Trading on Calendar Misconceptions

14-Week Quarter Revisited

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Abstract

This study examines the abnormal returns caused by the *14-week quarter anomaly*, a phenomenon where US firms define their fiscal quarters as 13 weeks to maintain precisely 52 weeks in each fiscal year. Consequently, one day (two days in leap years) is omitted annually. To realign with the calendar year, a week is added back every 5 or 6 years, resulting in one 14-week fiscal quarter during those periods.

Over a decade ago, Johnston et al. (2012) introduced the 14-week quarter anomaly. This thesis revisits and extends their study. The main findings of the thesis are that the 14-week quarter anomaly still persists, even after the publication of Johnston et al. (2012), and that it is more pronounced for firms with higher idiosyncratic risk. Specifically, investors can gain a 3.8 percentage point (16.1 pp annualized) abnormal return by merely buying and holding stocks during the 14-week quarters.

The thesis contributes to the literature on market efficiency, arbitrage, and financial reporting. The thesis provides new evidence on the existence and persistence of the 14-week anomaly, which challenges the efficient market hypothesis and suggests that investors are not fully rational or informed. The thesis also provides new insights into the role of idiosyncratic risk in explaining the 14-week quarter anomaly, which implies that arbitrage is limited or costly for these firms. Furthermore, the thesis sheds light on the implications of accounting policy choices for firm returns and investor behavior.

This thesis is built upon an extensive review of existing literature and examines data from 591 US firms spanning the years 2005 to 2023. Regression analyses employed in this study utilize a fixed effects method, account for industry- and year-effects, and employ heteroskedasticity-robust standard errors clustered at the firm level.

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Glossary

Term	Definition
14-week fiscal quarter	A quarter that contains 14 weeks instead of the usual 13 weeks, due to the 52/53 week reporting convention.
52/53 week reporting convention	An accounting practice that defines a fiscal year as 52 or 53 weeks, ending on a specific day of the week.
Abnormal return	The difference between the actual return of a security and the expected return based on a benchmark or a model.
Arbitrage	The practice of exploiting price differences between two or more markets or assets, to earn riskless profits without net investment.
Attenuation bias	A bias in model coefficients caused by measurement errors in independent variables, typically pushing the coefficient value toward zero.
Book-to-market	The ratio of the book value of equity to the market value of equity.
Catch-up quarter	The quarter that contains an extra week in a 52/53 week reporting convention. It is also called the 14-week quarter.
Confounding variable	A variable that correlates with both an explanatory variable and the dependent variable.
Declaration date	The date when dividends are declared.
Declared dividends	A dividend authorized and declared by the Board.
Earnings surprise	The difference between a company's reported earnings and expected earnings
Efficient market hypothesis (EMH)	A theory that states that capital markets are informationally efficient, meaning that prices of securities fully reflect available information at any given time.
Ex-dividend date	Buyers of stock on or after this date do not receive dividends.
Fixed effects method	A statistical technique that controls for time-invariant factors that may influence the dependent and/or explanatory variables in a panel data regression
Idiosyncratic risk	The risk that is specific to an individual asset or firm, and not related to the overall market risk

Payable date	The date when dividends are paid out to investors.
Post-earnings announcement drift (PEAD)	A financial anomaly observed in stock markets where a company's stock price tends to exhibit a persistent movement in the direction of an earnings surprise following its earnings announcement
Random walk expectation	The expectation that future values are unpredictable yet based on the previous value.
Record date	Shareholders registered on this date will receive the dividend.
Typewriter-firm	US firm following a 52/53-week accounting practice.

1 Introduction

The financial markets can act in peculiar ways. On one hand, they are known for their impressive efficiency, like how stock prices react within seconds to news such as those from CNBCTV's Morning Call and Midday Call segments (Busse & Clifton Green, 2002). On the other hand, there are moments where they overlook glaring factors. This thesis sheds light on one of these instances – the 14-week fiscal quarter anomaly. This anomaly has, for decades, bewildered markets, leading them to be surprised by the unsurprising.

Let's take a moment to understand the concept of a *14-week fiscal quarter*. In the usual calendar year, a quarter spans around 13 weeks. However, there are instances when certain firms, due to their specific accounting policies, report a 14-week fiscal quarter. This additional week holds substantial implications for their financial reports. For instance, introducing an extra week almost invariably boosts revenues. All else equal, in a 14-week quarter, revenues will be approximately 7.7% (1/13) higher than in a 13-week quarter. Yet, this added week is merely a transitory boost that dissipates in subsequent quarters, which adhere to the standard 13-week structure.

Now, you might wonder about the practical relevance of the 14-week anomaly. Specifically, will you ever encounter firms following this accounting practice? The answer is likely yes. Many prominent US companies like Apple, Coca-Cola, and Gap are using this policy.

At first glance, it might seem straightforward to anticipate the 14-week quarter. However, prior research, by Johnston et al. (2012), demonstrates that markets fail to predict the impact of this extra week. Consequently, the authors devised a trading strategy based on the 14-week quarter, yielding abnormal returns of 3.15% per quarter (12.6% annualized).

Considering this, it's intriguing to explore whether the 14-week anomaly still perplexes markets. Given that Johnston et al.'s (2012) study was published over a decade ago, this thesis aims to determine if abnormal returns persist or if the markets have started to rectify this noticeable anomaly. In addition, the thesis will examine the potential abnormal returns stemming from the 14-week quarter. To achieve this, we will delve into the primary research questions that guide this research.

1.1 Problem Statement

The thesis aims to examine how the abnormal returns from the 14-week trading strategy have developed in the period from 2005 to 2023.

1.2 Delimitations

To ensure a well-defined and focused examination of the research question, this thesis establishes its scope through the implementation of seven specific delimitations.

1. This study focuses exclusively on US firms, while it's worth noting that certain jurisdictions following IFRS allow for the 52/53-week reporting convention[1] (IFRS Foundation, 2015).
2. The research is confined to the time interval between 2005 and 2023. This deliberate choice provides a comprehensive representation and enhances the statistical power of the regression models.
3. The assessment of abnormal returns is solely based on buy-and-hold returns, without considering other return metrics.
4. The buy-and-hold return is determined by the adjusted closing price of the firm. This study does not engage with intraday stock price fluctuations but treats stock prices as constant until the end of the day.
5. Regarding the statistical methods used, it's worth noting that efforts were made to examine and address assumptions to the best extent possible. However, due to practical constraints inherent in the study, complete adherence to all statistical assumptions was not feasible.
6. The analysis does not include all firms using the 52/53-week reporting approach. Specifically, I exclude firms with 14-week quarters in a 52-week fiscal year. For instance, they might define their fiscal quarters as 12-14-12-14 weeks, with the first quarter (Q1) containing 12 weeks, the second quarter (Q2) containing 14 weeks, and so on. To ensure an accurate analysis, I exclude these cases. This is because investor reactions to this type of 14-week quarter could potentially dilute the impact of catch-up quarters. Thus, this thesis solely focuses on firms where fiscal quarters other than the 14-week ones consistently last 13 weeks.

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[1]If firms define their fiscal year as 364 days rather than 365, they can achieve the consistency of 52 weeks in most fiscal years, facilitating better period comparability and reporting convenience. However, at a certain time, the fiscal year needs to align with the calendar year. Consequently, every six or seven years (dependent on leap years), a fiscal year must comprise 53 weeks. This is why this accounting policy is often referred to as the 52/53 week reporting convention.

7. The term "arbitrage" takes on a more flexible interpretation within this study. While its traditional definition involves earning riskless profits without net investment (Bodie et al., 2018), I use the term more loosely. In this context, I refer to arbitrage as the professional trading of mispriced securities.

1.3 Research Design

This chapter outlines the research design utilized in the thesis to study how investors react to a 14-week fiscal quarter. This involves a clear presentation of the selected research strategy and approach, along with their reciprocity and implications. *Figure 1* provides a visual overview of the research design.

Figure 1.1 – Research Design

Source: Author's creation

1.3.1 Research Strategy

Choosing the right research strategy is crucial for maintaining a coherent project. This is achieved, in part, by closely aligning the research strategy with the research question. As a result, the research question should consistently serve as a guide for shaping the research strategy.

The research strategy serves as the methodological link between the scientific philosophy and the subsequent data collection process (Saunders et al., 2021). In this study, the selected research strategy is *quasi-experimental*, also known as a *natural experiment*. This choice aligns with the thesis' aim to explore the dynamics of returns during 14-week quarters. Following a typical approach in experimental research strategies, I will formulate hypotheses, which are elaborated in 3.3 Hypotheses Development.

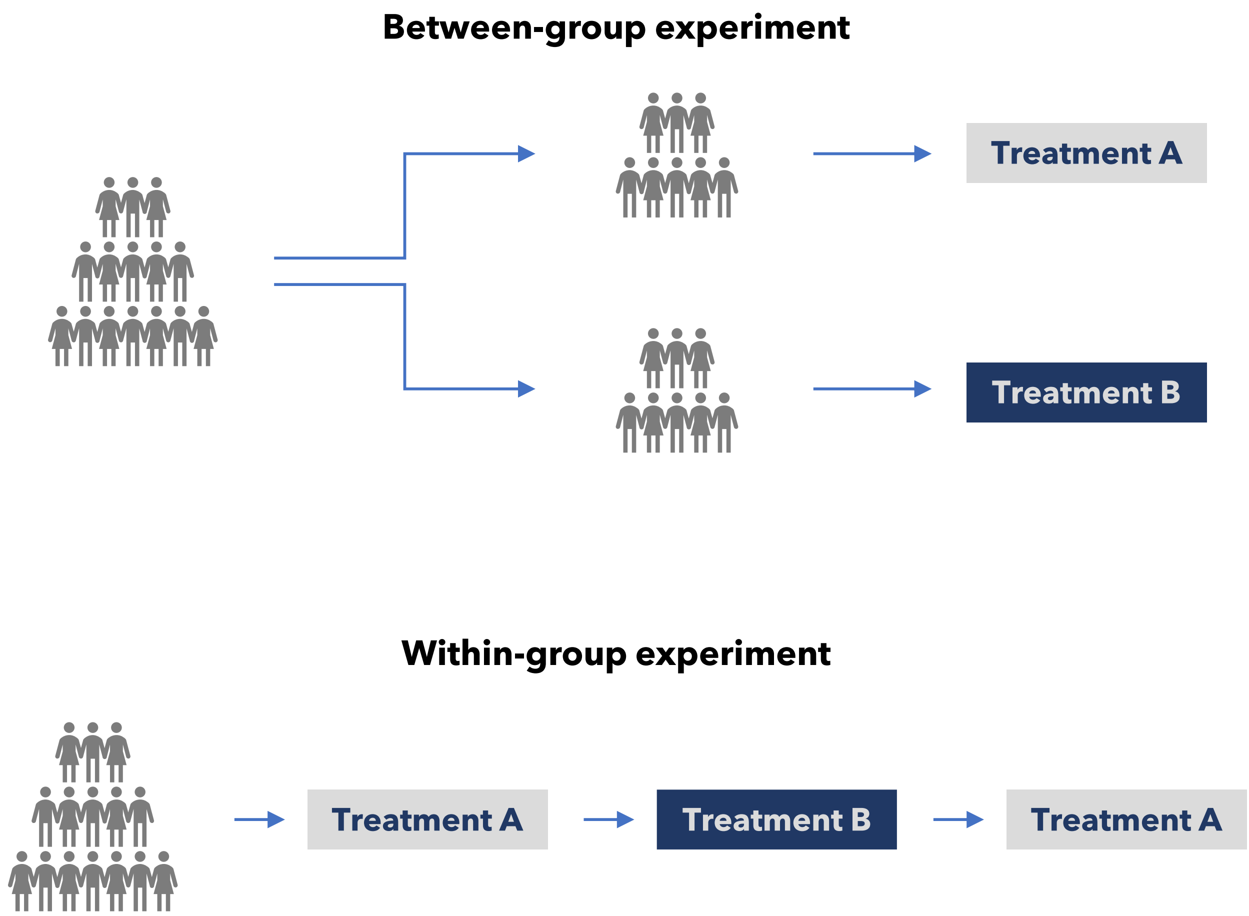
Among the various types of natural experiments, I am specifically employing a *within-group experiment*. Instead of having separate treatment and control groups, I focus on a single group – investors trading Typewriter-firm[2] stocks. This group encounters a series of randomized interventions, which are the occurrences of 14-week quarters.

The process begins with initial observations of 13-week quarters to establish a baseline before the intervention. Afterward, the randomized intervention (14-week quarter) is observed and measured. Subsequently, another baseline period of 13-week quarters is observed. This sequence is then repeated iteratively. This research strategy is illustrated in *Figure 1.2*.

A major pitfall of within-subject research strategies is the possibility of *carryover effects*. Carryover effects arise when familiarity with the process distorts the validity of the findings. Specifically, if experiencing one 14-week quarter enables investors to predict future 14-week quarters, the interventions cease to be truly random. This situation could have consequences for the research's validity. More insights into randomized interventions are discussed in 7.2.3 Pseudo-Natural Experiment.

[2] I use the term "Typewriter-firms" to refer to companies that have adopted the 52/53 week reporting period. This is elaborated in 2.2 Explanation of 52/53 accounting practice.

Figure 1.2 – Natural Experiments



Source: Author's creation

The within-group research strategies are principally linked with quantitative research designs. Looking at it from a classical standpoint (mono method), the research design has two main avenues: quantitative and qualitative. In this study, a quantitative research design is chosen to maintain a cohesive approach. Opting for a quantitative method frequently allows for the creation of clear-cut and measurable outcomes. As a result, this enhances the applicability and generalizability for practitioners.

The decision to adopt a quantitative design over a qualitative one is driven by the nature of the research question. The question aims to examine the relationship between 14-week quarters and stock prices, dealing with numerical data that are suitable for statistical analysis. Additionally, the research strategy involves control variables in line with experimental research principles, more details on these variables can be found in 5.2.4 Explanatory Variables.

I explored different research approaches, including the option of a case study. In a case study, the focus would likely have been on analyzing a small number of particular Typewriter-firms. However, this approach would have limited the study's applicability and generalizability. This could have posed challenges for future practitioners aiming to replicate the study.

To achieve the goal of producing measurable and generalizable conclusions, I opted for an econometric analytical approach. This method involves using statistics to analyze a fundamental dataset in conjunction with financial theories. Given the need for numerical data collection in response to the research question, I chose a quantitative design.

However, this choice comes with certain risks, primarily related to data quality. To ensure reliable outcomes, the data best maintain its original form, comprising factual observations. Additionally, using a substantial sample size is crucial. This helps ensure an appropriate level of external validity and to strengthen the robustness of the econometric outcomes.

1.3.2 Research Philosophy

The research philosophy represents the system of beliefs and assumptions used to generate knowledge. These assumptions inevitably support the desired research approach and strategy of the study to ensure a coherent research design (Saunders et al., 2021). In this project, the researcher follows a positivistic approach, which ensures separation between the researcher and the study (Easterby-Smith, 2015).

The positivistic stance emphasizes the presence of an objective reality existing independently from the observer. It suggests that the researcher's role is to reveal the underlying mechanisms that account for this reality (Easterby-Smith, 2015). Considering that this paper aims to explore the progression of abnormal returns in 14-week fiscal quarters, adopting a positivistic approach is considered fitting to ensure the research's validity. The objective is to scrutinize the external social world by relying on observed facts and employing objective methods.

To do this, the study first explains relevant concepts and theories about financial markets. Then, it analyzes the collected data through hypotheses, which allows for an objective and quantifiable investigation. Moreover, the research aims to generalize the findings of the 14-week anomaly by deriving theoretical and practical implications. These objective findings would be impracticable from the constructionist epistemological standpoint (Easterby-Smith, 2015).

1.3.3 Research Approach

Following the positivistic scientific philosophy, research can be approached through either deduction or induction. Deductive research involves creating a theory based on existing research and then empirically testing it through hypotheses. This approach focuses on identifying relationships between concepts and variables, often using quantitative data. To ensure reliability through replicability, the research methodology should be highly structured (Saunders et al., 2021).

In contrast, an inductive approach takes a more flexible approach. It begins with specific observations and then generates a new theoretical framework based on the results of empirical analysis (Saunders et al., 2021). In simpler terms, the inductive approach allows the data to shape the development of theory.

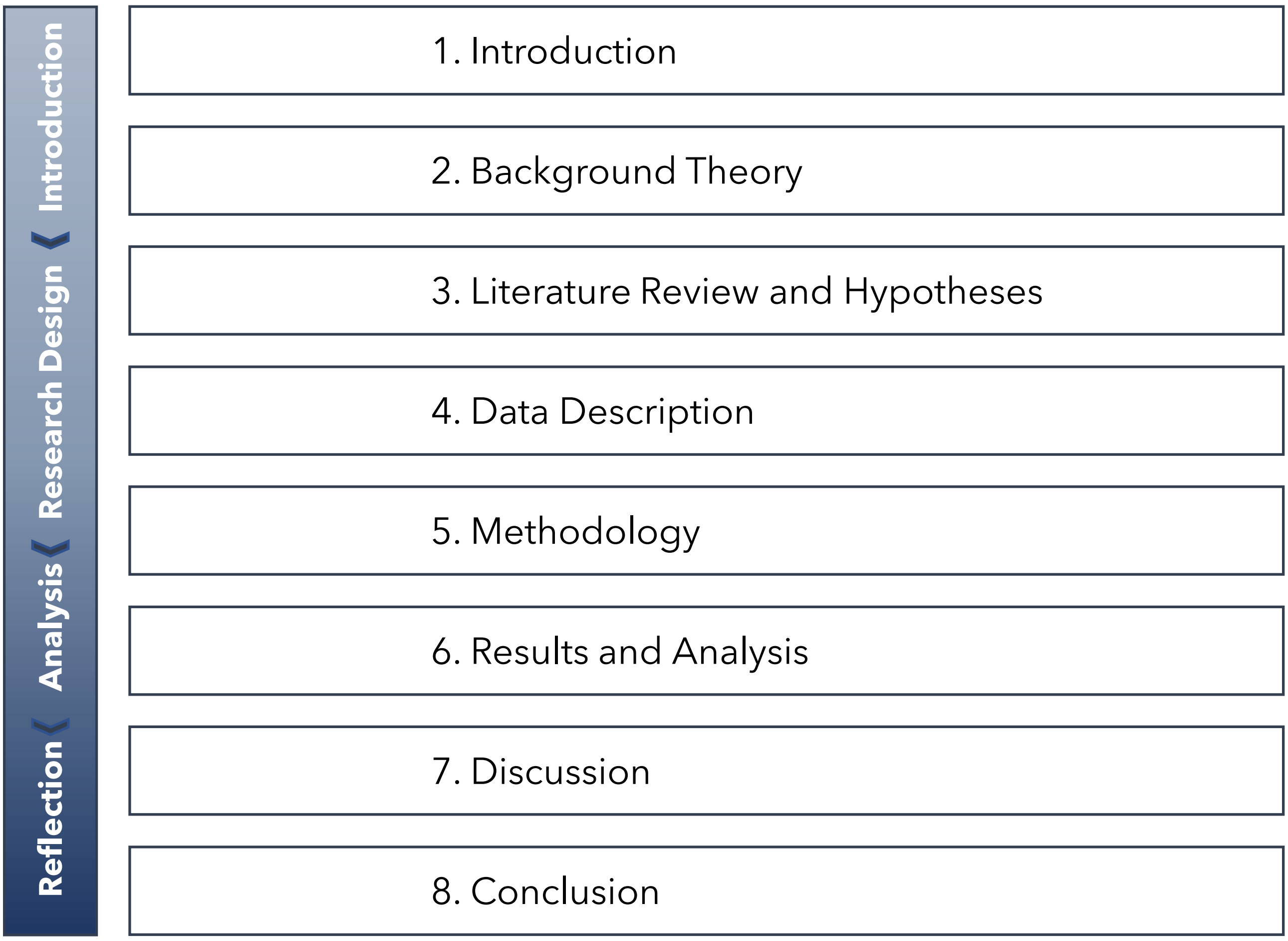
This study adopts a deductive approach to systematically address the research question at hand. This aligns with the chosen quasi-experimental research strategy. The deductive approach involves developing hypotheses from existing research in finance and accounting. These hypotheses are tested using empirical data from the U.S. stock market, using econometric methods for analysis.

In conclusion, this chosen methodology enables us to establish whether the hypothesis is falsified or verified (Saunders et al., 2021). Regardless of the outcome, the insights gained from the analysis are valuable. If the results are inconsistent with the premises, it prompts a need to adjust or reject the hypothesis. Conversely, if the results are consistent with the premises, it corroborates the hypothesis. In both scenarios, the analysis will enhance our comprehension of how markets respond to the 14-week anomaly.

1.4 Thesis Structure

The thesis follows Bloom's taxonomy (Andersen, 2013). It is designed to systematically guide the reader through the research process. Chapter 1 introduces the problem, presents the research question, sets boundaries for the study, and outlines the philosophical approach. Chapter 2 provides background theory on accounting practices, including an explanation and example of the 52/53 week accounting practice. Motivations for adopting this practice are discussed, along with a brief mention of its potential impact on stock prices. In Chapter 3, a review of relevant literature is presented. This includes research on capital market efficiency and market anomalies. The chapter also outlines the hypotheses developed based on this literature. Moving to Chapter 4, the data sources and collection process are described, establishing the foundation for the study's empirical aspects. Chapter 5 discusses the research methodology. This chapter consists of two sections: the first analyzes the methods used by Johnston et al. (2012), while the second outlines the methods applied in this study, highlighting differences. Chapter 6 presents and analyzes the results derived from the research, leading to Chapter 7. Here, the findings are broadly discussed, and key reflection points are presented. Finally, Chapter 8 concludes the thesis. The visual representation of the thesis structure can be found in *Figure 1.3*.

Figure 1.3 – Thesis Structure



Source: Author's creation

2 Background Insights

This chapter aims to provide a basic understanding of the equity capital markets, which form the broader financial context of this thesis. Specifically, the chapter outlines how markets often are thought to react to news about a company. Furthermore, the chapter introduces the concept of the 52/53 accounting practice, detailing its nature, the rationale behind its adoption, and finally giving an example of a firm using this practice. Essentially, this serves as the foundation for the investigation into the 14-week anomaly.

2.1 Equity Market Dynamics

To grasp the 14-week anomaly, it's important to have a basic understanding of how equity markets can behave. This involves being familiar with concepts like the efficient market hypothesis, arbitrage theory, and anomalies.

2.1.1 Efficient Market Hypothesis

The efficient market hypothesis (EMH) is a fundamental theoretical concept in finance. It states that capital markets are informationally efficient, meaning that prices of securities fully reflect available information at any given time (Fama, 1970). The concept was first introduced by Eugene Fama around the late 1960s and has since become a widely accepted yet debated topic in the academic literature. The EMH has three forms: weak, semi-strong, and strong, each with different implications for investors and other market participants.

First, the weak form of the EMH suggests that market trading data, such as the history of past prices, returns, trading volumes, and short interests, are reflected in current prices, rendering technical analysis useless. In other words, investors *cannot* generate superior returns by analyzing past prices or trends because the weak form of the EMH implies that if past trading data conveys reliable signals on future performance, then the information is already exploited by investors in the market (Fama, 1970).

Second, the semi-strong form of the EMH states that all publicly available information, including fundamental data on firms' product lines, quality of management, balance sheet composition, patents held, earning forecasts, and accounting practices, is reflected in the stock price, rendering fundamental analysis ineffective. In other words, investors *cannot* outperform the market by analyzing publicly available information (Bodie et al., 2018).

Third, the strong form of the EMH states that all information relevant to the firm, even insider information, is reflected in the stock price, rendering any form of active investment management ineffective. This means that investors *cannot* generate superior returns even with insider information, as it is already reflected in the stock price. Fama mentions that the strong-form is quite extreme and that the model probably is not an exact description of the world but is best viewed as a benchmark to judge inefficiencies in capital markets (Fama, 1970).

The occurrence of a fiscal year with an additional week is often exogenous to the firm and entirely predictable. Assuming the efficient market hypothesis holds, the announcement of an extra week in the fiscal year should not cause any significant impact on the stock price, given that all other factors remain constant. However, the efficient market hypothesis has been a subject of extensive debate and discussion. The EMH is further discussed in 3.1 Extensions and Critics of Efficient Markets.

2.1.2 Arbitrage Pricing Theory

In its original definition, an arbitrage opportunity occurs when an investor can earn riskless profits due to market inefficiencies. An example of an arbitrage opportunity is when shares of a stock are sold for different prices on two different exchanges. This creates an opportunity for investors to profit by buying the shares on the exchange where they are cheaper and simultaneously selling them on the exchange where they are more expensive. This type of arbitrage would yield a riskless profit to the investor. The Arbitrage Pricing Theory proposed by Ross (1976) relies upon the Law of One Price, which states that if two assets are economically identical, then they should trade at the same market price (Bodie et al., 2018). An implication of arbitrage trading is to enforce the law. Put differently, if arbitrageurs observe a violation of the law, they will engage in arbitrage activity – simultaneously buying the cheap asset, while selling the expensive one. In turn, the different prices of the asset will converge leading to an elimination of the arbitrage opportunity.

Practitioners often use the term arbitrage more loosely than initially proposed (Bodie et al., 2018). In this thesis, arbitrage will refer to professionals searching for mispriced securities. More specifically, I will focus on professional investors who observe and trade on anomalies in equity capital markets. These anomalies are explained in the next section.

2.1.3 Anomalies

Market anomalies exist when one can systematically predict abnormal risk-adjusted returns. Surprisingly, the anomalies can be quite simple to observe for example the *size effect*. This shows that smaller firms have had higher risk-adjusted returns, on average, than larger firms (Banz, 1981). Another example is the book-to-market ratio. This shows that the book-to-market ratio of equity can strongly predict a firm's returns (Fama & French, 1992).

In efficient markets, anomalies should be self-correcting. When arbitrageurs detect mispriced securities, their efforts to capitalize on these should push prices towards levels where abnormal profits cease to exist. Interestingly, this is actually the case. Markets appear to become more efficient as information about these anomalies is disseminated. In other words, academic publications inform investors about mispricing, leading to a decline in returns for post-published anomalies. Indeed, not only do abnormal returns decrease, but trading volume, stock variance, and short interest in overpriced stocks increase (McLean & Pontiff, 2016). Interestingly, the attenuation of alphas is most pronounced for larger firms, more liquid stocks, and those with lower idiosyncratic risk. While anomalies do not seem to disappear entirely, this suggests that markets are gradually becoming more efficient over time.

2.2 Explanation of 52/53 Accounting Practice

In the US, most companies have a fiscal year that includes 365 days spanning from e.g. *January 1st to December 31st* or *July 1st to June 30th*. However, some companies find it difficult to compare their financial results with previous periods because of the way weekends can fall in a given year.

To address this issue, many US companies have adopted a 52/53-week reporting convention. Instead of using a traditional calendar quarter, they define each fiscal quarter to be strictly 13 weeks. This choice results in a fiscal year with exactly 52 weeks. With a 52-week fiscal year, one day is omitted annually (two days in a leap year), requiring a week to be added to a fiscal quarter once every five or six years. The fiscal year containing this extra week is the one with the "infamous" 14-week quarter, making it a 53-week fiscal year. This practice is known as the 52/53-week reporting convention.

I coin these firms ***Typewriter-firms***, not because they produce typewriters, but to emphasize their behavior. Typewriters have regular, repetitive keystrokes, but when changing lines or returning the carriage, there's an irregular, longer motion. Similarly, these firms have repetitive 52-week fiscal years, but when catching up to a calendar year, the fiscal year must contain 53 weeks.

One example of a Typewriter-firm is Target Corporation. In its annual report for 2021, Target discloses in its *Summary of Accounting Policies*, "Our fiscal year ends on the Saturday nearest January 31. (…) Fiscal 2022 will end January 28, 2023, and will consist of 52 weeks.". However, the 52-week fiscal year is slightly shorter than a full calendar year (364 and 365 days, respectively). This has some implications for Target Corporation as they eventually need to add an extra week to a fiscal quarter to *catch up*. This is called the *catch-up quarter*, and it is a 14-week fiscal quarter. Under US accounting rules, Target Corporation will report an additional week of revenues and earnings during the catch-up quarter, which will make their announced revenues and earnings approximately 7.7% (1/13) higher, ceteris paribus.

Fortunately, the occurrence of catch-up quarters is predictable, and companies following this accounting practice are required to disclose their fiscal year policy in their financial statements. This information can typically be found in the footnotes. Take Dolby Laboratories for instance, they disclose the following under *Basis of Presentation* "Our fiscal year is a 52 or 53 week period ending on the last Friday in September. The fiscal years presented herein include the 53-week period ended September 30, 2022 (fiscal 2022), and the 52-week periods ended September 24, 2021 (fiscal 2021) and September 25, 2020 (fiscal 2020)". It is clearly stated – yet disguised in the notes – that the reported financial figures for 2022 represent 53 weeks of operations as opposed to the previous fiscal years.

2.3 Motivations for 52/53 Accounting Practice

Typewriter-firms exist in various industries, with retailers serving as a notable example due to their significant weekend activity. The adoption of a 52/53-week fiscal year benefits them by ensuring uniform weekdays and weekend days within each fiscal quarter, simplifying the comparison of financial data across years. Recognizing this advantage, the National Retail Federation even suggests that retailers adopt the 52/53-week fiscal year model (National Retail Federation, n.d.).

2.4 Example of 52/53 Accounting Practice

In this section, I will showcase Apple Inc.'s fiscal periods to illustrate the concept of the 52/53-week reporting convention. Apple concludes its fiscal year on the last Saturday of September, categorizing it as a Typewriter-firm. To align with the calendar year, an extra week was introduced in the first fiscal quarter of 2023, extending the duration to 14 weeks.

Table 2.1 below presents information on Apple's ten most recent fiscal quarters. Each row represents a fiscal quarter, and the "Fiscal Period End Date" column shows the end date of each fiscal quarter. This is used to deduce the number of weeks each fiscal quarter contains.

Table 2.1 – Apple Fiscal Quarter Overview

Fiscal Quarter	Fiscal Period End Date	Period in Weeks
2020Q4	26/09/2020	13.0
2021Q1	26/12/2020	13.0
2021Q2	27/03/2021	13.0
2021Q3	26/06/2021	13.0
2021Q4	25/09/2021	13.0
2022Q1	25/12/2021	13.0
2022Q2	26/03/2022	13.0
2022Q3	25/06/2022	13.0
2022Q4	24/09/2022	13.0
2023Q1	**31/12/2022**	**14.0**

Source: Compustat Daily Updates

The report released by Apple for 2023Q1 highlights a remarkable achievement for their service division. It attained a record-breaking revenue of $20.8 billion. Part of this achievement may be attributed to an additional week of service activities. Interestingly, the extra week is not mentioned in Apple’s press release (*Apple Reports First Quarter Results*, 2023).

3 Literature Review and Hypothesis Development

The efficient market hypothesis is a centerpiece of modern financial economics, as discussed in the previous chapter. Nevertheless, to gain a more comprehensive understanding of the efficient market hypothesis, this chapter will discuss some of the more critical perspectives. Additionally, within this chapter, you will find a brief literature review of the 14-week quarter theory.

3.1 Extensions and Critics of Efficient Markets

Prominent scholars offer extensions of the EMH. For instance, Grossman and Stiglitz (1980) demonstrated that an equilibrium exists in the presence of precise and *low-cost information*. The equilibrium refers to how prices in the market tend to reflect most of the available information. However, they argue that in certain markets, the cost of obtaining information is high, and investors need to allocate significant resources to access it. The high cost of information suggests that prices may not accurately reflect *all available* information as investors need to be compensated for obtaining the costly information (Grossman & Stiglitz, 1980). An empirical study made by Larcker & Lys (1987) shows that security prices are sufficiently noisy to create incentives for acquiring costly information.

Other academic scholars offer a more critical perspective of the efficient market hypothesis. Staunch critics of the EMH contend that fundamental market inefficiencies exist, resulting in deviations from fair prices and offering investors opportunities for outperformance. Among the list of inefficiencies that the literature offers, especially two inefficiencies are relevant to this research. Namely, the errors in information processing and impediments to arbitrage.

3.1.1 Errors in Information Processing

A significant body of literature explores theories and empirical generalizations related to *errors in information processing*. Notably, a set of experiments conducted by Kahneman and Tversky in 1982 indicates that our mindsets are adversely influenced by recent events – sometimes referred to as memory bias (Kahneman & Tversky, 1973, 1982). This has implications for market participants, who might put too much weight on recent experience compared to prior beliefs when making forecasts. In other words, memory-biased investors can simply *forget* to account for an extra week when processing earnings news for Typewriter-firms. Thus, they will likely interpret any increased earnings as improved company performance rather than simply an extended reporting period. This view is consistent with Johnston et al. (2012) who attribute investor inefficiency to limited attention. Other research suggests that market participants tend to have limited attention to financial reporting, which can affect investor perceptions and market pricing (Hirshleifer & Teoh, 2003). Overall, when investors are subject to errors in information processing, they can wrongfully interpret increased earnings news as improved performance rather than simply an extension in the reporting period. Such wrongful interpretation can have significant implications for stock prices since perceived improved performance can lead to mispricing of Typewriter-firms.

3.1.2 Impediments to Arbitrage

The practical impediments of arbitrage are well-documented. One key factor contributing to this is the concentration of arbitrage resources in the hands of a few players. Further, these few players may trade in only a limited number of assets, leaving them undiversified (Shleifer & Vishny, 1997). This brings a very important implication, specifically that investors are *not only* concerned with systematic risk but especially also with idiosyncratic risk. Schleifer & Vishny (1997) argue that idiosyncratic risk (or volatility) deters arbitrage. Moreover, they show that stocks with high idiosyncratic risk may be overpriced, and this overpricing is not eliminated by arbitrage because shorting them can be quite risky. More specifically, so-called glamour stocks (low book-to-market), tend to have a higher idiosyncratic risk than value stocks (high book-to-value). According to Schleifer and Vishny (1997), these volatile stocks exhibit greater mispricing and a higher average return to arbitrage. This limitation to arbitrage may have a direct implication for the mispricing of Typewriter-firms. Specifically, potential mispricing caused by a 14-week quarter might be more pronounced for glamour Typewriter-firms. This aspect plays a central role in the research and is integrated into the second hypothesis formulated in section 3.3 Hypotheses Development.

3.1.3 Post-Earnings Announcement Drift

Post-earnings announcement drift (PEAD) is a financial anomaly observed in stock markets where a company's stock price tends to exhibit a persistent movement in the direction of an earnings surprise following its earnings announcement. This phenomenon further challenges the efficient market hypothesis (Fink, 2021).

When a company releases its financial report, it publishes detailed information about the performance of revenue, earnings, and other key metrics. If the reported performance significantly surpasses or falls short of analysts' expectations, it results in an *earnings surprise*.

PEAD suggests that the market does not immediately and fully adjust the stock price to reflect the earnings surprise. Instead, the stock tends to continue drifting upwards (downwards) with a positive (negative) earnings surprise. PEAD is present over an extended period, sometimes several weeks or even months following the earnings announcement (Bernard & Thomas, 1989a). In relation to this study, PEAD's significance lies in the need to control it to isolate the potential effects of the 14-week quarter.

3.2 The 14-week Anomaly

Researchers from various academic traditions and disciplines (e.g. accounting, economics, and finance) study distinct aspects of seasonal fluctuations in firm earnings. Research on this topic is by no means new. Indeed, John Maynard Keynes recognized the surprising influence of these repeating patterns on stock prices nearly a century ago, noting in his 1936 work that "(…) the shares of American companies which manufacture ice tend to sell at a higher price in summer when their profits are seasonally high than in winter when no one wants ice" (Keynes, 1936). One might assume that investors would have developed trading strategies to take advantage of this obvious pattern, but as evidenced by recent research, this is not necessarily the case. Indeed, a recent empirical study by Chang and Hartzmark (2017) suggests that markets may fail to properly price information in seasonal earnings patterns. Despite the apparent simplicity of this phenomenon, it may be overlooked by investors, leading to significant market inefficiencies. One specific example of such seasonal fluctuations is the predictable shifts in reporting periods caused by a 52/53-week reporting convention. Johnston et al. (2012) were among the first to publicly theorize about the 14-week anomaly caused by naïve investors and analysts. Analyzing empirical data of US Typewriter-firms from 1996 to 2006, they found that investors could have achieved abnormal returns of 3.15% per quarter (12.6% annualized) by buying and holding stocks during firms' 14-week quarters. The study by Johnston et al. (2012) is further elaborated in 5.1 Johnston et al. Models and Methods.

3.3 Hypotheses Development

It seems likely that investors have developed trading strategies to exploit the 14-week anomaly coined by Johnston et al. (2012) and hence eliminated the abnormal return published more than a decade ago. Indeed, large institutional arbitrageurs may be discouraged from engaging in these abnormal returns due to the significant idiosyncratic risks associated with such a trading strategy (Shleifer & Vishny, 1997). Nonetheless, these impediments to arbitrage are deemed negligible since the trading strategy relies on a long position rather than a short position (Bodie et al., 2018; Johnston et al., 2012). This makes the strategy feasible for smaller investors as well, increasing the number of participants and potentially reducing the likelihood of observing abnormal returns. Arguably the paper is freely available to most scholars and many investors, and as this information is both precise and non-costly, equilibriums should be reached (Fama, 1970; Grossman & Stiglitz, 1980). Moreover, it should only take a few attentive investors to exploit the abnormal returns associated with the 14-week quarters (Johnston et al., 2012).

Specifically, I focus on the stock prices of Typewriter-firms when they publish a 14-week quarterly report. I hypothesize that buy-and-hold returns remain unchanged through the publication of a 14-week quarterly report, controlling for performance and other factors associated with returns. The first hypothesis is in null form:

- *H1: Typewriter-firms' returns are no different for 14-week fiscal quarters relative to 13-week quarters, after controlling for other determinants of returns.*

The second hypothesis investigates firm-specific heterogenetic patterns in the hypothesized abnormal returns. Specifically, I am exploring the concept that glamour stocks, often possessing greater idiosyncratic risk, might be less appealing to arbitrageurs. This could potentially amplify the 14-week mispricing.

Formally I test if book-to-market values of Typewriter-firms are associated with more pronounced abnormal returns during the 14-week quarter. This motivates the second hypothesis, in null form:

- *H2: There is no firm-specific heterogenetic variance in the abnormal returns of Typewriter-firms.*

4 Data Description

In this chapter, I explain the rationale behind the important decisions made during the data collection and screening processes. Additionally, the chapter offers descriptive statistics of the data, to give an overview of the sampled Typewriter-firms. The purpose of the data is to facilitate the research into investor reactions to a 14-week fiscal quarter.

4.1 Data Collection Process

A list of Typewriter-firms has been provided by the Supervisor. The list contains the GV-keys of 947 Typewriter-firms. The list was originally created for the paper by Jorgensen et al. (2022). I collected and matched additional data for each firm through the Compustat Fundamental Quarterly file. The dataset then consists of 947 Typewriter-firms with various financial items.

I have obtained relevant data for each firm, e.g. actual period of fiscal quarters, reporting date of fiscal quarters, quarterly revenue, quarterly income, and stock prices. I extracted this data from the Compustat Fundamentals Quarterly file, which is a database that contains financial and market information for publicly traded companies in the United States and Canada. This database offers access to over 300 annual and 100 quarterly data items, including income statements, balance sheets, and statements of cash flows, with quarterly data available since 1962 for some firms. The Compustat North America database was accessed through Wharton Research Data Service (WRDS).

Initially, the dataset spanned from the first calendar quarter of 1994 to the first calendar quarter of 2023, covering a large time frame and providing a robust sample for analysis. However, Compustat started registering the item "Actual Period End Date" from 2005 onwards. Hence all observations before 2005 are eliminated. The research period aims to enable a comparison of our findings with those of Johnston et al. (2012), who researched Typewriter-firms from 1994 to 2006. The overlapping years of 2005 and 2006 therefore serve as a point of reference to Johnston et al. (2012).

When all data was collected, I initiated the data screening process which is elaborated in the next section.

4.2 Data Screening Process

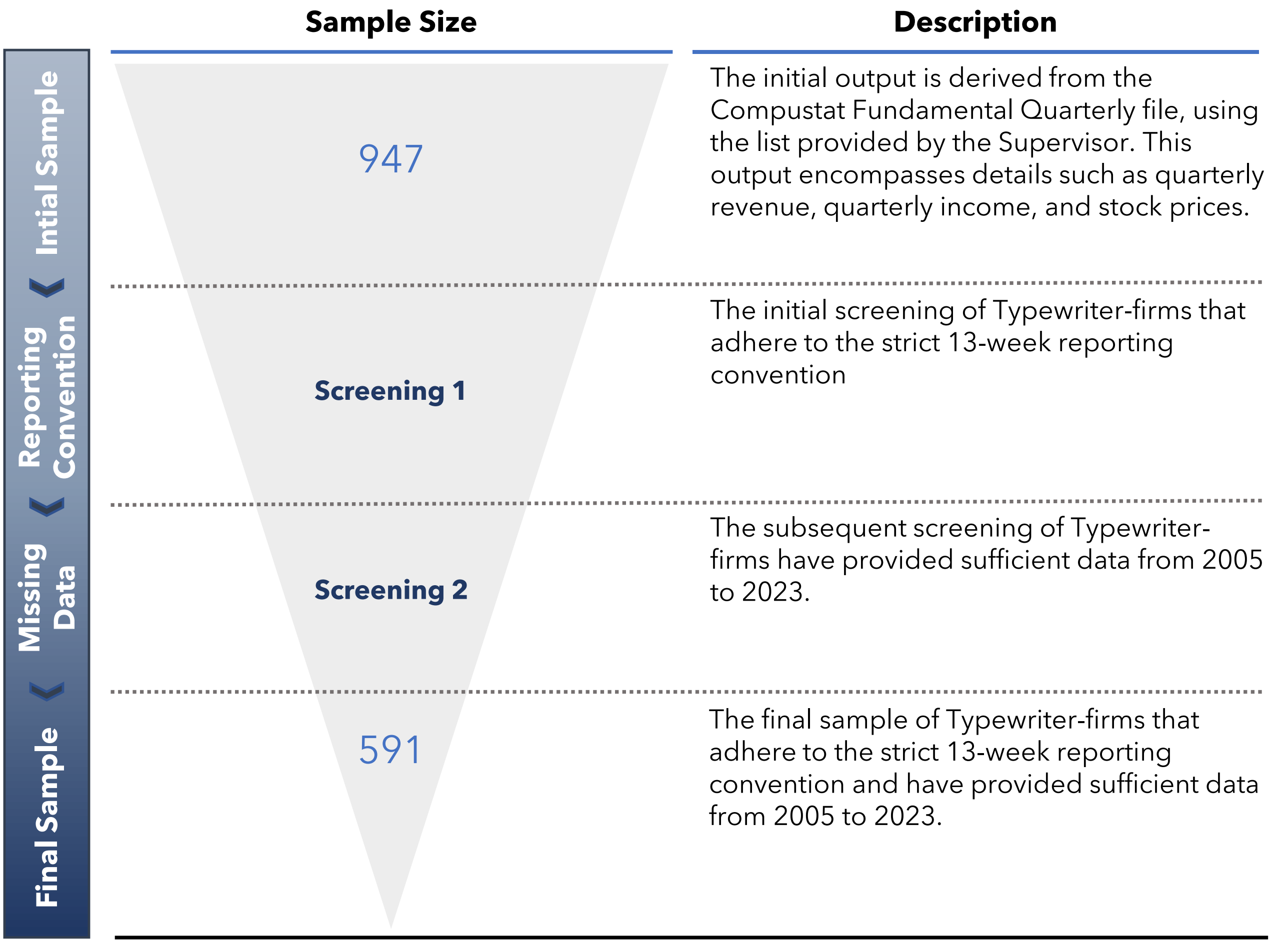
This section outlines the practical details of the data screening process, which involves two filters.

First, Specific Typewriter-firms caused noise in the study. These firms had 14-week quarters within a 52-week fiscal year. For instance, they structured their fiscal quarters as 12-14-12-14 weeks, meaning Q1 has 12 weeks, Q2 has 14 weeks, etc. To ensure the analysis remains accurate, it's crucial to exclude these observations. Simply because investor reactions to this type of 14-week quarter could dilute the impact of the catch-up quarter. Consequently, I narrow the focus to Typewriter-firms where non-14-week quarters strictly consist of 13 weeks.

Second, a notable portion of firms lacked sufficient data. To pre-empt issues related to missing data, I removed observations with insufficient information from the original sample. Specifically, any observations missing either reporting dates, stock prices, income figures, or revenue figures were removed from the sample.

The missing data could result from idiosyncratic events, often exogenous to the firm, such as M&As or privatizations. For example, consider Krispy Kreme, which had available data up until 2016 and after 2021. The company was privately owned in the meantime, hence it was not obligated to disclose quarterly reports (Fantozzi, 2021). However, missing data could also be due to endogenous events, like changes in reporting conventions. If the missing data is caused by endogenous events, this might cause statistical complications. Further insights into the intricacies of non-randomly missing data are discussed in section 7.2.2 Non-Random Missing Data.

Figure 4.1 – Data Screening Process



Source: Author's creation

The two screening processes eliminated a total of 356 firms from the sample. Resulting in a final sample of 591 firms.

Conclusively, from the initial sample of 947 firms, only 591 firms followed the strict 13-week accounting practice and were able to supply no missing data in Compustat between 2005 and 2023. This data screening process is illustrated in *Figure 4.2*.

4.3 Descriptive Statistics

Continuing from the earlier sections that covered data collection and screening processes, this section aims to provide a detailed description of the sampled dataset. Additionally, there will be a consistent comparison with the dataset from Johnston et al. (2012). This consistent comparison is vital for a meaningful and accurate comparison of results in later chapters.

4.3.1 Sample and Descriptive Statistics

Table 4.1 offers valuable insights through its four panels, which collectively illuminate the dataset. These panels cover the frequency of 14-week periods, the distribution of the additional week, and timing preferences. Notably, three out of the four panels contain the respective results from the study conducted by Johnston et al. (2012).

Panel A presents a breakdown of how 14-week observations are distributed among firms. Specifically, 150 firms have a single 14-week observation, while 203 firms have two 14-week observations. Furthermore, 87 firms have three 14-week observations, and 2 firms have four 14-week observations.

Panel B demonstrates how firms allocate the extra week among their fiscal quarters. It is evident that 78.42% of the sample chose to add the extra week to their fourth fiscal quarter, with 13.82% of the sample opting for the first quarter.

Panel C demonstrates the weekdays on which firms choose to *end* their 14-week fiscal quarter. Notably, 58.01% of firms opted to end their fiscal quarter on a Saturday, followed by 24.76% who favored concluding on a Sunday.

Finally, Panel D demonstrates the weekdays on which firms choose to *publish* their 14-week fiscal quarter. Wednesdays (30.79%) and Thursdays (30.67%) emerged as the most popular choices.

Importantly, the descriptive statistics provided here resemble the data presented by Johnston et al. (2012). The similarity in data strengthens the basis for comparing the two studies.

Table 4.1 – Sample and Descriptive Statistics

Panel A – 14-week Frequency

	Number of firms	Number of 14-week observations	Number of 14-week observations Johnston et al. (2012)
Zero 14-week observations	149	0	
One 14-week observation	150	150	395
Two 14-week observations	203	406	502
Three 14-week observations	87	261	36
Four 14-week observations	2	8	
Total	591	825	933

Panel B - Frequency of 14-week fiscal quarter

Fiscal quarter	Number of 14-week observations	Percentage of total (%)	Percentage of total (%) Johnston et al. (2012)
First	114	13.82	15.22
Second	32	3.88	3.22
Third	32	3.88	4.50
Fourth	647	78.42	77.06
Total	825	100.00	100.00

Panel C – Day of the week in which the 14-week quarter ends

Day of week	Number of observations	Percentage of total (%)	Percentage of total (%) Johnston et al. (2012)
Monday	4	0.48	0.21
Tuesday	19	2.27	0.75
Wednesday	7	0.84	0.75
Thursday	11	1.32	1.71
Friday	102	12.32	11.79
Saturday	479	58.01	58.10
Sunday	204	24.76	26.69
Total	825	100.00	100.00

Panel D – Day of the week in which the 14-week quarter is published

Day of week	Number of observations	Percentage of total (%)
Monday	87	10.55
Tuesday	177	21.45
Wednesday	254	30.79
Thursday	253	30.67
Friday	52	6.30
Saturday	1	0.12
Sunday	1	0.12
Total	825	100.00

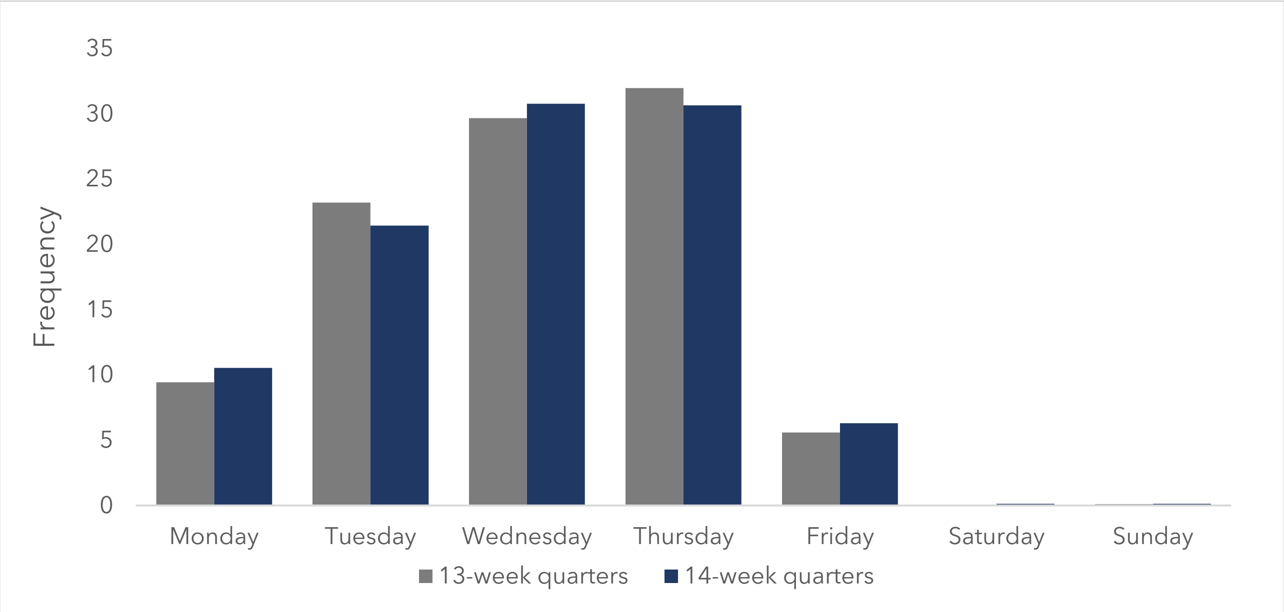
The sample includes 825 14-week quarters from 2005-2023 and 19,093 13-week quarters for 591 firms.

Observing the cluster of publications on weekdays was quite intriguing. Interestingly, more than 60% of the observed 14-week fiscal quarters are released on either a Wednesday or Thursday. Previous research by Damodaran (1989) has revealed an association between the chosen date of earnings announcements and abnormal returns. Particularly, the study pointed out that earnings and dividend announcements made on Fridays are more likely to include reports of financial decline, leading to negative abnormal returns compared to announcements made on other weekdays.

This pattern appears consistent with the observation that 14-week reports predominantly appear on Wednesdays and Thursdays. While it might be suspected that managers who intend to manipulate market reactions for abnormal returns would strategically opt for publication days other than Fridays, it's important to note that this is not necessarily true.

Examining the histogram depicted in *Figure 4.2*, which illustrates the frequency of publication weekdays for both 13- and 14-week quarters, it becomes apparent that there is not a noticeable discrepancy in the chosen publication weekday between these two types of fiscal quarters. This preliminary assessment suggests that the selection of publication days remains relatively consistent regardless of whether the reporting period is a 13- or 14-week quarter.

Figure 4.2 – Week Day Publications



Source: Author's creation

The sample is mainly composed of companies from two key sectors: manufacturing and retail. The breakdown of industries can be found in Appendix 1: Industry Representation of Sample. This appendix provides an overview of how firms are distributed based on their Standard Industrial Classification (SIC) codes.

Firms with SIC codes falling within the range of 20 to 39 are categorized within the Manufacturing industry. Similarly, those with SIC codes ranging from 52 to 59 fall within the Retail industry (SIC Business Data, 2023). Interestingly, more than 82.06% of the firms in this sample are categorized within the Manufacturing or Retail industry. This coincides with the data by Johnston et al. (2012), who also had a majority of firms in these sectors (92.89%). These distributions deviate from the actual distribution of businesses across the United States

Based on information from the United States Census Bureau's SUSB Tables, which use the North American Industry Classification System (NAICS), the combined portion of Manufacturing and Retail firms accounts for a mere 14.42% of all firms in the United States. For a detailed overview, please find Appendix 2: SUSB Table 2017.

While the sample employs the Standard Industrial Classification (SIC) classification, distinct from NAICS, it's evident that a disproportionate majority of firms within the sample are categorized within the Manufacturing or Retailing industry.

4.3.2 Univariate Tests and Descriptive Statistics

Table 4.2 provides descriptive statistics and univariate comparisons for the variables of interest between 14-week quarters and 13-week quarters. These variables have been constructed using the methodology outlined by Johnston et al. (2012) to ensure comparability. However, it's worth noting that we will not delve too deeply into the specific aspects of these variables in this section. A more detailed discussion on variables is presented later in section 5.2.4 Explanatory Variables. Remember, the primary goal of this chapter is to provide an overview of the data and evaluate the extent of data-comparability with Johnston et al. (2012).

Panel A provides the mean and standard deviation for earnings, revenues, and returns in 14-week quarters compared to *all* 13-week quarters. Panel B provides a more restrictive view, showing the mean of 14-week quarters compared to the same fiscal quarter from the previous year ($Q-4$) and the following year ($Q+4$). Please note, that I only provide significance tests for *differences* in variables, found in columns (3), (7), and (8).

In Panel A, the revenue metric (SUR) is significantly higher, on average, in 14-week quarters compared to 13-week quarters. While both earnings and returns show higher means in 14-week quarters compared to 13-week quarters, the differences are not substantial enough to confidently reject the null hypothesis. Put differently, there is a lack of statistical evidence to confirm that they deviate from 0.

In Panel B, it's clear that during 14-week quarters, the revenue is notably higher compared to the same fiscal quarter in adjacent years. Both differences are statistically significant at a 1% level. Similarly, *returns* are higher in 14-week quarters compared to the same fiscal quarters in adjacent years. However, there are variations in the level of significance. To elaborate, on the one hand, the univariate test indicates that returns are higher in 14-week quarters compared to the previous year ($Q - 4$) with a significance level of 5%. On the other hand, returns in 14-week quarters are also higher compared to the following year ($Q + 4$), yet with a more confident level of significance at 1%.

The disparity in significance levels is particularly interesting, as it is consistent with prior research advocating for asymmetric market responses to positive and negative news (Soroka, 2006). Indeed, the univariate test in *Table 4.2*, Panel B suggests that markets tend to exhibit a more pronounced negative reaction to the 13-week quarter following a 14-week quarter ($Q + 4$), in comparison to the positive reaction observed during the 14-week quarter itself.

Table 4.2 –Descriptive Statistics of Firm Performance in 13- and 14-week quarters

Panel A – Various Descriptives of all 13- and 14-week quarters

Variable Description	(1) 13-week quarters			(2) 14-week quarters			(3) Difference (2) − (1)	
	N	Mean	Std	N	Mean	Std	Mean	Std
Earnings								
SUE	16545	.0080	.314	723	.0113	.2240	.0033	.0118
Revenues								
SUR	16545	.0139	.305	723	.0584	.2649	.0445 ***	.0115
Returns								
$QTRBHAR$	17695	.0736	2.301	794	.1087	.5684	.0351	.0818

Panel B – 14-week quarter (Q) and same quarter from year before ($Q-4$) and year after ($Q+4$)

Mean	(4) Quarter $Q-4$ (13-weeks)	(5) Quarter Q (14-weeks)	(6) Quarter $Q+4$ (13-weeks)	(7) Difference (5)-(4)	(8) Difference (5)-(6)
Earnings					
SUE	.0041	.0113	.0021	.0071	.0091
Revenues					
SUR	.0191	.0584	−.0306	.0393 ***	.0890 ***
Returns					
$QTRBHAR$	.0616	.1087	.0110	.0471 *	.0977 ***

All variables in the table are winsorized at 1% and 99%. The table provides paired t-tests for columns (3), (7), and (8).

$SUR_{i,q}$ ($SUE_{i,q}$) is the seasonally adjusted change in revenues (earnings), scaled by last year's market value of equity (MVE); $QTRBHAR_{i,q}$ is the cumulative size-adjusted buy-and-hold return for firm i in quarter q. The specified return period is two days after the earnings announcement for the previous quarter $(q-1)$ to the day after the earnings announcement for quarter q.

The asterisk (*) indicates significance levels at 1% (***), 5% (**), and 10%(*).

The findings presented in Table 4.2 sufficiently resemble those of Johnston et al. (2012). For a comprehensive overview of their univariate results, please find Appendix 3: Univariate Test by Johnston et al. (2012).

5 Model Specification and Estimation Method

This chapter delves into a core component of this analysis, focusing on the economic models and estimation methods that form the foundation of the study. I will examine the models used by Johnston et al. (2012) in detail, gaining insights into their approach to analyzing revenues, earnings, and stock returns. Additionally, I will discuss the modifications to the methodology, aligning it with the research goals. The chapter also addresses key assumptions and diagnostics necessary for validating the estimation method. In essence, this chapter provides the essential groundwork for the subsequent findings and conclusions presented in this study.

5.1 Johnston et al. Models and Methods

Johnston et al. (2012) estimate two relevant economic models through the use of multivariate tests.[3] In the first model, they verified that revenues and earnings tend to be higher in 14-week quarters. In the second model, the researchers tested the primary hypothesis related to investor reactions to the impact of 14-week quarters. In the upcoming section, there will be a comprehensive description of their regression models, followed by an explanation of the statistical methods used to estimate these models.

5.1.1 The Auxiliary Model: Revenues and Earnings

Johnston et al. (2012) propose that even after accounting for positive serial correlation in firm performance, revenue and earnings show an increase during 14-week quarters. To examine this, they use an econometric model with the following structure:

Economic Model 1

$$X_{i,q} = \alpha_0 + \alpha_1 X_{i,q-1} + \alpha_2 14WK\_Q_{i,q} + \alpha_3 14WLY_{i,q} + \alpha_4 FQ4_{i,q} \times X_{i,q-1} + \sum \beta_k FQ_k + u_{i,q}$$

- $X_{i,q}$ is either $SUR_{i,q}$ or $SUE_{i,q}$.

[3] Johnston et al. (2012) estimate a total of three models, however the third model investigates analysts' forecasting errors, which are beyond the scope of this thesis.

$SUR_{i,q}$ ($SUE_{i,q}$) is the seasonally adjusted change in revenues (earnings), scaled by last year's market value of equity (MVE). This is the dependent variable.

- $X_{i,q-1}$ is a lagged version of the dependent variable $X_{i,q}$ i.e. $SUR_{i,q-1}$or $SUE_{i,q-1}$ of the previous fiscal quarter. These are control variables.
- $14WK_{i,q}$ is a dummy variable. The variable specifies if the quarter q is a 14-week quarter. Put differently, this variable equals one in 14-week quarters, and zero otherwise.
- $14WKLY_{i,q}$ is a dummy variable. The variable specifies if $q-4$ is a 14-week quarter. Put differently, this variable equals one when the same fiscal quarter in the previous fiscal year is a 14-week quarter, and zero otherwise.
- $FQ4_{i,q} \times X_{i,q-1}$ is an interaction variable. The variable allows for unknown persistence of the fourth fiscal quarter $SUR_{i,q}$or $SUE_{i,q}$.
- FQ_k $(k = 1, 2, 3)$ are indicator variables. These variables specify the current fiscal quarter. They equal one when the fiscal quarter equals k, and zero otherwise. Please note, that one quarter is omitted to avoid perfect multicollinearity. This is sometimes referred to as the dummy variable trap.
- Industry- and year-fixed effects are controlled.

5.1.2 The Primary Model: Stock Returns

Johnston et al. (2012) designed a model to examine their primary hypothesis. This model aims to determine whether the extra revenues and earnings generated from 14-week quarters affect the returns on Typewriter-firms' stocks or are correctly perceived as transitory. Put differently, they are testing if the impact of 14-week quarters can explain the returns of Typewriter-firms. The impact of the 14-week quarters is measured as unexpected additional revenues and earnings.

For unexpected revenues and earnings, Johnston et al. (2012) use *analyst forecast errors* when available, and *seasonal random walk expectations* when analyst forecasts are unavailable. In most cases, comprising around 60% of the dataset, a seasonal random walk expectation is employed. This involves the seasonally adjusted change in revenues and earnings, adjusted by the market value of equity in quarter $(q-4)$.

For the remaining observations, approximately 40% of the dataset, the researchers opt to use analysts' forecast errors. These forecast errors are computed as the difference between the median analyst forecast and the actual revenues and earnings. Similar to the previous method, these forecast errors are also scaled by the market value of equity in quarter $(q-4)$.

The underlying premise is that investors properly account for the extra week. Nonetheless, if this assumption does not hold, the additional revenues and earnings associated with 14-week quarters could lead to abnormal returns. To examine this, Johnston et al. (2012) conducted a multivariate regression to investigate the impact of the extra week. Their regression analysis is based on the following model:

Economic Model 2

$$QTRBHAR_{i,q} = \beta_0 + \beta_1 14WK_{i,q} + \beta_2 UE_{i,q-1} + \beta_3 \widehat{UE}_{i,q} + \beta_4 \widehat{UR}_{i,q} + \beta_5 FQ4 \times \widehat{UE}_{i,q} + \beta_6 FQ4_{i,q} \times \widehat{UR}_{i,q}$$
$$+ \beta_7 EXWKSUE_{i,q} + \beta_8 EXWKSUR_{i,q} + \sum \gamma_k FQ_k + u_{i,q}$$

- $QTRBHAR_{i,q}$ is the cumulative size-adjusted buy-and-hold return for firm i in quarter q. The specified return period is two days after the earnings announcement for the previous quarter $(q-1)$ to the day after the earnings announcement for quarter q. This is the dependent variable.
- $14WK_{i,q}$ is the same as above.
- FQ_k $(k = 1,2,3)$ are the same as above.
- Industry and year effects are controlled as above.

Revenue-specific variables

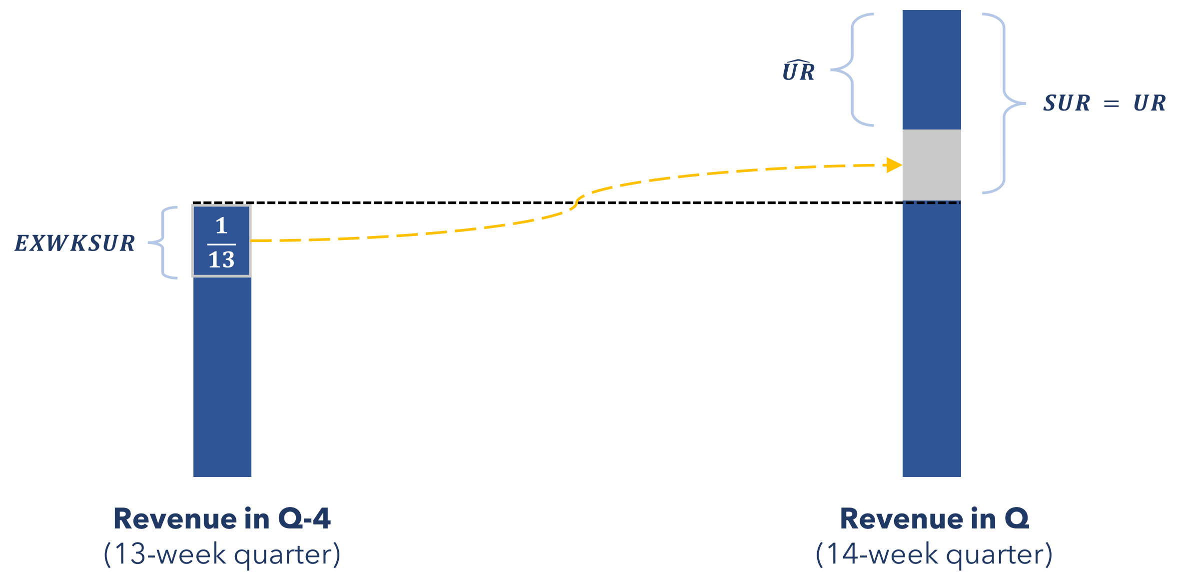
- $UR_{i,q}$ is the unexpected earnings captured as the analysts' forecast error scaled by the lagged MVE. However, when the analyst forecast error was not available, this variable was defined as $SUR_{i,q}$.
- $EXWKSUR_{i,q}$ is, for 14-week quarters, 1/13 of the revenues for quarter $(q-4)$ scaled by the market value of equity in the same period. The variable equals zero in 13-week quarters.
- $\widehat{UR}_{i,q} = UR_{i,q} - EXWKSUR_{i,q}$.

  $\widehat{UR}_{i,q}$ is the difference between the unexpected revenues (UR) and the estimated effect of the extra week $(EXWKSUR_{i,q})$. Put differently, this variable effectively removes one week of revenues from the unexpected revenues in 14-week quarters. This variable aims to control for the unexpected revenue that *cannot* be attributed to the extra week. The interconnections and definitions of the revenue-specific variables are illustrated in *Figure 5.1*.

On the one hand, where UR equals SUR, this variable can be sensible, as the change in revenues is affected by both innovations (or the lack of) and the addition of an extra week. In such instances, eliminating 1/13 of the revenues from $(q-4)$ will likely neutralize the effect of the extra week, leaving only the effect of innovation.

On the other hand, when UR equals analyst forecast error, the variable could become more complex, as subtracting the effect of an extra week seems senseless if analysts already anticipated the extra week.

Figure 5.1 – Illustration of Variables



Source: Author's creation

Earnings-specific variables

- $UE_{i,q}$ is the unexpected earnings captured as the analyst forecast error scaled by the market value of equity. However, when the analyst forecast error was unavailable this variable was defined as $SUE_{i,q}$. The lagged version of this variable is included to control for post-earnings announcement drifts from $(q-1)$.

- $EXWKSUE_{i,q}$ is, for 14-week quarters, 1/13 of the income before extraordinary items for the quarter $(q-4)$ scaled by the market value of equity for the quarter $(q-4)$. The variable equals zero in 13-week quarters.
- $\widehat{UE}_{i,q} = UE_{i,q} - EXWKSUE_{i,q}$. $\widehat{UE}_{i,q}$ is the difference between the unexpected earnings ($UE_{i,q}$) and the estimated effect of one extra week ($EXWKSUE_{i,q}$). Put differently, this variable effectively removes one week of earnings from the unexpected earnings in 14-week quarters.[4] This variable aims to control for unexpected earnings that *cannot* be attributed to the extra week

  Similar to revenues, subtracting the 14-week earnings from forecast errors can prove irrational if analysts successfully account for the extra week.

5.1.3 Non-Parametric Estimation Method

Johnston et al. (2012) use a non-parametric estimation method. This method allows researchers to relax certain functional form assumptions such as concavity, symmetry, and skewness (Linton, 2020). Specifically, Johnston et al. (2012) are concerned about the skewness in the distribution of SUR and SUE. By using non-parametric estimation methods, the model estimations are robust to functional form misspecification. Moreover, some non-parametric methods are shown to be almost as efficient as least squares methods for normal models and much more efficient when normality is violated (Randles et al., 2004). Since SUR and SUE are expected to be skewed in Johnston et al. (2012), their proposed estimation method should be more efficient than a least squares method.

To avoid issues with heteroskedasticity, Johnston et al. (2012) use heteroskedasticity-robust standard errors. Meanwhile, they control for any unobserved industry and year effects in all their models.

[4] The rationale of the argument depends on the firm's cost structure and profitability. For instance, if a firm has only variable costs, earnings can be scaled linearly. However, with substantial fixed costs, scaling earnings proportionally is not feasible. Fixed costs can greatly affect profitability, necessitating careful analysis when scaling earnings.

5.2 Modified Models and Methods

The modified approach presented in this thesis is based on the methodology applied by Johnston et al. (2012). To ensure a consistent level of comparability across the two studies, it is imperative to adopt a similar quantitative methodology. Nevertheless, I will provide discussions throughout this section to offer a comprehensive understanding of the employed approach.

Initially, this section will specify the economic models that serve as the foundation for testing the formulated hypotheses. Much like the approach taken by Johnston et al. (2012), I will introduce an Auxiliary Model and a Primary Model. Once the models are defined, I will delve into a discussion on estimation methods.

5.2.1 Modified Models

The economic models employed in this study are identical to those of Johnston et al. (2012). This is done to compare results effectively. To keep things simple, I use the same notations whenever suitable.

5.2.1.1 The Auxiliary Model

To investigate if revenues are higher during 14-week quarters, I conduct the same auxiliary test described in 5.1.1 The Auxiliary Model: Revenue and Earnings. This regression aims to assess whether there is a surge in revenues and earnings during 14-week quarters while accounting for positive serial correlation in firm performance. To examine this, the econometric model has the following structure:

Economic Model 3

$$X_{i,q} = \alpha_0 + \alpha_1 X_{i,q-1} + \alpha_2 14WK\_Q_{i,q} + \alpha_3 14WKLY_{i,q} + \alpha_4 FQ4_{i,q} \times X_{i,q-1} + \sum \beta_k FQ_k + u_{i,q}$$

All variables in the auxiliary model are the same as those specified by Johnston et al. (2012). The variables listed in section 5.1.1 The Auxiliary Model: Revenue and Earnings.

Specifically, I will examine the relationship between revenues (SUR) or earnings (SUE) and the occurrences of 14-week quarters. This relationship is examined with some control variables. These controls include post-earnings announcements drift (PEAD) ($X_{i,q-1}$), persistence in the fourth fiscal quarter ($FQ4$), and unobserved industry and year-fixed effects.

5.2.1.2 The Primary Model

The hypotheses are tested by estimating the primary model. The purpose of this model is to examine the relationship between stock returns and 14-week quarters. Once again, the model is identical to the one specified by Johnston et al. (2012).

Economic Model 4

$$QTRBHAR_{i,q} = \beta_0 + \beta_1 14WK_{i,q} + \beta_2 SUE_{i,q-1} + \beta_3 \widehat{UE}_{i,q} + \beta_4 \widehat{UR}_{i,q} + \beta_5 FQ4 \times \widehat{UE}_{i,q} + \beta_6 FQ4 \times \widehat{UR}_{i,q} + \beta_7 EXWKSUE_{i,q} + \beta_7 EXWKSUR_{i,q} + \sum \gamma_k FQ_k + u_{i,q}$$

All variables in the primary model are identical to those defined by Johnston et al. (2012). The variables are listed in section 5.1.2 The Primary Model: Stock Returns.

The primary model specifies the relationship between the returns ($QTRBHAR$) and the occurrences of 14-week quarters. This relationship is examined with some control variables. Once again, the covariates controlled for are PEAD ($SUE_{i,q-1}$), persistence in the fourth fiscal quarter ($FQ4$), and unobserved industry and year-fixed effects.

The remaining explanatory variables are designed to capture the unexpected impact of 14-week quarters. To isolate this unexpected impact, I estimate the proportion of revenues and earnings that can be attributed to the extra week.

5.2.2 Dependent Variable for the Auxiliary Model

For the auxiliary model, the dependent variables are the standardized unexpected revenue (earnings). The variable represents the scaled unexpected proportion of reported revenues (earnings). This is estimated as the difference between this quarter's reported revenues (earnings) and the revenues (earnings) from the same quarter last year. Lastly, this figure is standardized by the market value of equity in quarter ($Q-4$). The equation for standardized unexpected revenues is shown in *Equation 1*.

$$SUR_{i,q} = \frac{Revenues_{i,q} - Revenues_{i,q-4}}{MVE_{i,q-4}} \tag{1}$$

A key assumption is that, on average, market participants hold random walk expectations. However, this assumption might be subject to scrutiny, particularly considering the findings of Lo & MacKinlay (1988) which indicated that stock market prices do not follow a random walk pattern. Nevertheless, as other scholars suggest (see 3.1 Extensions and Critics of Efficient Markets), market participants might suffer from errors in information processing. Specifically, the study by Kahneman et al. (1982), indicates that market participants emphasize recent periods when forecasting new ones. This notion could imply that revenues in quarter $Q-4$ could potentially serve as a reference point for revenue expectations in quarter Q.

5.2.3 Dependent Variable for the Primary Model

In the primary model, the dependent variable is the quarterly buy-and-hold return. The variable represents an investor's gain or loss over a quarter. Put differently, the variable estimates the return achieved by buying a share two days after the previous earnings announcement and holding it until the day after the current earnings announcement. The variable is cum-dividend, meaning that it accounts for dividends. To understand how the buy-and-hold return is computed, please refer to *Equation 2*.

$$QTRBHAR_{i,q} = \frac{S_{i,1} - S_{i,0} + d_{i,q}}{S_{i,0}} \qquad (2)$$

Where $QTRBHAR$ is the quarterly cumulative size-adjusted buy-and-hold return for firm i during quarter q; $S_{i,t}$ is the adjusted closing price of a stock of firm i at time t, where $t = 0{,}1$. Time 1 is the day after quarter q earnings announcement. Time 0 is two days after quarter $q-1$ earnings announcement; $d_{i,q}$ is the cash dividends between time 1 and 0.

$QTRBHAR$ is the dependent variable of the primary model. All components of the $QTRBHAR$ are fixed and known to investors when the quarterly earnings are announced, except for $S_{i,1}$.[5]

[5] Dividends ($d_{i,q}$) can also be unknown to the market if they are declared in earnings announcement q. However, it takes three business days to register shares (Berk & DeMarzo, 2019), making it impractical for any firm to distribute cash dividends within two days after earnings announcement.

Dividends ($d_{i,q}$) are included in *Equation 2*. Dividends ($d_{i,q}$) are measured as cash dividends and arrearages from previous periods paid in the current period. Hence, stock dividends and preferred stock dividends are excluded from this item.

Dividends ($d_{i,q}$) shows the *declared dividends by ex-date*, which is more appropriate than *paid dividends*. Dividends by ex-date are more suitable to measure buy-and-hold returns, as dividends are paid to whoever owns the stock on the ex-dividend date. It turns out stock prices tend to drop on ex-dividend day (Bodie et al., 2018).

Hence, using paid dividends would introduce a negative bias when quarterly reports end in the period between an ex-dividend date and a payable date. This negative bias arises due to two factors: firstly, the omittance of pending cash dividends from the calculation, and secondly, the inclusion of dividends' effect on the stock price. In simpler terms, even though the stock price ($S_{i,1}$) is estimated ex-dividend, the pending cash dividends are not factored into the calculation. As a result, all buy-and-hold returns in this thesis are measured using dividend by ex-date.

The returns period as defined in *Equation 2* matches the period defined by Johnston et al. (2012). Discrepancies in defined return periods could effectively harm the ability to compare the results of the two studies. While Johnston et al. (2012) do not explicitly justify their chosen return period, it's logical to assume that a balance must be struck. On one hand, to grasp the complete impact of a quarter, it's necessary to include as much of the quarter as feasible. On the other hand, this inclusion should not extend so far that the effects from adjacent quarters affect the results.

5.2.4 Explanatory Variables

The explanatory variables have been defined, and this section will now present a concise overview of them. Most of these variables are measured similarly to the methodology applied by Johnston et al. (2012). However, there are some noteworthy discrepancies in the definitions of certain variables in this study. This section outlines these differences, thereby providing relevant insights. Furthermore, a comprehensive table that includes all the variables is presented, aiding in understanding their respective definitions. Concluding this section, there will be a discussion of omitted variables that might offer interesting insights.

A key difference in variable definitions relates to how unexpected revenues and earnings are measured. In Johnston et al. (2012), they estimate these using both analysts' forecast errors and a random walk expectation. Notably, analysts' forecast errors make up around 40% of the observations.

However, for this study, analysts' forecast errors are excluded, and only random walk expectations are considered to capture unexpected revenues and earnings. This decision is in line with approximately 60% of the observations in Johnston et al. (2012).

Another significant consideration pertains to the measurement of the market value of equity. While Johnston et al. (2012) provide limited information about their MVE measurement method, the approach in this thesis is quite straightforward. Here, MVE is calculated by multiplying the number of outstanding common shares at year-end by the share price. It's important to note that this calculation excludes treasury shares.

It's also worth mentioning that preferred shares are not factored into this MVE calculation. This decision aligns with the thesis' focus on understanding the responses of common shareholders in the context of 14-week quarters.

Additionally, it's noteworthy that all financial figures used in the regression analyses are scaled by the MVE.

Lastly, two variables have been introduced in the study. The first is a dummy variable termed *Post Publication* ($POPU$), assigned a value of one if the observation was recorded after the publication of Johnston et al.'s (2012) paper, and zero otherwise. This variable aims to enhance the comparability between this study and Johnston et al. (2012) research by distinguishing observations into pre- and post-publication periods. Furthermore, this distinction provides a more feasible basis for concluding how investors have implemented the trading strategy since its publication.

The second variable is a continuous variable termed *Book-to-Market* (BTM), estimated as the ratio of the book value of equity to the market value of equity. This variable is important when assessing the second hypothesis. Specifically, it enables the analysis of whether glamour stocks tend to exhibit a more pronounced abnormal return in 14-week quarters.

The reasoning behind the inclusion of these variables is elaborated on in 6.3 Further Analyses of Return Patterns.

Table 5.1 – Explanatory Variables Overview

Variable	Label	Definition
"True" Unexpected Earnings	$\widehat{UE}$	Unexpected earnings after subtracting earnings from an additional week
"True" Unexpected Revenues	$\widehat{UR}$	Unexpected revenues after subtracting revenues from an additional week
Book-to-Market	BTM	Book value of equity divided by market value of equity
Fiscal Quarter 1	$FQ1$	1 if it is the first fiscal quarter
Fiscal Quarter 2	$FQ2$	1 if it is the second fiscal quarter
Fiscal Quarter 3	$FQ3$	1 if it is the third fiscal quarter
Fiscal Quarter 4	$FQ4$	1 if it is the first fiscal quarter
Fourteen Week Quarter	$14WK$	1 if it is the catch-up quarter
Fourteen Week Quarter LY	$14WKQLY$	1 if the same quarter last year was a catch-up quarter
Fourteenth Week Earnings	$EXWKSUE$	Earnings in the 14th week
Fourteenth Week Revenues	$EXWKSUR$	Revenues in the 14th week
Lagged Earnings	L_SUE	Last quarter standardized unexpected earnings
Lagged Revenues	L_SUR	Last quarter standardized unexpected revenues
Market Value of Equity	MVE	The market value of all outstanding shares
Post Publication	$POPU$	1 if the quarter is reported after the publication of Johnston et al. (2012).

All continuous variables are winsorized at the 1st and 99th percentiles to avoid potential problems with outliers. This is consistent with Johnston et al. (2012).

5.2.4.1 Other Potentially Relevant Variables

In addition to the regressors detailed in *Table 5.1*, it is worth noting that other factors could be of interest to future research. These particular factors were considered in the analysis conducted by Johnston et al. (2012). Unfortunately, due to restricted access to databases, this study does not encompass these factors. Nevertheless, within this section, I have outlined some insights and considerations for potential future analyses.

Transparency in quarterly press releases can play a pivotal role in influencing abnormal returns. When firms *clearly disclose* the presence of an extra week in their reports, investors are more likely to make informed decisions. Specifically, in transparent environments, it might be easier for investors to anticipate the presence of an extra week.

This observation aligns with the study conducted by Dasgupta et al. (2010), which found that transparency is associated with increased synchronicity in stock returns. Moreover, it suggests that the disclosure of an extra week's presence might eliminate the possibility of abnormal returns.

To assess the level of transparency regarding 14-week periods, one approach is to examine quarterly earnings press releases. Then conduct a Keyword Extraction method to determine whether a relevant keyword e.g. "fourteen weeks" appears in these press releases. Access to these press releases can be obtained through the Lexis-Nexis database.

In future research, it's worth considering the inclusion of analysts' forecasts. Specifically, one can explore whether analysts consistently underestimate revenue and earnings for fourteen-week quarters. This could be because analysts might be subject to errors in information processing, making it plausible that their forecasts are based on thirteen-week quarters.

This can be analyzed by retrieving analysts' forecasts and comparing them to the reported revenue figures. Access to analysts' forecasts is available through the I/B/E/S database.

5.2.5 Modified Estimation Method

I employ a fixed effects (FE) method to estimate the models. FE methods are suitable when researchers suspect the existence of time-invariant factors (or fixed effects) that may or may not influence the dependent and/or explanatory variables. For instance, in cases where stock prices for firms in the *financial service industry* display higher sensitivity to earnings, it becomes necessary to control for such factors. These factors are not random and may adversely impact the regression outputs if left out.

When applied correctly, FE ensures that the effect of the explanatory variables is uninfluenced by time-invariant confounding factors. Put differently, FE accounts for all unobserved time-invariant noise. This approach effectively prevents certain econometric issues arising from a correlation between the entity's error term and the explanatory variable.

5.2.5.1 Fixed Effects Methods

The estimated FE model eliminates all unobserved time-invariant effects (δ_i), also referred to as unobserved heterogeneity. To understand the FE method better, let's delve into the details outlined in the following section. Consider the auxiliary model from 5.2.1.1 The Auxiliary Model.

$$X_{i,q} = \alpha_0 + \boldsymbol{\alpha_k V_{i,q}} + \delta_i + e_{i,q} \tag{4}$$

Where, $\boldsymbol{V}_{i,q}$ is a vector of the *identified* explanatory variables; δ_i is the time-invariant effects; $e_{i,q}$ is the composite error term. The composite error term represents the unobserved factors that vary over time and affect $X_{i,q}$.

To obtain the fixed effects transformation, average *Equation (4)* over time for each firm $\boldsymbol{i}$ to get:

$$\bar{X}_{i,q} = \alpha_0 + \boldsymbol{\alpha_k \bar{V}_{i,q}} + \delta_i + \bar{e}_{i,q} \tag{5}$$

Because δ_i is fixed over time, it appears in both *Equation 4* and *5*. Then subtract *Equation 4* and *5* to get:

$$X_{i,q} - \bar{X}_{i,q} = \boldsymbol{\alpha_k}(\boldsymbol{V_{i,q}} - \boldsymbol{\bar{V}_{i,q}}) + \delta_i + e_{i,q} - \bar{e}_{i,q} \tag{6}$$

Or

$$\ddot{X}_{i,q} = \boldsymbol{\alpha \ddot{V}_{i,q}} + \ddot{e}_{i,q} \tag{7}$$

Where $\ddot{X}_{i,q} = X_{i,q} - \bar{X}_{i,q}$ is the time-demeaned data on $X_{i,q}$, and similarly for $\ddot{\boldsymbol{V}}_{i,q}$ and $\ddot{e}_{i,q}$. Please note, that the unobserved effects (δ_i) are eliminated. The time-demeaned equation is estimated by pooled OLS (Wooldridge, 2015).

5.2.5.2 Assumptions for Estimation Method

The data suffers from unbalanced panels, indicating that some firms have missing quarterly observations. This situation introduces potential econometric issues, particularly when the cause of these missing data points is correlated with idiosyncratic errors (Wooldridge, 2015). Put differently, if the reason behind a missing observation correlates with the unobserved time-varying factors, it can lead to sample selection problems and subsequently biased estimations.

To illustrate this point further, let's refer back to the discussion in 4.2 Data Screening Process. For instance, during a certain period, Krispy Kreme operated as a privately owned entity and was not obligated to disclose quarterly reports. This situation introduces a potential bias, especially if stock returns are correlated with ownership type, such as being private or public. This correlation arises because ownership type is not only related to the dependent variable but also linked to the underlying reasons for missing data.

In section 4.2 Data Screening Process, observations were eliminated when Compustat did not contain all necessary information. However, this can be problematic if Compustat leaves out data on firms that are more likely to generate abnormal returns. It seems plausible that investors are more prone to be surprised by 14-week quarters when data is difficult to obtain. This indicates that we are dealing with a non-random sample, which violates assumption FE.2 (see Appendix 4: Fixed Effects Assumptions). Please refer to section 7.2.2 Non-Random Missing Data for a brief discussion on this matter.

5.2.6 Tests and Diagnostics

In this section, I present a set of practical tests aimed at evaluating the suitability of the estimation method and asses its underlying assumptions. These tests will help us make informed decisions and interpretations based on the analysis results. I perform each of these tests for both the Auxiliary and Primary regressions.

5.2.6.1 Test for Correlation between Unobserved Effects and Regressors (Hausman)

I conducted a Hausman test to determine whether random effects (RE) or fixed effects are the more suitable choice. The null hypothesis is as follows:

> Hypothesis 1:
> H0: The difference in coefficients is not systematic.

I apply Stata to compute the Hausman test. A failure to reject can mean that both RE and FE estimates are sufficiently similar and can be used indifferently (Wooldridge, 2015). Rejection can mean that there exists some systematic difference in the RE and FE estimates. This is most likely because the unobserved time-invariant effects (δ_i) are correlated with the explanatory variables, which violates a key assumption for random effects methods (see Appendix 2: Random Effects Assumptions for further clarification). The test results are shown in *Table 5.2*.

Table 5.2 – Test for Correlation between Unobserved Effects and Regressors

	SUR	SUE	$QTRBHAR$
$Prob > Chi2$	0.0000	0.0000	0.0084

Source: Author's creation

The probability values for all tests are significant at the 1% level. I reject the null hypothesis and conclude that fixed effects estimation is a better fit. The Stata output is provided in Appendix 6: Test for Correlation between Unobserved Effects and Regressors (Hausman).

5.2.6.2 Test for Year-Fixed Effects (Breusch-Pagan)

I conduct a joint F-test to establish the need for time-fixed effects. The null hypothesis is as follows:

> Hypothesis 2:
> H0: The coefficients of the year variables are jointly equal to 0.

The test is done by including a year-indicator variable in all three regressions (the two auxiliary and the primary regression). Subsequently, I apply Stata to compute a joint F-test for the year-indicator variable. A failure to reject means the year-fixed effects can be excluded from the model. A rejection means that the coefficients of the year-indicators are jointly different from 0. The test results are shown in *Table 5.3*.

Table 5.3 – Test for Year-Fixed Effects

	SUR	SUE	$QTRBHAR$
$Prob > F$	0.0000	0.0000	0.0000

Source: Author's creation

The p-values for all tests are significant at the 1% level. Hence, I reject the null hypothesis and conclude that year-fixed effects should be accounted for. The Stata output is provided in Appendix 7: Test for Year-Fixed Effects (Breusch-Pagan).

5.2.6.3 Test for Heteroskedasticity (Wald)

I conduct a Wald test for groupwise heteroskedasticity. The null hypothesis is as follows:

Hypothesis 3:
H0: Homoskedasticity (constant variance).

I apply Stata to conduct the Wald test. A failure to reject can mean that homoskedasticity is present in the data. This suggests a constant variance for all firms across time. A rejection can mean that heteroskedasticity may be present. Heteroskedasticity does not cause bias and inconsistency in OLS estimators. However, when heteroskedasticity is present, the usual standard errors and test statistics are no longer valid (Wooldridge, 2015). The test results are shown in *Table 5.4*.

Table 5.4 – Test for Heteroskedasticity

	SUR	SUE	$QTRBHAR$
$Prob > Chi2$	0.0000	0.0000	0.0000

Source: Author's creation

The p-values for all tests are significant at the 1% level. Hence, I reject the null hypothesis and conclude heteroskedasticity is present. Therefore, to address the issue of heteroskedasticity, I employ heteroskedasticity-robust standard errors (sometimes referred to as Huber-White standard errors). The Stata output is provided in Appendix 8: Test for Heteroskedasticity (Wald).

5.2.6.4 Test for Serial Correlation

I conducted a Wooldridge test for serial correlation in the idiosyncratic errors. The null hypothesis is as follows:

Hypothesis 4:
H0: No first-order serial correlation.

I apply Stata to conduct the Wooldridge test. A failure to reject can mean that no serial correlation is detected. A rejection can mean that the assumption of no serial correlation is violated. Serial correlation causes the standard errors of the coefficients to be artificially smaller. Serial correlation leads to, inter alia, a higher R^2. The test results are shown in *Table 5.5*.

Table 5.5 – Test for First-Order Serial Correlation

	SUR	SUE	$QTRBHAR$
$Prob > Chi2$	0.0000	0.0000	0.2407

Source: Author's creation

The p-values for all tests are significant at the 1% level except for the primary regression. Hence, I reject the null hypothesis and conclude serial correlation is present for the Auxiliary regressions. Hence, to address the issue of serial correlation, I choose to cluster observations at the panel level, a method known to yield consistent estimates of the standard errors (Drukker, 2003; Wooldridge, 2010). To maintain consistency throughout the analysis, I opt for clustered standard errors for all regressions, even though it may not be strictly required based on the Wooldridge test results. The Stata output is provided in Appendix 9: Test for Serial Correlation.

5.2.6.5 Summary

In summary, the results of these tests indicate that the fixed effects method is more suitable than the random effects method for this analysis. Additionally, I have detected the presence of year-effects, which should be accounted for. Furthermore, both heteroskedasticity and serial correlation are present in the data. To address these issues, I will use heteroskedasticity-robust standard errors clustered at the firm level.

6 Results and Analysis

This chapter provides an examination of the obtained results. The first part focuses on studying the revenue of Typewriter-firms, followed by an exploration of their earnings patterns. This helps us better understand how revenues and earnings behave over 14-week quarters. In the second part, I analyze and discuss regression models that statistically investigate the buy-and-hold returns of Typewriter firms during their 14-week fiscal quarters. Moving on to the third part, I delve even deeper into the analysis to uncover specific dynamics related to abnormal returns. Moreover, the second and third parts of this section aim to verify or falsify the two hypotheses formulated in 3.3 Hypotheses Development.

6.1 The Auxiliary Regression: Revenues and Earnings

The Auxiliary Regressions will provide insights into the relationship between 14-week quarters and revenues and earnings. To briefly summarize, I am testing if the seasonally adjusted change in revenues (earnings) is significantly higher in 14-week quarters, whilst controlling for serial correlation, PEAD, and fiscal fourth quarter persistence. The estimated regression is as follows:

Regression Model 1

$$X_{i,q} = \hat{\alpha}_0 + \hat{\alpha}_1 X_{i,q-1} + \hat{\alpha}_2 14WK_{i,q} + \hat{\alpha}_3 14WLY_{i,q} + \hat{\alpha}_4 FQ4_{i,q} \times X_{i,q-1} + \sum \hat{\beta}_k FQ_k + \hat{u}_{i,q}$$

Prior research (Fairfield et al., 2009; Johnston et al., 2012) suggest that SUR and SUE will be positively related to their respective lagged measures i.e. ($\hat{\alpha}_1 > 0$).

I expect the coefficient for the 14-week dummy ($14WK$) to be positive ($\hat{\alpha}_2 > 0$) for both SUR and SUE. For SUR, the rationale is that adding an extra week is likely to increase revenues, or at least have no significant effect on revenues. For SUE, however, according to the discussion in 5.1.2 The Primary Model: Stock Returns, the impact of an additional week on earnings depends largely on the cost structure of the specific company. Profitable firms are likely to see an increase in profits, while unprofitable firms can either experience a decrease in profits or incur further losses. Therefore, determining the expected direction of the coefficient for $14WK$ on SUE ($\hat{\alpha}_2$)

before estimation is challenging. Nonetheless, considering that 74.7% of the firms in the sample are profitable, I anticipate the regressed coefficient for $14WK$ on SUE to be positive.

Regarding the variable $14WKLY$, I expect the coefficient to be negative for both SUR and SUE ($\hat{\alpha}_3 < 0$). The rationale behind this expectation is similar to that of the $14WK$ coefficient. However, this time, the quarter has one week less compared to what was reported in $Q - 4$.

Based on Johnston et al. (2012), I expect the coefficient for fiscal fourth quarter persistence to be negative i.e. ($\hat{\alpha}_4 < 0$) for both SUR and SUE. Appendix 10: Johnston et al. (2012) Auxiliary Regression provides the estimations of the Auxiliary Regression by Johnston et al. (2012).

Table 6.1 reports results from the estimation of *Regression 1*. Results for SUR (SUE) are shown in Column 3 (4).

Table 6.1 – Results from the Auxiliary Regressions

$$X_{i,q} = \hat{\alpha}_0 + \hat{\alpha}_1 X_{i,q-1} + \hat{\alpha}_2 14WK_{i,q} + \hat{\alpha}_3 14WLY_{i,q} + \hat{\alpha}_4 FQ4_{i,q} \times X_{i,q-1} + \sum \hat{\beta}_k FQ_k + \hat{u}_{i,q}$$

	Expected sign	$X = SUR$	$X = SUE$
Intercept		-12.42*** (4.19)	3.10 (2.33)
$X_{i,q-1}$	+	.49*** (.06)	.27*** (.06)
$14WK_{i,q}$	+	55.48*** (8.18)	11.05 (8.73)
$14WLY_{i,q}$	-	-38.43*** (8.59)	.00 (7.63)
$FQ4_{i,q} \times X_{i,q-1}$	-	.45** (.17)	.01 (.07)
$FQ1$	?	20.81*** (5.28)	.80 (2.61)
$FQ2$	?	21.77*** (5.04)	2.71 (2.38)
$FQ3$	?	18.14*** (5.06)	1.63 (2.57)
Industry effects		Yes	Yes
Year effects		Yes	Yes
Adjusted R^2 (%)		39.21	8.98

Please find the comprehensive Stata output in Appendix 11.

The table provides coefficient estimates for each variable. The heteroskedasticity robust standard errors are provided in parenthesis below the coefficient estimates. The asterisk (*) indicates significance levels at 1% (***), 5% (**), and 10%(*).

6.1.1 Revenues Pattern

The regression analysis in *Table 6.1* provides insights into the relationship between seasonally adjusted changes in revenues and the explanatory variables. The regression indicates that revenues are significantly higher in 14-week quarters this is consistent with the discussion above. The coefficient estimate is positive at 55.48, meaning that revenues on average are higher than in 13-week quarters. Interpreting the absolute value of the coefficient is rather complex and does not provide much practical insight. To demonstrate, the coefficient for $14WK$ indicates that seasonally adjusted revenues on average are $55.48 million higher in 14-week quarters for every $1 billion MVE of a firm. I continue the interpretation of regression estimates by focusing on the signs for each coefficient rather than the absolute value.

As expected, the coefficient for $14WKLY$ is negative, which suggests that the seasonally adjusted revenues tend to be lower for 13-week quarters following a catch-up quarter. The rationale for this is similar to the one proposed for the coefficient of $14WK$.

Interestingly, the coefficient for fiscal fourth quarter persistence contradicts the findings of Johnston et al. (2012) as it turns out to be positive. This suggests that fourth fiscal quarter revenue innovations are more persistent. Put differently, the seasonally adjusted changes in revenues for t and $t + 1$ are more strongly correlated in the fourth fiscal quarter. One possible explanation for this phenomenon is that managers might choose to delay recognizing revenues in the current fiscal year if they surpass a certain threshold. This could be motivated by the desire to maximize their bonuses, particularly if they have already reached the upper limit for bonus eligibility. In such cases, managers might intentionally postpone the recognition of revenues to the next period, thereby boosting their performance in the subsequent fiscal year. This behavior can contribute to the observed positive coefficient for fiscal fourth quarter persistence, as it indicates a tendency for revenue recognition to be shifted to the following period. This explanation is consistent with prior research on the potential influence of managerial incentives and bonus structures on firm performance (Ngo et al., 2022).

However, it's important to note that this coefficient is the only one that is not statistically significant at a 1% level. In other words, the relationship between fourth-quarter persistence and SUR may not be strong enough to draw firm conclusions. Therefore, while our results are inconsistent with previous findings, it is crucial to acknowledge the lack of statistical significance in this particular coefficient, indicating that further investigation may be needed to determine their true relationship.

The quarter indicators are all significant at 1% levels with variations in sign and magnitude. This further emphasizes the importance of controlling for them. Moreover, SUR is strongly positively related to its lagged measure. This is consistent with prior research.

In summary, the analysis confirms a positive relationship between SUR and its lagged measure, consistent with prior research. Additionally, it highlights the higher revenues in 14-week quarters, the lower revenues in 13-week quarters following a catch-up quarter, and the unexpected positive coefficient for fiscal fourth quarter persistence. However, the lack of statistical significance in the latter coefficient emphasizes the need for additional research to determine its true significance.

6.1.2 Earnings Pattern

The regression analysis in *Table 6.1* provides insights into the relationship between seasonally adjusted changes in earnings and the explanatory variables. However, the results are concerning as they deviate significantly from the findings of Johnston et al. (2012), which raises questions about the consistency of the results.

In their study, Johnston et al. (2012) found a significant correlation between SUE and 14-week quarters. They observed that earnings were higher in 14-week quarters, and lower in 13-week quarters following a 14-week quarter. Given that a large majority of the sampled firms in this study are profitable (74.4%), I initially expected similar results.

Contrary to expectations and prior research, the results reported in *Table 6.1* do not indicate any correlation between SUE and 14-week quarters. Additionally, the statistical tests suggest the absence of fiscal fourth quarter persistence. The only variable that shows significance is the lagged measure of SUE.

The divergence from previous findings and the lack of significant relationships in the regression analysis raise concerns and call for further examination. The results presented in *Table 6.1* provide a different perspective on the relationship between SUE and the covariates, requiring a closer look and potentially a reevaluation of the factors influencing earnings patterns.

6.2 The Primary Regression: Stock Returns

The Primary Regression investigates the relationship between buy-and-hold returns and 14-week quarters. This provides insights into the potential of achieving abnormal returns. To briefly summarize, I am testing if the quarterly buy-and-hold returns are significantly higher during 14-week quarters. I run variants of the following regression model:

Regression Model 2

$$QTRBHAR_{i,q} = \hat{\beta}_0 + \hat{\beta}_1 14WK_{i,q} + \hat{\beta}_2 UE_{i,q-1} + \hat{\beta}_3 \widehat{UE}_{i,q} + \hat{\beta}_4 \widehat{UR}_{i,q} + \hat{\beta}_5 FQ4 \times \widehat{UE}_{i,q} + \hat{\beta}_6 FQ4_{i,q} \times \widehat{UR}_{i,q} + \hat{\beta}_7 EXWKSUE_{i,q} + \hat{\beta}_8 EXWKSUR_{i,q} + \sum \hat{\gamma}_k FQ_k + u_{i,q}$$

Consistent with the hypothesis in 3.3 Hypothesis Development, I expect no particular abnormal returns during 14-week quarters i.e. ($\hat{\beta}_1 \approx 0$). The argument for this proposition is the efficient markets and the publication of the theory by Johnston et al. in 2012. When markets are efficient the existence of an extra week should be anticipated by the market. Efficient markets will therefore contain correctly priced securities and offer no abnormal returns (there are no free lunches). However, Johnston et al. (2012) show that 14-week quarters actually offer the potential to earn abnormal returns. This phenomenon can be explained by impediments to arbitrage and errors in information processing. The research was published more than a decade ago, which could suggest that market participants have become aware of the abnormal returns. For this reason, I expect abnormal returns to be completely eliminated by now. Put differently, I expect the coefficient on $14WK$ to be *near zero*. The reason it should be *near zero* and not equal to zero is due to the sampled years. A significant number of quarters are overlapping between this study and that conducted by Johnston et al. (2012). The overlapping quarters will have an upward bias on the coefficient of 14-week quarters ($\hat{\beta}_1$).

I expect the coefficient for PEAD to be positive and significant i.e. ($\hat{\beta}_2 < 0$). This is consistent with prior research (Bernard & Thomas, 1989b; Rangan & Sloan, 1998).

The coefficients for true unexpected revenues and earnings are commonly known determinants for returns i.e. ($\hat{\beta}_3 > 0$) and ($\hat{\beta}_4 > 0$). These variables simply capture the unexpected revenues and earnings for a given quarter. The expected sign for these variables is straightforward, nonetheless, they are important to include as control variables.

The coefficients for fourth quarter persistence in revenues and earnings are expected to be negative i.e. ($\hat{\beta}_5 < 0$) and ($\hat{\beta}_6 < 0$), respectively. These expectations are primarily derived from the findings of former research (Johnston et al., 2012).

The coefficients for an extra week of unexpected revenues and earnings are expected to be positive i.e. ($\hat{\beta}_7 > 0$) and ($\hat{\beta}_8 > 0$), respectively. As discussed earlier, adding an extra week will most likely increase revenue. Earnings will also probably increase as the vast majority of sampled firms are profitable. *Table 6.2* reports results from the estimation of *Regression 2*.

Table 6.2 – Results from the Primary Regression

$$QTRBHAR_{i,q} = \hat{\beta}_0 + \hat{\beta}_1 14WK_{i,q} + \hat{\beta}_2 UE_{i,q-1} + \hat{\beta}_3 \widehat{UE}_{i,q} + \hat{\beta}_4 \widehat{UR}_{i,q} + \hat{\beta}_5 FQ4 \times \widehat{UE}_{i,q} + \hat{\beta}_6 FQ4_{i,q} \times \widehat{UR}_{i,q} + \hat{\beta}_7 EXWKSUE_{i,q} + \hat{\beta}_8 EXWKSUR_{i,q} + \sum \hat{\gamma}_k FQ_k + u_{i,q}$$

	Expected sign	Model 1	Model 2	Model 3
Intercept		.1514 ** (.0733)	.0586 *** (.0095)	.0586 *** (.0095)
$14WK_{i,q}$	+	−.0336 (.0719)	.0381 *** (.0143)	.0379 ** (.0162)
$UE_{i,q-1}$	+	.0000 (.0000)	−.0001 * (.0000)	−.0001 * (.0000)
$\widehat{UE}_{i,q}$	+		.0001 *** (.0000)	.0001 *** (.0000)
$\widehat{UR}_{i,q}$	+		−.0587 (.0634)	−.0589 (.0634)
$FQ4 \times \widehat{UE}_{i,q}$	-		−.0001 ** (.0000)	−.0001 ** (.0000)
$FQ4_{i,q} \times \widehat{UR}_{i,q}$	-		−.0479 (.0663)	−.0471 (.0670)
$EXWKSUE_{i,q}$	+			−2.905 *** (.9821)
$EXWKSUR_{i,q}$	+			−.0334 (.2258)
$FQ1$	?	−.1114 (.0895)	−.0220 (.0141)	−.0219 (.0141)
$FQ2$	?	−.0811 (.0903)	.0081 (.0179)	.0082 (.0179)
$FQ3$	?	−.1305 (.0997)	−.0319 *** (.0120)	−.0319 *** (.0120)
Industry effects		Yes	Yes	Yes
Year effects		Yes	Yes	Yes
Adjusted R^2 (%)		2.67	1.09	1.10

Please find the comprehensive Stata output in Appendix 13.

The table provides coefficient estimates for each variable. The heteroskedasticity robust standard errors are provided in parenthesis below the coefficient estimates. The asterisk (*) indicates significance levels at 1% (***), 5% (**), and 10%(*).

6.2.1 Return Patterns

In *Table 6.2*, we observe that Model 1 fails to demonstrate a significant relationship between 14-week quarters or PEAD and the variation in buy-and-hold returns, even after accounting for industry and year-specific effects. Despite this, the model does exhibit a modest $adjusted\ R^2$ value of 2.67%. To clarify, Model 1 can account for approximately 2.67% of the total variation in returns. Considering the insignificance of the explanatory variables, it is likely that the predominant factors contributing to this variation are the associated year and industry effects.

Model 2 is more sophisticated in terms of control variables. This enhanced model includes the true unexpected revenues (earnings) and fiscal fourth quarter persistence as variables. By controlling for the true unexpected revenues (earnings), the model can capture the transitory additional revenues (earnings) through the coefficient on the $14WK$ dummy.

The results presented in *Table 6.2* report a positive association between the coefficient for 14-week quarters ($14WK$) and returns, with statistical significance at the 1% level. Specifically, this implies that, on average, returns are 3.81 percentage points higher during 14-week quarters. These findings are consistent with the prior research by Johnston et al. (2012). Furthermore, the true unexpected earnings ($\widehat{UE}$) are positive and significant at the 1% level. This indicates a positive market reaction to unexpected earnings from innovations. In contrast, the coefficient for the true unexpected revenues ($\widehat{UR}$) turns out to be statistically insignificant, which is inconsistent with previous studies and was not anticipated. This suggests that, on average, the market does not react to unexpected fluctuations in revenues. Regarding fiscal fourth quarter persistence, it emerges as insignificant (significant) for revenues (earnings), aligning with the findings of Johnston et al. (2012). This consistent finding further reinforces the validity of the results.

Model 3 is the most sophisticated in terms of control variables. Within this model, I incorporate the transitory revenues ($EXWKSUR$) and earnings ($EXWKSUE$) associated with the 14th week. Notably, the significance levels for all variables remain consistent between Model 2 and Model 3, with exceptions arising solely for the 14-week indicator variable ($14WK$) and the newly introduced variables ($EXWKSUR$) and ($EXWKSUE$).

I observe a negative and statistically significant ($p < 0.01$) coefficient for $EXWKSUE$, indicating a negative association between transitory (and predictable) earnings for the 14th week and returns. These results are quite interesting as they differ from those of Johnston et al. (2012). Initially, it might be difficult to find logical reasons for a negative relationship between extra earnings and returns. However, when investigating the data more closely, a plausible explanation emerges. Recall from 4.3.2 Univariate Tests and Descriptive Statistics, that the mean value of $EXWKSUE$ is negative. Hence, on average the coefficient on $EXWKSUE$ will be multiplied by a negative value thereby resulting in a positive abnormal return.

The significance of the $14WK$ dummy coefficient diminishes in Model 3 compared to Model 2, indicating that a portion of the abnormal returns in 14-week quarters (as reported in Model 2) can be attributed to the transitory revenues ($EXWKSUR$) and earnings ($EXWKSUE$) from the additional week. However, the results indicate that $EXWKSUR$ and $EXWKSUE$ are not the only factors contributing to the abnormal returns during 14-week quarters. Please note, that the coefficient for the $14WK$ dummy is still significant at the 5% level. In other words, even after factoring in the transitory revenues and earnings from the extra week, there remains some unexplained systematic variance from the $14WK$ variable. The coefficient on $14WK$ indicates that, on average, an investor could generate a 3.8 percentage point abnormal return by buying a Typewriter-stock at the beginning of the catch-up quarter and selling it the day after the quarterly announcement.

Certain Typewriter-stocks might not be well-suited for arbitrage trading. For example a glamour Typewriter-stock. As previously discussed in section 3.1.2 Impediments to Arbitrage, glamour stocks tend to be considered unattractive targets for arbitrage trading activities. Keeping impediments to arbitrage in mind, we might resolve the persisting significance of $14WK$ by introducing a variable that addresses the concept of "ease-of-arbitrage." For instance, in the case of glamour Typewriter-firms, this factor could be represented by the book-to-market value. In 6.3.1 Impediments to Arbitrage Analysis, I will introduce a variable designed to shed light on the ease of arbitrage trading.

6.2.1.1 The Adjusted R^2

The $adjusted\ R^2$ value for Model 2 reports a notable decrease compared to that of Model 1. This observation implies that the model's performance deteriorates upon the introduction of additional control variables. This relationship can be formally examined due to the nested nature of the models, and the Breusch-Pagan test (also known as a joint-hypotheses test) provides a means for such examination.

The Breusch-Pagan test can assess whether the inclusion of extra control variables collectively improves a model. Its purpose aligns with the test conducted earlier 5.2.2.2 Test for Year-Fixed Effects (Breusch-Pagan), which aimed to detect the presence of any year-effects. According to the outcomes of the Breusch-Pagan test (untabulated), the added control variables exhibit joint statistical significance at a 1% level. Interestingly, despite the reduction in the $adjusted\ R^2$, the test results unveil an improvement in the model's performance with the inclusion of the control variables. Hence, it becomes evident that although the $adjusted\ R^2$ might not attain higher levels, the incorporation of these control variables improves the model's overall ability to describe variations in quarterly buy-and-hold returns.

Nonetheless, it's important to note that the $adjusted\ R^2$ values for all models in this study are notably lower in comparison to those reported by Johnston et al. (2012), ranging from 2.63% to 11.32% in their Model 1 and Model 3, respectively. This comparison indicates notable divergence between the two studies. One plausible explanation for the divergence could be attributed to differences in data collection, specifically the timeframes analyzed. This study spans from 2005 to 2023, whereas Johnston et al. (2012) spans from 1994 to 2006.

Lastly, there are notable variations in the methodologies employed. It's noteworthy that Johnston et al. (2012) employed non-parametric methods, specifically rank regressions, whereas this study adopts classic multiple linear regression models. The pivotal difference here revolves around the assumptions about normal distribution, skewness, and the handling of outliers.

6.2.1.2 Summary

In conclusion, the analysis presented in this section provides valuable insights into the relationship between 14-week quarters and abnormal returns. Model 1, emphasizes the significance of year and industry effects in explaining return variations. Model 2, with its enhanced controls, unveils a positive and statistically significant association between 14-week quarters and returns, consistent with previous research by Johnston et al. (2012). The introduction of true unexpected earnings as a control further strengthens the understanding of market reactions to earnings innovations.

Model 3's inclusion of transitory earnings and revenues adds depth to the analysis, revealing a negative relationship between transitory earnings and returns.

The persistence of the $14WK$ coefficient's significance, even after accounting for transitory earnings and revenues, suggests that additional factors, such as the suitability of certain stocks for arbitrage trading, could be relevant. The proposition of introducing an "ease-of-arbitrage" variable offers an interesting stream for further exploration. By investigating the concept of ease of arbitrage through variables like book-to-market value, we can gain a more comprehensive understanding of the drivers behind the persistent significance of the 14-week coefficient. Nonetheless, the analysis presents a compelling trading strategy indicating that, on average, investors have the potential to earn a 3.8 percentage point (16.1 pp annualized) abnormal return simply by buying and holding the stock of Typewriter-firms right from the beginning to the end of each 14-week quarter.

In the forthcoming section 6.3.1 Impediments to Arbitrage Analysis, we will delve into the analysis of this "ease-of-arbitrage" variable, aiming to shed further light on the nuances of arbitrage trading of Typewriter firms.

Considering the hypotheses formulated in 3.3 Hypothesis Development, I am now able to *reject* the first hypothesis and conclude that *Typewriter-firms' returns are statistically higher in 14-week fiscal quarters relative to 13-week quarters, a trend that persists even when controlling* for true unexpected revenues and earnings.

6.3 Further Analyses of Return Patterns

The anomalous behavior of investors documented in the previous section prompts a further analysis that can be broadly divided into two main streams. (1) There is an examination of systematic variation in the extent of abnormal returns among specific Typewriter-firms, contingent on their suitability for arbitrage trading. (2) There is an exploration of distinctive patterns in abnormal returns observed before and after the publication of Johnston et al. (2012). This section delves into these investigative streams, offering supplementary insights to facilitate a continued exploration of the 14-week anomaly.

6.3.1 Impediments to Arbitrage Analysis

The anomalous behavior of investors documented in the previous section can be more pronounced for firms suffering from impediments to arbitrage. I specifically refer to the concept of glamour stocks by Schleifer and Vishny (1997). Recall from 3.1.2 Impediments to Arbitrage, that firms with a high book-to-value tend to have high idiosyncratic risks and are therefore less likely to be targets for arbitrage trading. Therefore, I expect that glamour (high book-to-market value) Typewriter firms are associated with larger abnormal returns in 14-week quarters.

I collect the data from the Compustat Fundamental Quarterly file. The book value of equity item noted as *Stockholders' Equity* includes common equity, preferred equity, and non-redeemable noncontrolling interests of the company. The market value of equity item noted as *Market Value* is the consolidated company-level market value for all issues, including trading and non-trading issues. There are a total of 19.865 book-to-market values implying missing values of 53 observations.

To test whether quarterly buy-and-hold returns are more positive for glamour Typewriter-firms and whether the positive returns are associated with the extra week's revenues and earnings, I run variants of the following regression model:

Regression Model 3

$$QTRBHAR_{i,q} = \hat{\beta}_0 + \hat{\beta}_1 14WK_{i,q} + \hat{\beta}_2 UE_{i,q-1} + \hat{\beta}_3 \widehat{UE}_{i,q} + \hat{\beta}_4 \widehat{UR}_{i,q} + \hat{\beta}_5 FQ4 \times \widehat{UE}_{i,q} + \hat{\beta}_6 FQ4_{i,q} \times \widehat{UR}_{i,q}$$
$$+ \hat{\beta}_7 EXWKSUE_{i,q} + \hat{\beta}_8 EXWKSUR_{i,q} + \hat{\beta}_9 BTM_{i,q} + \hat{\beta}_{10} EXWKSUE_{i,q} * BTM_{i,q}$$
$$+ \hat{\beta}_{11} EXWKSUR_{i,q} * BTM_{i,q} + \sum \hat{\gamma}_k FQ_k + u_{i,q}$$

Regression 3 introduces the continuous variable BTM, which covers the book-to-market value for each observation. The BTM is calculated as the book value of equity in quarter q divided by the market value of equity in quarter q. *Table 6.3* reports results from the estimation of *Regression 3*.

Table 6.3 – Results from Impediments to Arbitrage Analysis

$$QTRBHAR_{i,q} = \hat{\beta}_0 + \hat{\beta}_1 14WK_{i,q} + \hat{\beta}_2 UE_{i,q-1} + \hat{\beta}_3 \widehat{UE}_{i,q} + \hat{\beta}_4 \widehat{UR}_{i,q} + \hat{\beta}_5 FQ4 \times \widehat{UE}_{i,q} + \hat{\beta}_6 FQ4_{i,q} \times \widehat{UR}_{i,q} + \hat{\beta}_7 EXWKSUE_{i,q} + \hat{\beta}_8 EXWKSUR_{i,q} + \hat{\beta}_9 BTM_{i,q} + \hat{\beta}_{10} EXWKSUE_{i,q} * BTM_{i,q} + \hat{\beta}_{11} EXWKSUR_{i,q} * BTM_{i,q} + \sum \hat{\gamma}_k FQ_k + u_{i,q}$$

	Expected sign	Model 1	Model 2	Model 3
Intercept		$.1536$ ** (.0756)	$.0583$ *** (.0095)	$.0582$ *** (.0095)
$14WK_{i,q}$	+	$-.0285$ (.0662)	$.0378$ *** (.0143)	$.0357$ ** (.0162)
$BTM_{i,q}$	+	$-.0107$ (.0152	$.0013$ *** (.0003)	$.0013$ *** (.0003)
$UE_{i,q-1}$	+	$.0000$ (.0000)	$-.0001$ * (.0000)	$-.0001$ * (.0000)
$\widehat{UE}_{i,q}$	+		$.0001$ *** (.0000)	$.0001$ *** (.0000)
$\widehat{UR}_{i,q}$	+		$-.0722$ (.0650)	$-.0720$ (.0650)
$FQ4 \times \widehat{UE}_{i,q}$	-		$-.0001$ ** (.0000)	$-.0001$ ** (.0000)
$FQ4_{i,q} \times \widehat{UR}_{i,q}$	-		$-.0395$ (.0691)	$-.0419$ (.0698)
$EXWKSUE_{i,q}$	+			-1.959 (1.392)
$EXWKSUR_{i,q}$	+			$-.0884$ (.2438)
$BTM_{i,q} * EXWKSUE_{i,q}$	+			-2.119 *** (.6152)
$BTM_{i,q} * EXWKSUR_{i,q}$	+			$-.0313$ (.0544)
$FQ1$	?	$-.1144$ (.0925)	$-.0215$ (.0141)	$-.0213$ (.0141)
$FQ2$	?	$-.0828$ (.0919)	$.0085$ (.0180)	$.0085$ (.0180)
$FQ3$	?	$-.1295$ (.0986)	$-.0316$ *** (.0120)	$-.0316$ *** (.0120)
Industry effects		Yes	Yes	Yes
Year effects		Yes	Yes	Yes
Adjusted R^2 (%)		2.92	1.15	1.16

Please find the comprehensive Stata output in Appendix 15.

The table provides coefficient estimates for each variable. The heteroskedasticity robust standard errors are provided in parenthesis below the coefficient estimates. The asterisk (*) indicates significance levels at 1% (***), 5% (**), and 10%(*).

Results are reported in *Table 6.3*. In the first regression, Model 1, I only control for 14-week quarters, post-earnings announcement drift, and fiscal quarter effects. The coefficient on BTM is not significant.

In Model 2, I introduce the current quarter's unexpected revenues ($\widehat{UR}$) and earnings ($\widehat{UE}$). I also control for the fiscal fourth quarter persistence (Rangan & Sloan, 1998). The unexpected earnings are significantly positively related to quarterly returns ($p < 0.01$), consistent with previous research. The coefficient on the Book-to-Market variable (BTM) is significantly positive ($p < 0.01$), suggesting that glamour stocks tend to yield higher returns. These findings are consistent with those of McLean & Pontiff (2016).

Finally, in Model 3, I introduce the transitory earnings and revenue components attributable to the extra week. If the glamour anomaly is associated with the earnings from the extra week, then the coefficients on the interaction variables $BTM * EXWKSUR$ and $BTM * EXWKSUE$ will be positive. I find that the coefficient on $BTM * EXWKSUR$ is not significant, while the coefficient on $BTM * EXWKSUE$ is significantly positive ($p < 0.01$), as noted in *Table 6.3*.

This outcome suggests that glamour stocks exhibit a more pronounced abnormal return associated with the additional earnings stemming from the extra week. One plausible explanation for this phenomenon is that glamour Typewriter stocks present greater idiosyncratic risks for arbitrage traders. Consequently, the 14-week quarter abnormal return is less exploited for these stocks. Considering the hypotheses formulated in 3.3 Hypotheses Development, I am now able to *reject* the second hypothesis and conclude that: *There is firm-specific heterogenetic variance in the abnormal returns of Typewriter-firms.*

6.3.2 Post-Publication Analysis

This section will include another dimension to the anomalous investor behavior documented in the previous section. In 2012, Johnston et al. introduced the 14-week quarter trading strategy. For this reason, I am now testing if investors have managed to capitalize on this strategy after its publication in 2012.

The paper on 14-week quarters by Johnston et al. was published in the Journal of Accounting and Economics in February 2012 (Volume 53). As such, I construct a variable that can distinguish between the period before and after the publication date. This new variable does not require any extra data; its purpose is merely to differentiate the two time periods.

To test if investors have succeeded in implementing the trading strategy, I run variants of the following regression model:

Regression Model 3

$$QTRBHAR_{i,q} = \hat{\beta}_0 + \hat{\beta}_1 14WK_{i,q} + \hat{\beta}_2 UE_{i,q-1} + \hat{\beta}_3 \widehat{UE}_{i,q} + \hat{\beta}_4 \widehat{UR}_{i,q} + \hat{\beta}_5 FQ4 \times \widehat{UE}_{i,q} + \hat{\beta}_6 FQ4_{i,q} \times \widehat{UR}_{i,q} + \hat{\beta}_7 EXWKSUE_{i,q} + \hat{\beta}_8 EXWKSUR_{i,q} + \hat{\beta}_9 POPU_{i,q} + \hat{\beta}_{10} EXWKSUE_{i,q} * POPU_{i,q} + \hat{\beta}_{11} EXWKSUR_{i,q} * POPU_{i,q} + \sum \hat{\gamma}_k FQ_k + u_{i,q}$$

Regression 4 introduces the dummy variable ($POPU$), which indicates whether an observation was made before or after the publication of Johnston et al. (2012). The *Post Publication* variable equals one when the observation is made after the publication of Johnston et al (2012), and zero otherwise.

Table 6.4 – Results from the Post Publication analysis

$$QTRBHAR_{i,q} = \hat{\beta}_0 + \hat{\beta}_1 14WK_{i,q} + \hat{\beta}_2 UE_{i,q-1} + \hat{\beta}_3 \widehat{UE}_{i,q} + \hat{\beta}_4 \widehat{UR}_{i,q} + \hat{\beta}_5 FQ4 \times \widehat{UE}_{i,q} + \hat{\beta}_6 FQ4_{i,q} \times \widehat{UR}_{i,q} + \hat{\beta}_7 EXWKSUE_{i,q} + \hat{\beta}_8 EXWKSUR_{i,q} + \hat{\beta}_9 POPU_{i,q} + \hat{\beta}_{10} EXWKSUE_{i,q} * POPU_{i,q} + \hat{\beta}_{11} EXWKSUR_{i,q} * POPU_{i,q} + \sum \hat{\gamma}_k FQ_k + u_{i,q}$$

	Expected sign	Model 1	Model 2	Model 3
Intercept		$-.6200$ (.6798)	$.0347$ (.0249)	$.0338$ (.0250)
$14WK_{i,q}$	+	$-.0801$ (.1173)	$.0367$ ∗∗ (.0142)	$.0366$ ∗∗ (.0162)
$POPU_{i,q}$		$.8437$ (.8227)	$.0261$ (.0209)	$.0271$ (.0211)
$UE_{i,q-1}$	+	$-.0001$ (.0000)	$-.0001$ ∗ (.0000)	$-.0001$ ∗ (.0000)
$\widehat{UE}_{i,q}$	+		$.0001$ ∗∗∗ (.0000)	$.0001$ ∗∗∗ (.0000)
$\widehat{UR}_{i,q}$	+		$-.0587$ (.0634)	$-.0589$ (.0634)
$FQ4 \times \widehat{UE}_{i,q}$	-		$-.0001$ ∗∗ (.0000)	$-.0001$ ∗∗ (.0000)
$FQ4_{i,q} \times \widehat{UR}_{i,q}$	-		$-.0478$ (.0663)	$-.0472$ (.0671)
$EXWKSUE_{i,q}$	+			8.8370 (11.9930)
$EXWKSUR_{i,q}$	+			$-.2383$ (.5506)
$POPU_{i,q} * EXWKSUE_{i,q}$	+			$.2126$ (.5625)
$POPU_{i,q} * EXWKSUR_{i,q}$	+			-11.8085 (.11.9991)
$FQ1$	?	$-.0299$ ∗ (.0172)	$-.0196$ (.0152)	$-.0193$ (.0152)
$FQ2$	?	$-.0039$ (.0226)	$.0105$ (.0187)	$.0107$ (.0187)
$FQ3$	?	$-.0534$ ∗ (.0268)	$-.0296$ ∗∗ (.0125)	$-.0294$ ∗∗ (.0126)
Industry effects		Yes	Yes	Yes

Year effects	Yes	Yes	Yes
Adjusted R^2 (%)	2.85	1.09	1.08
Please find the comprehensive Stata output in Appendix 16.			

The table provides coefficient estimates for each variable. The heteroskedasticity robust standard errors are provided in parenthesis below the coefficient estimates. The asterisk (*) indicates significance levels at 1% (***), 5% (**), and 10%(*).

Results are reported in *Table 6.4*. If investors learned about and used the trading strategy after the paper was published, I would expect to observe less noticeable abnormal returns in the post-publication period.

In all three models, the variables covering potential systematic variation in pre- and post-publication periods are insignificant. Essentially, this implies that categorizing observations into the distinct pre- and post-publication periods does not present any systematic variation. Consequently, it appears that the markets have not effectively realized the trading strategy proposed by Johnston et al. (2012). If I found that there was a difference between pre- and post-publication returns, the abnormal returns documented in 6.2 The Primary Regression: Stock Returns, might have been attributable to the returns in the pre-publication period. Hence, this section corroborates the results of the primary analysis.

These findings align with criticisms of the efficient markets hypothesis, suggesting its limitations. However, they are inconsistent with the findings of Mclean & Pontiff (2016), indicating that academic publications might not have adequately informed investors about the 14-week anomaly, resulting in limited market reactions. An additional regression was performed to further explore this conundrum. Please find the details in section 7.2.5 Inconsistency with Mclean & Pontiff (2016).

6.3.2.1 Lagged Post-Publication Analysis

Considering the potential time lag in market reactions, it might be an intriguing idea to extend the cut-off period. Specifically, I explore the implications of delaying the cut-off period for $POPU$ by a year. Specifically, I generate $POPU\_1$ defined as equal to 1 when observations are made over a year after publication, and 0 otherwise. This variable is interacted with the 14-week dummy variable ($14WK$) to examine whether the abnormal returns cease to exist a year after the publication of Johnston et al. (2012).

If the coefficient of the interaction term ($14WK * POPU\_1$) is insignificant, while the coefficient of $14WK$ remains significantly positive, it indicates that the abnormal return has disappeared in the post-publication period. Notably, the analysis shows that both coefficients, $14WK * POPU\_1$ and $14WK$, are insignificant.

I extended the analysis by considering six different variables, each with an individual cut-off period. The first cut-off period was the fiscal year before the initial publication, and the subsequent five cut-off periods covered the five consecutive fiscal years after the publication. However, none of these variables showed significant coefficients. You can find the detailed regression results for the three consecutive years in Appendix 17: Further Analysis on Post Publication.

Overall, these findings corroborate the results discussed in 6.3.2 Post Publication Analysis. It indicates that investors have not been able to capitalize on the trading strategy put forth by Johnston et al. (2012), even extending over five years after the publication of the paper.

7 Discussion

This chapter explores the implications of the findings, considering both theoretical and practical aspects. Additionally, I discuss critical points for reflection that could be valuable for future research.

7.1 Practical and Theoretical Implications

The study offers insights into the peculiar phenomenon of the 14-week anomaly. Notably, it verifies the presence of abnormal returns that can be achieved by capitalizing on this market inefficiency. The study's focus revolves around an investor who adopts a buy-and-hold approach to stocks during catch-up quarters. Specifically, the marginal investor would buy the Typewriter-stock two days after the prior earnings announcement and hold it until one day after the quarterly announcement of the 14-week quarter. This trading strategy earns abnormal returns of 3.8 percentage points per quarter, which translates to an annualized 16.1 percentage points. It's worth mentioning that this approach relies on taking a long position rather than a short position, rendering it more feasible for smaller investors to implement.

Furthermore, the study reveals that Typewriter-firms associated with higher idiosyncratic risk, measured as book-to-market value, tend to exhibit a more pronounced abnormal return during the 14-week quarter.

The findings are relevant for any investor aiming to capitalize on this market inefficiency. However, as documented in the analysis, I find no substantial evidence to reject the notion that the abnormal returns remain unchanged even after the initial publication by Johnston et al. (2012). This suggests that no or few investors are trading by this strategy. Hence, I do not deem it plausible that this study will have any practical implications either.

The study supports the literature stream which is critical towards the efficient market hypothesis. Once again, the analysis underscores the fact that the market anomaly identified by Johnston et al. (2012) has not been effectively exploited, indicating a lack of efficiency in equity capital markets.

7.2 Critical Points of Reflection

There are important points to consider concerning this study. These points can offer new perspectives and aim to facilitate an objective evaluation of the study's findings.

7.2.1 Divergence in Methodology

The first point of reflection is regarding the divergence of methodologies. At the core of this study lies the intention to compare its results with the findings of Johnston et al. (2012). Nevertheless, there are notable disparities in the methodologies employed, with the most significant distinction being the estimation methods utilized.

Recall from 5.2.5 Modified Estimation Method, this study applies a classic multiple linear regression method, while Johnston et al. (2012) opt for non-parametric methods to assess their hypotheses. Unlike linear regression models, non-parametric methods allow researchers to avoid assumptions about the functional forms of variables. And so, to ensure a certain level of comparability between the two studies, I refrained from incorporating variables of differing orders or forms. Put differently, I regarded the comparability of the two studies as more important than achieving perfect functional forms for the variables in the regression model.

This could be a pivotal consideration, as some readers might argue for the possible existence of a non-linear relationship between the dependent and independent variables.

7.2.2 Non-Random Missing Data

In 4.2 Data Screening Process, observations were excluded due to incomplete information in Compustat. Nonetheless, a potential issue arises if Compustat's omissions disproportionately affect firms prone to exhibiting abnormal returns. The underlying idea is that when data is harder to come by, investors may encounter challenges in accessing it as well. Consequently, when investors struggle to gather the necessary data, they are less likely to incorporate the additional week into their earnings forecasts. As a result, the observations omitted could potentially exhibit more pronounced abnormal returns during the 14-week quarter. If this holds, the primary analysis findings might be biased towards 0 (also referred to as attenuation bias), as I am effectively leaving out firms that display abnormal returns.

7.2.3 Pseudo-Natural Experiment

Recall from [1.3.1 Research Strategy](), interventions in this context may not follow a complete randomization process. This lack of randomization arises due to the predictability of 14-week quarters. If investors anticipate the occurrence of the 14-week quarters, the situation cannot be considered a natural experiment.

In [2.2 Explanation of 52/53 Accounting Practice](), it was noted that firms openly disclose the fiscal years that include 53 weeks. Consequently, if investors carefully review the annual reports of Typewriter-firms, they can anticipate the presence of catch-up quarters years before they happen. If this holds, it would be appropriate to consider a different research strategy.

7.2.4 B/M Interaction Effects

In the analysis of the interaction effect discussed in [6.3.1 Impediments to Arbitrage Analysis](), there may be alternative explanations at play. In this thesis, I suggest that the observed interaction effect occurs because these firms possess high idiosyncratic risks, making arbitrage trading challenging. However, another plausible explanation for the anomalous market behavior is that various anomalies complement each other.

These anomalies may exhibit interaction effects, despite not being directly related to a firm's idiosyncratic risk. For instance, consider the well-known *January Effect*, where firms with previously declining stock prices tend to experience a rise in January (Thaler, 1987). It could be worthwhile to investigate if there is an interaction effect between the January Effect and the 14-week quarter anomaly. This example is just one instance, but the concept can be expanded to explore interactions with other anomalies as well.

7.2.5 Inconsistency with McLean & Pontiff

The findings of this thesis are inconsistent with those of Mclean & Pontiff (2016). Recall that this thesis suggests that the academic publication of Johnston et al. (2012) has not adequately informed markets about the anomaly, resulting in limited observed market reaction.

Nonetheless, Mclean & Pontiff (2016) further show that the attenuation of alphas is more pronounced for firms with lower idiosyncratic risk. In this thesis, we saw a more pronounced 14-

week abnormal return for high idiosyncratic risk firms. It's plausible that only these firms demonstrate post-publication abnormal returns. To explore this, I conducted a kitchen-sink regression that incorporated both the post-publication dummy and the B/M variable. Surprisingly, there are no qualitative differences. Put differently, this is consistent with the conclusion that the market has not adequately reacted to the publication of the 14-week trading strategy.

7.2.6 Management of Earnings

An important confound to consider is related to principal-agency theory, particularly in cases where a CEO neglects their fiduciary duty by prioritizing their self-interest. This situation can introduce firm-specific variables that have the potential to impact both revenues and earnings. A prime example of such a variable is CEO pay. A study conducted by Ngo et al. (2022) illustrates that the sensitivity of CEO pay to performance significantly influences the management of earnings. Therefore, in cases where a company links CEO compensation to firm performance, it might motivate the CEO to place their self-interest above other considerations. As a result, this might encourage the CEO to make choices that influence reported income through accrual methods.

This scenario presents an econometric challenge if the underlying, unobserved factors are connected to an explanatory variable. Specifically, this situation becomes problematic if the CEO's decisions to manipulate accruals often occur in the 14-week quarter. If the CEO chooses to increase (decrease) earnings, this will lead to a positive (negative) bias on the 14-week coefficient.

However, due to the practical constraints of this thesis, it was not feasible to incorporate management of earnings into the analysis.

8 Conclusion

This study investigates data from 591 US typewriter firms spanning the years 2005 to 2023. The thesis reveals the presence of positive abnormal returns during 14-week quarters, consistent with the research by Johnston et al. (2012).

The primary objective of this thesis has been to examine the 14-week quarter anomaly. Specifically, it sought to determine whether it was still possible to achieve abnormal returns by trading on this anomaly, even more than a decade after its initial publication. Furthermore, the study aimed to explore whether firms perceived as less attractive to arbitrageurs exhibited more pronounced abnormal returns. Interestingly, both hypotheses were verified.

This thesis is grounded in an extensive review of existing literature, which presents two contrasting perspectives on market efficiency. One side consists of supporters sharing extensions, while the other side consists of critics sharing opposing views. The literature provides an array of arguments suggesting why the 14-week anomaly should no longer exist, while simultaneously presenting an array of arguments for its potential persistence, all of which are consistently referenced in subsequent sections of this thesis.

This thesis provides a thorough overview of the dataset. Through descriptive statistics and univariate tests, it is demonstrated that the dataset closely resembles that used by Johnston et al. (2012), reinforcing the validity of comparisons between the studies.

The analysis is based on a fixed effects estimation method, designed to account for any omitted time-invariant factors. In addition, four supplementary tests reveal the presence of *time-invariant confounding factors, year-fixed effects, heteroskedasticity, and first-order serial correlation*. As a result, all regression analyses in this study employ a fixed effects method, which incorporates industry- and year-effects and employs heteroskedasticity-robust standard errors clustered at the firm level.

The findings of this thesis are derived from a comprehensive analysis of 14-week quarters. This analysis initially focuses on revenue and earnings patterns during 13- and 14-week quarters, demonstrating a significant increase in revenues during 14-week quarters. This leads to the subsequent examination of return patterns during these periods, revealing significantly higher returns in 14-week quarters. Put differently, abnormal returns exist during the catch-up quarter.

Additionally, the analysis shows that investors can earn a 3.8 percentage point (16.1 pp annualized) abnormal return by buying and holding the stock of Typewriter-firms during their 14-week quarter. Part of these abnormal returns can be attributed to the additional week, while another portion remains unaccounted for.

The final part of the analysis is divided into two distinct streams. The first stream indicates that the abnormal return is more prominent for firms characterized as unattractive for arbitrage. In the second stream, it is demonstrated that these results persist in the markets even when controlling for post-publication effects Johnston et al. (2012).

The thesis contributes to the literature on market efficiency and arbitrage. The thesis provides new evidence on the existence and persistence of the 14-week anomaly, which challenges the efficient market hypothesis and suggests that investors are not fully rational or informed. The thesis also provides new insights into the role of idiosyncratic risk in explaining the 14-week anomaly, which implies that arbitrage is limited or costly for these firms.

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Appendices

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10 Appendix

This chapter includes all appendices that are deemed relevant to provide further explanations throughout the thesis.

Contents

Appendix 1: Industry Representation of Sample

Two-digit SIC code	**Industry description**	**Number of firms in the sample**
10	Metal Mining	1
13	Oil and Gas Extraction	2
16	Heamy Construction, Except Building Construction, Contractor	1
20	Food and Kindred Products	35
22	Textile Mill Products	6
23	Apparel, Finished Products from Fabrics & Similar Materials	20
24	Lumber and Wood Products, Except Furniture	5
25	Furniture and Fixtures	10
26	Paper and Allied Products	4
27	Printing, Publishing and Allied Industries	6
28	Chemicals and Allied Products	9
30	Rubber and Miscellaneous Plastic Products	3
31	Leather and Leather Products	5
32	Stone, Clay, Glass, and Concrete Products	1
33	Primary Metal Industries	4
34	Fabricated Metal Products	9
35	Industrial and Commercial Machinery and Computer Equipment	32
36	Electronic & Other Electrical Equipment & Components	89
37	Transportation Equipment	8
38	Measuring, Photographic, Medical, & Optical Goods, & Clocks	47
39	Miscellaneous Manufacturing Industries	5
40	Railroad Transportation	1
42	Motor Freight Transportation	1
44	Water Transportation	1
45	Transportation by Air	2
47	Transportation Services	2
48	Communications	4
49	Electric, Gas and Sanitary Services	2

50	Wholesale Trade - Durable Goods	14
51	Wholesale Trade - Nondurable Goods	9
52	Building Materials, Hardware, Garden Supplies & Mobile Homes	4
53	General Merchandise Stores	17
54	Food Stores	14
55	Automotive Dealers and Gasoline Service Stations	5
56	Apparel and Accessory Stores	46
57	Home Furniture, Furnishings and Equipment Stores	9
58	Eating and Drinking Places	54
59	Miscellaneous Retail	38
61	Nondepository Credit Institutions	1
62	Security & Commodity Brokers, Dealers, Exchanges & Services	6
65	Real Estate	3
67	Holding and Other Investment Offices	7
70	Hotels, Rooming Houses, Camps, and Other Lodging Places	2
72	Personal Services	2
73	Business Services	22
75	Automotive Repair, Services and Parking	2
78	Motion Pictures	2
79	Amusement and Recreation Services	4
80	Health Services	1
81	Legal Services	1
82	Educational Services	2
87	Engineering, Accounting, Research, and Management Services	10
99	Nonclassifiable Establishments	1

Appendix 2: SUSB Table 2017

Number of employer firms in the United States, by industry 2019	
Number of employer firms in the United States in 2017, by industry	
Accommodation and Food Services	553,714
Administrative and Support and Waste Management and Remediation Services	355,021
Agriculture, Forestry, Fishing and Hunting	22,135
Arts, Entertainment, and Recreation	137,779
Construction	730,589
Educational Services	97,128
Finance and Insurance	238,268
Health Care and Social Assistance	665,331
Industries not classified	11,406
Information	82,998
Management of Companies and Enterprises	26,073
Manufacturing	243,687
Mining, Quarrying, and Oil and Gas Extraction	18,630
Other Services (except Public Administration)	704,018
Professional, Scientific, and TechnicalServices	825,595
Real Estate and Rental and Leasing	327,773
Retail Trade	636,560
Transportation and Warehousing	197,326
Utilities	6,096
Wholesale Trade	287,385
Publication Details	

Published by	US Census Bureau
Publication date	February 2022
Original source	census.gov
ID	487754

Appendix 3: Univariate Test by Johnston et al. (2012)

Descriptive statistics of firm performance in 14-week and 13-week quarters.

Panel A—All 13- and 14-week quarters

Variable description	(1) 13-week quarters				(2) 14-week quarters				(3) Differences (2)−(1)	
	N	Mean	Median	Std	*N*	Mean	Median	Std	Mean	Median
REVENUES										
R/P	20,986	0.6417***	0.3755***	0.803	933	0.7547***	0.4275***	0.927	0.1130***	0.0520***
SUR	20,986	0.0359***	0.0205***	0.140	933	0.0767***	0.0435***	0.156	0.0408***	0.0230***
RFE	7,841	−0.0022***	0.0000	0.035	407	0.0138***	0.0072***	0.036	0.0160***	0.0072***
EARNINGS										
E/P	20,986	0.0107***	0.0130***	0.035	933	0.0123***	0.0159***	0.045	0.0016	0.0029***
SUE	20,986	0.0029***	0.0017***	0.034	933	0.0038***	0.0025***	0.044	0.0009	0.0008***
EFE	9,019	0.0003***	0.0003***	0.005	493	0.0003	0.0005***	0.006	0.0000	0.0002***
RETURNS										
EADCAR	20,986	0.0044***	0.0019***	0.079	933	0.0089***	0.0083***	0.081	0.0045*	0.0064**
QTRBHAR	20,986	−0.0029*	−0.0150***	0.223	933	0.0243***	0.0032*	0.260	0.0272***	0.0182***

Panel B—14-week quarter (*Q*) and same fiscal quarter from year before (*Q*−*4*) and year after (*Q*+*4*)

Variable description	(4) Quarter *Q*−*4* (13-week qtr)	(5) Quarter *Q* (14-week qtr)	(6) Quarter *Q*+*4* (13-week qtr)	(7) Difference (5)−(4)	(8) Difference (5)−(6)
REVENUES					
R/P					
Mean	0.6208***	0.6906***	0.6640***	0.0699***	0.0267
Median	0.3919***	0.4209***	0.3703***	0.0175***	0.0276***

Table 2 (*continued*)

Panel B—14-week quarter (Q) and same fiscal quarter from year before (Q−4) and year after (Q+4)

Variable description	(4) Quarter $Q-4$ (13-week qtr)	(5) Quarter Q (14-week qtr)	(6) Quarter $Q+4$ (13-week qtr)	(7) Difference (5)−(4)	(8) Difference (5)−(6)
SUR					
Mean	0.0505***	0.0735***	−0.0079	0.0230***	0.0814***
Median	0.0259***	0.0431***	0.0000	0.0102***	0.0468***
RFE					
Mean	0.0001	0.0123***	−0.0101***	0.0121***	0.0223***
Median	0.0008	0.0060***	−0.0024***	0.0044***	0.0111***
EARNINGS					
E/P					
Mean	0.0170***	0.0184***	0.0122***	0.0014	0.0062***
Median	0.0160***	0.0172***	0.0135***	0.0003	0.0029***
SUE					
Mean	0.0064***	0.0057***	0.0014	−0.0007	0.0043
Median	0.0023***	0.0027***	0.0005	−0.0009	0.0036***
EFE					
Mean	0.0007***	0.0005**	−0.0001	−0.0002	0.0005
Median	0.0005***	0.0005***	0.0003***	−0.0000	0.0001**
RETURNS					
EADCAR					
Mean	0.0110***	0.0144***	0.0037	0.0035	0.0107***
Median	0.0037***	0.0103***	0.0022	0.0064*	0.0054**
QTRBHAR					
Mean	−0.0293**	0.0366***	−0.0048	0.0652***	0.0412***
Median	−0.0381***	0.0122***	−0.0132	0.0364***	0.0619***

All variables in the table are winsorized at 1% and 99%. Panel A presents descriptive data for all 14-week quarters from 1994 to 2006 and all 13-week quarters for 658 firms. Column 3 presents the significance level of differences in means (t-test) and medians (Wilcoxon Rank Sum tests).
Panel B presents data for the 14-week quarter (Q), and corresponding fiscal quarters from the year before ($Q-4$) and year following ($Q+4$). Both $Q-4$ and $Q+4$ are 13-week quarters. Observations are included only if data are available for $Q-4$, Q and $Q+4$. There are 705 observations available for each variable, except for *RFE* ($N=263$) and *EFE* ($N=332$). Differences presented in column 7 and column 8 are matched pair differences where each observation in 14-week quarter Q is matched with 13-week quarter $Q-4$ and 13-week quarter $Q+4$, respectively. Positive differences indicate that the variable value in Q is higher than its realization in $Q-4$ (column 7) or $Q+4$ (column 8).
R/P is Revenue scaled by market value of equity at the end of the same fiscal quarter in the previous year. *SUR* is the seasonally adjusted change in revenues, scaled by market value of equity at the end of the same fiscal quarter in the previous year; *RFE* (Revenue Forecast Errors) are actual revenues less analysts' revenue forecast for the quarter, scaled by market value of equity at the beginning of the quarter; *E/P* is income before extraordinary items adjusted for special items (after-tax) scaled by market value of equity at the end of the same fiscal quarter in the previous year; *SUE* is the seasonally adjusted change in income (excluding extraordinary and special items), scaled by market value of equity at the end of the same fiscal quarter in the previous year; *EFE* (Earnings Forecast Errors) are actual earnings per share less analysts' earnings forecast for the quarter, scaled by stock price at the beginning of the quarter; *EADCAR* is the cumulative size-adjusted abnormal returns from the day before to the day after the quarter's earnings announcement date; and *QTRBHAR* is the size-adjusted buy-and-hold returns cumulated from two days after the earnings announcement for the previous quarter to one day after the current quarter's earnings announcement date.
In Panel B, pair-wise differences in variable values between Q and $Q-4$ and Q and $Q+4$ are first computed for each 14-week observation at the firm level. The reported differences are the mean and median of the distribution of pair-wise differences. Significance of means (medians) is determined by t-tests (Wilcoxon Rank Sum tests).
*, **, *** indicate significance at the 10%, 5% and 1% levels, respectively.

Appendix 4: Fixed Effects Assumptions

Assumption FE.1

For each i, the model is

$$y_{it} = \beta_1 x_{it1} + \ldots + \beta_k x_{itk} + a_i + u_{it},\ t = 1, \ldots, T,$$

where the β_j are the parameters to estimate and a_i is the unobserved effect.

Assumption FE.2

We have a random sample from the cross section.

Assumption FE.3

Each explanatory variable changes over time (for at least some i), and no perfect linear relationships exist among the explanatory variables.

Assumption FE.4

For each t, the expected value of the idiosyncratic error given the explanatory variables in *all* time periods and the unobserved effect is zero: $\mathrm{E}(u_{it}|\mathbf{X}_i, a_i) = 0$.

Under these first four assumptions—which are identical to the assumptions for the first-differencing estimator—the fixed effects estimator is unbiased. Again, the key is the strict exogeneity assumption, FE.4. Under these same assumptions, the FE estimator is consistent with a fixed T as $N \rightarrow \infty$.

Assumption FE.5

$\mathrm{Var}(u_{it}|\mathbf{X}_i, a_i) = \mathrm{Var}(u_{it}) = \sigma_u^2$, for all $t = 1, \ldots, T$.

Assumption FE.6

For all $t \neq s$, the idiosyncratic errors are uncorrelated (conditional on all explanatory variables and a_i): $\mathrm{Cov}(u_{it}, u_{is}|\mathbf{X}_i, a_i) = 0$.

Under Assumptions FE.1 through FE.6, the fixed effects estimator of the β_j is the best linear unbiased estimator. Since the FD estimator is linear and unbiased, it is necessarily worse than the FE estimator. The assumption that makes FE better than FD is FE.6, which implies that the idiosyncratic errors are serially uncorrelated.

Assumption FE.7

Conditional on $\mathbf{X}_i$ and a_i, the u_{it} are independent and identically distributed as Normal$(0, \sigma_u^2)$.

Assumption FE.7 implies FE.4, FE.5, and FE.6, but it is stronger because it assumes a normal distribution for the idiosyncratic errors. If we add FE.7, the FE estimator is normally distributed, and t and F statistics have exact t and F distributions. Without FE.7, we can rely on asymptotic approximations. But, without making special assumptions, these approximations require large N and small T.

Appendix 5: Random Effects Assumption

Assumption RE.2

In addition to FE.4, the expected value of a_i given all explanatory variables is constant: $E(a_i|\mathbf{X}_i) = \beta_0$.

This is the assumption that rules out correlation between the unobserved effect and the explanatory variables, and it is the key distinction between fixed effects and random effects. Because we are assuming a_i is uncorrelated with all elements of $\mathbf{x}_{it}$, we can include time-constant explanatory variables. (Technically, the quasi-time-demeaning only removes a fraction of the time average, and not the whole time average.) We allow for a nonzero expectation for a_i in stating Assumption RE.4 so that the model under the random effects assumptions contains an intercept, β_0, as in equation (14.7). Remember, we would typically include a set of time-period intercepts, too, with the first year acting as the base year.

Appendix 6: Test for Correlation between Unobserved Effects and Regressors (Hausman)

```
.
. hausman fixed random, sigmamore
```

	Coefficients (b) fixed	Coefficients (B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
wk	.0537613	.041116	.0126453	.003463
sue				
L1.	-.0000592	-.0000575	-1.69e-06	3.20e-06
UE	.0000783	.0000798	-1.46e-06	4.56e-06
UR	-.0000183	-.0000179	-4.00e-07	.0000118
FQ4UE	-.0000479	-.000049	1.18e-06	4.34e-06
FQ4UR	-9.71e-06	-.0000101	3.85e-07	2.94e-06
EXWKSUE	-.0023127	-.0032915	.0009789	.0003712
EXWKSUR	-.0001631	2.95e-06	-.0001661	.0000699
q1	-.0198026	-.0216848	.0018822	.0009649
q2	.0067977	.0061142	.0006836	.0011858
q3	-.0330712	-.0336347	.0005635	.0013561

```
                          b = Consistent under H0 and Ha; obtained from xtreg.
           B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

   chi2(11) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            =  25.23
Prob > chi2 = 0.0084
```

Appendix 7: Test for Year-Fixed Effects (Breusch-Pagan)

```
. testparm i.fiscalyear

 ( 1)  2012.fiscalyear = 0
 ( 2)  2013.fiscalyear = 0
 ( 3)  2014.fiscalyear = 0
 ( 4)  2015.fiscalyear = 0
 ( 5)  2016.fiscalyear = 0
 ( 6)  2017.fiscalyear = 0
 ( 7)  2018.fiscalyear = 0
 ( 8)  2019.fiscalyear = 0
 ( 9)  2020.fiscalyear = 0
 (10)  2021.fiscalyear = 0
 (11)  2022.fiscalyear = 0
 (12)  2023.fiscalyear = 0

       F( 12,   483) =   14.12
            Prob > F =    0.0000
```

Appendix 8: Test for Heteroskedasticity (Wald)

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (484)  =   4.3e+07
Prob>chi2 =      0.0000
```

Appendix 9: Test for Serial Correlation

```
. xtserial QTRBHAR wk lsue UE UR FQ4UE FQ4UR EXWKSUE EXWKSUR q1 q2 q3 fiscalyear naics

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,     448) =      1.380
           Prob > F =      0.2407
```

Appendix 10: Johnston et al. (2012) Auxiliary Regression

Table 3
Incremental revenues and earnings in 14-week quarters and fourth quarter following 14-week quarters.

$$X_{i,q} = \alpha_0 + \alpha_1 X_{i,q-1} + \alpha_2\, 14WK\_Q_{i,q} + \alpha_3\, 14WK\_Q+4_{i,q} + \alpha_4 FQ4 \times X_{i,q-1} + \sum \beta_k FQ_k + e_{i,q}$$

	Expected sign	*X=SUR*	*X=SUE*
Intercept	?	0.1294***	0.2444***
		(5.47)	(8.97)
X_{q-1}	+	0.7068***	0.5217***
		(82.50)	(49.77)
14WK_Q	+	0.0963***	0.0265***
		(13.04)	(2.76)
14WK_Q+4	−	−0.1127***	−0.0124
		(−13.54)	(−1.24)
$FQ4 \times X_{q-1}$	−	−0.1044***	−0.1767***
		(−7.79)	(−11.16)
FQ1	?	0.0434***	0.0754***
		(5.68)	(8.15)
FQ2	?	−0.0069**	0.0019
		(−2.15)	(0.49)
FQ3	?	−0.0051	−0.0017
		(−1.63)	(−0.40)
Industry fixed effects		Yes	Yes
Year fixed effects		Yes	Yes
Adjusted R^2 (%)		52.21	25.22

The sample includes 933 14-week quarters from 1994 to 2006 and 20,986 13-week quarters for 658 firms that report based on a 52/53 week fiscal year. All non-indicator variables are replaced by their fractional ranks in the regression.
SUR is the seasonally adjusted change in revenues, scaled by market value of equity at the end of quarter $q-4$; *SUE* is the seasonally adjusted change in income before extraordinary items (adjusted for special items) scaled by market value of equity at the end of quarter $q-4$; *14WK_Q* is a dummy variable that equals one if the quarter contains 14 weeks, and zero otherwise; *14WK_Q+4* is a dummy variable that equals one if the same quarter of the previous year contains 14 weeks, and zero otherwise; FQ_k $(k=1,2,3,4)$ are indicator variables set equal to one if the fiscal quarter=k, and zero otherwise; and $FQ4 \times X_{q-1}$ allows fourth quarter earnings and revenue surprises to have differential persistence than other quarters (Rangan and Sloan, 1998).
t-Statistics, based on Huber-White standard errors clustered at the firm level, are provided in parentheses below the coefficient estimates.
***, ** indicate significance at the 1% and 5% levels, respectively.

Appendix 11: Auxiliary Regression Output (SUE and SUR)

```
. reghdfe SUR l.SUR wk wkly i.q4#c.l.SUR q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 6 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs   =     15,885
Absorbing 2 HDFE groups                           F(   7,     502) =      27.66
Statistics robust to heteroskedasticity           Prob > F        =     0.0000
                                                  R-squared       =     0.4010
                                                  Adj R-squared   =     0.3921
                                                  Within R-sq.    =     0.3156
Number of clusters (gvkey)   =        503         Root MSE        =   197.8780

                                 (Std. err. adjusted for 503 clusters in gvkey)
```

SUR	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
SUR						
L1.	.4890447	.064411	7.59	0.000	.3624964	.6155931
wk	55.48324	8.177674	6.78	0.000	39.41656	71.54992
wkly	-38.43459	8.585319	-4.48	0.000	-55.30217	-21.56701
q4#cL.SUR						
1	.44807	.1751246	2.56	0.011	.1040026	.7921374
q1	20.81029	5.284444	3.94	0.000	10.42794	31.19264
q2	21.77475	5.039157	4.32	0.000	11.87431	31.67519
q3	18.14014	5.055569	3.59	0.000	8.207456	28.07282
_cons	-12.42506	4.186419	-2.97	0.003	-20.65012	-4.199998

Absorbed degrees of freedom:

Absorbed FE	Categories	- Redundant	= Num. Coefs
naics	214	0	214
fiscalyear	14	1	13

```
. reghdfe sue l.sue wk wkly i.q4#c.l.sue q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs   =     14,393
Absorbing 2 HDFE groups                           F(   7,     476) =       4.94
Statistics robust to heteroskedasticity           Prob > F        =     0.0000
                                                  R-squared       =     0.1038
                                                  Adj R-squared   =     0.0898
                                                  Within R-sq.    =     0.0730
Number of clusters (gvkey)   =        477         Root MSE        =   174.7419

                              (Std. err. adjusted for 477 clusters in gvkey)
------------------------------------------------------------------------------
             |               Robust
         sue | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
         sue |
         L1. |   .2728572   .0579903     4.71   0.000     .1589084    .3868059
             |
          wk |   11.05539   8.731426     1.27   0.206    -6.101519    28.21229
        wkly |   .0044926   7.632866     0.00   1.000    -14.99379    15.00277
             |
    q4#cL.sue |
           1 |    .005207   .0716326     0.07   0.942    -.1355482    .1459621
             |
          q1 |   .7965708   2.610109     0.31   0.760    -4.332189    5.925331
          q2 |   2.710361   2.387446     1.14   0.257    -1.980875    7.401598
          q3 |   1.627574   2.578847     0.63   0.528    -3.439757    6.694905
       _cons |   3.098327   2.326407     1.33   0.184    -1.472971    7.669625
------------------------------------------------------------------------------

Absorbed degrees of freedom:
-----------------------------------------------------+
 Absorbed FE | Categories  - Redundant  = Num. Coefs |
-------------+---------------------------------------|
       naics |       204           0         204     |
  fiscalyear |        13           1          12     |
-----------------------------------------------------+
```

Appendix 12: Johnston et al. (2012) Primary Regression

Table 6
Market reaction in 14-week quarters.

$$QTRBHAR_{i,q} = \alpha_0 + \alpha_1 14\_WK_{i,q} + \alpha_2 UE_{i,q-1} + \alpha_3 \widehat{UE}_{i,q} + \alpha_4 \widehat{UR}_{i,q} + \alpha_5 FQ4 \times \widehat{UE}_{i,q} + \alpha_6 FQ4 \times \widehat{UR}_{i,q} + \alpha_7 EXWKSUE_{i,q} + \alpha_8 EXWKSUR_{i,q} + \sum \beta_k FQ_k + e_{i,q}$$

	Expected sign	*Model 1*	*Model 2*	*Model 3*
Intercept		0.4545***	0.3704***	0.3683***
		(23.91)	(20.99)	(20.73)
14WK	+	0.0377***	0.0456***	−0.0165
		(3.59)	(4.44)	(−0.67)
UE_{q-1}	+	0.0703***		
		(9.15)		
$\widehat{UE}_q$	+		0.3029***	0.3033***
			(33.87)	(33.94)
$\widehat{UR}_q$	+		0.0657***	0.0659***
			(7.77)	(7.79)
$FQ4 \times \widehat{UE}_q$	−		−0.0925***	−0.0883***
			(−5.45)	(−5.17)
$FQ4 \times \widehat{UR}_q$	−		−0.0206	−0.0224
			(−1.17)	(−1.28)
$EXWKSUE_q$	+			0.1221***
				(3.36)
$EXWKSUR_q$	+			0.0028
				(0.08)
FQ1	?	0.0492***	−0.0111	−0.0092
		(7.98)	(−0.97)	(−0.80)
FQ2	?	0.0101*	−0.0504***	−0.0487***
		(1.70)	(−4.31)	(−4.15)
FQ3	?	−0.0026	−0.0583***	−0.0565***
		(−0.46)	(−5.06)	(−4.90)
Industry fixed effects		Yes	Yes	Yes
Year fixed effects		Yes	Yes	Yes
Adjusted R^2 (%)		2.63	11.26	11.32

The sample includes 933 14-week quarters from 1994 to 2006 and 20,986 13-week quarters for 658 firms that report based on a 52/53 week fiscal year. All non-indicator variables are replaced by their fractional ranks in the regression.
$QTRBHAR_{i,q}$ is the cumulative size-adjusted buy-and-hold return for firm *i* from two days after the earnings announcement for quarter $q-1$ to the day after the earnings announcement for quarter *q*.
UE is unexpected earnings, and is equal to analysts' earnings forecast error scaled by stock price when forecasts are available (N=9,302). Earnings forecast error equals actual earnings less the median forecast as of two days after the earnings announcement for $q-1$ (beginning of the return cumulation period), scaled by stock price at the end of $q-1$. In cases where forecasts are unavailable (N=12,617), *UE*=*SUE*, the change in income before extraordinary items (adjusted for special items) from quarter $q-4$ to quarter *q*, scaled by market value of equity in quarter $q-4$. $EXWKSUE_q$, for 14-week quarters is 1/13 of the income before extraordinary items (adjusted for special items) for quarter $q-4$, scaled by market value of equity (MVE) in quarter $q-4$; $EXWKSUE_q$ equals zero for 13-week quarters. $\widehat{UE} = UE(-)EXWKSUE$.
UR is unexpected revenues, which equals analysts' revenue forecast error scaled by *MVE* at the end of $q-1$, when revenue forecasts are available (N=8,248). When revenue forecasts are unavailable, *UR*=*SUR*, the seasonally adjusted change in sales, scaled by market value of equity in quarter $q-4$; $EXWKSUR_q$ for 14-week quarters is 1/13 of the revenues for quarter $q-4$, scaled by market value of equity in quarter $q-4$; $EXWKSUR_q$ equals zero for 13-week quarters. $\widehat{UR} = UR(-)EXWKSUR$.
$FQ_k(k=1,2,3,4)$ are indicator variables set equal to one if the fiscal quarter=*k*, and zero otherwise.
t-Statistics, based on Huber-White standard errors clustered at the firm level, are provided in parentheses below the coefficient estimates.
***, * indicate significance at the 1% and 10% levels, respectively.

Appendix 13: Primary Regression Output

```
. reghdfe QTRBHAR wk l.sue  q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 5 iterations)

HDFE Linear regression                            Number of obs   =     14,549
Absorbing 2 HDFE groups                           F(   5,    481) =       4.79
Statistics robust to heteroskedasticity           Prob > F        =     0.0003
                                                  R-squared       =     0.0416
                                                  Adj R-squared   =     0.0267
                                                  Within R-sq.    =     0.0004
Number of clusters (gvkey)   =        482         Root MSE        =     2.4756

                                 (Std. err. adjusted for 482 clusters in gvkey)
```

QTRBHAR	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
wk	-.0336146	.0718995	-0.47	0.640	-.1748904	.1076613
sue						
L1.	-.0000386	.0000343	-1.13	0.261	-.0001059	.0000287
q1	-.1114295	.089511	-1.24	0.214	-.2873104	.0644514
q2	-.0810698	.0903303	-0.90	0.370	-.2585605	.0964208
q3	-.1305143	.0997324	-1.31	0.191	-.3264792	.0654506
_cons	.1514248	.0733419	2.06	0.039	.0073147	.2955349

Absorbed degrees of freedom:

Absorbed FE	Categories	- Redundant	= Num. Coefs
naics	206	0	206
fiscalyear	13	1	12

```
. reghdfe QTRBHAR wk l.sue UE UR FQ4UE FQ4UR q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs   =     14,383
Absorbing 2 HDFE groups                           F(   9,     476) =       4.57
Statistics robust to heteroskedasticity           Prob > F        =     0.0000
                                                  R-squared       =     0.0263
                                                  Adj R-squared   =     0.0109
                                                  Within R-sq.    =     0.0023
Number of clusters (gvkey)   =        477         Root MSE        =     0.6114

                                (Std. err. adjusted for 477 clusters in gvkey)
------------------------------------------------------------------------------
             |               Robust
     QTRBHAR | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
          wk |   .0381355   .0143078     2.67   0.008     .0100212    .0662499
             |
         sue |
         L1. |  -.0000554   .0000336    -1.65   0.100    -.0001215    .0000107
             |
          UE |    .000082    .000028     2.93   0.004     .0000269    .0001371
          UR |  -.0586993   .0633998    -0.93   0.355    -.1832774    .0658789
       FQ4UE |  -.0000718   .0000336    -2.13   0.033    -.0001379   -5.69e-06
       FQ4UR |  -.0479434   .0663182    -0.72   0.470     -.178256    .0823693
          q1 |  -.0220399   .0140807    -1.57   0.118    -.0497078    .0056281
          q2 |   .0081281   .0178951     0.45   0.650    -.0270351    .0432912
          q3 |  -.0319189   .0119946    -2.66   0.008    -.0554878   -.0083499
       _cons |   .0586404    .009498     6.17   0.000     .0399772    .0773037
------------------------------------------------------------------------------

Absorbed degrees of freedom:
-----------------------------------------------------+
 Absorbed FE | Categories  - Redundant  = Num. Coefs |
-------------+---------------------------------------|
       naics |       204           0         204     |
  fiscalyear |        13           1          12     |
-----------------------------------------------------+
```

```
. reghdfe QTRBHAR wk l.sue UE UR FQ4UE FQ4UR EXWKSUE EXWKSUR q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs   =     14,383
Absorbing 2 HDFE groups                           F(  11,     476) =      4.54
Statistics robust to heteroskedasticity           Prob > F        =     0.0000
                                                  R-squared       =     0.0265
                                                  Adj R-squared   =     0.0110
                                                  Within R-sq.    =     0.0025
Number of clusters (gvkey)   =        477         Root MSE        =     0.6114

                                (Std. err. adjusted for 477 clusters in gvkey)
```

QTRBHAR	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
wk	.0378762	.0161524	2.34	0.019	.0061373	.0696151
sue						
L1.	-.0000552	.0000336	-1.64	0.101	-.0001213	.0000108
UE	.000082	.000028	2.93	0.004	.0000269	.000137
UR	-.0589402	.0634107	-0.93	0.353	-.1835397	.0656593
FQ4UE	-.0000738	.0000336	-2.20	0.029	-.0001398	-7.75e-06
FQ4UR	-.0471326	.0669704	-0.70	0.482	-.1787268	.0844615
EXWKSUE	-2.905306	.9820627	-2.96	0.003	-4.83502	-.9755915
EXWKSUR	-.0334108	.2257974	-0.15	0.882	-.4770937	.4102721
q1	-.021913	.0140967	-1.55	0.121	-.0496125	.0057865
q2	.0081993	.0178885	0.46	0.647	-.026951	.0433496
q3	-.0318544	.012008	-2.65	0.008	-.0554496	-.0082593
_cons	.0585756	.0095023	6.16	0.000	.039904	.0772473

Absorbed degrees of freedom:

Absorbed FE	Categories	- Redundant	= Num. Coefs
naics	204	0	204
fiscalyear	13	1	12

Appendix 14: Joint F-test

```
. xtreg QTRBHAR wk l.sue UE UR FQ4UE FQ4UR EXWKSUE EXWKSUR q1 q2 q3, fe

Fixed-effects (within) regression               Number of obs     =     14,390
Group variable: gvkey                           Number of groups  =        484

R-squared:                                      Obs per group:
     Within  = 0.0031                                         min =          1
     Between = 0.0001                                         avg =       29.7
     Overall = 0.0026                                         max =         49

                                                F(11,13895)       =       3.88
corr(u_i, Xb) = -0.0272                         Prob > F          =     0.0000

------------------------------------------------------------------------------
     QTRBHAR | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
          wk |   .0465488   .0294361     1.58   0.114    -.0111499    .1042475
             |
         sue |
         L1. |  -.0000625   .0000301    -2.08   0.038    -.0001215   -3.48e-06
             |
          UE |   .0000736   .0000357     2.06   0.040     3.51e-06    .0001436
          UR |   -.081288   .0251309    -3.23   0.001    -.1305479   -.0320281
       FQ4UE |  -.0000495   .0000599    -0.83   0.409     -.000167     .000068
       FQ4UR |  -.0493783   .0470459    -1.05   0.294    -.1415945    .0428379
     EXWKSUE |  -2.259673   2.002659    -1.13   0.259    -6.185154    1.665808
     EXWKSUR |   .0505047   .3610154     0.14   0.889    -.6571342    .7581437
          q1 |  -.0179047   .0151223    -1.18   0.236    -.0475465     .011737
          q2 |   .0089946   .0149147     0.60   0.546    -.0202402    .0382295
          q3 |  -.0310614   .0149462    -2.08   0.038    -.0603579   -.0017649
       _cons |   .0570911   .0110405     5.17   0.000     .0354502     .078732
-------------+----------------------------------------------------------------
     sigma_u |  .19687397
     sigma_e |  .61368404
         rho |  .09331342   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(483, 13895) = 1.04                  Prob > F = 0.2609

. testparm l.sue UE UR FQ4UE FQ4UR EXWKSUE EXWKSUR

 ( 1)  L.sue = 0
 ( 2)  UE = 0
 ( 3)  UR = 0
 ( 4)  FQ4UE = 0
 ( 5)  FQ4UR = 0
 ( 6)  EXWKSUE = 0
 ( 7)  EXWKSUR = 0

       F(  7, 13895) =    4.03
            Prob > F =    0.0002
```

Appendix 15: Book-to-Value analysis

```
. reghdfe QTRBHAR wk BTM l.sue q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 5 iterations)

HDFE Linear regression                            Number of obs   =     14,542
Absorbing 2 HDFE groups                           F(   6,    479) =       3.87
Statistics robust to heteroskedasticity           Prob > F        =     0.0009
                                                  R-squared       =     0.0441
                                                  Adj R-squared   =     0.0292
                                                  Within R-sq.    =     0.0030
Number of clusters (gvkey)   =        480         Root MSE        =     2.4730

                                 (Std. err. adjusted for 480 clusters in gvkey)
```

QTRBHAR	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
wk	-.0284532	.0661736	-0.43	0.667	-.1584797	.1015733
BTM	-.0107139	.0152042	-0.70	0.481	-.040589	.0191612
sue						
L1.	-.0000374	.0000345	-1.08	0.279	-.0001052	.0000304
q1	-.1144476	.0925357	-1.24	0.217	-.2962736	.0673784
q2	-.0827886	.0919285	-0.90	0.368	-.2634215	.0978443
q3	-.1295488	.09862	-1.31	0.190	-.3233301	.0642325
_cons	.1536166	.0755401	2.03	0.043	.0051858	.3020475

Absorbed degrees of freedom:

Absorbed FE	Categories	- Redundant	= Num. Coefs
naics	206	0	206
fiscalyear	13	1	12

```
. reghdfe QTRBHAR wk BTM l.sue UE UR FQ4UE FQ4UR q1 q2 q3, absorb(naics fiscalyear) vc
> e(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs     =     14,377
Absorbing 2 HDFE groups                           F(  10,     474)  =       8.57
Statistics robust to heteroskedasticity           Prob > F          =     0.0000
                                                  R-squared         =     0.0270
                                                  Adj R-squared     =     0.0115
                                                  Within R-sq.      =     0.0030
Number of clusters (gvkey)    =        475        Root MSE          =     0.6113

                               (Std. err. adjusted for 475 clusters in gvkey)
```

QTRBHAR	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
wk	.0377436	.014328	2.63	0.009	.0095894	.0658979
BTM	.0013422	.0002903	4.62	0.000	.0007718	.0019126
sue						
L1.	-.0000555	.0000336	-1.65	0.099	-.0001216	.0000105
UE	.0000821	.0000281	2.93	0.004	.000027	.0001373
UR	-.072163	.06499	-1.11	0.267	-.199867	.0555411
FQ4UE	-.0000714	.0000336	-2.13	0.034	-.0001373	-5.44e-06
FQ4UR	-.0394513	.0691274	-0.57	0.568	-.1752855	.0963828
q1	-.0214635	.0141152	-1.52	0.129	-.0491996	.0062725
q2	.0084953	.0180094	0.47	0.637	-.0268928	.0438833
q3	-.0315913	.0119996	-2.63	0.009	-.0551704	-.0080122
_cons	.0582965	.0095278	6.12	0.000	.0395746	.0770183

Absorbed degrees of freedom:

Absorbed FE	Categories	- Redundant	= Num. Coefs
naics	204	0	204
fiscalyear	13	1	12

```
. reghdfe QTRBHAR wk BTM l.sue UE UR FQ4UE FQ4UR EXWKSUE EXWKSUR EXWKSURBTM EXWKSUEBTM
> q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs     =     14,377
Absorbing 2 HDFE groups                           F(  14,      474) =      12.29
Statistics robust to heteroskedasticity           Prob > F          =     0.0000
                                                  R-squared         =     0.0274
                                                  Adj R-squared     =     0.0116
                                                  Within R-sq.      =     0.0033
Number of clusters (gvkey)    =        475        Root MSE          =     0.6113

                                   (Std. err. adjusted for 475 clusters in gvkey)
------------------------------------------------------------------------------
             |               Robust
     QTRBHAR | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
          wk |   .0357126   .0161885     2.21   0.028     .0039024    .0675227
         BTM |   .0013473   .0002883     4.67   0.000     .0007808    .0019139
             |
         sue |
         L1. |  -.0000556   .0000336    -1.65   0.099    -.0001216    .0000105
             |
          UE |   .0000821   .0000281     2.92   0.004     .0000269    .0001373
          UR |  -.0720038   .0649528    -1.11   0.268    -.1996348    .0556271
       FQ4UE |  -.0000732   .0000335    -2.19   0.029    -.0001389   -7.45e-06
       FQ4UR |  -.0419411   .0698356    -0.60   0.548    -.1791669    .0952846
     EXWKSUE |  -1.958687   1.392316    -1.41   0.160    -4.694561    .7771882
     EXWKSUR |    .088358   .2437723     0.36   0.717      -.39065     .567366
  EXWKSURBTM |  -.0313185   .0544047    -0.58   0.565    -.1382227    .0755857
  EXWKSUEBTM |  -2.119019   .6152151    -3.44   0.001    -3.327905   -.9101325
          q1 |  -.0213754   .0141293    -1.51   0.131    -.0491392    .0063885
          q2 |   .0085479   .0179975     0.47   0.635    -.0268169    .0439127
          q3 |  -.0315664   .0120199    -2.63   0.009    -.0551852   -.0079476
       _cons |    .058249   .0095359     6.11   0.000     .0395112    .0769869
------------------------------------------------------------------------------

Absorbed degrees of freedom:
-----------------------------------------------------+
 Absorbed FE | Categories  - Redundant  = Num. Coefs |
-------------+---------------------------------------|
       naics |       204           0         204     |
  fiscalyear |        13           1          12     |
-----------------------------------------------------+
```

Appendix 16: Post Publication Analysis

```
. reghdfe QTRBHAR wk popu l.sue q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs     =     14,549
Absorbing 2 HDFE groups                           F(   6,     481)  =       3.40
Statistics robust to heteroskedasticity           Prob > F          =     0.0027
                                                  R-squared         =     0.0434
                                                  Adj R-squared     =     0.0285
                                                  Within R-sq.      =     0.0023
Number of clusters (gvkey)   =        482         Root MSE          =     2.4733

                               (Std. err. adjusted for 482 clusters in gvkey)
```

QTRBHAR	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
wk	-.0801264	.1172757	-0.68	0.495	-.3105623	.1503096
popu	.8437282	.8227315	1.03	0.306	-.7728636	2.46032
sue						
L1.	-.0000574	.000039	-1.47	0.142	-.000134	.0000193
q1	-.0298764	.0172054	-1.74	0.083	-.0636834	.0039306
q2	-.0038511	.0225862	-0.17	0.865	-.0482309	.0405287
q3	-.0534439	.0268149	-1.99	0.047	-.1061327	-.000755
_cons	-.6200362	.6797798	-0.91	0.362	-1.955741	.7156687

Absorbed degrees of freedom:

Absorbed FE	Categories	- Redundant	= Num. Coefs
naics	206	0	206
fiscalyear	13	1	12

```
. reghdfe QTRBHAR wk popu l.sue UE UR FQ4UE FQ4UR q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs   =     14,383
Absorbing 2 HDFE groups                           F(  10,    476) =       4.33
Statistics robust to heteroskedasticity           Prob > F        =     0.0000
                                                  R-squared       =     0.0264
                                                  Adj R-squared   =     0.0109
                                                  Within R-sq.    =     0.0023
Number of clusters (gvkey)   =        477         Root MSE        =     0.6114

                                 (Std. err. adjusted for 477 clusters in gvkey)
```

QTRBHAR	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
wk	.0366889	.0141888	2.59	0.010	.0088085	.0645692
popu	.0261491	.0209324	1.25	0.212	-.0149823	.0672804
sue						
L1.	-.0000559	.0000337	-1.66	0.098	-.0001222	.0000103
UE	.000082	.000028	2.92	0.004	.0000269	.0001371
UR	-.0586857	.0634111	-0.93	0.355	-.1832859	.0659146
FQ4UE	-.0000725	.0000335	-2.17	0.031	-.0001382	-6.77e-06
FQ4UR	-.0477842	.0663388	-0.72	0.472	-.1781372	.0825689
q1	-.0195547	.015152	-1.29	0.197	-.0493277	.0102184
q2	.0104826	.0187311	0.56	0.576	-.0263231	.0472884
q3	-.0295695	.0125393	-2.36	0.019	-.0542087	-.0049303
_cons	.0347452	.0248879	1.40	0.163	-.0141585	.083649

Absorbed degrees of freedom:

Absorbed FE	Categories	- Redundant	= Num. Coefs
naics	204	0	204
fiscalyear	13	1	12

```
. reghdfe QTRBHAR wk popu l.sue UE UR FQ4UE FQ4UR EXWKSUE EXWKSUR EXWKSURPOPU EXWKSUEP
> OPU q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs     =     14,383
Absorbing 2 HDFE groups                           F(  14,     476)  =       3.83
Statistics robust to heteroskedasticity           Prob > F          =     0.0000
                                                  R-squared         =     0.0265
                                                  Adj R-squared     =     0.0108
                                                  Within R-sq.      =     0.0025
Number of clusters (gvkey)   =        477         Root MSE          =     0.6114

                                   (Std. err. adjusted for 477 clusters in gvkey)
```

QTRBHAR	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
wk	.0365551	.016207	2.26	0.025	.004709	.0684012
popu	.0271181	.0210641	1.29	0.199	-.0142719	.0685081
sue						
L1.	-.0000558	.0000337	-1.65	0.099	-.000122	.0000105
UE	.0000819	.000028	2.93	0.004	.0000269	.000137
UR	-.0588826	.0634279	-0.93	0.354	-.1835158	.0657506
FQ4UE	-.0000739	.0000334	-2.21	0.027	-.0001396	-8.23e-06
FQ4UR	-.0471741	.0670683	-0.70	0.482	-.1789606	.0846124
EXWKSUE	8.837007	11.99297	0.74	0.462	-14.7287	32.40271
EXWKSUR	-.2382519	.5506284	-0.43	0.665	-1.320215	.843711
EXWKSURPOPU	.2125881	.5624643	0.38	0.706	-.8926319	1.317808
EXWKSUEPOPU	-11.80854	11.99906	-0.98	0.326	-35.38621	11.76913
q1	-.0192778	.0151716	-1.27	0.204	-.0490893	.0105338
q2	.0106668	.0187343	0.57	0.569	-.0261453	.0474789
q3	-.0293816	.0125648	-2.34	0.020	-.0540709	-.0046924
_cons	.033765	.0249971	1.35	0.177	-.0153534	.0828834

Absorbed degrees of freedom:

Absorbed FE	Categories	- Redundant	= Num. Coefs
naics	204	0	204
fiscalyear	13	1	12

Appendix 17: Further analysis on Post Publication

g popu1 = qdate > tq(2013.q3)

```
. reghdfe QTRBHAR wk##popu1 l.sue q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs   =     14,549
Absorbing 2 HDFE groups                           F(   7,     481) =       4.11
Statistics robust to heteroskedasticity           Prob > F        =     0.0002
                                                  R-squared       =     0.0417
                                                  Adj R-squared   =     0.0268
                                                  Within R-sq.    =     0.0006
Number of clusters (gvkey)   =        482         Root MSE        =     2.4755

                                (Std. err. adjusted for 482 clusters in gvkey)
------------------------------------------------------------------------------
             |               Robust
     QTRBHAR | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
        1.wk |  -.1592251   .1787039    -0.89   0.373    -.5103619    .1919117
     1.popu1 |  -.2324399   .1323335    -1.76   0.080     -.492463    .0275832
             |
    wk#popu1 |
        1 1  |   .1563602   .1395985     1.12   0.263     -.117938    .4306585
             |
         sue |
         L1. |  -.0000388   .0000344    -1.13   0.260    -.0001063    .0000288
             |
          q1 |  -.1359991   .1032575    -1.32   0.188    -.3388906    .0668924
          q2 |  -.1048387   .1034862    -1.01   0.312    -.3081795    .0985022
          q3 |  -.1545399   .1133099    -1.36   0.173    -.3771834    .0681036
       _cons |   .3444285   .1823206     1.89   0.059    -.0138148    .7026718
------------------------------------------------------------------------------

Absorbed degrees of freedom:
-----------------------------------------------------+
 Absorbed FE | Categories  - Redundant  = Num. Coefs |
-------------+---------------------------------------|
       naics |       206           0         206     |
  fiscalyear |        13           1          12     |
-----------------------------------------------------+
```

g popu2 = qdate > tq(2014.q3)

```
. . reghdfe QTRBHAR wk##popu2 l.sue q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs   =     14,549
Absorbing 2 HDFE groups                           F(   7,     481) =       5.67
Statistics robust to heteroskedasticity           Prob > F        =     0.0000
                                                  R-squared       =     0.0416
                                                  Adj R-squared   =     0.0266
                                                  Within R-sq.    =     0.0004
Number of clusters (gvkey)    =        482        Root MSE        =     2.4757

                              (Std. err. adjusted for 482 clusters in gvkey)
```

QTRBHAR	Coefficient	Robust std. err.	t	P>|t|	[95% conf. interval]	
1.wk	-.1228014	.1516273	-0.81	0.418	-.4207351	.1751324
1.popu2	-.0514537	.100065	-0.51	0.607	-.2480723	.1451649
wk#popu2						
1 1	.1286606	.1179576	1.09	0.276	-.1031153	.3604365
sue						
L1.	-.0000388	.0000342	-1.13	0.258	-.0001061	.0000285
q1	-.1160629	.0988543	-1.17	0.241	-.3103025	.0781768
q2	-.0857419	.0995468	-0.86	0.389	-.2813421	.1098584
q3	-.1353477	.1090651	-1.24	0.215	-.3496506	.0789551
_cons	.1886785	.1455016	1.30	0.195	-.0972188	.4745758

Absorbed degrees of freedom:

Absorbed FE	Categories	- Redundant	= Num. Coefs
naics	206	0	206
fiscalyear	13	1	12

g popu3 = qdate > tq(2015.q3)

```
. reghdfe QTRBHAR wk##popu3 l.sue q1 q2 q3, absorb(naics fiscalyear) vce(cluster gvkey)
(dropped 7 singleton observations)
(MWFE estimator converged in 6 iterations)

HDFE Linear regression                            Number of obs   =     14,549
Absorbing 2 HDFE groups                           F(   7,    481) =       3.75
Statistics robust to heteroskedasticity           Prob > F        =     0.0006
                                                  R-squared       =     0.0416
                                                  Adj R-squared   =     0.0266
                                                  Within R-sq.    =     0.0004
Number of clusters (gvkey)   =        482         Root MSE        =     2.4757

                               (Std. err. adjusted for 482 clusters in gvkey)
------------------------------------------------------------------------------
             |               Robust
     QTRBHAR | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
        1.wk |  -.0852842   .1154631    -0.74   0.460    -.3121587    .1415903
     1.popu3 |   -.058249   .0741494    -0.79   0.433    -.2039458    .0874477
             |
    wk#popu3 |
        1 1  |   .0870331   .0774275     1.12   0.262    -.0651049    .2391711
             |
         sue |
         L1. |  -.0000386   .0000343    -1.13   0.261    -.0001059    .0000288
             |
          q1 |  -.1166031   .0960669    -1.21   0.225    -.3053657    .0721595
          q2 |  -.0861426   .0966804    -0.89   0.373    -.2761107    .1038256
          q3 |  -.1356326   .1061254    -1.28   0.202    -.3441594    .0728941
       _cons |   .1879614   .1189317     1.58   0.115    -.0457284    .4216512
------------------------------------------------------------------------------

Absorbed degrees of freedom:
-----------------------------------------------------+
 Absorbed FE | Categories  - Redundant  = Num. Coefs |
-------------+---------------------------------------|
       naics |       206           0         206     |
  fiscalyear |        13           1          12     |
-----------------------------------------------------+
```