when they perceive high adverse selection costs which result in low trading volume prior to the announcement. Using a sample comprised of annual earnings announcement in the Korean market over the 2001-2010 period, (Park et al., 2014) found abnormal trading volume is significantly negative before earnings announcements which is consistent with (Chae, 2005) 's hypothesis.

However, this is driven by the abnormal trading volume prior to negative earnings surprise rather than positive earnings surprises. (Park et al., 2014) attributed this observation to higher information asymmetry among investors before negative earnings surprises than positive earnings surprises which could be perhaps because managers voluntarily disclose good earnings while delaying the disclosure of bad news. (S. Kim & Lim, 2016) finds that pre-announcement trading volume declines for low analyst coverage while in fact increases for high analyst coverage firms. In addition, consistent with (Park et al., 2014), they document that trading volume prior to bad news is lower than volume prior to good news. They attribute these finds to increasing availability of public information with regards to the upcoming earnings announcement through either pre-disclosure analyst research or corporate disclosure.

2.3 Informativeness of earnings announcements

Whether earnings announcements carry informational value has long been a central question for financial markets research. Using a U.S. sample of 506 annual earnings announcements for the 1961-1965 period, (Beaver, 1968) established that earnings announcements have information content as evidenced by significant abnormal volume and abnormal volatility around earning announcement dates. In particular, he found that the squared price fluctuations were 67% higher and trading volumes were 33% higher in the earnings announcement week compared to non-announcement period which he defined as eight weeks before and eight weeks after the week of earnings announcement. Following this seminal work, several studies with more extensive datasets and different methodologies such as (Morse, 1981), (Kiger, 1972), (Bamber, 1986) and (Ziebart, 1990) reached similar conclusions on the information content of earnings. However, there have also been studies which argues that informativeness of earnings information may be limited. Most of these studies regress stock returns on accounting metrics such as level of earnings or change in earnings to gauge how much of the return variation is explained by earnings information. (Lev, 1989) documents that earnings account for roughly 5% to 10% of the variation in stock returns in both time-series and cross-sectional tests. (Amir & Lev, 1996) focuses on cellular phone companies to argue that financial information disclosed at earnings announcements might have limited value for technology-based growth industries. They ran panel regressions of cumulative market-adjusted returns at different windows around earnings announcements for 14 cellular phone stocks for the period 1974-1993 on basic accounting metrics as well as nonfinancial operating performance indicators such as market penetration. The results of these regression indicate that pure financial information is not significant in explaining security returns on a stand-alone basis, but is significant when complemented with non-financial data. (Ball & Shivakumar, 2008) takes a somewhat different approach and regress calendar-year security returns on their four quarterly earnings-announcement window returns. Based on R^2 values of these regressions, they find that each quarterly earnings announcement accounts for roughly 1% to 2% of the total annual information which they conclude to be not a huge incremental amount of information to the market.

A related research question is how the informativeness of earnings announcements has evolved over time. Using a broad sample of 92,613 firm-quarter observations for the 1972-1998 period, (Landsman & Maydew, 2002) finds that the magnitude of abnormal volume and volatility increased over time which they took as evidence of increased informativeness of earnings announcements. (Francis et al., 2002) looks at three different explanations for (Landsman & Maydew, 2002)'s finding of increased information content of earnings. These are increase in the absolute amount of unexpected earnings conveyed in the announcements, increase in the intensity of investors' average reaction to unexpected earnings and increase in the amount of information released at earnings announcements. Their findings do not support the first two explanations and they conclude that the observed increase in information content is driven by the expansion in the amount of concurrent information disclosed in firms' earnings announcements over time. In particular, they find that the length of earnings announcement press release grew from an average of 517 words in 1980 to 2,427 words in 1999 while disclosure of detailed income statement grew monotonically from 8.5% to 77.8%. (Collins et al., 2009) confirms increase in information disclosed by firms at the same time as earnings announcements is a driver of increase in information content. However, they also find that the market's increased reliance on non-GAAP Street earnings which are typically disseminated concurrently with firms' earnings announcements by analyst estimate clearinghouses such as IBES is also a factor in explaining informativeness. The increase in informativeness of earnings announcements is also documented by studies which do not find an overwhelming evidence for information value of these announcements. (Ball & Shivakumar, 2008) finds that the earnings announcement window returns explain a bigger part of annual security returns with highest abnormal R^2 values being recorded in the last three years of their sample period which runs from 1972 to 2006. They arrive at a similar finding when they look at abnormal volume which they define as event-window abnormal volume as percent of annual volume. Similar to return regression, highest median abnormal volume is observed in the last four years.

The international evidence on information value of earnings is scarce compared to the evidence for the U.S. Earlier work which utilized relatively limited data sets such as (Odabasi, 1998) for Turkey, (Rippington & Taffler, 1995) for the U.K, (Pellicer & Rees, 1999) for Spain, (Gajewski & Quéré, 2001) for France and (Sponholtz, 2008) for Denmark are supportive of the hypothesis that earnings announcements have information content, but their sample sizes do not allow for an extensive cross-sectional or temporal analysis of information content. A more recent and comprehensive study is (DeFond et al., 2007) which analyzes over 50,000 annual earnings announcements in 26 countries for the period 1995 through 2002. They measure the information content of earnings announcements as the 2-day abnormal return variance around earnings announcement and show that the information content is higher for countries with higher quality earnings, stronger enforcement of insider trading laws, more frequent interim financial reporting and greater financial disclosure. (Truong, 2012) analyzes information content of earnings announcement in New Zealand for the period 1994-2009 using a sample of more than 2500 semi-annual earnings announcements. He finds that the information content of earnings announcements as measured by abnormal volume and abnormal volatility has increased significantly over time for both interim and preliminary earnings announcements. (Truong, 2012) also tests the relation between the adoption of IFRS and the information content of earnings announcements and shows that the information content of earnings announcements increase considerably in the post-IFRS adoption period in New Zealand. (Truong, 2012) argues that this is consistent with the view that the IFRS adoption improved the quality of accounting information and partly explains the rising trend in the information content of earnings announcements.

CHAPTER 3

PEAD: EVIDENCE FROM TURKEY

We study the PEAD anomaly and its determinants in Borsa Istanbul using quarterly earnings announcements and three different surprise measures. We find evidence that supports the existence of PEAD in the Turkish stock market. Sorting stocks each quarter into three quantiles according to an earnings surprise measure based on past earnings, we find both statistically and economically significant difference of 2.9% in average cumulative abnormal return between high earnings surprise firms and low earnings surprise firms in the 60 days following the announcement. The hedge returns obtained using analyst forecast based surprise measure as well earnings announcement return based surprise measure are also significant at 2.9% and 2.2% respectively. The positive relation between post-announcement abnormal returns and the surprise in earnings remain significant after controlling for an extensive list of explanatory variables. Among these explanatory variables, we find that firm size has a negative impact on the magnitude of this positive association between surprise and subsequent equity returns. Finally, using two separate approaches we show that multifactor models fail to explain the return differentials following earnings announcements.

3.1 Variables and sample selection

In this section, we introduce the earnings surprise measures we use in this study along with the post-announcement abnormal return metric and the explanatory variables.

3.1.1 Earnings surprise measures

We use three approaches to quantify earnings surprise; standardized unexpected earnings using time-series forecast (SUETF), standardized unexpected earnings using analyst consensus forecast (SUEAF) and earnings announcement reaction (EAR). The first measure, SUETF assumes earnings follow a seasonal random walk model and is constructed for a given security i in quarter q as in equation 1.a by dividing the difference between the reported earnings for the current quarter and its value in q-4 by the market value of equity at the end of quarter q, with all measured in Turkish lira. The main advantage for this measure as opposed to using more sophisticated time-series models is that it requires minimal time-series length for earnings and hence can be measured for almost every firm-quarter observation. (Foster et al., 1984) show that seasonal random walk model's forecast errors perform as well as more sophisticated time-series techniques.

The second measure, SUEAF is defined as in equation 1.b by dividing the difference between the reported earnings for the current quarter and the mean analyst consensus forecast by the value of market capitalization at the end of quarter q. The second measure is arguably a better proxy for the unobserved true market expectation for the earnings as forming expectations for future earnings is a primary professional task for analysts. However, not all stocks are followed by analysts and analyst expectations do not necessarily contain all the information that the market participants collectively possess.

The third measure, the earnings announcement return (EAR) is defined as in equation 1.c by subtracting the buy-and-hold return of the announcing firm i from that of the size and book-to-market (B/M) matching portfolio over the three trading day window [t-1,t+1] around the earnings announcement day t. At the end of June in each year t, a stock is matched to one of 6 size-B/M portfolios based on the market capitalization at the end of June in year t and the book value at the last fiscal year-end in year t-1 divided by market capitalization at the end of year t-1.[1] EAR is advantageous as a measure, because unlike the previous two measures it reflects the degree of surprise of all market participants for the full earnings event and not just earnings. However, the main disadvantage of this measure is that other factors unrelated to the earnings news could mask the earnings announcement impact.

$$SUETF_{i,q} = \frac{\left(E_{i,q} - E_{i,q-4}\right)}{MV_{i,q}} \quad (1.a)$$

$$SUEAF_{i,q} = \frac{\left(E_{i,q} - F_{i,q}\right)}{MV_{i,q}} \quad (1.b)$$

$$EAR_{i,q} = \prod_{k=t-1}^{t+1} \left(1 + R_{i,k}\right) - \prod_{k=t-1}^{t+1} \left(1 + R_{p,k}\right) \quad (1.c)$$

To address outliers and potential non-linearities, in the literature the surprise measures are typically transformed into coded decile scores based on their rank within each calendar quarter (see for instance (Bernard & Thomas, 1990)). Since the sample size is much more limited compared to the U.S sample typically studied in the literature,

[1] The size-B/M portfolios are constructed using listed stocks in Borsa Istanbul similar to (Fama & French, 1993) by the intersection of two size and three B/M groups. The groups and subsequently 6 size-B/M portfolios are formed at the end of June in each year t by creating two size quantiles and three B/M quantiles by sorting stocks on size and B/M. The size sort is based on market capitalization at the end of June and the B/M sort is based on the ratio of the book value at the last fiscal year-end in year t-1 to market capitalization at the end of year t-1. Then, daily-returns of the equal-weighted portfolios are calculated from July of year t to June of year t+1 for each of the size-B/M portfolios.

we transform our SUETF, SUEAF, and EAR measures into coded tertile (three-quantile) scores and scale the coded score from 0 to 1. We denote the most negative surprise quantile as Q1 and the most positive surprise quantile as Q3.

3.1.2 Defining post-announcement abnormal return

The post-announcement cumulative abnormal return (CAR[2,61]) measures the delayed reaction to the earnings announcement and is the main metric used in quantifying the drift phenomenon. Similar to (Hirshleifer et al., 2009), we define CAR[2,61] as in equation 2.a, the difference between buy-and-hold return of the announcing firm i and that of the size and book-to-market (B/M) matching portfolio that the stock belongs to over the 60 trading-day window [t+2,t+61] following the earnings announcement date at day t.[2] Then, we define PEAD[2,61] as the difference between average CAR[2,61] for those company-quarter observations in the best surprise quantile (Q3) and the average CAR[2,61] for those company-quarter observations in the worst surprise quantile (Q1). Consistent with (Bernard & Thomas, 1989) 's finding that most of the drift occurs in the first three calendar months (roughly corresponding to 60 trading days), we conduct the ensuing tests mostly using the 60 trading-day window. However, we also conduct additional tests using CAR[2,21] and CAR[2,41] to observe the evolution of the relation between the degree of earnings surprise and abnormal return through event time.

$$CAR[2,61]_{i,q} = \prod_{k=t+2}^{t+61} \left(1 + R_{i,k}\right) - \prod_{k=t+2}^{t+61} \left(1 + R_{p,k}\right) \qquad (2.a)$$

[2] The construction of 6 size-B/M portfolios and matching of stocks to these portfolios follows the same methodology used for forming the EAR surprise measure.

$$PEAD[2,61] = \overline{CAR[2,61]}_{i,q\in Q3} - \overline{CAR[2,61]}_{i,q\in Q1} \qquad (2.b)$$

3.1.3 Explanatory Variables

In this subsection, we look at variables that have been analyzed in the literature as potential explanations for the PEAD phenomenon. We group these in four categories: limited investor attention, limits to arbitrage, information environment & investor sophistication and other control variables.

3.1.3.1 Limited investor attention

(Hirshleifer et al., 2009) using a sample of quarterly earnings announcements from 1995 to 2004 in the U.S stock market found that the immediate price and volume reaction to a firm's earnings surprise is weaker and the PEAD is stronger when there is a greater number of same-day earnings announcements made by other firms. They attributed this to limited attention investors possess and being distracted from the task of valuing a firm when there are other concurrent earnings announcements. We define the variable CONCEARNINGS for firm i at quarter t as the number of earnings released at the same day as firm i. On the other hand, (Dellavigna & Pollet, 2009) using a sample of quarterly earnings announcements from 1984 to 2006 tested the investor inattention hypothesis by comparing the response to earnings announcement on Friday when investor inattention is more likely to the response in other weekdays. They found that Friday announcements have a 15% lower immediate response and 70% higher delayed response compared to non-Friday announcements. To look at the impact of announcement day on the magnitude of the drift, we define the variable FRIDUM which takes the value of 1 for announcements on Friday and 0 for announcements in any other day.

3.1.3.2 Limits to arbitrage

In a world where arbitrage is neither riskless nor costless to exploit, the magnitude of PEAD could be expected to have a positive correlation with arbitrage risk and arbitrage cost. We follow (Mendenhall, 2004) by defining arbitrage risk as the idiosyncratic volatility. In the PEAD context, one should expect a higher drift for stocks with higher idiosyncratic volatility as arbitrageurs will be less willing to take positions in these stocks despite believing they are mispriced. We measure the idiosyncratic volatility IVOL as the standard deviation of residual values from the time-series market model regression $R_{i,k}=\alpha_{i,q}+\beta_{i,q}R_{m,k}$ we run for the trading-day window of [t-61,t-2] where t is the announcement date and $R_{m,k}$ denotes daily return on the BIST-100 index. To proxy arbitrage cost (i.e. transaction cost), we use a modified version of (Amihud, 2002) measure of illiquidity. (Ben-Rephael et al., 2017) made an inflation-adjustment on (Amihud, 2002)'s illiquidity measure to account for outliers while (Karolyi et al., 2012) presented a log-transformed version of it.[3] To both account for the relatively high inflation during our sample period as well as reduce the effect of outliers, we use (Karolyi et al., 2012)'s illiquidity measure with an inflation adjustment. Accordingly, we define the control variable ILLIQUIDITY as the average value of the logarithm of the sum of a constant and the ratio of absolute daily return by inflation adjusted daily trading volume (in millions of Turkish lira) during the trading-day window of [t-61,t-2] as in equation 3 where $D_{i,q}$ is the number of days for which data are available for stock i in the [t-61,t-2] window.

[3] These along with other illiquidity measures are extensively studied in (Atilgan et al., 2016) which looks at illiquidity premium in Borsa Istanbul.

$$ILLIQUIDITY_{i,q} = \frac{1}{D_{i,q}} \sum_{k=t-61}^{t-2} ln\left(1 + \frac{|R_{i,k}|}{VOL_{i,k}Inf_k}\right) \tag{3}$$

3.1.3.3 Information environment and investor sophistication

In their seminal paper, (Foster et al., 1984) pointed out the negative correlation between firm size and the magnitude of the drift. Since then, it had been used as one of the main variables to control for the information environment of the firm. Larger firms arguably have a more transparent information environment as well as a more sophisticated investor base both of which could facilitate more efficient incorporation of information at the earnings announcement to price and accordingly lower PEAD. To this end, we introduce the variable SIZE which is the market capitalization at the end of the prior calendar year and is measured in millions of U.S. dollars. As a more direct proxy for investor sophistication, (Bartov et al., 2000) used proportion of firm shares held by institutional investors as an explanatory variable. Using a U.S. sample of quarterly earnings between 1989 and 1993, they found that investor sophistication as proxied by proportion of firm shares held by institutional investors is negatively correlated with the magnitude of PEAD. (Bartov et al., 2000) argued that this is caused by institutional investors which are better equipped to do efficient pricing of the earnings information and attenuates the drift that follows the announcement. We define the control variable IO as the ratio of the sum of shares held by foreign and domestic institutional investors to total number of floating shares at the end of the prior calendar year. Another variable which is related to the information environment is the reporting lag. (Chambers & Penman, 1984) looked at the relation between the timeliness of earnings report and the magnitude of price reaction to the release of the earnings report. They defined timeliness as the reporting lag from the end of the fiscal period covered by the report to the date of the report. The higher the reporting lag the more information investors could gather related to the upcoming earnings report prior to the announcement. As (Chambers & Penman, 1984) suggested, late reporting firms allow for a longer information gathering period at which investors could benefit from other voluntary disclosures by the firm itself as well as information gleaned from earnings reports of early-announcing firms. These earnings relevant information could be embedded in the prices prior to the announcement and cause the reaction to the actual announcement to be muted. (Chambers & Penman, 1984) tested this hypothesis for a sample of 100 randomly selected U.S. firms for the 1970-1976 period and did not find a significant negative relation between reporting lags and the variability of stock returns around earnings announcements except for small firms with positive announcements. On the other hand, (Hirshleifer et al., 2009) with a more extensive dataset documents a negative relation between reporting lag and both the immediate and delayed market reaction to the earnings announcement. We measure the control variable REPORTLAG as the number of days from the quarter-end until the earnings announcement date.

3.1.3.4 Other control variables

Similar to (Hung et al., 2015), we also use firm characteristics which include the B/M, the ratio of book value at the end previous fiscal year to market value of equity at the end of previous calendar year, the BETA estimated from regressing daily stock returns on BIST-100 index returns for the period of [t-61,t-2] and the PRERET measured as the buy-and-hold return adjusted for BIST-100 index return for the same period used in calculating beta as control variables.

3.1.4 Sample selection and summary statistics

The accounting data we use in this study comes from Rasyonet which is a local financial analysis software solutions provider to brokerage houses, asset management companies and banks while the market and earnings announcement date data comes from Bloomberg. The institutional ownership data is taken from Turkey's Central Securities Depositary (MKK). Finally, to account for industry fixed-effects in our multivariate regression, we use the two-digit Global Industry Classification Standard (GICS) code which we obtain from Compustat Global Capital IQ Database.[4] We start with an initial full sample of 16,061 observations which consist of all company-quarters for which Rasyonet earnings data and Bloomberg announcement date data is available for the 2007-2018 period. Then, we apply the selection criteria below to reach our final full sample of 6,471 observations. To reduce the effect of outliers, we winsorize all the continuous variables at the top and bottom 1% of their quarterly distribution.

i. We only include observations of firms with fiscal year ending in December. More than 95% firms listed at Borsa Istanbul have fiscal year ending in December.
ii. We require the accounting and market data necessary to calculate the earnings surprise measures, the post-announcement abnormal return metrics and explanatory variables to be available for all company-quarter observations.

[4] GICS at the two-digit level is comprised of 11 sectors which are Communication services, Consumer discretionary, Consumer staples, Energy, Financials, Health Care, Industrials, Information technology, Materials, Real Estate and Utilities.

iii. We only include observations of firms which has market capitalization greater than US$100mn and non-negative book value at the end of the prior year. We also require a firm to have at least two-thirds of daily returns available in the return window necessary to calculate CAR and EAR.[5]

The full sample is utilized for the portfolio and regression analyses we conduct using the SUETF and EAR earning surprise measures. For analyses which use SUEAF surprise measure as well, we use the analyst forecast sample. For this sample, in addition to the selection criteria below, we also require there is at least one analyst estimate in earnings surveys administered by the local financial news network CNBC-E up until 2014 and by Bloomberg since then. This additional requirement results in a sample size of 2,398 observations for the analyst forecast sample. Table 1 and Table 2 present descriptive statistics for the two samples used. The general tendency of analysts to cover more liquid, larger market capitalization stocks with higher institutional ownership is reflected at our sample as well. The median stock in the analyst forecast sample is covered by 9 analysts, has a market capitalization of US$1.3bn and 81% of its floating shares is owned by institutional investors. On the other hand, the median stock in our full sample is not covered by an analyst, has a market capitalization of US$0.4bn and 69% of its floating shares is owned by institutional investors.

[5] In the rare case that an observation which otherwise satisfies the two-third daily return condition gets delisted before the end of its drift period, we assume the stock earns the return of its size-B/M matching portfolio after delisting.

Table 1. Summary Table for PEAD Full Sample

	Mean	S.D.	Min.	10th Pct..	25th Pct..	50th Pct..	75th Pct..	90th Pct..	Max.
CAR [2,61]	-0.00	0.16	-0.66	-0.17	-0.10	-0.02	0.07	0.19	1.07
SUETF	-0.00	0.07	-0.83	-0.04	-0.01	0.00	0.01	0.04	1.14
EAR	-0.00	0.04	-0.19	-0.04	-0.02	-0.00	0.02	0.04	0.24
CONCEARNINGS	33.00	31.08	1.00	4.00	8.00	19.00	53.00	84.00	112.00
IVOL	0.02	0.01	0.00	0.01	0.01	0.02	0.02	0.03	0.08
ILLIQUIDITY	0.06	0.13	0.00	0.00	0.00	0.01	0.05	0.14	2.09
SIZE	1501	2870	101	129	193	384	1065	4463	21906
REPORTLAG	48.90	33.58	17.12	30.00	37.00	43.00	57.00	70.00	785.00
IO	0.61	0.29	0.00	0.18	0.39	0.68	0.86	0.94	1.00
B/M	0.82	0.59	0.04	0.22	0.39	0.69	1.07	1.59	4.21
BETA	0.74	0.36	-0.39	0.28	0.49	0.73	0.97	1.21	2.31
PRERET	0.01	0.17	-0.55	-0.16	-0.09	-0.01	0.08	0.19	1.54
Observations	6471								

Table 2. Summary Table for PEAD Analyst Forecast Sample

	Mean	S.D.	Min.	10th Pct..	25th Pct..	50th Pct..	75th Pct..	90th Pct..	Max.
CAR [2,61]	-0.00	0.13	-0.51	-0.16	-0.09	-0.01	0.08	0.16	0.81
NO. OF ANALYSTS	9.73	4.52	1.00	4.00	6.00	9.00	13.00	16.00	20.55
SUEAF	-0.00	0.03	-0.75	-0.02	-0.00	0.00	0.01	0.02	0.55
CONCEARNINGS	26.37	28.80	1.00	3.00	6.00	13.00	36.00	79.00	112.00
IVOL	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.06
ILLIQUIDITY	0.01	0.03	0.00	0.00	0.00	0.00	0.01	0.03	0.75
SIZE	3186	3994	109	276	547	1276	4382	9044	21906
REPORTLAG	44.36	21.44	18.00	28.00	34.00	41.00	50.00	65.00	785.00
IO	0.75	0.19	0.07	0.43	0.65	0.81	0.90	0.95	0.99
B/M	0.78	0.53	0.06	0.24	0.40	0.69	1.01	1.50	2.99
BETA	0.84	0.34	-0.28	0.42	0.61	0.84	1.08	1.29	1.95
PRERET	0.00	0.12	-0.45	-0.13	-0.08	-0.01	0.07	0.15	0.75
Observations	2398								

3.2 Empirical results

This section presents univariate as well as multivariate evidence on the existence of PEAD in the Turkish stock market. The last part of the section looks at the determinants of the post-announcement drift with an in-depth analysis of variables which are documented in the literature to have a bearing on PEAD .

3.2.1 Existence of PEAD in Borsa Istanbul

Figure 1 shows the market's price reaction to earnings announcement by plotting the average cumulative abnormal return from trading day 0 to trading day 61 relative to the earnings announcement day for each surprise quantile with the surprise measure being SUETF. The immediate market reaction which can be measured by the cumulative abnormal return on day 1 is on average positive as expected for firms that fall into positive surprise quantile Q3 and negative for firms that fall into negative surprise quantile Q1. However, the average CAR for the firms in quantile Q3 continues to drift up beyond day 1, while continues to drift down for quantile Q3 firms. This widening differential provides a preliminary graphical evidence for PEAD in our sample.

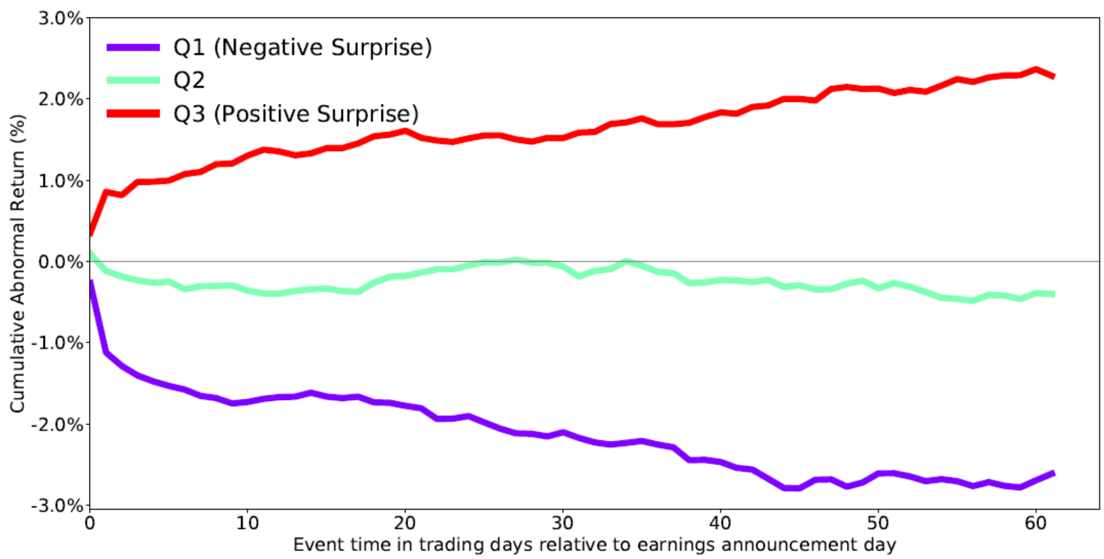

Figure 1. Cumulative abnormal return over event time

Besides SUETF, we utilize SUEAF and EAR, the other two surprise measures most commonly used in the literature. Panel A of Table 3 displays the correlation between these three measures on a subsample based on the availability of all the three measures. The moderate correlation between them, in particular between EAR and the other two earnings-based measure indicate that they capture different aspects of the surprise embedded in the earnings announcement. Figure 2 shows average CAR[2,61] across surprise quantiles. Regardless of the surprise measure used, CAR[2,61] is on average positive following announcements falling under top quantile in terms of earnings surprise, while there is negative drift following announcements in negative surprise quantile. The difference in CAR for Q3 (positive surprise quantile) and Q1 (negative surprise quantile) points to the presence of PEAD independent of the surprise measure used. This difference also corresponds to the return of a hedge portfolio formed on the basis of the surprise measure with long positions in all stocks at the top one-third and short positions in the bottom one-third of the surprise ranking. Panel B of Table 3 shows that the PEAD exists and is statistically significant at 1% level at all horizons for SUETF and SUEAF and at 5% level for EAR. The p-values are calculated using standard errors adjusted for heteroskedasticity and clustering by earnings quarter. The drift over the window [2,61] is 2.9% when analyst and time-series forecasts are used to build the surprise measure, while it is lower at 2.2% when earnings announcement reaction measure is used.[6]

[6] In untabulated analysis, we calculate PEAD at these horizons using the alternative time-series surprise measure which standardizes the difference between reported earnings for the current quarter and its value in q-4 by its standard deviation over the previous eight quarters (see (Chordia et al., 2009)). We find PEAD[2,21],PEAD[2,41] and PEAD[2,61] to be 1.1%, 2.2% and 3.5% respectively with significance at 1% level.

Table 3. Correlation of Surprise Measures and PEAD

PANEL A: Correlation Matrix of Surprise Measures			
	SUETF	SUEAF	EAR
SUETF	1.00		
SUEAF	0.46***	1.00	
EAR	0.24***	0.33***	1.00
PANEL B: PEAD at Different Horizons			
	PEAD [2,21]	PEAD [2,41]	PEAD [2,61]
SUETF	0.0118***	0.0219***	0.0294***
	(3.75)	(4.44)	(4.26)
SUEAF	0.0131***	0.0261***	0.0290***
	(3.09)	(4.39)	(3.63)
EAR	0.00763**	0.0121**	0.0218***
	(2.17)	(2.61)	(3.88)

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

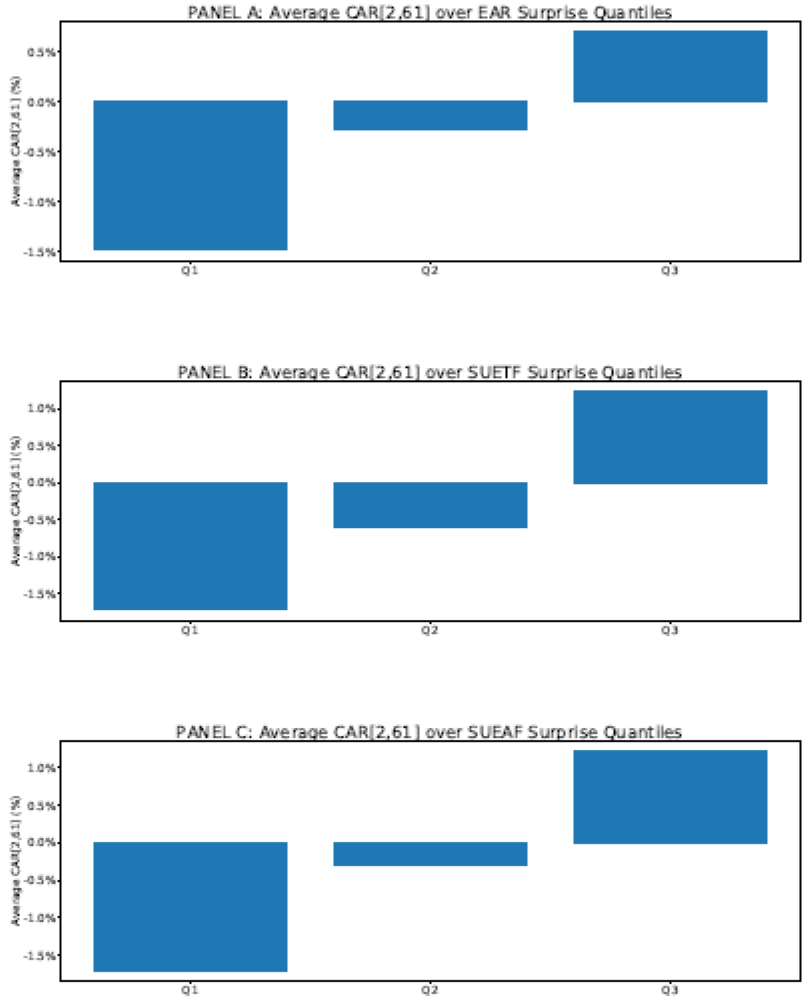

Figure 2. Average CAR[2,61] by surprise quantiles

Furthermore, PEAD is prevalent throughout our sample period between 2007 and 2018. Figure 3 shows that PEAD is positive in 11 years out of 12 using SUETF as surprise measure, while it is positive in 10 years out of 12 using EAR and 9 years out of 12 using SUEAF.

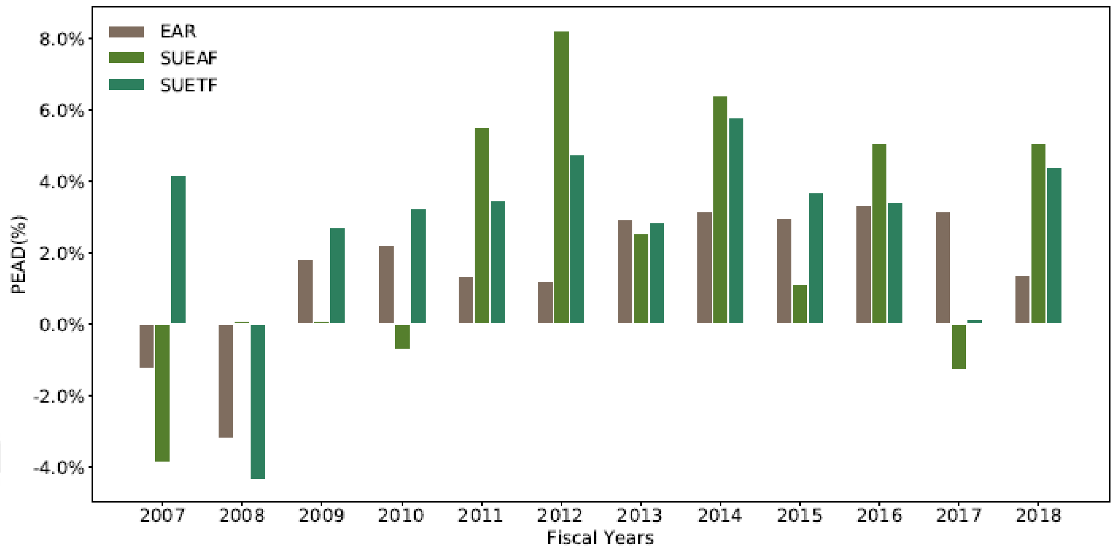

Figure 3. Time-series of PEAD

3.2.2 Multivariate regression analysis

We conduct multivariate regression analysis for our full sample to control for variables that may potentially influence market response to earnings surprises. Table 4 shows the correlation between CAR[2,61], the two surprise measures for our full sample and the control variables. CAR[2,61] is positively correlated with both SUETF and EAR with Spearman correlation coefficients of 0.0865 and 0.0605 respectively. FRIDUM has relatively low correlation with other stock characteristics which implies that Friday announcers are not systematically different from non-Friday announcers. As would be expected, there is a significant positive correlation between SIZE and IO and significant negative correlation between SIZE and ILLIQUIDITY.

Table 4. Correlation between CAR, Surprise Measures and Explanatory Variables

	CAR[2,61]	SUETF	EAR	CONCEARNINGS	FRIDUM	IDIOVOL	ILLIQUIDITY	SIZE	REPORTLAG	IO	BM	BETA	PRERET
CAR[2,61]	1.00												
SUETF	0.09^{***}	1.00											
EAR	0.06^{***}	0.24^{***}	1.00										
CONCEARNINGS	-0.03^{*}	-0.04^{**}	-0.00	1.00									
FRIDUM	-0.02	-0.04^{**}	-0.03^{*}	0.17^{***}	1.00								
IDIOVOL	-0.02^{*}	-0.01	-0.08^{***}	0.01	0.04^{***}	1.00							
ILLIQUIDITY	-0.02	-0.06^{***}	0.01	0.08^{***}	0.03^{*}	0.11^{***}	1.00						
SIZE	0.04^{**}	0.01	0.06^{***}	-0.20^{***}	-0.05^{***}	-0.18^{***}	-0.48^{***}	1.00					
REPORTLAG	-0.00	-0.04^{***}	-0.04^{***}	-0.04^{***}	0.02	0.14^{***}	0.06^{***}	-0.10^{***}	1.00				
IO	0.01	0.03^{*}	0.06^{***}	-0.16^{***}	-0.03^{*}	-0.08^{***}	-0.12^{***}	0.54^{***}	-0.17^{***}	1.00			
BM	0.03^{*}	0.03^{*}	-0.01	0.04^{***}	0.02	-0.08^{***}	-0.08^{***}	-0.20^{***}	0.08^{***}	-0.14^{***}	1.00		
BETA	0.02	0.02	-0.05^{***}	-0.04^{**}	0.01	0.14^{***}	-0.45^{***}	0.20^{***}	-0.00	0.03^{**}	0.09^{***}	1.00	
PRERET	0.03^{*}	0.13^{***}	-0.02	-0.06^{***}	0.00	0.22^{***}	-0.06^{***}	0.01	0.03^{*}	0.01	0.06^{***}	-0.01	1.00

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

We run regressions of post-announcement abnormal return on the earnings surprise tertile rank, the control variables and the interaction terms of these variables with the surprise measure. We mitigate the effect of skewness in SIZE by using the logged value of this variable. We add industry and quarter fixed-effects and cluster standard errors by quarter to control for correlation of returns of same quarter announcements. Also, we standardize all control variables by subtracting the mean and dividing by its standard deviation. We utilize SUETF and EAR as surprise measures and three different time horizons (N=21,41,61) for CAR. Specifically, we estimate the following equations where X denotes the set of control variables.

$$CAR[2,N] = a_0 + a_1 SUETF + \sum_{i=1}^{n}(b_i X_i) + \sum_{i=1}^{n}\big(c_i(SUETF * X_i)\big) + \epsilon \qquad (4.a)$$

$$CAR[2,N] = a_0 + a_1 EAR + \sum_{i=1}^{n}(b_i X_i) + \sum_{i=1}^{n}\big(c_i(EAR * X_i)\big) + \epsilon \qquad (4.b)$$

Table 5 and Table 6 show the results of these regressions. Looking at Table 5, we see that the coefficient on SUETF is significant at 1% level for all horizons. On the other hand at Table 6 the coefficient on EAR is significant at 1% level for regressions on CAR[2,41] and CAR[2,61] and at 5% level for the regression on CAR[2,21]. Since we use surprise measures after transforming them into coded tertile scores ranging from 0 to 1 and standardize the control variables, these coefficients also represent the magnitude of PEAD when moving from the top quantile, Q3 to the bottom quantile, Q1 for observations with average firm characteristics. Accordingly, for CAR[2,61] which represents the horizon most tested in the literature, for the average firm we find PEAD of 2.78% using SUETF and 2.26% using EAR.

Both of the estimated values are economically significant and are in fact on par with the PEAD estimates found in the univariate analysis displayed on the Panel B of Table 3. Therefore, we conclude that the positive association between earnings surprise and post-announcement abnormal returns for our sample is robust to the inclusion of explanatory variables. Looking at the determinants of the drift phenomenon, we find SIZE to be the most important determinant for the relation between post-announcement abnormal return and the degree of surprise at the earnings announcement. In particular, the coefficients on the interaction between SIZE and both surprise measures are significant at the 5% level. We find a one-standard deviation increase in logged market value of equity decreases the sensitivity of market reactions to earnings news by 50% using SUETF and by 54% using EAR. This finding is consistent with the hypothesis that the drift is lower for larger firms, possibly because earnings information is more efficiently processed for such firms. Apart from SIZE, we do not find any other explanatory variable which has a bearing on the relation between CAR and the earnings surprise for both surprise measures.

Table 5. Regression on CAR using SUETF Measure for Earnings Surprise

	(1) CAR [2,21]		(2) CAR [2,41]		(3) CAR [2,61]	
SUETF	0.0106***	(3.53)	0.0206***	(4.56)	0.0278***	(4.50)
CONCEARNINGS	-0.00206	(-1.08)	-0.00497*	(-1.81)	-0.00933***	(-2.85)
FRIDUM	0.00361**	(2.09)	0.00251	(1.07)	0.00173	(0.59)
IVOL	0.00179	(0.59)	0.00759	(1.49)	0.00753	(1.29)
ILLIQUIDITY	0.0000753	(0.04)	-0.000946	(-0.22)	-0.00249	(-0.42)
SIZE	0.00424	(1.48)	0.00880*	(1.89)	0.00556	(0.92)
REPORTLAG	0.00767***	(4.27)	0.00847***	(5.66)	0.00881**	(2.58)
IO	-0.00199	(-0.98)	-0.00278	(-0.89)	-0.00320	(-0.81)
B/M	0.00150	(0.73)	0.00299	(0.90)	0.00330	(0.83)
BETA	0.00244	(0.70)	-0.00168	(-0.37)	0.00109	(0.20)
PRERET	0.00166	(0.50)	-0.00669	(-1.42)	-0.00761	(-1.33)
SUETF * CONCEARNINGS	-0.000297	(-0.10)	-0.000170	(-0.05)	0.00492	(1.04)
SUETF * FRIDUM	-0.00568**	(-2.08)	-0.00181	(-0.51)	-0.00475	(-1.06)
SUETF * IVOL	-0.00534	(-1.27)	-0.0169***	(-2.93)	-0.0190***	(-2.73)
SUETF * ILLIQUIDITY	0.00172	(0.51)	0.00435	(0.65)	0.00489	(0.57)
SUETF * SIZE	-0.00557	(-1.65)	-0.0157***	(-2.87)	-0.0140**	(-2.03)
SUETF * REPORTLAG	0.00195	(0.53)	-0.00156	(-0.66)	-0.00717	(-1.62)
SUETF * IO	0.00496	(1.67)	0.00403	(0.92)	0.00483	(0.82)
SUETF * B/M	0.000825	(0.31)	0.00196	(0.50)	0.00215	(0.47)
SUETF * BETA	-0.00274	(-0.71)	0.00348	(0.60)	0.00239	(0.32)
SUETF * PRERET	0.00386	(0.90)	0.00839	(1.29)	0.0119	(1.60)
Constant	-0.0146	(-1.63)	-0.0270**	(-2.32)	-0.0379***	(-2.74)
Fixed effects			Industry, Quarter			
No. Obs.	6471		6471		6471	
Adj. R^2	0.0174		0.0253		0.0303	

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6. Regression on CAR using EAR Measure for Earnings Surprise

	(1) CAR [2,21]		(2) CAR [2,41]		(3) CAR [2,61]	
EAR	0.00871**	(2.63)	0.0127***	(2.82)	0.0226***	(4.20)
CONCEARNINGS	-0.000168	(-0.08)	-0.00219	(-0.64)	-0.00591	(-1.55)
FRIDUM	0.00393*	(1.97)	0.00245	(1.04)	0.00227	(0.78)
IVOL	0.00331	(0.89)	0.00384	(0.94)	0.00195	(0.42)
ILLIQUIDITY	0.00204	(0.96)	0.00182	(0.51)	-0.000417	(-0.12)
SIZE	0.00495**	(2.12)	0.00527	(1.41)	0.00451	(0.94)
REPORTLAG	0.00814***	(3.16)	0.00926***	(6.39)	0.00754***	(3.00)
IO	-0.00143	(-0.61)	-0.00317	(-0.95)	-0.00307	(-0.75)
B/M	0.00590**	(2.65)	0.00804**	(2.59)	0.00677*	(1.97)
BETA	0.00149	(0.50)	0.000650	(0.18)	0.00112	(0.31)
PRERET	0.00295	(1.07)	-0.00460	(-1.25)	-0.00247	(-0.59)
EAR * CONCEARNINGS	-0.00430	(-1.56)	-0.00592	(-1.39)	-0.00248	(-0.46)
EAR * FRIDUM	-0.00614*	(-1.75)	-0.00168	(-0.43)	-0.00563	(-1.26)
EAR * IVOL	-0.00876	(-1.57)	-0.00903	(-1.23)	-0.00690	(-0.88)
EAR * ILLIQUIDITY	-0.00180	(-0.44)	-0.000430	(-0.09)	0.00164	(0.31)
EAR * SIZE	-0.00709**	(-2.26)	-0.00882*	(-1.76)	-0.0122**	(-2.14)
EAR * REPORTLAG	0.00178	(0.44)	-0.00617	(-1.39)	-0.00600	(-1.17)
EAR * IO	0.00356	(1.05)	0.00471	(0.88)	0.00431	(0.72)
EAR * B/M	-0.00772**	(-2.64)	-0.00748	(-1.64)	-0.00445	(-0.86)
EAR * BETA	-0.000139	(-0.05)	-0.000132	(-0.03)	0.00420	(0.78)
EAR * PRERET	0.00250	(0.57)	0.00656	(1.06)	0.00472	(0.69)
Constant	-0.0141	(-1.57)	-0.0237**	(-2.17)	-0.0358***	(-2.88)
Fixed effects			Industry, Quarter			
No. Obs.	6471		6471		6471	
Adj. R^2	0.0182		0.0205		0.0258	

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.3 Explaining PEAD by multifactor models

In this section we further investigate the robustness of our findings by examining whether PEAD returns can be explained by multifactor models of (Fama & French, 1993) and (Fama & French, 2015). The first approach we use is to analyze the returns of portfolios which buy or sell stocks based on the degree of earnings surprise ((Hirshleifer et al., 2009), (Dellavigna & Pollet, 2009)). For each surprise measure, at the end of each month from June 2007 to May 2019, we sort stocks into three equally-weighted portfolios based on their most recent quarterly earnings surprise within the last three months. Then, we form zero-investment drift portfolios that are long the positive surprise portfolio Q3 and short the negative surprise portfolio Q1. This results in three drift portfolios for our three surprise measures with monthly returns of R^{Q3}_{SUETF}- R^{Q1}_{SUETF} , R^{Q3}_{SUEAF}- R^{Q1}_{SUEAF} , R^{Q3}_{EAR}- R^{Q1}_{EAR} respectively. We evaluate the abnormal return of these portfolios by looking at the alphas from a time-series regression of their monthly returns on the risk factors using (Fama & French, 1993) three-factor model and (Fama & French, 2015)'s five-factor model. The five-factor model includes profitability (RMW) and investment (CMA) factors in addition to the market factor (R_m-R_f), size (SMB) and value (HML) factors of Fama-French three-factor model. The market factor return is calculated as the excess return on the BIST-100 index where TRY 3-month Libor rate is used as the risk-free rate proxy. Similar to (Atilgan et al., 2016), we generate these factors by forming monthly quintile portfolios from the universe of stocks listed in Borsa Istanbul. The quintile portfolios for value, size, profitability, and investment factors are based on sorting stocks on their book-to-market ratio, market capitalization, operating profitability, and asset growth respectively. Then for monthly factor returns, the average monthly return difference between the highest and lowest quintile portfolio is calculated. [7] The columns 1 through 3 of Table 7 reports the results of regressions of portfolio returns on the Fama-French three factors where the standard errors are corrected for heteroskedasticity and autocorrelation using Newey-West estimator with 12 lags. Measuring abnormal return with the intercept of these regressions, we find that SUETF and SUEAF drift portfolios have monthly abnormal returns of 1.1% and 0.8% respectively, significant at 1% level while EAR drift portfolio have an abnormal return of 0.5% significant at the 5% level. The columns 4 through 6 report abnormal

[7] We make sure that the accounting variables are known before the formation of monthly quintile portfolios they are used for. In particular, the monthly sorts between the end of June of year t and the end of May of year t+1 for the book-to-market ratio is based on the ratio of the book value at the last fiscal year-end in year t-1 to market capitalization at the end of year t-1. Similarly, operating profitability is measured as the ratio of operating profit to book value at the fiscal year ending in year t-1 while asset growth is based on the change in total assets from the fiscal year ending in year t-2 to year t-1 divided by total assets in year t-2.

returns which are of a similar magnitude to results in columns 1 through 3 and are measured using Fama-French five-factor model. The abnormal return is statistically significant at the 1% level for the SUETF drift portfolio, 5% level for the SUEAF portfolio, but no longer significant at the 5% level for the EAR portfolio. These findings are generally supportive of our univariate and multivariate regression results and show both statistically and economically significant abnormal returns for PEAD-based monthly portfolios.

Table 7. Performance of PEAD Portfolios

	(1)	(2)	(3)	(4)	(5)	(6)
	R^{Q3}_{SUETF} - R^{Q1}_{SUETF}	R^{Q3}_{SUEAF} - R^{Q1}_{SUEAF}	R^{Q3}_{EAR} - R^{Q1}_{EAR}	R^{Q3}_{SUETF} - R^{Q1}_{SUETF}	R^{Q3}_{SUEAF} - R^{Q1}_{SUEAF}	R^{Q3}_{EAR} - R^{Q1}_{EAR}
Constant	0.0112***	0.00773***	0.00466**	0.0117***	0.00710**	0.00423
	(4.70)	(2.62)	(2.06)	(4.97)	(2.38)	(1.53)
Market	0.0942*	0.118**	-0.142**	0.0924*	0.126**	-0.137**
	(1.78)	(2.18)	(-2.24)	(1.68)	(2.22)	(-2.26)
SMB	0.0648*	0.0299	-0.101	0.0197	0.0478	-0.0827
	(1.72)	(0.39)	(-1.25)	(0.34)	(0.40)	(-1.08)
HML	-0.119*	-0.00377	0.0405	-0.129**	-0.00197	0.0434
	(-1.79)	(-0.04)	(0.28)	(-1.99)	(-0.02)	(0.29)
RMW				-0.0831	0.0706	0.0542
				(-0.94)	(0.40)	(0.45)
CMA				0.0358	0.115	0.0531
				(0.40)	(1.27)	(0.65)
No. of Obs.	144	144	144	144	144	144
Adj. R2	0.0313	0.0442	0.0893	0.0256	0.0395	0.0794

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The second robustness exercise we employ follows the approach in (D. Kim & Kim, 2003). For each quarterly earnings announcement at day t, we regress daily returns over the 60 trading-day window of [t+2,t+61] on daily returns of the market (R_m-R_f), size (SMB) and value (HML), profitability (RMW) and investment (CMA) factors of (Fama & French, 2015). Panel A of Table 8 presents the average of the time-series regression coefficients of Fama-

French's five-factor model and their t-statistics in each of the three SUETF portfolios. The standard errors of the reported averages are calculated using the variance of the estimated coefficients of time-series regressions. Looking at the intercept estimate, we find an average daily abnormal return of -0.026% for the negative surprise quantile Q1 with a t-statistic of -4.07, significant at 1% level while the average daily abnormal return is 0.023% for the positive surprise quantile Q3 with a t-statistic of 3.54, significant again at the 1% level. On the other hand, the Q2 quantile which includes neutral earnings announcements has an average abnormal return which is not statistically significantly different from 0. The results in Panel B and Panel C of Table 8 show that results are qualitatively similar when we use SUEAF or EAR as surprise measures. This analysis also leads us to conclude that the five-factor model of (Fama & French, 2015) is not able to capture the earnings surprise related variation in returns following earnings announcements.

Table 8. Average of Regression Coefficients of Post-Announcement Returns on (Fama & French, 2015) Factors

(Model: $R_{it} - R_{ft} = \alpha_i + \beta_{1i}(R_{mt} - R_{ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}CMA_t + \beta_{5i}RMW_t + \varepsilon_{it}$)

Panel A: SUETF Portfolios

		$\overline{\widehat{\alpha_i}}$	$\overline{\widehat{\beta_{1i}}}$	$\overline{\widehat{\beta_{2i}}}$	$\overline{\widehat{\beta_{3i}}}$	$\overline{\widehat{\beta_{4i}}}$	$\overline{\widehat{\beta_{5i}}}$	Sample Size
SUETF	Q1	-0.000261	0.730	0.176	0.103	-0.000744	-0.00693	2173
		(-4.07)	(82.98)	(12.35)	(7.83)	(-0.06)	(-0.49)	
	Q2	-0.0000206	0.730	0.138	0.00560	-0.00659	0.0215	2139
		(-0.34)	(84.15)	(10.45)	(0.45)	(-0.53)	(1.74)	
	Q3	0.000228	0.739	0.148	0.0828	0.0118	-0.00478	2159
		(3.54)	(87.73)	(11.32)	(6.95)	(0.91)	(-0.37)	

Panel B: SUEAF Portfolios

		$\overline{\widehat{\alpha_i}}$	$\overline{\widehat{\beta_{1i}}}$	$\overline{\widehat{\beta_{2i}}}$	$\overline{\widehat{\beta_{3i}}}$	$\overline{\widehat{\beta_{4i}}}$	$\overline{\widehat{\beta_{5i}}}$	Sample Size
SUEAF	Q1	-0.000214	0.796	0.0536	0.0986	-0.0277	-0.00740	817
		(-2.45)	(62.39)	(2.90)	(5.70)	(-1.55)	(-0.39)	
	Q2	0.0000784	0.866	0.0307	-0.00632	-0.00275	0.0134	780
		(1.10)	(60.86)	(1.87)	(-0.40)	(-0.16)	(0.86)	
	Q3	0.000297	0.814	-0.0158	0.0644	-0.0107	-0.00300	801
		(3.63)	(60.49)	(-0.85)	(3.82)	(-0.57)	(-0.16)	

Panel C: EAR Portfolios

		$\overline{\widehat{\alpha_i}}$	$\overline{\widehat{\beta_{1i}}}$	$\overline{\widehat{\beta_{2i}}}$	$\overline{\widehat{\beta_{3i}}}$	$\overline{\widehat{\beta_{4i}}}$	$\overline{\widehat{\beta_{5i}}}$	Sample Size
EAR	Q1	-0.000139	0.770	0.179	0.0676	0.00133	-0.000538	2173
		(-2.17)	(87.72)	(12.75)	(5.16)	(0.10)	(-0.04)	
	Q2	-0.0000377	0.714	0.158	0.0660	0.0210	0.00586	2139
		(-0.61)	(85.10)	(12.08)	(5.40)	(1.65)	(0.45)	
	Q3	0.000122	0.715	0.125	0.0582	-0.0176	0.00425	2159
		(1.90)	(82.43)	(9.34)	(4.80)	(-1.36)	(0.33)	

CHAPTER 4

TRADING VOLUME AT EARNINGS ANNOUNCEMENTS

In this chapter, we study the determinants of abnormal trading volume around earnings announcements in Borsa Istanbul. Sorting stocks each quarter into three quantiles according to a past earnings-based surprise measure, we find both statistically and economic significant difference in volume between the positive news quantile and the negative news quantile. This finding runs counter to the extant literature which argues for a link between abnormal volume at the earnings announcement and the magnitude of the surprise regardless of the sign of the surprise. The positive relation between the degree of the surprise and abnormal volume exists in both the announcement window and the post-announcement window. The relation remains significant when we control for potential explanatory variables such as absolute value of surprise, absolute price change, firm size, change in firm beta and other firm characteristics. Finally, we discuss a potential behavioral explanation which centers on overconfident noise traders whose attention is grabbed by the positive surprises.

4.1 Variables and sample selection

In this section, we define the abnormal volume measure we use along with the explanatory variables utilized to explain the abnormal volume at earnings announcements. This section also includes information on how we form our sample and the summary statistics of this sample.

4.1.1 Defining abnormal volume

The majority of empirical studies in trading volume use turnover that is the number of shares traded divided by number of shares outstanding as the trading volume measure. The use of turnover allows to control for firm size as well as upward time trend in number of shares traded and number of shares outstanding. Also, in the literature, a natural log transformation is typically applied to the volume measure to mitigate the extreme kurtosis and skewness in the raw measure. Accordingly, we measure trading volume for firm i at day j relative to the announcement date t, $V_{i,t-j}$ as the logarithm of trading volume in shares divided by number of shares outstanding. Then the daily abnormal volume $ABV_{i,t-j}$ is defined as the difference between $V_{i,t-j}$ and the average value of $V_{i,k}$ during the non-announcement period [t-45,t-16]. We measure the abnormal volume at the earnings announcement, ABV[-1,1] for firm i at announcement date t as the average of $ABV_{i,t-1}$, $ABV_{i,t}$ and $ABV_{i,t+1}$. Consistent with the prior literature, we pick a three-day trading window [t-1,t+1] around the earnings announcement. This allows us to capture volume reaction to announcements made before or after trading hours. In a similar fashion, we measure pre-announcement abnormal volume, ABV[-10,-2] and post-announcement abnormal, ABV[2,10] by taking averages of daily abnormal turnovers for their relevant windows.

$$V_{i,t-j} = ln\left(\frac{TradingVolume_{i,t-j}}{Outstanding_{i,t-j}}\right) \qquad (5.a)$$

$$ABV_{i,t-j} = V_{i,t-j} - \frac{1}{30}\sum_{k=t-45}^{t-16} V_{i,k}\,, \qquad j = -10,\ldots,10 \qquad (5.b)$$

4.1.2 Explanatory variables

This subsection outlines variables which we used to explain the volume dynamics around earnings announcements. These include both the earnings surprise as well the magnitude of the surprise, absolute price change, firm size, change in firm beta and other control variables.

4.1.2.1 Earnings surprise

We use SUETF as our surprise measure. It assumes earnings follow a seasonal random walk model and is constructed for a given security i in quarter q as in equation 1.a by dividing the difference between the reported earnings for the current quarter and its value in q-4 by the market value of equity at the end of quarter q, with all measured in Turkish lira. To address outliers and potential non-linearities, we define the variable QSUETF by transforming the SUETF measure into coded tertile (3-quantile) scores and the scale the coded score from 0 to 1. We denote the most negative surprise quantile as Q1 and the most positive surprise quantile as Q3. We also define a binary variable POSSURPDUM which takes a value of 1 if the firm-quarter observation is in Q3 and 0 otherwise.

4.1.2.2 Magnitude of surprise

A positive association between trading volume at earnings announcements and the absolute value of earnings surprise has been widely documented in the literature (see for instance (Bamber, 1987), (Bamber et al., 1997) and (Atiase & Gift, 2015)). A more surprising announcement should be expected to be more informative and result in greater shift in aggregate expectations which in turn induce trading. In addition, (Bamber, 1987) hypothesized that more surprising announcements should lead to differential interpretation or in other words disagreement among investors and hence positive abnormal volume. Indeed, (Brown & Han, 1992) showed that most surprising announcements result increase disagreement or belief dispersion in the market as evidenced by increase in cross-sectional variance of analyst forecasts. To this end, we define the variable ABSSUETF, the absolute value of earnings surprise, SUETF.

4.1.2.3 Absolute price change

The positive relation between trading volume and absolute price change has been reported in many studies going back to (Ying, 1966). In the context of earnings announcements, (O. Kim & Verrecchia, 1991)'s theoretical model also predicts a positive correlation between trading volume and contemporaneous price change at earnings announcements. This price reaction controls for both the average precision (i.e. quality) of pre-disclosure information that investors possess as well as the surprise in the earnings announcement. We define ABSRET[-1,1] as the absolute return for the three trading day window of [t-1,t+1] where t is the announcement date. (Karpoff, 1987) documents that the volume and absolute return reaction are more pronounced for positive returns compared to negative returns. To account for this asymmetry, similar to (Garfinkel & Sokobin, 2006) we also define two other variables, $ABSRET[-1,1]^{+}$ for positive returns and $ABSRET[-1,1]^{-}$ for negative returns.

4.1.2.4 Firm size

We use firm size as a proxy for the average precision of pre-disclosure information and disagreement at the earnings announcement (see for instance (Bamber, 1987), (Atiase & Bamber, 1994), (Bamber et al., 1997)). There is a negative relation between firm size and pre-disclosure uncertainty. The reduced availability of pre-disclosure information for smaller firms translates to an increase in pre-disclosure uncertainty. Indeed, (Bamber et al., 1997) finds a negative correlation of 24% between their size measure and pre-disclosure dispersion in analyst forecasts. To this end, we introduce the variable SIZE which is the market capitalization at the end of the prior calendar year and is measured in millions of U.S. dollars.

4.1.2.5 Change in firm beta

As surveyed in (Bamber et al., 2011), the overwhelming majority of the literature focuses on informational differences across investors, pre-disclosure uncertainty and magnitude of earnings surprises. One exception is (Kross et al., 1994) which argues that earnings announcement contain valuable information with regards to the risk profile of firms. As investors perceive change in the risk of an announcing firm, they like to rebalance their portfolio as the risk of the portfolio is no longer aligned with their risk preferences. According to (Kross et al., 1994), this misalignment along with heterogeneity in risk preferences across investors induce trading at earnings announcements. They measure change in the risk of a firm by the absolute percent change in beta between one-year windows in pre-announcement and post-announcement periods. We use the change in firm beta between post-announcement and pre-announcement periods as a measure for change in firm risk (see (Kross et al., 1994)).

We estimate pre-announcement and post-announcement beta from regressions of daily stock returns on BIST-100 index returns for the periods of [t-61,t-2] and [t+2,t+61] respectively. Then, we define change in firm beta, $\Delta Beta$ as the absolute percent change of beta between pre-announcement and post-announcement periods.

4.1.2.6 Other control variables

Trading in a security could also be affected by fluctuations in market-wide trading which could occur for a multitude of reasons such as seasonality, shifts in risk preferences or change in macroeconomic conditions. In order to make sure we do not capture market-wide variation in trading volume, we add market's abnormal trading volume, MARKETABV[-1,1] as a control variable. The market abnormal trading volume on a given day is given by the abnormal volume average of all firms in our sample where equation 5.b is used to calculate abnormal volume for each firm. We also use firm characteristics as control variables. These include the B/M, the ratio of book value at the end of the previous fiscal year to market value of equity at the end of previous calendar year, the BETA estimated from regressing daily stock returns on BIST-100 index returns for the period of [t-61,t-2] and the PRERET measured as the buy-and-hold return adjusted for BIST-100 index return for the same period used in calculating beta.

4.1.3 Sample selection and summary statistics

We use the same sample selection criteria applied in section 3.1.4 to reach a full sample of 6,471 observations. Table 9 below displays the summary statistics for the abnormal volume measures and explanatory variables.

Table 9. Summary Table for the Abnormal Volume at Earnings Sample

	Mean	S.D.	Min.	10th Pct.	25th Pct.	50th Pct.	75th Pct.	90th Pct.	Max.
ABV[-10,-2]	-0.00	0.62	-2.17	-0.75	-0.40	-0.03	0.36	0.79	2.44
ABV[-1,1]	0.13	0.76	-2.54	-0.80	-0.36	0.10	0.60	1.10	3.08
ABV[2,10	0.01	0.71	-2.19	-0.85	-0.45	-0.03	0.42	0.91	3.14
SUETF	-0.00	0.07	-0.83	-0.04	-0.01	0.00	0.01	0.04	1.14
ABSSUETF	0.03	0.06	0.00	0.00	0.00	0.01	0.03	0.08	1.14
[-1,1]	0.03	0.03	0.00	0.00	0.01	0.02	0.04	0.07	0.33
MARKETABV[-1,1]	0.00	0.25	-0.89	-0.29	-0.17	-0.02	0.17	0.34	0.74
SIZE	1501	2870	101	129	193	384	1065	4463	21906
Beta	0.64	1.58	0.00	0.05	0.14	0.30	0.57	1.12	27.12
B/M	0.82	0.59	0.04	0.22	0.39	0.69	1.07	1.59	4.21
BETA	0.74	0.36	-0.39	0.28	0.49	0.73	0.97	1.21	2.31
PRERET	0.01	0.17	-0.55	-0.16	-0.09	-0.01	0.08	0.19	1.54
Observations	6471								

4.2 Empirical results

In this section, we report our findings. In the first part, we conduct a univariate analysis reporting abnormal volume dynamics in the pre-announcement, at the announcement and post-announcement periods. The second part is a multivariate regression where we look at which characteristics explain the variation in abnormal volume at earnings announcements.

4.2.1 Univariate analysis

The Total column on Table 10 shows the daily cross-sectional average of abnormal volume in the [-5,5] window surrounding the earnings announcement along with summary measures, ABV[-10,-2], ABV[-1,1], ABV[2,10]. Firstly, we find positive abnormal volume at the earnings announcement as average ABV[-1,1] stands at 0.187 with significance at 1% level. Looking at the volume dynamics in more detail at daily level, we observe that highest average abnormal volume is achieved at the announcement date, day 0 and the day following the announcement date, day 1.

Table 10. Daily Average Abnormal Volume Around Earnings Announcement Date by Earnings Surprise

	Q1	Q2	Q3	TOTAL	Q3-Q1 Diff
-5	-0.00723	-0.0267	-0.00206	-0.0119	0.00516
	(-0.36)	(-1.35)	(-0.11)	(-1.05)	(0.19)
-4	0.00135	-0.0355	-0.00906	-0.0143	-0.0104
	(0.07)	(-1.75)	(-0.47)	(-1.24)	(-0.37)
-3	-0.0220	-0.0257	0.00965	-0.0127	0.0317
	(-1.11)	(-1.24)	(0.48)	(-1.08)	(1.12)
-2	0.0169	-0.0165	0.0229	0.00786	0.00602
	(0.83)	(-0.84)	(1.19)	(0.69)	(0.22)
-1	-0.0327	-0.0591**	0.0290	-0.0209	0.0618*
	(-1.65)	(-2.88)	(1.54)	(-1.83)	(2.26)
0	0.0528**	0.0758***	0.222***	0.117***	0.169***
	(2.60)	(3.78)	(10.66)	(9.89)	(5.81)
1	0.189***	0.235***	0.519***	0.314***	0.330***
	(8.89)	(10.95)	(22.37)	(24.51)	(10.50)
2	0.0202	0.0354	0.208***	0.0880***	0.188***
	(0.99)	(1.66)	(9.97)	(7.28)	(6.46)
3	0.0190	0.00846	0.176***	0.0679***	0.157***
	(0.90)	(0.42)	(8.43)	(5.66)	(5.30)
4	-0.0100	-0.00670	0.120***	0.0345**	0.130***
	(-0.49)	(-0.33)	(5.91)	(2.92)	(4.52)
5	-0.0415*	-0.0397	0.0736***	-0.00255	0.115***
	(-2.01)	(-1.91)	(3.50)	(-0.21)	(3.91)
[-10,-2] Average	0.0164	-0.0156	0.00262	0.00124	-0.0138
	(1.15)	(-1.13)	(0.20)	(0.16)	(-0.71)
[-1,1] Average	0.0665***	0.0801***	0.253***	0.133***	0.187***
	(3.84)	(4.76)	(15.02)	(13.51)	(7.73)
[2,10] Average	-0.0173	-0.0401**	0.0931***	0.0120	0.110***
	(-1.08)	(-2.63)	(5.85)	(1.32)	(4.90)

Although abnormal volume is significant at 1% level for both days, the abnormal volume on day 1 is in fact almost three times the abnormal volume on day 0 (0.314 vs. 0.117). We attribute this to most firms announcing their results after trading hours, which results in the first market reaction to the disclosed results to be observed on the day following the announcement day. The positive abnormal volume gradually declines following day 1, with daily volume no longer significantly different from zero beyond day 4. This decline is also reflected in our post-announcement abnormal volume measure, ABV[2,10] which is not significantly different from zero.

Figure 4 provides a graphical illustration of the evolution of cumulative abnormal volume around earnings announcements. The cumulative abnormal volume which is measured from t=-10 to t=10 begins to increase at t=-1, peaks at t=4 and gradually decline afterwards.

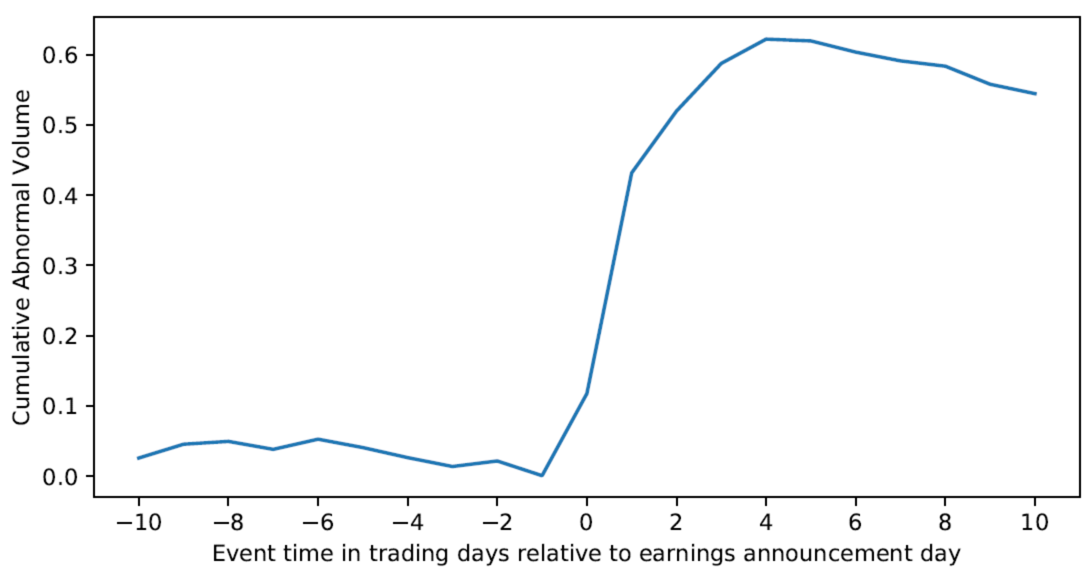

Figure 4. Average cumulative abnormal volume

Our finding that significant abnormal volume is observed at the earnings announcements may not be really surprising as it is consistent with the earlier studies beginning with (Beaver, 1968) which documents similar positive abnormal volumes. Our more surprising and new finding is that in our sample the volume reaction around earnings announcement is dependent on the sign of the surprise. The focus of the prior literature has been on the relation between abnormal volume and the magnitude of earnings surprise measured usually with the absolute value of the earnings surprise, whereas here our focus is on the degree of the earnings surprise. In particular, the average ABV[-1,1] is found to be 0.253 for firms with positive earnings news (Q3) compared to the average ABV[-1,1] of 0.080 for firms with neutral earnings news (Q2) and 0.067 for those with bad news (Q1). The penultimate column on Table 10 shows that the difference in averages of ABV[-1,1] between Q3 and Q1 firms is statistically significant at 1% level with a t-stat value of 7.73. If the salient factor was the magnitude of the surprise, one would have expected ABV[-1,1] to be high for both positive surprise and negative surprise firms compared to neutral news firms. Yet, in our sample we find firms in quantile Q1 to have the lowest abnormal volume at the announcement whereas firms in quantile Q3 have the highest abnormal volume. This surprise dependent reaction to earnings announcements extends to the post-announcement period. In particular, the average ABV[2,10] is significantly positive at 0.093 for positive surprise firms, whereas it is negative for Q1 and Q2 firms. Looking at abnormal volume on daily basis, Table 10 also shows that the average abnormal volume for positive surprise firms is greater than the rest for all days in the earnings announcement window as well as in the post-announcement window. Figure 5 plots the cumulative abnormal volume by earnings surprise from t=-10 to t=10 and clearly illustrates the dichotomy between positive surprise group and the rest. For the positive surprise sample, the cumulative abnormal volume begins to climb up in anticipation of the announcement and continues to increase every day after the announcement is made. On the other hand, for Q1 and Q2 firms, there is a limited increase in cumulative abnormal volume at the announcement. This increase does not persist and the cumulative abnormal volume declines in the post-announcement window with a higher decline in the neutral news group.

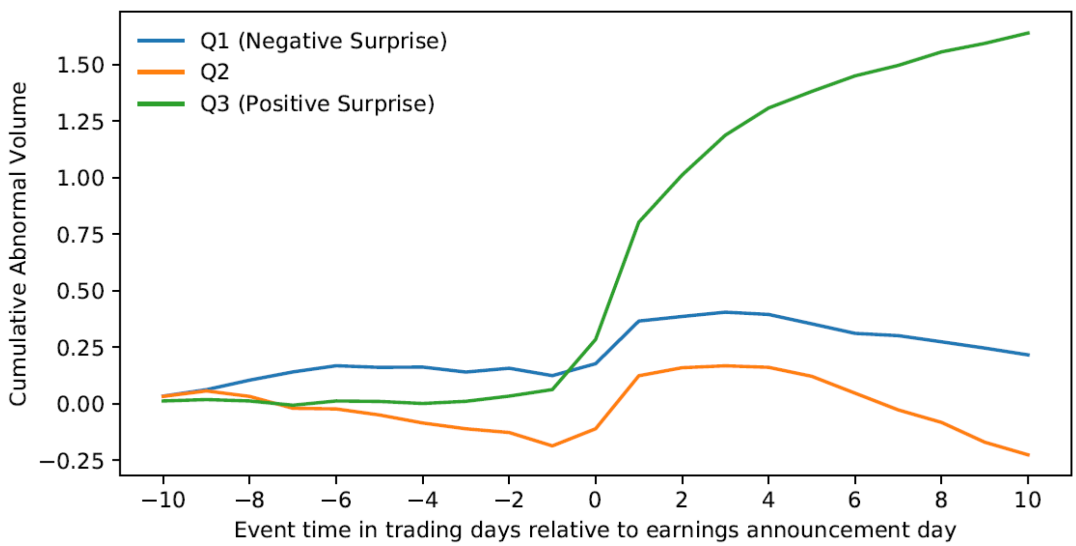

Figure 5. Average cumulative abnormal volume across surprise quantiles

We also provide evidence on trading volume prior to earnings announcements. We find the average pre-announcement abnormal volume, ABV[-10,-2] to be 0.001 which is not statistically significantly different from zero. Figure 5 also shows that the cumulative abnormal volume for the pre-announcement period is close to zero. This is in contrast to (Chae, 2005) who using a U.S. sample reports more than 15% decline in trading volume prior to earnings announcements. Furthermore, unlike the findings of (Park et al., 2014) and (S. Kim & Lim, 2017), we do not find the pre-announcement abnormal volume to be lower for bad news firms than good news firms. In fact, the average pre-announcement abnormal volume is 0.016 for Q1 quantile firms compared to 0.003 for Q3 quantile firms, but the difference is not statistically significant.

4.2.2 Multivariate analysis

In this section, we conduct multivariate regression analysis to look at the relation between abnormal volume and the earnings surprise after controlling for variables which in the literature are reported to influence the volume reaction. Table 11 shows the correlation between ABV[-1,1] and explanatory variables. As expected, ABV[-1,1] has a fairly strong correlation with contemporaneous absolute price change, ABSRET[-1,1] as well as market's abnormal volume MARKETABV[-1,1]. The abnormal volume at the earnings announcement is also positively correlated with SUETF as well as the absolute value of the surprise ABSSUETF while it is negatively correlated with BETA.

Table 11. Correlation Table Between Abnormal Volume and Control Variables

	ABV[-1,1]	SUETF	ABSSUETF	ABSRET[-1,1]	MARKETABV[-1,1]	SIZE	ΔBETA	B/M	BETA	PRERET
ABV[-1,1]	1									
SUETF	0.110***	1								
ABSSUETF	0.0640***	0.0494***	1							
ABSRET[-1,1]	0.229***	0.0280*	0.0804***	1						
MARKETABV[-1,1]	0.299***	-0.0145	0.0107	0.0632***	1					
SIZE	0.00350	0.00913	-0.215***	0.0267*	0.0193	1				
ΔBETA	-0.00884	-0.00762	0.00624	-0.0702***	0.0171	-0.184***	1			
B/M	0.00403	0.0302*	0.273***	-0.0174	0.00241	-0.197***	-0.0692***	1		
BETA	-0.0360**	0.0211	0.0456***	0.149***	-0.0292*	0.203***	-0.441***	0.0904***	1	
PRERET	-0.0116	0.130***	-0.00695	0.0608***	-0.0377**	0.0148	0.0100	0.0587***	-0.0122	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The column (1) on Table 12 presents the results of the regression of ABV[-1,1] on the positive surprise dummy, POSSURPDUM. In this regression, we also include industry and quarter fixed-effects and cluster standard errors by quarter to control for correlation of returns of same quarter announcements. Our use of POSSURPDUM as an explanatory variable is motivated by the observation that the abnormal volume reaction is similar for Q1 and Q2 tertiles, whereas the volume reaction at the good news firms of Q1 tertile far exceeds the other two group. The coefficient on POSSURPDUM is 0.181 and is significant at 1% level. The column (2) adds the control variables to the regression. We mitigate the effect of skewness in SIZE by using the logged value of this variable. Also, we standardize all control variables by subtracting the mean and dividing by its standard deviation. The coefficient on POSSURPDUM remains significant at 1% level and indicates that the abnormal volume at earnings announcement remains higher for firms at the top tertile (Q3) compared to the rest after controlling for the other explanatory variables. The positive surprise firm with average firm characteristics has 110% higher abnormal volume at earnings announcements than a negative/neutral news firm group with similar characteristics. Interestingly once we control for the sign of the surprise using POSSURPDUM, the magnitude of the surprise measured using ABSSUETF does not have a significant relation with volume. Among the other explanatory variables, in line with the previous literature we see that both ABSRET[-1,1] and MARKETABV[-1,1] are both strongly positively associated with trading volume at the earnings announcements. There is also a statistically negative relation between BETA and ABV[-1,1]. To account for the asymmetry in relation between volume and absolute return between positive and negative returns ((Karpoff, 1987)), we also run a regression which uses ABSRET$[-1,1]^{+}$ for positive returns and ABSRET[-

1,1]$^-$ for negative returns as regressors instead of ABSRET[-1,1]. The results presented on column (3) show that our findings remain qualitatively the same, with the coefficient on POSSURPDUM remaining significant at 1% level. Finally, as a further robustness check, instead of POSSURPDUM we use QSUETF which is a coded tertile score of SUETF scaled from 0 to 1. The coefficient on QSUETF is significant at 1% level, and shows that controlling for other variables, the difference in abnormal volume is 0.133 between Q3 and Q1. As with other specifications, the coefficient on ABSSUETF is insignificant.

Table 12. Regression of Trading Volume Around Earnings Announcement on Earnings Surprise and Other Control Variables

	(1) ABV[1,1]		(2) ABV[-1,1]		(3) ABV[-1,1]		(4) ABV[-1,1]	
POSSURPDUM	0.181***	(6.97)	0.162***	(7.65)	0.132***	(6.18)		
ABSSUETF			0.00797	(0.74)	0.00912	(0.82)	0.0178	(1.41)
ABSRET[-1,1]			0.203***	(11.52)				
MARKETABV[-1,1]			0.209***	(11.94)	0.204***	(12.07)	0.203***	(11.97)
SIZE			0.0142	(1.02)	0.0105	(0.75)	0.00715	(0.51)
ΔBETA			-0.0180	(-1.20)	-0.0168	(-1.15)	-0.0169	(-1.17)
B/M			0.00971	(0.86)	0.00825	(0.76)	0.0118	(1.09)
BETA			-0.0593***	(-4.59)	-0.0544***	(-4.35)	-0.0533***	(-4.23)
PRERET			-0.0153	(-1.22)	-0.00928	(-0.71)	-0.00965	(-0.73)
ABSRET[-1,1]$^+$					0.224***	(9.90)	0.225***	(9.92)
ABSRET[-1,1]$^-$					0.112***	(8.21)	0.114***	(8.28)
QSUETF							0.133***	(4.79)
Constant	0.194***	(3.95)	0.146***	(3.24)	0.150***	(3.39)	0.131***	(2.84)
Fixed effects	Industry, Quarter							
No. Obs.	6471		6471		6471		6471	
Adj. R^2	0.0725		0.178		0.186		0.185	

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

CHAPTER 5

INFORMATIVENESS OF EARNINGS ANNOUNCEMENTS

We find significantly positive abnormal volume (AVOL) and abnormal absolute return (AAR) in the three-day window around the earnings announcement which shows that earnings have information content for investors during our sample period. Furthermore, both proxies demonstrate a positive time trend after controlling for various firm characteristics and surprise measures. We take this as evidence that overall informativeness of earnings has increased over time. We observe that this increase is most prevalent for growth companies and earnings announcements with high absolute surprise. We provide partial support for the hypothesis that value of earnings announcements has increased after an improvement in information dissemination technology with the inception of the online disclosure platform, KAP.

5.1 Variables and sample selection

In this section, we describe the two metrics we use to measure information content of earnings announcements and the variables we use to explain its over time dynamics. The final part of the section outlines the criteria we use to choose our sample and the summary statistics.

5.1.1 Measures for information content of earnings announcements

We use abnormal volume (AVOL) and abnormal absolute return (AAR) as measures to proxy information content of earnings announcements. We define AVOL similar to

(Dellavigna & Pollet, 2009) as the difference between the average log trading volume during the announcement window [t-1,t+1] and the average log trading volume during the non-announcement period [t-60,t-11] (see equation 6.a). On the other hand, we define AAR similar to (Asthana & Balsam, 2001) as the difference between the average absolute value of daily return during the announcement window [t-1,t+1] and the average absolute value of daily return during the non-announcement period of [t-60,t-11] normalized by the standard deviation of absolute return during the non-announcement period. (see equation 6.b). When constructing both abnormal volume and abnormal absolute return measures, [t-10,t-2] window is intentionally excluded from the non-announcement period to avoid the impact of any market activity in anticipation of the upcoming earnings report.

$$AVOL_{i,q} = \frac{1}{3}\sum_{k=t-1}^{t+1} \ln\left(V_{i,k}\right) - \frac{1}{50}\sum_{k=t-60}^{t-11} \ln\left(V_{i,k}\right) \qquad (6.\mathrm{a})$$

$$AAR_{i,q} = \frac{\frac{1}{3}\sum_{k=t-1}^{t+1}\left|R_{i,k}\right| - \frac{1}{50}\sum_{k=t-60}^{t-11}\left|R_{i,k}\right|}{\sigma_{\left|R_{i,k}\right|}} \qquad (6.b)$$

5.1.2 Explanatory variables

This subsection presents the explanatory variables we use to explain the information content at earnings announcement with a specific focus on dynamics over time.

5.1.2.1 Time trend and annual earnings indicator

In order to examine how AVOL and AAR at earnings announcements change over time, we define a time trend variable, TIME which is incremented by 1 for each month in the sample period, taking values ranging from 1 to 133. The amount of information content of interim earnings announcements could differ from the level of information at annual/fourth quarter earnings announcements as extensively discussed at (Basu et al., 2002). In order to account for this difference, we introduce a binary variable ANDUM which takes a value of 1 if the announcement is a fourth quarter/annual earnings announcement and 0 if the announcement is an interim earnings announcement.

5.1.2.2 Absolute value and direction of surprise

Consistent with (O. Kim & Verrecchia, 1991)'s model, (Bamber, 1987) found that there is a positive correlation between abnormal trading volume at earnings announcements and the absolute magnitude of earnings surprise. Accordingly, we include absolute value of unexpected earnings as an explanatory variable as in (Landsman & Maydew, 2002) and (Truong, 2012). The variable |UE| is constructed for a given security i in quarter q as in equation 7 by dividing the absolute value of the difference between the reported net profit for the current quarter and its value in q-4 by the value of market cap at the end of quarter q. Several studies document an asymmetry between reaction to negative and positive earnings surprises (see (Skinner & Sloan, 2002), (Conrad et al., 2002)). In order to capture this potential difference, we introduce the dummy variable SURPSIGN which takes the value of 1 if UE for firm i in quarter q is above the median UE for that quarter and 0 otherwise.

$$|UE|_{i,q} = \frac{\left|A_{NetProfit_{i,q}} - A_{NetProfit_{i,q-4}}\right|}{MarketCap_{i,q}} \tag{7}$$

5.1.2.3 KAP indicator

Starting from June 2009, all listed companies at the Borsa Istanbul are required to disclose material information including earnings reports through the online Public Disclosure Platform (KAP). In order to analyze the impact of KAP on the informativeness of earnings releases, we introduce the dummy variable POST-KAP which takes the value of 1 for the period June 2009-May 2010 which we designate as the post-KAP period and 0 for the period June 2008-May 2009 which we designate as the pre-KAP period. Similar to (Hung et al., 2015), our analysis is restricted to a 1-year before KAP introduction and 1-year after KAP introduction to reduce the effect of potentially confounding events.

5.1.2.4 Other control variables

As noted in (Landsman & Maydew, 2002), an observed change in our information content proxies could be simply due to change in composition of sample firms over time. In order to control for these changes, we introduce SIZE measured as the market value of equity in billions of U.S. dollars at the end of quarter q, B/M measured as the ratio of the quarter-end book value to market value of equity and BETA estimated from regressing daily stock returns on BIST-100 index returns for the non-announcement period of [t-30,t-394]. For the regression analysis, we use the logarithm of SIZE instead of SIZE as the distribution of the raw values of this variable is highly skewed.

5.1.3 Sample selection and summary statistics

We start with an initial sample of 16,061 observations for which earnings data is available from the local data vendor Rasyonet and announcement date data is available from Bloomberg for the fiscal quarters in the 2007-2017 period. Then, we apply the selection criteria below to reach our final full sample of 12,143 observations from 396 companies. To reduce the effect of outliers, we winsorize all the continuous variables at the top and bottom 1% of their quarterly distribution. To analyze the impact of the adoption of KAP on 1 Jun 2009, we select a subsample of 2,030 observations by requiring an observation to have an earnings announcement in Jun 2008-May 2010 period on top of the selection criteria below.

i. We only include firms with fiscal year ending in December. More than 95% firms listed at Borsa Istanbul have fiscal year ending in December.

ii. We require market cap value and book value are available at the end of the quarter t and require them to be greater than US$5mn and non-negative respectively.

iii. There is at least 12 months of past return and volume data to compute abnormal absolute return, abnormal volume and beta.

Table 13 presents descriptive statistics for the full sample used. The average values for the two information content proxies we employ are both significantly greater than 0 with average AVOL at 0.14 and average AAR at 0.28. This points to an extensive market reaction and accordingly significant information content at earnings announcements. However, there is also significant variation in market reaction as AVOL and AAR are -

0.40 at the 25th percentile indicating that there is no positive abnormal market reaction to a significant part of the sample. The average observation in our sample has a firm size of US$0.78bn, a book-to-market ratio of 1.09 and absolute unexpected earnings of 5%.

Table 13. Summary Table for the Information Value of Earnings Sample

	Mean	Standard Dev	10th Pct.	25th Pct.	50th Pct.	75th Pct.	90th Pct.
AVOL	0.14	0.83	-0.82	-0.40	0.09	0.61	1.15
AAR	0.28	1.14	-0.65	-0.40	-0.02	0.62	1.52
ANDUM	0.25	0.43	0.00	0.00	0.00	0.00	1.00
SIZE	0.78	2.07	0.01	0.03	0.11	0.41	1.64
B/M	1.09	6.38	0.27	0.48	0.81	1.31	1.98
BETA	0.65	0.42	0.16	0.39	0.64	0.90	1.16
|UE|	0.05	0.09	0.00	0.01	0.02	0.05	0.12
SURPRISE SIGN	0.50	0.50	0.00	0.00	0.00	1.00	1.00
Observations	12143						

5.2 Empirical results

Figure 6 graphically illustrates a gradual increase in both abnormal volume and abnormal absolute return at earnings announcements over the sample period of 2007-2017. In order to understand the dynamics behind this increase, we employ a regression-based approach similar to (Landsman & Maydew, 2002) and regress AVOL and AAR against the time trend variable, TIME, the annual earnings dummy, ANDUM and the interaction between this variable and TIME (see specifications at equation 8 below). The columns (1) and (2) on Table 14 reports the results of these regressions for which t-statistics are corrected for heteroskedasticity and serial correlation using the Huber-White maximum likelihood estimation procedure. The time trend coefficient for both AVOL and AAR regressions are significantly positive with t-statistics of 9.1 and 6.5 respectively. This provides strong evidence that the information content of earnings as proxied by AVOL and AAR have increased over time in our sample period. On the other hand, the evidence on whether earnings informativeness is higher or lower for annual earnings announcements is mixed. The coefficient on ANDUM at column (1) is positive and significant at the 1% level, while it is significantly negative at column (2). Hence, abnormal volume is higher for annual earnings announcements, while abnormal absolute return is lower. An interesting finding is that the coefficient on TIME*ANDUM at column (1) is negative and significant at the 1% level indicating that the time trend in abnormal volatility is weaker for annual announcements compared to interim announcements. We obtain qualitatively similar results when we define AVOL and AAR using earnings announcement windows of [-1,0] and [0,1] rather than the [-1,1] window utilized in this study.

The columns (3) and (4) show the results when we add the variables |UE|, SURPSIGN, ln(SIZE), B/M and BETA and interaction variables of these variables with TIME to the regression. The time trend coefficients for both AVOL and AAR remain significant at 1% level suggesting that the increase in informativeness of earnings announcement is robust to the inclusion to a set of explanatory variables. The observation that the AVOL is higher, but AAR is lower for annual earnings announcements compared to interim earnings announcement also continues to hold true after adding control variables as evidenced by the significantly positive coefficient on ANDUM at column (3) and significantly negative coefficient on the same variable at column (4). The negative coefficient on TIME*ANDUM at column (3) confirms our finding that the time trend in AVOL is weaker for year-end announcements. Finally, for both AVOL and AAR the coefficients on TIME*B/M are significantly negative at the 1% level while the coefficients on TIME*|UE| are significantly positive at the 1% level. We interpret these results as growth companies and earnings announcements with bigger absolute surprise having a more pronounced positive trend in information content of earnings announcements.

$$AVOL = \alpha + \beta_1 TIME + \beta_2 ANDUM + \beta_3 TIME * ANDUM + \epsilon \qquad (8.a)$$

$$AAR = \alpha + \beta_1 TIME + \beta_2 ANDUM + \beta_3 TIME * ANDUM + \epsilon \qquad (8.b)$$

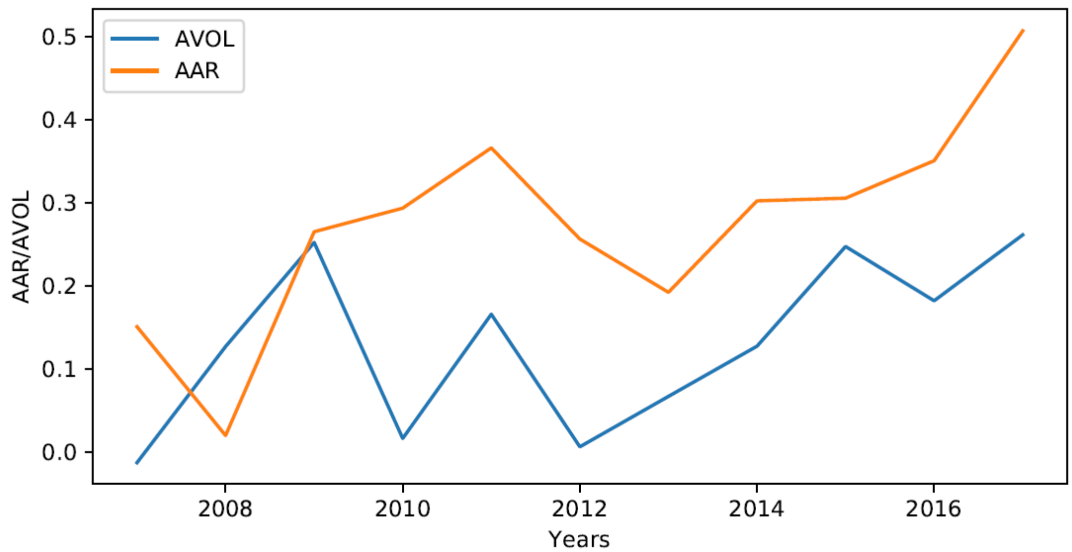

Figure 6. AVOL and AAR progression over the period 2007-2017

Table 14. Regression of AVOL and AAR Against Time and Firm Characteristics

	(1) AVOL	(2) AAR	(3) AVOL	(4) AAR
TIME	0.00212***	0.00217***	0.00329***	0.00209***
	(9.10)	(6.50)	(5.93)	(2.74)
ANDUM	0.280***	-0.137***	0.278***	-0.0832*
	(7.61)	(-2.94)	(7.45)	(-1.78)
TIME * ANDUM	-0.00328***	0.000466	-0.00350***	-0.000338
	(-7.14)	(0.77)	(-7.55)	(-0.56)
ln(SIZE)			-0.0159*	0.00679
			(-1.80)	(0.59)
B/M			0.0594***	0.0546***
			(3.84)	(3.18)
BETA			0.0277	-0.311***
			(0.63)	(-5.75)
|UE|			0.121	-0.230
			(0.72)	(-1.10)
SURPRISE SIGN			0.115***	0.0490
			(3.71)	(1.16)
TIME * ln(SIZE)			0.000242**	0.000208
			(2.23)	(1.42)
TIME * B/M			-0.000704***	-0.000642***
			(-3.90)	(-3.18)
TIME * BETA			-0.000751	0.000662
			(-1.43)	(1.02)
TIME * |UE|			0.00650***	0.0105***
			(2.66)	(3.01)
TIME * SURPRISE SIGN			0.000665*	0.000785
			(1.66)	(1.39)
Constant	-0.0230	0.152***	-0.198***	0.291***
	(-1.29)	(6.18)	(-4.36)	(4.97)
Observations	12143	12143	12143	12143

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In order to analyze the impact of the introduction of the Public Disclosure Platform (KAP) on the informativeness of earnings announcements, we run the regressions at equation 9 below on the KAP sample. The significantly positive coefficients on the POST-KAP variable at columns (2) and (4) on Table 15 show that the AAR is higher in the post-KAP period compared to pre-KAP period in both the specification without control variables as well as the specification with control variables.

However, our results do not point to a similar positive change in AVOL due to KAP being made available as the coefficients on the POST-KAP are not significantly different from 0 at columns (1) and (3). The adoption of KAP had a significant impact on the abnormal absolute return around earnings announcements but did not have a similar impact on the abnormal volume. Therefore, our findings provide only partial supportive evidence for the hypothesis that the earnings announcements garner higher market reaction with the improvement in the information dissemination technology with KAP.

$$AVOL = \alpha + \beta_1 POST - KAP + \beta_2 ANDUM + \beta_3 POST - KAP * ANDUM + \epsilon \quad (9.a)$$

$$AAR = \alpha + \beta_1 POST - KAP + \beta_2 ANDUM + \beta_3 POST - KAP * ANDUM + \epsilon \quad (9.b)$$

Table 15. Regression of AVOL and AAR Against Adoption of KAP and Firm Characteristics (2008-2010)

	(1) AVOL	(2) AAR	(3) AVOL	(4) AAR
POST-KAP	-0.0183	0.390^{***}	0.0494	0.344^{***}
	(-0.47)	(7.04)	(0.42)	(2.64)
ANDUM	0.241^{***}	0.0460	0.207^{***}	0.0354
	(3.84)	(0.64)	(3.07)	(0.45)
POST-KAP * ANDUM	-0.175^{**}	-0.414^{***}	-0.124	-0.381^{***}
	(-2.10)	(-3.93)	(-1.38)	(-3.29)
ln(SIZE)			-0.0139	0.0343^{**}
			(-0.86)	(2.13)
B/M			0.0695^{***}	0.0562^{*}
			(2.91)	(1.93)
BETA			0.0176	-0.250^{***}
			(0.21)	(-3.24)
|UE|			-0.0458	-0.157
			(-0.29)	(-1.01)
SURPRISE SIGN			0.139^{***}	0.133^{**}
			(2.63)	(2.36)
POST-KAP * ln(SIZE)			0.0192	0.00291
			(0.92)	(0.10)
POST-KAP * B/M			0.00999	-0.0433
			(0.21)	(-0.58)
POST-KAP * BETA			-0.0932	0.0752
			(-0.88)	(0.69)
POST-KAP * $\|UE\|$			0.648	1.437^{**}
			(1.59)	(2.42)
POST-KAP * SURPRISE SIGN			0.0305	-0.0655
			(0.43)	(-0.68)
Constant	0.170^{***}	0.0638^{**}	-0.0331	0.177^{**}
	(5.89)	(2.20)	(-0.33)	(2.07)
Observations	2030	2030	2030	2030

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

CHAPTER 6

CONCLUSION

In the first part of the thesis, we examine PEAD in Turkey by looking at quarterly earnings announcements and different surprise measures allowing for a direct comparison with similar studies conducted for the U.S market. We document that the drift anomaly is economically and statistically significant using different surprise measures and at different horizons. Also, we observe that PEAD is stable over our sample period of 2007-2018 with positive PEAD recorded in the overwhelming majority of the years. The drift phenomenon remains significant after controlling for a full battery of explanatory variables documented to have a bearing on it. Using any of the two surprise measures for our full sample, we find increasing firm size weakens the positive relation between earnings surprise and post-announcement returns. This lends supports to the view that PEAD is caused by investor underreaction to earnings news. However, we were not able to find similar strong evidence that the strength of this relation varies with other variables that are documented to be proxies for limited investor attention or limits to arbitrage. Supporting the robustness of our findings, we demonstrate that neither (Fama & French, 1993)'s three-factor model nor (Fama & French, 2015)'s five-factor model are able to fully explain the returns of monthly earnings surprise based portfolios. We reach the same conclusion with an alternative approach which adjusts post-announcement daily raw returns for risk using (Fama & French, 2015) factors. These analyses provide further support to the view that the PEAD is caused by delayed market reaction rather than incorrect risk measurement.

Then, we proceed to look at the determinants of trading volume around earnings announcements in Turkey using quarterly earnings announcement for the 2007-2018 period. Besides providing a full-blown analysis of the subject for a major emerging market, we find a rather strong relation between trading volume and earnings surprise which so far has not been documented in the literature. The widely documented relation between volume and the magnitude of the surprise disappears once the sign of the earnings surprise is used a control variable. Other than the degree of the surprise, we find the absolute price change around earnings announcements, market-wide volume and beta to have a bearing on the abnormal volume. It is not easy to immediately reconcile our findings with the existing theories of trading volume around earnings announcements. An argument around informativeness would need to show that positive surprises are much more informative than negative surprises. However, the absolute price change to a great extent should capture signal strength. Yet, we observe that the positive association between surprise and trading volume remains even after controlling for absolute price change. On the other hand, an explanation around belief revisions due to higher pre-disclosure information asymmetry or differential interpretations should show that positive surprise announcements have systematically higher belief revisions than negative surprise announcements. We partly control for the belief revisions explanation by including firm size as an explanatory variable. Smaller firms have higher pre-disclosure uncertainty and higher investor disagreement at earnings announcements. We are not able employ the commonly used analyst-based proxies due to lack of detailed analyst data for our sample. Still, even if belief revisions is a valid explanation, it is hard to imagine that the analyst-based proxies would fully be able to capture it. Prior literature does not document a systematic difference in pre-disclosure forecast dispersion or higher forecast revision at earnings announcement between positive and negative surprises that is sufficient to explain such a huge discrepancy in volume reaction. Furthermore, as discussed in (Bamber et al., 2011), analyst-based proxies are far from perfect as analysts are a relatively well-informed subset of market participants and does not reflect belief differentials in the whole set of investors. We think one potential explanation for the observed phenomenon could come from the behavioral finance literature. (Peress & Schmidt, 2020) divides investors into three groups. The first two are speculators and market makers which are characterized as informed agents. The third group is noise traders which (Black, 1986) defines as investors who do not have access to inside information, but irrationally trade on noises as if it were information. This type of investors typically trades for reasons unrelated to stock fundamentals. Noise traders could be for instance day traders which are individual investors who buys and sells the same amount of stock in one day ((Linnainmaa, 2005)). Investor overconfidence is a salient feature of noise traders. As in the model of (Odean, 1998), overconfident investors are likely to overestimate the quality of their private information with respect to other investors. This causes higher investor disagreement and in turn leads to higher trading volume. Supporting the link between overconfidence and trading volume, (Odean, 1999) finds that trading volume is excessive for at least those with discount brokerage accounts in the sense that their returns are reduced on average due to trading. (Barber & Odean, 2008) hypothesizes and tests that bounded rationality coupled with overconfidence in the quality of their own information could lead individual investors to be net buyers of stocks which draw their attention such as stocks that are in the news, stocks that experience high abnormal volume and stocks with extreme one-day returns. They argue that investors have typically thousands of stocks to choose from when deciding which stock to buy. Having limited capability in processing information, when buying stocks individuals tend to limit their choice set to only those stocks which grab their attention. On the other hand, as they only hold a handful of stocks in their portfolio at any time and are mostly subject to short-sale constraints, the same argument does not apply to selling. This results in net buying by individual investors. In the context of earnings announcements, (Barber & Odean, 2008) provides a behavioral underpinning to the observation that individuals or small investors tend to be net buyers following both positive and negative announcements ((Hirshleifer et al., 2008), (Lee, 1992)).

We think the observed high trading volume at positive announcements that cannot be explained by the usual determinants of trading volume could be related to noise traders which are attracted to positive surprise announcements. Using a similar reasoning as in (Barber & Odean, 2008), this could occur because a surprise announcement grabs the noise trader's attention. This could either occur directly due to news itself as well as indirectly as the noise trader observes the high price change or high volume that results due to information release. Once a high positive surprise stock grabs the attention of noise traders, their overconfidence may play a role in deciding to trade in the stock as they believe that they are somehow superior in processing the information and predicting future returns. Different interpretations of the new information increase belief heterogeneity which in turns lead to abnormal volume. We think day traders in particular could have a special role for this explanation. There is no research to our knowledge which explicitly looks at the impact of day trading on abnormal volume in public announcements. However, under the scenario we outline here, day traders who tend not to carry positions to the next day and motivated simply by intraday moves could have significant impact on volume without a similar impact on daily prices. This explanation brings the natural question of why the same mechanism does not equally work for announcements with bad news that might as well attract overconfident traders' attention. We offer two potential explanations for this phenomenon. First explanation is that bad news is not as advertised as good news and accordingly does not grab the same kind of attention as good news. Company managers are selective in making voluntary disclosures as they are more willing to provide a more detailed disclosure for good news than bad news (see (Rogers & Van Buskirk, 2008) and references therein). This voluntary disclosure also likely to lead to more media attention for positive surprises. The impact of more good news disclosure could be further amplified by brokers which out of business concerns may prefer to issue more buy recommendation than sell recommendation and contact their clients around earnings announcements ((Lee, 1992)). This argument in general terms ties to (Hong et al., 2000)'s hypothesis that firm-specific negative information diffuses gradually across the investing public. The second explanation is related to the possibility of noise traders being selective by only taking positions in the direction of short-term trend of a stock. One can envision day traders which try to exploit the positive intraday trend in positive surprise firms in the earnings announcement window. On the other hand, they are not able to do the same for bad news firms due to short-sale constraints. In further research, we think data on the type of investors who buy and sell around earnings announcements could prove especially valuable in providing necessary data to test out these and other explanations for the abnormal volume patterns we observe around earnings announcements.

In the final part of the thesis, we look at informativeness of earnings announcements and its time trend in Borsa Istanbul using abnormal volume and abnormal absolute return as measures for information content. We show that earnings announcements are significant information events with both measures being significantly positive around the three-day window surrounding the earnings announcement. Furthermore, we find a positive time trend in informativeness which is most pronounced in growth companies and announcements with high absolute surprise. Analyzing interim earnings announcements in addition to annual earnings announcements allow us to observe how information content of annual announcements compare with information content in interim announcements. We find higher abnormal volume, but lower abnormal absolute return at annual earnings announcements which suggest that annual announcements are not strictly superior to interim announcements in terms of their informational value for investors. Finally, we examine the introduction of the online disclosure platform KAP as an improvement in information dissemination technology. We find an increase in abnormal absolute return after the introduction of KAP, but no change in abnormal volume. We think a fruitful venue for further research could be conducting a comprehensive study to see which of the competing explanations such as increase in concurrent information, improvement in access to information or change in investor sophistication best explains the increasing informativeness of earnings announcements.

REFERENCES

Ahmed, A. S., & Schneible, R. A. (2007). The impact of regulation fair disclosure on investors' prior information quality - Evidence from an analysis of changes in trading volume and stock price reactions to earnings announcements. *Journal of Corporate Finance*, *13*(2–3), 282–299. https://doi.org/10.1016/j.jcorpfin.2006.11.003

Ahmed, A. S., Schneible, R. A., & Stevens, D. E. (2003). An empirical analysis of the effects of online trading on stock price and trading volume reactions to earnings announcements. *Contemporary Accounting Research*, *20*(3), 413–439. https://doi.org/10.1506/N2XD-TF8Y-JT4L-L6V0

Amihud, Y. (2002). Illiquidity and stock returns: Cross-section and time-series effects. *Journal of Financial Markets*, *5*(1), 31–56. https://doi.org/10.1016/S1386-4181(01)00024-6

Amir, E., & Lev, B. (1996). Value-relevance of nonfinancial information: The wireless communications industry. *Journal of Accounting and Economics*, *22*(1), 3–30. https://doi.org/https://doi.org/10.1016/S0165-4101(96)00430-2

Ariff, M., Loh, A. L. C., & Chew, P. M. K. (1997). The impact of accounting earnings disclosures on stock prices in Singapore. *Asia Pacific Journal of Management*, *14*(1), 17–29. https://doi.org/10.1023/A:1015429012076

Asthana, S., & Balsam, S. (2001). The effect of EDGAR on the market reaction to 10-K filings. *Journal of Accounting and Public Policy*, *20*(4–5), 349–372. https://doi.org/10.1016/S0278-4254(01)00035-7

Atiase, R. K., & Bamber, L. S. (1994). Trading volume reactions to annual accounting earnings announcements. The incremental role of predisclosure information asymmetry. *Journal of Accounting and Economics*, *17*(3), 309–329. https://doi.org/10.1016/0165-4101(94)90031-0

Atiase, R. K., & Gift, M. J. (2015). The informedness effect and volume of trade. *Journal of Accounting, Auditing and Finance*, *30*(4), 407–430. https://doi.org/10.1177/0148558X15571735

Atilgan, Y., Ozgur Demirtas, K., & Gunaydin, A. D. (2016). Liquidity and equity returns in Borsa Istanbul. *Applied Economics*, *48*(52), 5075–5092. https://doi.org/10.1080/00036846.2016.1170935

Ball, R., & Brown, P. (1968). An empirical evaluation of accounting income numbers. *Journal of Accounting Research*, *6*(2), 159–178. https://doi.org/10.2307/2490232

Ball, R., & Shivakumar, L. (2008). How much new information is there in earnings? *Journal of Accounting Research*, *46*(5), 975–1016. https://doi.org/10.1111/j.1475-679X.2008.00299.x

Bamber, L. S. (1986). The information content of annual earnings releases: A trading volume approach. *Journal of Accounting Research*, *24*(1), 40–56. https://doi.org/10.2307/2490803

Bamber, L. S. (1987). Unexpected earnings, firm size, and trading volume around quarterly earnings announcements. *Accounting Review*, *62*(3), 510–532.

Bamber, L. S., Barron, O. E., & Stevens, D. E. (2011). Trading volume around earnings announcements and other financial reports: Theory, research design, empirical evidence, and directions for future research. *Contemporary Accounting Research*, *28*(2), 431–471. https://doi.org/10.1111/j.1911-3846.2010.01061.x

Bamber, L. S., Barron, O. E., & Stober, T. L. (1997). Trading volume and different aspects of disagreement coincident with earnings announcements. *The Accounting Review*, *72*(4), 575–597. http://www.jstor.org/stable/248176

Bamber, L. S., Barron, O. E., & Stober, T. L. (1999). Differential interpretations and trading volume. *Journal of Financial and Quantitative Analysis*, *34*(3), 369–386. https://doi.org/DOI: 10.2307/2676264

Bamber, L. S., & Cheon, Y. S. (1995). Differential price and volume reactions to accounting earnings announcements. *The Accounting Review*, *70*(3), 417–441. http://www.jstor.org/stable/248532

Barber, B. M., & Odean, T. (2008). All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies*, *21*(2), 785–818. https://doi.org/10.1093/rfs/hhm079

Barron, O. E., Schneible, R. A., & Stevens, D. E. (2018). The changing behavior of trading volume reactions to earnings announcements: Evidence of the increasing use of accounting earnings news by investors. *Contemporary Accounting Research*, *35*(4), 1651–1674. https://doi.org/10.1111/1911-3846.12371

Bartov, E., Radhakrishnan, S., & Krinsky, I. (2000). Investor sophistication and patterns in stock returns after earnings announcements. *Accounting Review*, *75*(1), 43–63. https://doi.org/10.2308/accr.2000.75.1.43

Basu, S., Hwang, L., & Jan, C.-L. (2002). *Auditor conservatism and quarterly earnings* (SSRN Scholarly Paper No. ID 2428862). Rochester, NY: Social Science Research Network.

Battalio, R. H., & Mendenhall, R. R. (2005). Earnings expectations, investor trade size, and anomalous returns around earnings announcements. *Journal of Financial Economics*, *77*(2), 289–319. https://doi.org/10.1016/j.jfineco.2004.08.002

Battalio, R. H., & Mendenhall, R. R. (2007). *Post-earnings announcement drift: Timing and liquidity costs* (SSRN Scholarly Paper No. ID 937257). Rochester, NY: Social Science Research Network.

Beaver, W. H. (1968). The information content of annual earnings announcements. *Journal of Accounting Research*, *6*, 67. https://doi.org/10.2307/2490070

Ben-Rephael, A., Da, Z., & Israelsen, R. D. (2017). It depends on where you search: Institutional investor attention and underreaction to news. *Review of Financial Studies*, *30*(9), 3009–3047. https://doi.org/10.1093/rfs/hhx031

Bernard, V. L., & Thomas, J. K. (1989). Post-earnings-announcement drift: Delayed price response or risk premium? *Journal of Accounting Research*, *27*, 1. https://doi.org/10.2307/2491062

Bernard, V. L., & Thomas, J. K. (1990). Evidence that stock prices do not fully reflect the implications of current earnings for future earnings. *Journal of Accounting and Economics*, *13*(4), 305–340. https://doi.org/10.1016/0165-4101(90)90008-R

Bhushan, R. (1994). An informational efficiency perspective on the post-earnings announcement drift. *Journal of Accounting and Economics*, *18*(1), 45–65. https://doi.org/10.1016/0165-4101(94)90018-3

Black, F. (1986). Noise. *The Journal of Finance*, *41*(3), 529–543. https://doi.org/10.1111/j.1540-6261.1986.tb04513.x

Brandt, M. W., Kishore, R., Santa-Clara, P., Venkatachalam, M., Brandt, M. W., Santa-Clara, P., & Venkatachalam, M. (2008). *Earnings announcements are full of surprises* (SSRN Scholarly Paper No. ID 909563). Rochester, NY: Social Science Research Network.

Brown, L. D., & Han, J. C. Y. (1992). The impact of annual earnings announcements on convergence of beliefs. *The Accounting Review*, *67*(4), 862–875. http://www.jstor.org/stable/248328

Brown, L. D., & Han, J. C. Y. (2000). Do stock prices fully reflect the implications of current earnings for future earnings for AR1 firms? *Journal of Accounting Research*, *38*(1), 149–164. https://doi.org/10.2307/2672926

Carhart, M. M. (1997). On persistence in mutual fund performance. *Journal of Finance*, *52*(1), 57–82. https://doi.org/10.1111/j.1540-6261.1997.tb03808.x

Chae, J. (2005). Trading volume, information asymmetry, and timing information. *Journal of Finance*, *60*(1), 413–442. https://doi.org/10.1111/j.1540-6261.2005.00734.x

Chambers, A. E., & Penman, S. H. (1984). Timeliness of reporting and the stock price reaction to earnings announcements. *Journal of Accounting Research*, *22*(1), 21–47. https://doi.org/10.2307/2490700

Chan, L. K. C., Jegadeesh, N., & Lakonishok, J. (1996). Momentum strategies. *The Journal of Finance*, *51*(5), 1681–1713. https://doi.org/10.1111/j.1540-6261.1996.tb05222.x

Chordia, T., Goyal, A., Sadka, G., Sadka, R., & Shivakumar, L. (2009). Liquidity and the post-earnings-announcement drift. *Financial Analysts Journal*, *65*(4), 18–32. https://doi.org/10.2469/faj.v65.n4.3

Collins, D. W., Li, O. Z., & Xie, H. (2009). What drives the increased informativeness of earnings announcements over time? *Review of Accounting Studies*, *14*(1), 1–30. https://doi.org/10.1007/s11142-007-9055-y

Conrad, J., Cornell, B., & Landsman, W. R. (2002). When is bad news really bad news? *The Journal of Finance*, *57*(6), 2507–2532. https://doi.org/10.1111/1540-6261.00504

DeFond, M., Hung, M., & Trezevant, R. (2007). Investor protection and the information content of annual earnings announcements: International evidence. *Journal of Accounting and Economics*, *43*(1), 37–67. https://doi.org/https://doi.org/10.1016/j.jacceco.2006.09.001

Dellavigna, S., & Pollet, J. M. (2009). Investor inattention and friday earnings announcements. *Journal of Finance*, *64*(2), 709–749. https://doi.org/10.1111/j.1540-6261.2009.01447.x

Fama, E. (1998). Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics*, *49*(3), 283–306. https://doi.org/https://doi.org/10.1016/S0304-405X(98)00026-9

Fama, E., & French, K. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *33*(1), 3–56.

Fama, E., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, *116*, 1–22.

Foster, G., Olsen, C., & Shevlin, T. (1984). Earnings releases, anomalies, and the behavior of security returns. *The Accounting Review*, *59*(4), 574–603. http://www.jstor.org/stable/247321

Francis, J., Schipper, K., & Vincent, L. (2002). Earnings announcements and competing information. *Journal of Accounting and Economics*, *33*(3), 313–342. https://doi.org/https://doi.org/10.1016/S0165-4101(02)00058-7

Gajewski, J.-F., & Quéré, B. P. (2001). The information content of earnings and turnover announcements in France. *European Accounting Review*, *10*(4), 679–704. https://doi.org/10.1080/09638180127397

Garfinkel, J. A., & Sokobin, J. (2006). Volume, opinion divergence, and returns: A study of post-earnings announcement drift. *Journal of Accounting Research*, *44*(1), 85–112. https://doi.org/10.1111/j.1475-679X.2006.00193.x

George, T. J., Kaul, G., & Nimalendran, M. (1994). Trading volume and transaction costs in specialist markets. *The Journal of Finance*, *49*(4), 1489–1505. https://doi.org/10.1111/j.1540-6261.1994.tb02463.x

Griffin, J. M., Kelly, P. J., & Nardari, F. (2010). Do market efficiency measures yield correct inferences? A comparison of developed and emerging markets. *Review of Financial Studies*, *23*(8), 3225–3277. https://doi.org/10.1093/rfs/hhq044

Grossman, S. (1976). On the efficiency of competitive stock markets where trades have diverse information. *The Journal of Finance*, *31*(2), 573–585. https://doi.org/10.1111/j.1540-6261.1976.tb01907.x

Grossman, S., & Stiglitz, J. E. (1980). On the impossibility of informationally efficient markets. *The American Economic Review*, *70*(3), 393–408. http://www.jstor.org/stable/1805228

Hew, D., Skerratt, L., Strong, N., & Walker, M. (1996). Post-earnings-announcement drift: Some preliminary evidence for the UK. *Accounting and Business Research*, *26*(4), 283–293. https://doi.org/10.1080/00014788.1996.9729519

Hirshleifer, D. A., Lim, S. S., & Teoh, S. H. (2009). Driven to distraction: Extraneous events and underreaction to earnings news. *Journal of Finance*, *64*(5), 2289–2325. https://doi.org/10.1111/j.1540-6261.2009.01501.x

Hirshleifer, D. A., Myers, J. N., Myers, L. A., & Teoh, S. H. (2008). Do individual investors cause post-earnings announcement drift? Direct evidence from personal trades. *Accounting Review*, *83*(6), 1521–1550. https://doi.org/10.2308/accr.2008.83.6.1521

Holthausen, R. W., & Verrecchia, R. E. (1990). The Effect of informedness and consensus on price and volume behavior. *The Accounting Review*, *65*(1), 191–208.

Hong, H., Lim, T., & Stein, J. C. (2000). Bad news travels slowly: Size, analyst coverage, and the profitability of momentum strategies. *Journal of Finance*, *55*(1), 265–295. https://doi.org/10.1111/0022-1082.00206

Hung, M., Li, X., & Wang, S. (2015). Post-earnings-announcement drift in global markets: Evidence from an information shock. *Review of Financial Studies*, *28*(4), 1242–1283. https://doi.org/10.1093/rfs/hhu092

Jones, C. P., & Litzenberger, R. H. (1970). Quarterly earnings reports and intermediate stock price trends. *The Journal of Finance*, *25*(1), 143–148. https://doi.org/10.2307/2325806

Kandel, E., & Pearson, N. D. (1995). Differential interpretation of public signals and trade in speculative markets. *Journal of Political Economy*, *103*(4), 831–872. https://doi.org/10.1086/262005

Karolyi, G. A., Lee, K., & Dijk, M. A. Van. (2012). Understanding commonality in liquidity around the world. *Journal of Financial Economics*, *105*(1), 82–112. https://doi.org/10.1016/j.jfineco.2011.12.008

Karpoff, J. M. (1986). A theory of trading volume. *The Journal of Finance*, *41*(5), 1069–1087. https://doi.org/10.1111/j.1540-6261.1986.tb02531.x

Karpoff, J. M. (1987). The relation between price changes and trading volume: A survey. *The Journal of Financial and Quantitative Analysis*, *22*(1), 109–126. https://doi.org/10.2307/2330874

Kiger, J. E. (1972). An empirical investigation of NYSE volume and price reactions to the announcement of quarterly earnings. *Journal of Accounting Research*, *10*(1), 113–128. https://doi.org/10.2307/2490222

Kim, D., & Kim, M. (2003). A multifactor explanation of post-earnings announcement drift. *The Journal of Financial and Quantitative Analysis*, *38*(2), 383. https://doi.org/10.2307/4126756

Kim, O., & Verrecchia, R. E. (1991). Trading volume and price reactions to public announcements. *Journal of Accounting Research*, *29*(2), 302–321. https://doi.org/10.2307/2491051

Kim, O., & Verrecchia, R. E. (1997). Pre-announcement and event-period private information. *Journal of Accounting and Economics*, *24*(3), 395–419. https://doi.org/10.1016/S0165-4101(98)00013-5

Kim, S., & Lim, S. C. (2017). Does trading volume increase or decrease prior to earnings announcements? *Advances in Quantitative Analysis of Finance and Accounting*, 15, 137-183.

Kross, W., Ha, G. L., & Heflin, F. (1994). A test of risk clientele effects via an examination of trading volume response to earnings announcements. *Journal of Accounting and Economics*, *18*(1), 67–87. https://doi.org/10.1016/0165-4101(94)90019-1

Landsman, W. R., & Maydew, E. L. (2002). Has the information content of quarterly earnings announcements declined in the past three decades? *Journal of Accounting Research*, *40*(3), 797–808. http://www.jstor.org/stable/3542273

Lee, C. M. C. (1992). Earnings news and small traders. An intraday analysis. *Journal of Accounting and Economics*, *15*(2–3), 265–302. https://doi.org/10.1016/0165-4101(92)90021-S

Lerman, A., & Tan, Q. (2019). *Rethinking determinants of trading volume at earnings announcements* (SSRN Scholarly Paper No. ID 3310682). Rochester, NY: Social Science Research Network.

Lev, B. (1989). On the usefulness of earnings and earnings research: Lessons and directions from two decades of empirical research. *Journal of Accounting Research*, *27*, 153–192. https://doi.org/10.2307/2491070

Linnainmaa, J. (2005). *The individual day trader*. Working Paper, University of California at Los Angeles.

Livnat, J., & Mendenhall, R. R. (2006). Comparing the post-earnings announcement drift for surprises calculated from analyst and time series forecasts. *Journal of Accounting Research*, *44*(1), 177–205. https://doi.org/10.1111/j.1475-679X.2006.00196.x

Mendenhall, R. R. (2004). Arbitrage risk and post-earnings-announcement drift. *Journal of Business*, *77*(4), 875–894. https://doi.org/10.1086/422627

Morse, D. (1981). Price and trading volume reaction surrounding earnings announcements: A closer examination. *Journal of Accounting Research*, *19*(2), 374–383. https://doi.org/10.2307/2490871

Mugaloglu, Y. I., & Erdag, E. (2011). The relationship between stock return volatility and public disclosure: The case of Istanbul Stock Exchange Online Public Disclosure Platform. *Journal of Applied Economics & Business Research*, *1*(2), 93. http://www.aebrjournal.org/uploads/6/6/2/2/6622240/3.mugaloglu.pdf

Ng, J., Rusticus, T. O., & Verdi, R. S. (2008). Implications of transaction costs for the post-earnings announcement drift. *Journal of Accounting Research*, *46*(3), 661–696. https://doi.org/10.1111/j.1475-679X.2008.00290.x

Odabasi, A. (1998). Security returns reactions to earnings announcements: A case study on the Istanbul stock exchange. *Bogazici Journal: Review of Social, Economic and Administrative Studies*, *12*(2), 3–19.

Odean, T. (1998). Volume, volatility, price, and profit when all traders are above average. *Journal of Finance*, *53*(6), 1887–1934. https://doi.org/10.1111/0022-1082.00078

Odean, T. (1999). Do investors trade too much? *The American Economic Review*, *89*(5), 1279–1298. http://www.jstor.org/stable/117058

Park, T. J., Lee, Y., & Roy Song, K. (2014). Informed trading before positive vs. negative earnings surprises. *Journal of Banking and Finance*, *49*, 228–241. https://doi.org/10.1016/j.jbankfin.2014.09.016

Pellicer, M. J. A., & Rees, W. P. (1999). Regularities in the equity price response to earnings announcements in Spain. *European Accounting Review*, *8*(4), 585–607. https://doi.org/10.1080/096381899335727

Peress, J., & Schmidt, D. (2020). Glued to the TV: Distracted noise traders and stock market liquidity. *Journal of Finance*, *75*(2), 1083–1133. https://doi.org/10.1111/jofi.12863

Piotroski, J. D. (2000). Value investing: The use of historical financial statement information to separate winners from losers. *Journal of Accounting Research*, *38*, 1–41. https://doi.org/10.2307/2672906

Rendleman, R. J., Jones, C. P., & Latané, H. A. (1982). Empirical anomalies based on unexpected earnings and the importance of risk adjustments. *Journal of Financial Economics*, *10*(3), 269–287. https://doi.org/https://doi.org/10.1016/0304-405X(82)90003-4

Rippington, F. A., & Taffler, R. J. (1995). The information content of firm financial disclosures. *Journal of Business Finance & Accounting*, *22*(3), 345–362. https://doi.org/10.1111/j.1468-5957.1995.tb00878.x

Rogers, J. L., & Van Buskirk, A. (2008). *Bundled forecasts and selective disclosure of good news*. Working Paper, University of Chicago.

Skinner, D. J., & Sloan, R. G. (2002). Earnings surprises, growth expectations, and stock returns or don't let an earnings torpedo sink your portfolio. *Review of Accounting Studies*, *7*(2), 289–312. https://doi.org/10.1023/A:1020294523516

Sponholtz, C. (2008). The information content of earnings announcements in Denmark. *International Journal of Managerial Finance*, *4*(1), 4–36. https://doi.org/10.1108/17439130810837366

Truong, C. (2011). Post-earnings announcement abnormal return in the Chinese equity market. *Journal of International Financial Markets, Institutions and Money*, *21*(5), 637–661. https://doi.org/10.1016/j.intfin.2011.04.002

Truong, C. (2012). Information content of earnings announcements in the New Zealand equity market, a longitudinal analysis. *Accounting & Finance*, *52*(s1), 403–432. https://doi.org/10.1111/j.1467-629X.2011.00438.x

Utama, S., & Cready, W. M. (1997). Institutional ownership, differential predisclosure precision and trading volume at announcement dates. *Journal of Accounting and Economics*, *24*(2), 129–150. https://doi.org/10.1016/S0165-4101(98)00003-2

Van Huffel, G., Joos, P., & Ooghe, H. (1996). Semi-annual earnings announcements and market reaction: Some recent findings for a small capital market. *European Accounting Review*, *5*(4), 693–713. https://doi.org/10.1080/09638189600000043

Watts, R. L. (1978). Systematic 'abnormal' returns after quarterly earnings announcements. *Journal of Financial Economics*, *6*(2), 127–150. https://doi.org/https://doi.org/10.1016/0304-405X(78)90027-2

Wurgler, J., & Zhuravskaya, E. (2002). Does arbitrage flatten demand curves for stocks? *Journal of Business*, *75*(4), 583–608. https://doi.org/10.1086/341636

Ying, C. C. (1966). Stock market prices and volumes of sales. *Econometrica*, *34*(3), 676–685. https://doi.org/10.2307/1909776

Ziebart, D. A. (1990). The trading association of activity between and consensus beliefs surrounding earnings announcements. *The Accounting Review*, *65*(2), 477–488.