

Information Flow in Capital Markets

*Novel empirical evidence on information processing in financial markets
and the role of behavioral biases*



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ABSTRACT

The abstract is provided in both German and English.

Since the start of the 21st century, the world has seen a significant proliferation of openly available information. While drastic increases in the availability of information have been observed in all areas of everyday life, they are particularly pronounced in financial markets. In parallel, technological evolution and novel methods of data analysis have significantly altered how information is analyzed and incorporated by investors. Despite its merits for market efficiency and price discovery, this development entails a significant risk of increased information asymmetries due to a higher disparity between sophisticated investors who are able to make use of such technology and those investors who are not. Research has further shown that investors, when provided with too much information at once, are not able to fully comprehend and incorporate all information leading to irrational investment behavior. It is hence of particular importance to fully understand how information is provided, processed, and incorporated in financial markets.

While there already exists a growing literature on biased decision-making and information processing in financial markets, research gaps remain. Questions that are, so far, still unanswered in most contexts are, for example: Does the increasing access to information enable sophisticated institutional investors to correctly assess and seize behavioral biases of executives? Are retail investors able to correctly interpret (and potentially devalue) information signals provided by irrational executives? How do investors behave in times of crises and concomitant information overload? Do investors also incorporate the informational quality of public disclosures (and not only its information content) when assessing a firm's prospects and risks? Do executives anticipate these market reactions and potentially strategically manipulate information signals to provoke market reactions for the firm's or their own benefit?

By conducting four disjunct empirical research studies of which each constitutes one chapter of this dissertation, I hope to close some of these research gaps. More precisely, in the first two chapters, I shed light on whether and how investors react to information signals provided by overconfident executives (Chapter 2) and how information of such executives is perceived in times of crises (Chapter 3). These studies are then further complemented by an analysis of how investors in particularly emotionally charged stocks react to different events in times of particularly high information overflow (e.g., during a crisis) in Chapter 4. Finally, an analysis of whether investors also incorporate measures

of informational quality and not only the information itself in their investment decisions and whether executives anticipate and strategically manage investor reactions to certain disclosures concludes in Chapter 5. I will provide further details on each of these chapters in the following paragraphs.

The analysis of behavioral biases and their consequences for executives and firms is one of the most popular areas of research in behavioral finance literature. Research thereby focuses on the impact of biases on managerial decision-making but mostly neglects how sophisticated investors incorporate information on such biases in their investment decisions. However, given the aforementioned advances in information processing technology and trading methods, it is very likely that more sophisticated investors already integrate softer information on the behavioral characteristics of executives in their investment decisions. In the first study of this dissertation, I investigate whether shareholder activists, a particularly sophisticated group of institutional investors, react to overconfidence signals of executives. I thereby specifically focus on the relevance of the chief financial officer (CFO) who typically plays an important role in negotiations and collaborations with activists. Based on a sample of 16,470 firm-year observations and 506 activist investments I provide initial evidence that activists indeed take CFO overconfidence into account. More precisely, the results indicate that the presence of CFO overconfidence significantly decreases the probability to get targeted by a shareholder activist. These results support recent academic findings that shareholder activists prefer targets with executives signaling a higher likelihood of negotiation success and consider, in this case, CFO overconfidence as a warning signal for prolonged negotiations. This effect increases with the strength of CFO overconfidence and is robust to different overconfidence proxies. I further provide evidence that markets react significantly less positively to activist investments in firms with overconfident CFOs than to investments in firms with non-overconfident CFOs indicating that ordinary investors acknowledge the lower likelihood of negotiation success for such investments.

While these results indicate that sophisticated investors such as shareholder activists react to overconfidence signals provided by executives, it remains unclear whether investors in general incorporate such information signals in their investment decisions. Given that investors often trade upon information signals provided by executives (e.g., in corporate disclosures or press conferences), it is of particular interest to analyze whether investors correctly assess the informational value of such information signals. Ordinary investment decisions in individual stocks though might not provide investors with sufficient incentives to properly evaluate behavioral characteristics of an executive given that investors can diversify their holdings comparably easily (at least compared to shareholder activists).

This might be different for investments that are highly contingent on the rational behavior of executives such as directors' dealings. In my second study, I therefore analyze whether investors consider behavioral characteristics of executives when reacting to directors' dealings. I thereby specifically focus on investor reactions to directors' dealings after the outbreak of COVID-19 as research shows that a high informational quality of such trades is particularly valuable during times of high market uncertainty and volatility. More precisely, based on 1,271 insider trades of chief executive officers (CEOs) and CFOs in March 2020, I show that investors devalue confidence signals provided by purchase transactions of overconfident executives. While purchase decisions of executives do not appear to provide the typical confidence signals of directors' dealings in a firm's prospects during COVID-19, investors react significantly more negatively to purchases undertaken by overconfident executives than to purchases undertaken by their non-overconfident peers. This indicates a lack of trust in the value of the information signal provided by the directors' dealings of these executives and thus supports the hypothesis that investors incorporate signals on behavioral biases in their assessment of the informational quality of directors' dealings.

Research shows that information overload was particularly high during COVID-19. The results of the second study indicate that investors can still at least partially process and incorporate relevant information regarding executive overconfidence. It remains unclear though whether this also holds true for investors in particularly emotionally charged and COVID-19-affected stocks. In my third study, I hence analyze how investors in stock-listed football clubs reacted to the outbreak of COVID-19 and whether some clubs were differently affected than others. This setting is particularly rewarding for two reasons: firstly, research suggests that investors in football stocks often have investment motives other than purely financial considerations (e.g., fan investments) and, secondly, the football industry is one of the most severely affected industries by COVID-19. Based on a sample of 22 European football stocks I show that football clubs exhibit significant negative abnormal returns after a variety of different COVID-19 related events immediately after the outbreak of COVID-19 in Europe. I further provide empirical evidence that these negative abnormal returns are particularly pronounced for clubs still competing in international cup competitions due to a concomitant extraordinary exposure to international business and travel restrictions of such clubs. Finally, further analyses of trading volumes indicate that although investors initially seem to overreact to the outbreak of COVID-19, investor confidence seems to return comparably quickly to pre-COVID-19 levels.

The first three studies of this dissertation provide novel evidence on how investors react to information signals provided by biased executives and shed light on how information is processed during times of high uncertainty and volatility. All three studies implicitly assume that the analyzed information signals are unbiased and hence not manipulated by executives. Research suggests though that some executives indeed strategically manage which and how information is provided to investors. The unbiased provision of information is particularly important in markets with high information asymmetries as well as for topics that involve comparatively high information gathering costs or considerable uncertainty regarding the informational quality of disclosures. Uncertainties regarding informational quality are particularly high for information on risks related to environment-, social-, and governance- (ESG) related activities of a firm due to a lack of quantifiable data and significant differences in how ESG information is assessed by external rating providers and agencies. In the fourth empirical study of this dissertation, I thus investigate how investors in risk markets react to the informational quality of ESG-related corporate disclosures and whether executives try to elicit beneficial market reactions to such disclosures by strategically adapting the disclosure's informational quality. Based on a sample of 2,309 business and risk sections from annual reports of S&P 1500 firms I provide novel insights that investors in particularly liquid risk markets integrate informational quality of ESG-related information (particularly tone and numerical disclosure) in their risk assessment. More precisely, I show that investors consider firms with ESG disclosures written in a more positive tone as less risky than their peers. This effect is particularly strong for disclosures related to the environment (compared to the other two topics, social and governance, subsumed under ESG). Additionally, I find initial evidence that executives indeed engage in strategic impression management regarding ESG-related information with ESG disclosures being significantly more positively framed the lower a firm's external ESG rating in the previous year.

In all four studies, I provide novel insights into how information is processed in financial markets. The findings of this dissertation further contribute to the still growing strand of behavioral finance literature and offer important implications for practitioners and investors. Taken together, the studies of this dissertation not only indicate that investors incorporate the overall quality of information signals in addition to the information itself but also provide further evidence that executives in some context strategically adapt which and how information is provided to the public.

ZUSAMMENFASSUNG

Die Verfügbarkeit von Daten aller Art hat seit Beginn des 21. Jahrhunderts exponentiell zugenommen. Diskussionen um die Relevanz und Auswertung von Daten haben dabei mittlerweile eine derartige Omnipräsenz in Wirtschaft und Industrie erreicht, dass Experten schon von einem anbrechenden Datenzeitalter (in manchen Zusammenhängen auch Informationszeitalter) sprechen. Während eine stetig zunehmende Verfügbarkeit von Informationen aller Art in allen Bereichen des täglichen Lebens zu beobachten ist, ist diese auf den Finanzmärkten besonders stark ausgeprägt. Währenddessen hat sich die Art und Weise, wie Informationen von Investoren analysiert und verarbeitet werden durch technologischen Fortschritt sowie neuartige Methoden zur Datenanalyse signifikant verändert. Obwohl eine schnellere Auswertung von Informationen oft auch mit einer effizienteren Preisgestaltung und damit einer höheren Effizienz von Aktienmärkten einhergeht, bringt diese Entwicklung auch die Gefahr größerer Informationsasymmetrien mit sich. Dies ist insbesondere dadurch bedingt, dass Unterschiede zwischen erfahrenen Investor*innen, die in der Lage sind, sich das vielfältige Angebot an fortgeschrittenen Datenanalysemethoden und –technologien zu Nutze zu machen, und solchen, die dies nicht sind, größer werden. Vorangegangene wissenschaftliche Untersuchungen zeigen zudem, dass Investor*innen dazu neigen, irrationale Anlageentscheidungen zu treffen, wenn sie zu viele Informationen auf einmal erhalten (im Folgenden: „information overflow“). Daher ist es von besonderer Bedeutung, genau zu verstehen, wie Informationen auf Finanzmärkten bereitgestellt sowie in Investitionsentscheidungen berücksichtigt und verarbeitet werden.

Zwar gibt es bereits eine Vielzahl an wissenschaftlichen Arbeiten, die den Einfluss von irrationaler Entscheidungsfindung und Informationsverarbeitung auf Finanzmärkte untersuchen, doch bestehen diesbezüglich weiterhin Forschungslücken. Fragen, die sich in diesem Zusammenhang immer noch stellen, sind zum Beispiel: Ermöglicht der zunehmende Zugang zu Finanzinformationen institutionellen Investor*innen eine bessere Einschätzung der Konsequenzen von möglichen Verhaltensfehlern und irrationalen Entscheidungsfindungsprozessen von Vorstand*innen? Sind Anleger*innen in der Lage, Informationssignale von irrationalen und/oder irrational handelnden Vorstand*innen richtig zu interpretieren (und diese entsprechend in ihrer Entscheidungsfindung weniger stark zu gewichten)? Wie verhalten sich Investor*innen in Krisenzeiten und einem potenziell damit einhergehenden „information overflow“? Berücksichtigen Investor*innen bei der Beurteilung des Risikos eines Unternehmens neben dem Informationsgehalt selbst auch die Qualität in Jahresabschlüssen bereitgestellter Informationen? Beziehen Vorstand*innen derartige

Marktreaktionen in ihre Entscheidungen mit ein und manipulieren gegebenenfalls sogar strategisch Informationssignale, um Marktreaktionen zum eigenen Vorteil oder zum Vorteil des Unternehmens zu provozieren?

Durch die Durchführung von vier eigenständigen empirischen Forschungsstudien, die jeweils ein Kapitel dieser Dissertation bilden, hoffe ich, einige dieser Forschungslücken zu schließen. In den ersten beiden Kapiteln untersuche ich dabei, ob und wie Anleger*innen auf Informationssignale von übermäßig selbstbewussten (im Folgenden: overconfident bzw. Overconfidence) Vorständ*innen reagieren (Kapitel 2) und wie die in Krisenzeiten getroffenen Entscheidungen solcher Vorständ*innen von Investor*innen wahrgenommen werden (Kapitel 3). Ergänzt werden diese Untersuchungen in Kapitel 4 durch eine Analyse, wie Aktionär*innen besonders emotional aufgeladener Aktien in Zeiten eines besonders hohen Informationsangebots (z.B. während Krisen) auf verschiedene Ereignisse reagieren. Abschließend wird in Kapitel 5 untersucht, ob Investor*innen auch die Informationsqualität und nicht nur den Informationsgehalt selbst in ihre Anlageentscheidungen miteinbeziehen. Außerdem untersuche ich in diesem Kapitel, ob Vorständ*innen Reaktionen von Investor*innen auf bestimmte besonders Risiko-orientierte Veröffentlichungen antizipieren und strategisch steuern. Im Folgenden werden diese vier Untersuchungen kurz beschrieben und ausgewählte Ergebnisse näher erläutert.

Die Analyse von Verhaltensmustern und deren Konsequenzen für Vorständ*innen und Unternehmen ist eines der beliebtesten Forschungsgebiete in der Verhaltensökonomie. Vorgegangene Untersuchungen konzentrieren sich dabei oft auf die Auswirkungen von Verhaltensmustern auf die Entscheidungsfindung von Vorständ*innen und die von diesen geführten Unternehmen. Vereinzelt wird ebenfalls untersucht, wie irrationale Verhaltensmuster und Entscheidungen von Vorständ*innen sich auf die Investitionsentscheidungen von Investor*innen auswirken. Eine Differenzierung zwischen einzelnen Investorengruppen erfolgt zumeist nicht, sodass es bisher nur sehr wenige Erkenntnisse dazu gibt, ob besonders erfahrene (institutionelle) Investor*innen Informationen über irrationale Verhaltensmuster von Vorständ*innen in ihre Anlageentscheidungen einbeziehen. Angesichts des zuvor erwähnten technologischen Fortschritts in der Informationsverarbeitung sowie der steigenden Nutzung moderner, automatisierter Handelsmethoden durch institutionelle Anleger ist es jedoch sehr wahrscheinlich, dass erfahrenere, institutionelle Investor*innen weiche Informationen über Verhaltensmerkmale von Vorständ*innen in ihren Anlageentscheidungen berücksichtigen. In der ersten wissenschaftlichen Arbeit dieser Dissertation untersuche ich daher, ob Shareholder Activists, eine besonders versierte Gruppe

institutioneller Investor*innen, auf Overconfidence-Signale von Vorständ*innen reagieren. Dabei konzentriere ich mich speziell auf die Relevanz des CFOs, der typischerweise eine wichtige Rolle bei Verhandlungen und Kooperationen mit Aktivisten spielt. Auf der Grundlage einer Stichprobe von 16.470 Firmenbeobachtungen und 506 aktivistischen Investitionen zeige ich, dass Shareholder Activists tatsächlich die Overconfidence des CFOs eines möglichen Investitionsziels in ihre Anlageentscheidung miteinbeziehen. Genauer gesagt zeigen die Ergebnisse, dass das Vorhandensein von CFO-Overconfidence die Wahrscheinlichkeit, von einem Shareholder Activist ins Visier genommen zu werden, signifikant verringert. Diese Ergebnisse unterstützen jüngste Untersuchungen, die zeigen, dass Shareholder Activists Investitionen in Unternehmen bevorzugen, deren Vorständ*innen Eigenschaften aufweisen, die eine höhere Wahrscheinlichkeit für erfolgreiche Verhandlungen implizieren. Die Ergebnisse der ersten Untersuchung meiner Dissertation zeigen hierbei, dass Shareholder Activists Anzeichen für CFO-Overconfidence als Warnsignal für langwierige, schwierige Verhandlungen interpretieren. Dieser Effekt nimmt mit der Stärke der Overconfidence des CFOs zu und ist robust gegenüber verschiedenen Berechnungsmethoden für Overconfidence. Darüber hinaus zeigen die Ergebnisse dieser Untersuchung, dass Investor*innen deutlich weniger positiv auf aktivistische Investitionen in Unternehmen mit overconfidenten CFOs reagieren als auf Investitionen in Unternehmen mit nicht-overconfidenten CFOs. Dies deutet darauf hin, dass Investor*innen Investitionen in derartige Unternehmen als weniger erfolgsversprechend ansehen und daher gegebenenfalls schon zum Investitionszeitpunkt von einer niedrigeren Erfolgswahrscheinlichkeit von Verhandlungen ausgehen.

Während die Ergebnisse der ersten Studie darauf hindeuten, dass erfahrene Investor*innen wie Shareholder Activists auf Overconfidence-Signale von Vorständ*innen reagieren, bleibt unklar, ob Investor*innen im Allgemeinen derartige Informationssignale in ihre Anlageentscheidungen einbeziehen. Da Investor*innen häufig auf Informationssignale von Vorständ*innen (z. B. in Jahresabschlüssen, Ad-Hoc Mitteilungen oder Pressekonferenzen) reagieren, ist es von besonderem Interesse zu analysieren, ob Investor*innen den Informationswert solcher Informationssignale richtig einschätzen. Gewöhnliche Investitionsentscheidungen in einzelne Aktien bieten Investor*innen möglicherweise jedoch nicht genügend Anreize, die Verhaltensmerkmale einer Führungskraft umfassend in ihre Anlageentscheidung mit einzubeziehen, da Investor*innen ihre Portfolios verhältnismäßig leicht diversifizieren können (zumindest im Vergleich zu Shareholder Activists). Anders verhält es sich allerdings möglicherweise bei Investitionen, die in hohem Maße vom rationalen

Verhalten von Führungskräften abhängen. Ein Beispiel hierfür sind sogenannte Directors' Dealings (legale Insidergeschäfte von Vorständ*innen). In der zweiten Untersuchung dieser Dissertation untersuche ich daher, ob Investor*innen Hinweise auf mögliches irrationales Verhalten von Vorständ*innen berücksichtigen, wenn sie auf Directors' Dealings reagieren. Dabei konzentriere ich mich speziell auf die Reaktionen der Investor*innen auf Insidergeschäfte während der COVID-19-Pandemie, da die Forschung zeigt, dass eine hohe Informationsqualität solcher Transaktionen in Zeiten hoher Marktunsicherheit und Volatilität besonders wichtig ist. Im Einzelnen zeige ich auf der Grundlage von 1.271 Insidergeschäften von CEOs und CFOs im März 2020, dass Investor*innen das Vertrauenssignal in die Zukunft des betreffenden Unternehmens ignorieren, das normalerweise durch derartige Kaufgeschäfte von Vorständ*innen signalisiert wird. Dies äußert sich insbesondere dadurch, dass Investor*innen im Gegensatz zu in vorhergehender Literatur gefundenen positiven Reaktionen auf Aktienkäufe von Vorständ*innen stark negativ auf Kaufentscheidungen von Vorständ*innen während COVID-19 reagieren. Investor*innen reagieren dabei signifikant negativer auf Käufe, die von overconfidenten Vorständ*innen getätigt werden als auf Käufe, die von nicht-overconfidenten Vorständ*innen getätigt werden. Dies deutet auf ein mangelndes Vertrauen in den Wert des Informationssignals hin, das von den Geschäften dieser Vorständ*innen ausgeht, und stützt somit die Hypothese, dass Anleger mögliche negative Effekte von Verhaltensverzerrungen in ihre Bewertung der Informationsqualität der Geschäfte von Vorständ*innen einbeziehen.

Vorangegangene wissenschaftliche Untersuchungen zeigen, dass die Informationsdichte für Investor*innen während der COVID-19-Pandemie besonders hoch war. Die Ergebnisse der zweiten Untersuchung dieser Dissertation deuten darauf hin, dass Investor*innen zumindest teilweise dennoch in der Lage sind, relevante Informationen über die Overconfidence von Vorständ*innen aufzunehmen und Investitionsentscheidungen entsprechend anzupassen. Unklar bleibt jedoch, ob dies auch für Aktionär*innen von Unternehmen zutrifft, die besonders stark von der COVID-19-Pandemie getroffen wurden, sowie Aktionär*innen neben finanziellen Anreizen zusätzliche Investitionsanreize (z.B. emotionaler Natur) bieten. In meiner dritten Untersuchung analysiere ich daher, wie Aktionär*innen börsennotierter Fußballvereine auf den Ausbruch von COVID-19 reagieren und welche Kriterien dazu beitragen, dass einige der betrachteten Vereine besonders stark von den Auswirkungen der COVID-19-Pandemie betroffen sind. Aktien von Fußballunternehmen bieten sich dabei aus zwei Gründen für diese Analyse an: Erstens zeigen vorhergehende wissenschaftliche Studien, dass Aktionär*innen von Fußballvereinen häufig neben finanziellen Anreizen auch emotionale Motive

haben, eine Aktie eines Vereins zu erwerben (z. B. Fan-Investitionen), und zweitens ist die Fußballbranche eine der am stärksten von COVID-19 betroffenen Branchen. Anhand einer Stichprobe von 22 europäischen Fußballaktien zeige ich, dass Fußballvereine unmittelbar nach dem Ausbruch von COVID-19 in Europa signifikante negative abnormale Renditen nach mehreren COVID-19-bezogenen Ereignissen aufweisen. Ich liefere außerdem empirische Belege dafür, dass Vereine, die zu diesem Zeitpunkt noch an internationalen Pokalwettbewerben teilgenommen haben, dabei durch ihre verhältnismäßig hohe Abhängigkeit von internationalen Reisebeschränkungen besonders hohe negative abnormale Renditen aufweisen. Weitergehende Analysen der Handelsvolumina in der Zeit direkt nach dem Ausbruch der COVID-19-Pandemie ergeben, dass Investor*innen zwar scheinbar anfänglich auf den Ausbruch von COVID-19 überreagieren, ihr Vertrauen jedoch vergleichsweise schnell auf das Niveau von vor dem Ausbruch von COVID-19 zurückzukehren scheint.

Die ersten drei Studien dieser Dissertation liefern neue Erkenntnisse darüber, wie Investor*innen auf Informationssignale irrationaler Vorständ*innen reagieren, und geben Aufschluss darüber, wie Informationen in Zeiten hoher Unsicherheit und Volatilität verarbeitet werden. Alle drei Studien gehen implizit davon aus, dass die analysierten Informationssignale unverzerrt sind und somit nicht von Vorständ*innen manipuliert wurden. Vorangegangene wissenschaftliche Studien deuten jedoch darauf hin, dass Vorständ*innen in einigen Fällen tatsächlich strategisch anpassen, welche und wie Informationen veröffentlicht werden. Die unverfälschte Bereitstellung von Informationen ist allerdings besonders wichtig in Märkten mit hoher Informationsasymmetrie sowie für Themen, die mit hohen Kosten der Informationsbeschaffung oder erheblicher Unsicherheit hinsichtlich der Informationsqualität von unternehmerischen Veröffentlichungen zu diesem Thema verbunden sind. Ein Thema, das in besonderem Maße mit Unsicherheiten hinsichtlich der Informationsqualität verbunden ist, sind Environment, Social und Governance (ESG) bezogene Risiken eines Unternehmens (vor allem aufgrund fehlender quantifizierbarer Daten und erheblicher Unterschiede in der Bewertung von ESG-Informationen durch externe Ratinganbieter und -agenturen). In der vierten empirischen Untersuchung dieser Dissertation analysiere ich daher, wie Investoren in Risikomärkten auf die Informationsqualität ESG-bezogener Unternehmensveröffentlichungen reagieren und ob Vorständ*innen versuchen, durch strategische Anpassung der Informationsqualität vorteilhafte Marktreaktionen hervorzurufen. Basierend auf einer Stichprobe von 2.309 „Business and Risk“-Kapiteln aus Jahresberichten von S&P 1500 Unternehmen liefere ich damit neue Erkenntnisse

darüber, dass Investoren in besonders liquiden Risikomärkten die Informationsqualität von ESG-bezogenen Informationen (insbesondere deren Ton und den Anteil quantifizierbarer Informationen) in ihrer Risikobewertung berücksichtigen. Dabei zeige ich vor allem, dass Anleger Unternehmen, die ESG-Informationen in einem positiveren Ton veröffentlichen, als weniger riskant einschätzen als ihre Konkurrenten. Dieser Effekt ist besonders stark für umweltbezogene Informationen ausgeprägt. Darüber hinaus bietet die Untersuchung erste Belege dafür, dass Vorständ*innen tatsächlich strategische Anpassungen im Bezug darauf vornehmen, wie ESG-bezogene Informationen in Jahresabschlüssen formuliert werden. Die Ergebnisse liefern hierbei Indizien, dass Informationen zu ESG-Risiken signifikant positiver formuliert werden, je schlechter das externe ESG-Rating eines Unternehmens im Vorjahr ausgefallen ist.

In allen vier Studien liefere ich neue Erkenntnisse dazu, wie Informationen von Anleger*innen in Finanzmärkten berücksichtigt und verarbeitet werden. Die Ergebnisse meiner Forschung leisten hierbei einen wichtigen Beitrag zur akademischen Forschung und haben wichtige Implikationen für Praxisanwender*innen und Investor*innen. Zusammengenommen zeigen die Studien dieser Dissertation, dass Investor*innen neben den Informationen selbst auch die Gesamtqualität der zur Verfügung gestellten Informationen berücksichtigen. Darüber hinaus liefern die Untersuchungen dieser Dissertation zudem weitere Belege dafür, dass Vorständ*innen in bestimmten Kontexten strategische Überlegungen vornehmen, welche Informationen und auf welche Weise diese der Öffentlichkeit zur Verfügung gestellt werden.

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LIST OF ABBREVIATIONS

AR	<i>Abnormal Return</i>
BHAR	<i>Buy-and-Hold Abnormal Return</i>
BMP	<i>Standardized Cross-Sectional Test (after Boehmer, Musumeci, and Poulsen)</i>
BVB	<i>Ballspielverein Borussia 09 e.V.</i>
CAAR	<i>Cumulative Average Abnormal Return</i>
CAPM	<i>Capital Asset Pricing Model</i>
CAR	<i>Cumulative Abnormal Return</i>
CDS	<i>Credit Default Swap</i>
CEO	<i>Chief Executive Officer</i>
CFO	<i>Chief Financial Officer</i>
CISDM	<i>Center for International Securities and Derivatives Markets</i>
COVID-19	<i>Corona Virus Disease 2019</i>
CRSP	<i>Center for Research in Security Prices</i>
CSR	<i>Corporate Social Responsibility</i>
DFL	<i>Deutsche Fußball Liga</i>
DID	<i>Differences-in-Differences</i>
EBIT	<i>Earnings Before Interest and Taxes</i>
EBITDA	<i>Earnings Before Interest, Taxes, Depreciation, and Amortization</i>
EC	<i>ExecuComp</i>
ECA	<i>European Club Association</i>
EDGAR	<i>Electronic Data Gathering, Analysis, and Retrieval</i>
ESG	<i>Environment, Social, and Governance</i>
ETF	<i>Exchange-Traded Fund</i>
EU	<i>European Union</i>
EUR	<i>Euro</i>
FC	<i>Football Club</i>
FE	<i>Fixed Effects</i>
FTSE	<i>Financial Times Stock Exchange Group</i>
GDP	<i>Gross Domestic Product</i>
HHI	<i>Herfindahl-Hirschman Index</i>
I/B/E/S	<i>Institutional Brokers Estimate System</i>
IPO	<i>Initial Public Offering</i>
IRRC	<i>Investor Responsibility Research Center</i>
IT	<i>Information Technology</i>
ISS	<i>Institutional Shareholder Services</i>
KPMG	<i>Klynveld Peat Marwick Goerdeler</i>
LDA	<i>Latent Dirichlet Allocation</i>

LMD	<i>Loughran-McDonald</i>
MD&A	<i>Management's Discussion and Analyses</i>
MTB	<i>Market-to-Book</i>
OC	<i>Overconfidence</i>
OLS	<i>Ordinary Least Squares</i>
OTC	<i>Over-the-Counter</i>
PLC	<i>Public Limited Company</i>
R&D	<i>Research & Development</i>
ROA	<i>Return on Assets</i>
S&P	<i>Standard & Poor's</i>
S&P 1500	<i>Standard & Poor's Composite 1500 Index</i>
SARS	<i>Severe Acute Respiratory Syndrome</i>
SD	<i>Standard Deviation</i>
SEC	<i>Securities and Exchange Commission</i>
SEO	<i>Seasoned Equity Offering</i>
SHA	<i>Shareholder Activism</i>
SIC	<i>Standard Industrial Classification</i>
SME	<i>Small and Medium Enterprises</i>
T-Bill	<i>Treasury Bill</i>
TR	<i>Thomson Reuters</i>
TRBC	<i>Thomson Reuters Business Classification</i>
UEFA	<i>Union of European Football Associations</i>
U.S.	<i>United States</i>
USD	<i>United States Dollar</i>
VADER	<i>Valence Aware Dictionary and Sentiment Reasoner</i>
WHO	<i>World Health Organization</i>

Chapter 1

INTRODUCTION

In this chapter, I outline the motivation, context, and structure of my dissertation. Each of the four content sections of my dissertation is thereby shortly summarized and put into context with regard to the overarching research model of the dissertation.

1.1. Motivation and research context

In 2020 alone, more than 64 zettabytes of new data were produced, copied, and consumed globally with more data being generated in any two days than all of humanity produced before the year 2003 (International Data Corporation, 2020).¹ While the proliferation of data is spanning across all business areas, it is particularly pronounced in financial markets. The average annual report length of a U.S. firm, for example, increased by nearly 40% between 1997 and 2014 with the most comprehensive annual reports now reaching nearly 110,000 words, longer than some of the world's most popular novels (Monga & Chasan, 2015).² In parallel, the evolution of technology in recent years has significantly altered the way how information is analyzed and incorporated into investment decisions. Sophisticated, often institutional, investors such as hedge funds increasingly deploy new investment approaches using algorithm-based trading (e.g., high-frequency trading) and sophisticated text mining techniques such as natural language processing and complex pattern analyses. As this potentially further increases disparities between sophisticated and non-sophisticated, ordinary investors (Haeberle, 2019), it is particularly important to fully understand how the proliferation of new information affects financial markets.

Traditional finance literature long argued that investors generally benefit from a high availability of information as it leads to more efficient price discovery and more informative market prices (Fama, 1970, 1991; Fishman & Hagerty, 1992). Following the efficient market hypothesis of Fama (1970, 1991) price changes are assumed to always reflect the correct reaction of market participants to genuinely new information. Humans are thereby assumed to be rational in reacting to new information, able to process and incorporate all new information correctly, and always act according to the paradigm of being a rational utility-maximizing agent (*homo oeconomicus*). However, recent examples of substantial stock market price spikes that seemingly occurred without the publication of any new substantial fundamental information such as the price swings of the so-called meme stocks GameStop and AMC Entertainment³ and the 14,000% rally of the cryptocurrency Dogecoin in early 2021 increasingly cast doubt on the notion of rational incorporation of information in financial markets.

¹ To put this into relation, one zettabyte is equivalent to the storage of about 250 billion DVDs (Cisco, 2011).

² 100,000 words correspond to around ~300 pages in standard formatting.

³ On January 27, 2021, the market cap of GameStop, a loss-making retailer of video games, gaming merchandise, and consumer electronics, suddenly increased to USD 24 bn up from below USD 2 bn in December 2020 (Phillips and Lorenz, 2021). While the stock price increase was seemingly unwarranted by firm fundamentals, it seemed to be primarily fueled by members of WallStreetBets, a subforum of the social news website Reddit. Several, particularly vocal, members believed the stock was oversold by institutional investors and therefore encouraged other members

Research from the still emerging field of behavioral finance provides an alternative explanation of how information is incorporated into prices. In behavioral finance, humans are no longer rational utility-maximizing agents who are able to correctly analyze all available information and act accordingly but rather individuals who are subject to behavioral biases and judgment errors and are incapable of integrating all available information in their decision-making (Tversky & Kahneman, 1974). The higher availability of relevant information observed in recent years may hence only be useful for ordinary investors as long as they can process and act upon emerging information accordingly. Schroder et al. (1967) and Speier et al. (1999), however, show that the individual performance in decision-making tasks increases with additional information only up to a certain point after which it declines significantly (this point is also called “information overload”). The issue of information overload is thereby even further aggravated when task complexity increases (e.g., in trading decisions under uncertainty) (Payne et al., 1996).

In the context of the increasing proliferation of information, information overload can affect market efficiency in two ways. Firstly, research provides evidence that information overload may cause irrational behavior by, for example, causing investors to sub-optimally allocate funds in the direction of least resistance (e.g., by choosing the default option when asked how to structure their pension investments) (Agnew & Szykman, 2005) or by increasing investor confirmation bias⁴ (Goette et al., 2020). Secondly, as O. Kim and Verrecchia (1994) point out new financial information, particularly when it is complex, often leads to higher information asymmetries⁵ between market participants. The authors thereby argue that the dissemination of increasingly complex information (e.g., in corporate disclosures) enables more sophisticated traders to make superior judgments in their trading decisions than other, less-informed market participants who might not be able to correctly interpret such information. These information asymmetries are likely to increase significantly with the amount of data available to investors as sophisticated institutional traders are often better able to make use of information aggregation technologies and/or advanced text-mining such as natural language

to buy GameStop stock regardless of fundamentals to provoke a short squeeze. Although no information was provided that was not publicly available before, the herd behavior that followed the initial news coverage of WallStreetBets and involved a significant number of unsophisticated first-time investors (Otani, 2021), made the stock one of the most traded stocks on the U.S. stock market (Lowenstein, 2021). Similar WallStreetBets-induced price swings were also observed for the movie theater chain AMC Entertainment and a few other stocks.

⁴ Confirmation bias describes the tendency to seek, categorize, and/or ignore new information according to an individual’s experience, knowledge, or expectations (Goette et al., 2019).

⁵ In his seminal paper, Akerlof (1970) defines information asymmetry as a situation where one party in a relationship (in this case, sellers of a product/security) possesses more information than the other party (in this case, the buyer of a product/security).

processing to leverage the observed proliferation of available information. The potential negative externalities of information overload are even further aggravated by the current evolution of technology-based trading strategies (e.g., high-frequency trading) which are often exclusively available to experienced institutional investors.

Taken together, the proliferation of information through corporate disclosures, internet forums, news sites, and financial data providers as well as the concomitant increase of information asymmetries poses interesting new avenues of research: Does the increasing access to information enable sophisticated institutional investors to correctly assess and seize behavioral biases of executives? Are retail investors able to correctly interpret (and potentially devalue) information signals provided by irrational decision-makers in exchange-listed firms? How do investors behave in times of crises and concomitant information overload? Do investors also incorporate the informational quality of public disclosures (and not only its information content) when assessing a firm's prospects and risks? Do executives anticipate these market reactions and potentially strategically manipulate information signals to provoke market reactions for the firm's or their own benefit?

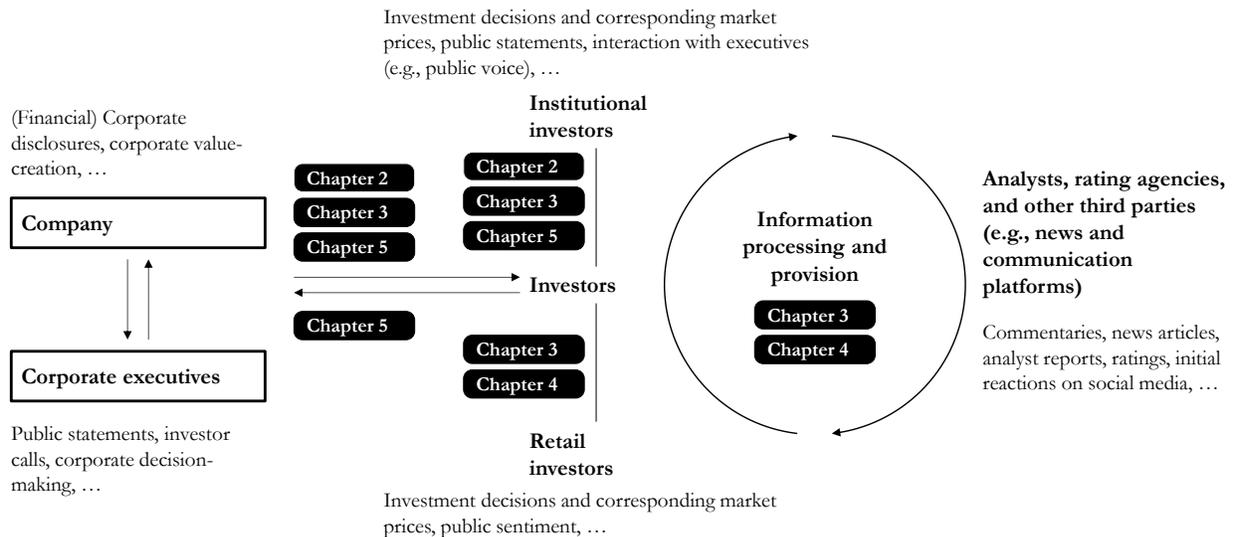
The goal of my dissertation is to provide a holistic view on the interaction between information processing (and concomitant potential information overload) and behavioral biases of market participants as well as to offer potential answers to some of the aforementioned research questions. To structure my analyses, I revert to the segmentation of behavioral biases in financial markets provided by Malmendier (2018) who states that there are three different types of market participants with potentially irrational behavior: investors, corporate managers, and other third parties such as financial intermediaries, journalists, and analysts. In each of the four research papers of my dissertation, I either analyze (potentially) irrational market participants who interact with rational managers, rational market participants who interact with irrational managers, or irrational third parties (e.g., market makers, analysts, journalists) who interact with rational market participants and managers.

1.2. Structure of the dissertation and research questions

In this dissertation, I conduct four distinct empirical studies to further link behavioral finance research with research on how information is processed by capital market participants. Each of the empirical studies thereby focuses on a different part of the information flow in financial markets and constitutes a comprehensive self-standing research paper (i.e., including separate sections on literature, theory and hypotheses, methodology, results, implications, and conclusion). Figure 1-1 further outlines how the

four papers of this dissertation jointly help to further disentangle the relationship between the provision and processing of information and Malmendier's (2018) three different types of market participants relevant for behavioral finance literature.

Figure 1-1: Overview of information flow and focus of each chapter of this dissertation



This figure provides an overview of the flow of information in financial markets (own representation). It further outlines how the four papers of this dissertation help to disentangle the relationships between different types of market participants and how information (e.g., on behavioral biases of executives) is provided to and processed by investors.

Chapter 2 contains the first study and sheds light on how publicly available information on behavioral characteristics and biases of corporate executives is processed and incorporated into investment decisions by shareholder activists, a particularly publicly visible sub-group of institutional investors known for trying to influence a target's managerial decision-making. In Chapter 3, I further expand the analysis of how publicly available information on corporate executive characteristics and behavioral biases is incorporated into investment decisions from institutional investors to all investors. More precisely, I analyze whether investors devalue information signals provided by biased executives in times of high market volatility and concomitant high risk of information overflow during the outbreak of the novel Coronavirus (COVID-19) in early 2020. These insights are further complemented by the third empirical study in Chapter 4 which shifts the perspective from the impact of a period of high market volatility on the interplay between irrational executives and investors to its impact on potentially irrational market participants. Specifically, I examine how investors in football stocks, a subgroup of particularly emotionally charged stocks, react to the information signals in the wake of the outbreak of COVID-19. Chapter 5 focuses on the interplay between information provided

by corporate executives and a market's risk assessment of the respective firm. While the previous studies are focused on how markets react to information signals, this study goes a step further by analyzing how informational quality plays a role and whether executives manipulate how information is provided by using strategic impression management strategies. Lastly, in Chapter 6, I provide an overarching conclusion summarizing my main findings and elaborate on the contributions to academic research and practical implications. I conclude the chapter with suggestions for further research.

All sections combined, this dissertation provides a comprehensive picture of how information is processed in financial markets and how information processing interacts with behavioral biases and irrational behavior of market participants. In the following, I provide further details on each empirical study, outline their overall research questions, and contextualize each section regarding related academic literature (a summary of the theoretical and practical contributions of each study as well as the main research questions can also be found in Table 1-1 at the end of this chapter).

1.2.1. CFO overconfidence and shareholder activism

Information conveyed by executives of publicly listed corporations has long helped investors, analysts, and other interested third parties to contextualize value-relevant corporate decisions. Investors thereby traditionally focused primarily on the information conveyed in earnings calls, management presentations, and executive-driven sections of annual reports (e.g., Business Description & Risk and Management Discussion & Analysis (MD&A) sections in a firm's 10K). However, with increasing information availability and technological means to analyze available information, investors began to also incorporate softer factors such as how the information is provided (e.g., tone and wording) as well as the behavior of the firm's executives. Multiple hedge funds and other sophisticated institutional investors, for example, have established proprietary behavioral analyses units (Albert Bridge Capital, 2021), launched dedicated behavioral-focused investment funds (J.P. Morgan, 2021), or engaged behavioral intelligence firms to analyze executive behavior and language (Vardi, 2013). While previous research shows that investors take behavioral biases into account (Hilary & Hsu, 2011; Malmendier & Tate, 2008), research with regard to how sophisticated institutional investors incorporate behavioral biases in their investment decisions remains sparse.

In my first study, I analyze whether shareholder activists, a particularly sophisticated type of institutional investor that often tries to actively influence corporate decision-making, incorporate behavioral biases of executives in their investment decisions. I thereby specifically focus on the relevance of the CFO who typically plays an important role in negotiations and collaborations with

activists (Teitelbaum, 2017), and the specific bias of managerial overconfidence. Most behavioral finance research focused on managerial biases centers around executive overconfidence or some variation of it (e.g., hubris, narcissism)⁶ and hence provides proven, well-established models to proxy overconfidence to which institutional investors might revert to.

With my dissertation, I hope to address three important gaps in corporate finance research. First, research on the antecedents of shareholder activism still yields controversial results and mainly focuses on firm fundamentals and governance factors (Goranova & Ryan, 2014). By analyzing whether activists also incorporate behavioral executive characteristics in their investment decisions, I help to further strengthen and expand initial findings by Francis et al. (2021) and Gupta et al. (2018) who show that activists consider CEO characteristics such as gender when investing in a target to assess the likelihood of negotiation success. Second, research on behavioral biases of executives and the link between executives and shareholder activism has so far exclusively focused on CEOs. To my knowledge, there exists no research yet on the role of the CFO and potential biases of the CFO for the target selection process of shareholder activists. Third, my research links the so far disjunct research strands of behavioral finance and shareholder activism. By analyzing the CFOs of all S&P 1500 for the years 2003 to 2017, I thereby provide empirical evidence to the following two research questions:

RQ1-1: Do shareholder activists consider information on executive (behavioral) characteristics in their investment decision?

RQ1-2: What role does the CFO play for shareholder activists?

More precisely, based on a sample of 16,470 firm-year observations and 506 activist investments, I analyze whether the presence of an overconfident CFO impacts the likelihood of an activist investment in a given year. Using different multivariate logit regressions, established proxies of overconfidence, and controlling for other CFO characteristics such as gender and age as well as CEO overconfidence, I provide evidence that activists indeed take CFO overconfidence into account. More precisely, the results further support the hypotheses of Francis et al. (2021) and Gupta et al. (2018) by indicating that CFO overconfidence significantly decreases the probability to be targeted by an activist as CFO overconfidence is potentially linked to a lower likelihood of negotiation success. This effect increases with the strength of CFO overconfidence and is robust to different overconfidence proxies. The

⁶ According to Malmendier (2018) 51% of all papers focused on managerial biases (until 2018) analyze managerial overconfidence and its effects on managerial decision-making.

results further indicate that ordinary investors acknowledge the lower likelihood of negotiation success of activist investments in firms with overconfident CFOs and react significantly less positively to such investments than to investments in firms with non-overconfident CFOs.

1.2.2. Market perception of C-level overconfidence

The results of the first study indicate that sophisticated investors such as shareholder activists indeed incorporate behavioral characteristics of executives in their investment decisions. It remains unclear though whether investors in general are willing and able to commit the required resources and time to incorporate information on behavioral characteristics in their investment decisions. This is especially true given that ordinary investment decisions potentially do not provide investors with sufficient incentives to incorporate information on behavioral characteristics as they are typically better able to diversify than shareholder activists (Denes et al., 2017). This might be different for investment decisions though which are highly dependent on the rational behavior of such executives. One example of such investment decisions are trades based on so-called directors' dealings.

Directors' dealings are trades by key executives of a firm in the shares of their own company and typically increase the informational value of a firm's stock prices by providing signals about the firm's prospects to the market (Leland, 1992). Investors often trade upon directors' dealings and, for example, follow significant purchases undertaken by executives (Bettis et al., 1997; Lakonishok & Lee, 2001). It is hence of particular importance that the information signal conveyed by directors' dealings is of high quality and that executives engaging in directors' dealings act rationally. Research, however, on whether investors incorporate potential behavioral biases and executive characteristics in their investment decisions following directors' dealings remains sparse.

In the second study of this dissertation, I hence analyze whether investors take executive characteristics into account when reacting to directors' dealings during the outbreak of COVID-19. The high degree of uncertainty immediately following the outbreak of COVID-19 provides an ideal setting for this research as Gangopadhyay et al. (2009) indicate that the informational value of directors' dealings is particularly high during times of high uncertainty and market volatility. I thereby especially focus on the effect of CEO and CFO overconfidence on the reaction to directors' dealings and hence address the aforementioned research gap concerning the importance of CEO/CFO characteristics regarding investor reactions to directors' dealings. More precisely, I provide empirical evidence to the following two research questions:

RQ2-1: Do investors consider CEO/CFO behavioral characteristics when assessing the information content of directors' dealings?

RQ2-2: How do investors react to directors' dealings during COVID-19?

The empirical analyses are based on 1,271 directors' dealings of CEOs and CFOs of S&P 1500 firms and are restricted to the month of March 2020 to focus on the immediate effects of COVID-19. The results provide evidence that purchases by overconfident executives provoke a more negative market reaction in the aftermath of the outbreak of COVID-19 than purchases by their non-overconfident peers indicating a lack of trust in the value of the information signal provided by the directors' dealings of these executives. The results further show that the stock market reaction is more pronounced to transactions by female executives supporting the findings of gender stereotyping of Gregory et al. (2013). Taken together, the results extend the findings of my first study by showing that not only shareholder activists take into account behavioral characteristics of executives in their investment decisions but also investors in general.

1.2.3. A beautiful game on hold

The results of the first two studies show that investors in general, and shareholder activists in particular, incorporate insights on behavioral characteristics and biases of executives in their investment decisions. The second study further shows that this also holds true in times of high market uncertainty and volatility immediately after the outbreak of COVID-19. Both studies, however, implicitly assume that investors are rational and optimally react to potential inefficiencies caused by behavioral biases of executives. Examples such as the aforementioned price swings of meme stocks in January 2021, however, indicate that investors are not necessarily rational. Given that information overload was particularly high during COVID-19 (Liu et al., 2021; Mohammed et al., 2021) and its effect on irrational investor behavior, it might be conceivable that some subgroups of shareholders act less rationally during the outbreak of COVID-19 than others.

Research shows that investors indeed act irrationally and consider factors other than the dissemination of new information (and factors unrelated to the stock market) such as weather (Hirshleifer & Shumway, 2003), which day of the week it is (French, 1980), and football results (Edmans et al., 2007) in their investment decisions. This is further supplemented by findings of DeAngelo et al. (2010) who show that corporate executives are aware of this and try to seize these irrationalities by, for example, timing seasoned equity offerings (SEOs) to profit from comparably high

market valuations. An investor subgroup that might be particularly susceptible to the impact of emotion in times of high volatility and market uncertainty are investors in football stocks. Tiscini and Strologo (2016), for example, argue that football stocks are often also held because of socio-economic benefits to shareholders such as the emotional benefits of owning a part of your favorite team.

In my third study of this dissertation, I analyze how investors in stock-listed football clubs react to the outbreak of COVID-19 and whether some clubs are differently affected than others. This setting is particularly rewarding for two reasons. Firstly, the football industry is one of the industries most affected by the outbreak of COVID-19 as competitions around the world were suspended for several months following the outbreak of COVID-19. If investors in such stocks act rationally it can be expected that they exert similar behavior to what is observed by Rösch and Kaserer (2013) who find that investors tend to move out of illiquid, lower-quality stocks in times of crises and high market volatility. Secondly, as Liu et al. (2021) and Mohammed et al. (2021) point out, the flashing events after the outbreak of COVID-19 might have led to significant COVID-19 related information overflow which in turn might have particularly induced irrational investor behavior. More precisely, I provide empirical evidence to the following two research questions:

RQ3-1: How did the outbreak of COVID-19 affect investors in football stocks?

RQ3-2: Which clubs were affected most severely by the outbreak of COVID-19?

The empirical analyses are based on a sample of 22 European football stocks and focused on the months immediately following the outbreak of COVID-19. Using an event study methodology specifically adapted for illiquid stocks, I show that football clubs exhibit significant negative abnormal returns after the announcement of the first national European lockdown in Italy (March 9) and the respective announcement of league suspensions for each club. In further robustness checks, I find no such effects for these event dates for similarly adversely affected stocks in the travel and hospitality industry. Those clubs that were particularly affected by these events were predominantly clubs that were still competing in international cup competitions and, hence, had a comparably high revenue exposure in case of a prolonged COVID-19-induced interruption of competitions. The substantial differences between clubs competing internationally and their peers also persist in subsequent analyses of trading volumes. The results of these analyses indicate that clubs still competing internationally exhibited significantly higher trading volumes after the outbreak of COVID-19 signaling a lower degree of investor confidence in the respective stocks. Furthermore, these analyses also suggest that

although investors initially seem to overreact to the outbreak of COVID-19, investor confidence seems to return comparably quickly to pre-COVID-19 levels.

1.2.4. The information content of ESG disclosures and the public perception of credit risk

The first three studies of this dissertation indicate that although investors and executives tend to be irrational in certain situations, investors seem to incorporate informational quality when reacting to information signals provided by corporate executives (e.g., by devaluing purchase decisions undertaken by overconfident executives). The analyses, however, implicitly assume that the corporate executives who exhibit overconfidence signals are not aware of the aforementioned market reactions by investors and hence do not strategically manipulate such signals. Research, however, increasingly indicates that some executives indeed engage in strategic impression management (Falschlunger et al., 2015; Hribar et al., 2017). This should be particularly relevant for information linked to topics that exhibit significant information asymmetries such as disclosures on ESG-related topics.⁷

Research regarding the informational quality of ESG-related disclosure, concomitant market reactions, and the impact of executives on such informational quality remains sparse and is primarily focused on equity markets. ESG-related information, however, is even more important for debt markets as well as for the market's assessment of a firm's risk given that ESG risks are often important tail risks for investors in such markets (Reber et al., 2021). A lack of quantifiable data and significant differences in how ESG information is assessed by external rating providers and agencies (Berg et al., 2020) significantly complicate an unbiased outside-in assessment of informational quality regarding a firm's ESG-related risks for investors. This makes investors in risk markets particularly dependent on the accuracy of the provided ESG information and thus susceptible to a biased dissemination of information by executives (Feifei Li & Polychronopoulos, 2020).

In the fourth empirical study of this dissertation, I hence analyze how investors in risk markets react to the informational quality of ESG-related financial disclosures and whether corporate executives try to anticipate these reactions by engaging in strategic impression management. I thereby specifically focus on investors in Credit Default Swaps (CDS)⁸ and expand the first three studies in two ways.

⁷ The risk of information asymmetry and its potential effect on returns are particularly high for ESG-related disclosures as the provided information is often qualitative and might hence be interpreted differently by different investors and rating agencies (Berg et al., 2020).

⁸ CDS insure the buyer against a default of a specific corporate bond and constitute one of the largest Over-the-Counter (OTC) markets. CDS spreads are particularly suitable as a risk measure as they are highly standardized, reflect debt-related news and changes in creditworthiness more quickly than credit ratings, and are traded with a higher frequency than corporate bonds (Finnerty et al., 2013; Hull et al., 2004).

Firstly, the first three studies are focused on unidirectional settings in which investors either react to irrational behavior of executives or to external events such as the outbreak of COVID-19. In this study, I expand the findings of the previous studies by also analyzing how executives try to incorporate market reactions to disclosures in their decision-making and whether they actively attempt to provoke beneficial market reactions. Secondly, I particularly build on the findings of the second study which finds that investors incorporate external information to evaluate the quality of information signals. More precisely, I analyze in a more comprehensive approach whether investors incorporate how and in what quality information is conveyed in corporate disclosures. I thus provide empirical evidence to the following two research questions:

RQ4-1: How does the informational quality of ESG disclosures affect a firm's perceived risk by investors?

RQ4-2: Do executives engage in strategic impression management regarding ESG?

The empirical analyses are based on a sample of 2,309 annual reports of S&P 1500 firms over the years 2003 to 2016 and focus on the reaction of CDS markets to the informational quality of ESG-related disclosures in the business and risk section of a firm's 10K-filing, a section directly under the influence of a firm's executives. Using natural language processing and text mining, I find that investors in CDS markets indeed integrate the informational quality of ESG-related information (particularly tone and numerical disclosure) in their assessment of a firm's creditworthiness. These results are particularly strong for disclosures of particularly risk-relevant information such as information related to the environment. More precisely, I find that a higher degree of environment-related information leads to a tightening of CDS spreads. The same is true for environment-related disclosures that are written in a more positive tone and contain more numerical information indicating that information related to these potentially high tail risks seem to be more relevant for investors. I further find initial evidence that executives indeed engage in strategic impression management regarding ESG-related information as firms with subpar ESG scores tend to disclose significantly more positive ESG-related disclosures and a higher degree of quantitative information in subsequent years.

Table 1-1: Structure of the dissertation

Study	Chapter 2 <i>CFO overconfidence and shareholder activism</i>	Chapter 3 <i>Market perception of C-level overconfidence</i>	Chapter 4 <i>A beautiful game on hold</i>	Chapter 5 <i>The information content of ESG disclosures and the public perception of credit risk</i>
Overarching research questions	<p>RQ1-1: Do shareholder activists consider information on executive (behavioral) characteristics in their investment decision?</p> <p>RQ1-2: What role does the CFO play for shareholder activists?</p>	<p>RQ2-1: Do investors consider CEO/CFO behavioral characteristics when assessing the information content of directors' dealings?</p> <p>RQ2-2: How do investors react to directors' dealings during COVID-19?</p>	<p>RQ3-1: How did the outbreak of COVID-19 affect investors in football stocks?</p> <p>RQ3-2: Which clubs were affected most severely by the outbreak of COVID-19?</p>	<p>RQ4-1: How does the informational quality of ESG disclosures affect a firm's perceived risk by investors?</p> <p>RQ4-2: Do executives engage in strategic impression management regarding ESG?</p>
Research design and sample size	Empirical analysis of 506 activist investments in S&P 1500 firms between 2003 and 2017	Empirical analysis of 1,271 directors' dealings of S&P 1500 CEOs/CFOs after the outbreak of COVID-19	Empirical analysis of 22 stock-listed football clubs after the outbreak of COVID-19	Empirical and textual analysis of 2,309 business and risk sections of annual reports of S&P 1500 firms
Methodology	Logit/ordinary-least-squares regressions, event study, difference-in-differences	Ordinary-least-squares regressions, event study	Ordinary-least-squares regressions, event study	Ordinary-least-squares regressions, natural language processing, text mining
Academic relevance of results	Analyze relevance of CFOs and (behavioral) characteristics for activists	Link (behavioral) executive characteristics to market reactions to directors' dealings	Understand how stocks in industries particularly affected by COVID-19 react to COVID-19	Empirically support research on strategic impression management and expand it to ESG
Practical relevance of results	Provide CEOs/CFOs with further insights into potential investment motives of activists	Help investors to analyze signals of the informational quality of directors' dealings	Help club executives to understand how and when different clubs were affected by COVID-19	Provide an open-source mechanism to analyze ESG-related informational quality to investors

Chapter 2

CFO OVERCONFIDENCE AND SHAREHOLDER ACTIVISM⁹

A key objective of shareholder activists is to persuade a firm's management to change its strategy. CFOs play an important role in negotiations, yet activism research mainly focuses on CEOs. We examine the relationship between CFO overconfidence and the likelihood to get targeted by activists. Using established overconfidence measures, we provide evidence that activists take CFO overconfidence into account when deciding to invest in a firm with firms managed by overconfident CFOs being significantly less likely to get targeted. These effects increase with the strength of CFO overconfidence and persist for different overconfidence proxies. Firms with overconfident CFOs also exhibit less positive abnormal returns after activism events. These results extend recent evidence by indicating that activists also focus on a target firm's CFO and are likely to take the negotiation willingness of a potential target's executives into account when deciding whether to invest in a firm.

⁹ This chapter is largely based on a working paper co-authored with Dirk Schiereck and Denis Schweizer.

2.1. Introduction

"If every company were managed well, there wouldn't be any need for activists. There might still be a few, but there wouldn't be any reason for them. But the truth is that at some companies, the managers forget who they are really working for and it becomes their own playpen. And at others the managers are sometimes incompetent." (Buffet, 2015)

In the past years, there has been an avid public debate about the benefits and drawbacks of shareholder activists. ShareAction's pivotal role in the announcement of British supermarket group Tesco to increase healthy food options in 2021 (Davey, 2021), Elliott Management's involvement in Marathon Petroleum Corp leading to a spinoff of its gas station business to the owners of the convenience store chain 7-Eleven in 2020 (R. Elliott, 2020), and Carl Icahn's partially successful demand for a large-scale share buyback by Apple in 2015 (Treanor, 2015) are only a few examples of minority shareholders forcing major changes at multi-billion-dollar corporations. While some of these activist-imposed changes have led to long-term value-creation, activists are often regarded as short-termist with most of the returns only benefiting the activist investor – often at the expense of other, more long-term shareholders (Cremers et al., 2018). In past years, public companies have received more pressure from shareholders than ever before with activist campaigns reaching an all-time high in 2018 in which activist shareholders have targeted a total of 227 companies globally (Lazard, 2019). Additionally, while activist campaigns have traditionally focused on the CEO, recent campaigns are increasingly also directed at CFOs who either have to defend themselves against activist-imposed replacement requests or are tasked to implement activist demands during the campaign (Teitelbaum, 2017).¹⁰ Insights with regard to whether shareholder activists only target companies because of financial and strategic reasons or whether they also consider characteristics of their executives remain scarce though. However, given the recent surge in activism, it becomes even more important for potential target companies and legislators to decipher the antecedents of an activist investment.

Despite a comprehensive coverage of shareholder activism in recent research, reported evidence on antecedents primarily focuses on firm fundamentals and governance characteristics of targets. So far, research only sparsely considers a potential impact of management characteristics on activist target selection (see, e.g., Goranova and Ryan (2014) for a comprehensive overview of studies on the

¹⁰ Most recently, GameStop's CFO Jim Bell was forced out of office by activist investor Ryan Cohen (Trentmann and Maurer, 2019) and 44% of all CFOs surveyed in Deloitte's North America CFO Signals Survey in the third quarter of 2019 stated that they experienced at least one form of shareholder activism in the respective year (Ruggeri and Beine, 2019).

antecedents of shareholder activism). However, amid the recent increase in the popularity of shareholder activism and the concomitant increase in competition among investors, shareholder activists increasingly seem to show difficulties in identifying undervalued targets purely based on market data and firm fundamentals (Herbst-Bayliss, 2019). Superior stock selection skills in identifying undervalued targets, however, are a key source of a shareholder activist's long-term value proposition and are, hence, imperative to its investment success (Cremers et al., 2018). Taken together with the notion of Cremers et al. (2018) that a key differentiator of activists is their ability to successfully negotiate with and extract information from a target firm's management, this gives reason to assume that investors turn to additional, softer factors such as a target firm's management characteristics in their investment decision process.

Our paper tries to shed light on this aspect by analyzing whether the presence of an overconfident CFO impacts the likelihood that shareholder activists target a company. We thereby address two gaps in current literature. Firstly, shareholder activism research so far focuses on the impact of the CEO on target selection and activist investment success while the impact of other C-level executives is mostly neglected. However, while it is true that most shareholder concerns publicly address a company's CEO as the main driver of the company's long-term strategy, the CFO has an at least similarly important role for shareholders. This is particularly true for activist investors given that key responsibilities of a CFO are to manage shareholder communication (including negotiations with shareholder activists) as well as to actively preempt a shareholder activist investment in the first place (e.g., by periodic fire drills with the top management team of the company). Additionally, many demands of shareholder activists (which are closely aligned with the initial reason for the activist investment in the respective company) involve decisions in the responsibility of a company's CFO such as share buybacks, dividends, leverage, and, to a large extent, divestitures. Secondly, besides a few studies on gender which show that shareholder activists tend to prefer companies run by female CEOs due to a higher likelihood of negotiation success (Francis et al., 2021; Gupta et al., 2018), little research has focused on senior executive characteristics. More precisely, although executive biases such as overconfidence have been shown to impact key determinants of the investment success of shareholder activists such as firm performance (Malmendier & Tate, 2005) and the likelihood of negotiation success (Caputo, 2013), virtually no research has focused on executive biases as an antecedent of shareholder activism so far. Taken together with the important role a CFO plays for shareholder activists, CFO

characteristics and biases such as overconfidence should therefore at least to some extent impact the decision of shareholder activists to target a company.

The results of this paper indicate that CFO overconfidence indeed influences the likelihood of a company to be approached by a shareholder activist. The provided evidence strongly supports the hypothesis that shareholder activists prefer CFOs with characteristics that indicate a higher possibility for successful negotiations and are, hence, put off by the presence of CFO overconfidence. This is particularly true for CFOs with a higher degree of overconfidence. Depending on the strength of overconfidence the odds to be approached by a shareholder activist are between 1.41 to 1.76 times lower than for non-overconfident CFOs. Further analyses support these findings by showing that firms that switched from an overconfident to a non-overconfident CFO are more likely to be targeted by shareholder activists than their peers that remained with an overconfident CFO in the three years following the transition. We further show that investors in activist target firms seem to account for a lower likelihood of negotiation success for target firms with overconfident CFOs and react significantly less positively to investments in such firms. Finally, we also at least partially extend previous findings of Francis et al. (2021) and Gupta et al. (2018) regarding the impact of executive gender on shareholder activism from CEOs to CFOs thereby further supporting the hypothesis that activists, *ceteris paribus*, prefer executives with characteristics indicating a higher likelihood of negotiation success.

The rest of the paper is organized as follows: In section 2.2 we give an overview of related literature in behavioral finance (with a focus on research on overconfidence) and shareholder activism and derive our key hypotheses. Section 2.3 outlines the data sample and describes the methodology as well as the proxies for CFO overconfidence. Section 2.4 summarizes the results and examines whether CFO overconfidence impacts the probability of a shareholder activist investment in the respective firm. This section also includes several further analyses to outline additional factors impacting the decision of shareholder activists to target a firm and a description of our robustness tests. A discussion of our results and an overview of their implications conclude the paper in section 2.5.

2.2. Literature review and hypothesis development

2.2.1. Related research on executive overconfidence

Research on overconfidence has its starting point in Roll's (1986) work in which he first analyzed whether hubris, a form of overconfidence in an executive's personal abilities to steer a company, could partially explain irrational takeover premiums paid over a target's stock price. By revisiting existing

findings on takeovers, he shows that hubris of bidders is at least as good an explanation for high takeover premiums as inefficient target management, synergies, and taxes. Hayward and Hambrick (1997) corroborate these findings by showing that hubris measured by a CEO's perceived self-importance as well as recent praise of the CEO by media outlets lead to higher takeover premiums.

However, it was not until Malmendier and Tate (2005) that academics began to focus on a broader definition of CEO overconfidence as the tendency of executives to perceive their company and its economic prospects as undervalued by the market and its impact on managerial decision-making. They thereby analyze the impact of overconfidence across a variety of different strategic decisions ranging from investment decisions of executives (Malmendier & Tate, 2005) over acquisition frequency (Malmendier & Tate, 2008) to financing decisions (Malmendier et al., 2011). In their seminal 2005 paper, Malmendier and Tate use data on executive option-trading behavior of Forbes 500 CEOs provided by Hall and Liebman (1998) and corporate investment decisions to show that overconfident CEOs overestimate future cash flows from investment projects and respond more significantly to free cash flows and the availability of internal resources than rational CEOs.¹¹ Malmendier and Tate expand their findings in 2008 to merger decisions and find that the tendency of overconfident CEOs to overestimate future cash flows from investment projects leads to an increase in merger activity of the respective company and a higher share of value-destructive mergers. This is even more pronounced if the CEO has abundant internal resources or no access to external financing and for diversifying mergers. This is in line with Heaton's (2002) notion that overconfident CEOs perceive their company as undervalued by the capital market and, therefore, refrain from external financing which is in most cases dependent on valuations by the capital market. The tendency of overconfident CEOs to prefer cash and internal resources over external financing is further supported by Aktas et al. (2019) who show that the relative value of cash reserves in firms with overconfident CEOs is highly dependent on whether the firm is financially constrained or not. Cash reserves are on average relatively more valuable in firms managed by overconfident CEOs than in firms with rational CEOs, particularly if the firm is financially constrained but exhibits high growth opportunities.

While Malmendier and Tate mostly focus on value-destructive consequences of CEO overconfidence, Hirshleifer et al. (2012) show that overconfident CEOs are more successful

¹¹ In a later paper, Malmendier and Tate (2015) confirm their results for different time periods by using a more detailed Thomson Reuters-based proxy for executive option trading behavior that is not only available for Forbes 500 companies but all publicly listed companies in the United States.

innovators given the right circumstances. Like Malmendier and Tate (2005) they base their analyses on an option-based proxy for overconfidence supplemented by a press-based proxy that compares the number of press articles portraying an executive as overconfident with the number of press articles portraying the executive as rational. Humphery-Jenner et al. (2016) further expand the literature on overconfidence by analyzing how rational boards of directors can exploit biased managerial decision-making of overconfident executives. Using an option-based approach to proxy overconfidence that is very similar to Hirshleifer et al. (2012) and Malmendier and Tate (2015) the authors show that companies tend to exploit an overconfident executive's tendency to overvalue a company's prospects by offering compensation packages that are more reliant on option payments. This relationship increases with CEO bargaining power and extends to overconfident non-CEO executives.

Although the analyses of Humphery-Jenner et al. (2016) underline the relevance of behavioral biases of non-CEO executives, literature on non-CEO overconfidence remains sparse. Hsieh et al. (2018) show that companies are more likely to avoid taxes if their CEO and CFO are both overconfident. This is supported by Malmendier et al. (2020) who show that, when CEO and CFO are assessed jointly, the CFO's overconfidence type (overconfident vs. rational) determines the decision whether to revert to external financing (and if so to which external financing type) or not. They also show that overconfident CEOs tend to fall to the similarity bias by often hiring overconfident CFOs leading to a multiplier effect.

2.2.2. Related literature on shareholder activism

There exist a variety of different definitions of shareholder activism in corporate finance literature, depending on the type of activist (e.g., hedge funds, other institutional investors, individual investors, other stakeholders), the activist's motivation (e.g., financial, operational, social) and the employed type of activism strategy (e.g., arbitrage, public letters to the board, proxy fights). According to Gillan and Starks (2007, p. 55), shareholder activists can essentially be described as "investors who, dissatisfied with some aspect of a company's management or operations, try to bring about change within the company without a change in control". Means by which activists try to impose their demands on target companies are wide-ranging and inter alia include negotiations with executives behind closed doors, public voice via open letters to the board, proxy contests at general shareholder's meetings, demands for board representation, and many more. Activists thereby often try to resolve some type of agency conflict that results from the separation of ownership and control inherent in any publicly listed

company (Gillan & Starks, 2007).¹² Beyond the motivation to resolve agency conflicts research has focused on four distinct motivations behind shareholder activism: 1) short-term financial motivation (e.g., undervaluation, merger arbitrage), 2) performance improvement (e.g., operational inefficiencies, foregone divestitures), 3) governance changes (e.g., CEO incentives, board structure and replacement, compensation), and 4) insufficient practices (predominantly for social activism - e.g., environmental/social efforts, working climate) (Brav et al., 2008; Denes et al., 2017; Goranova & Ryan, 2014). According to Brav et al. (2008) activist campaigns often encompass demands across these four objectives.

While shareholder activism theoretically shows potential to mitigate agency conflicts¹³, discussions around the short- and long-term value of shareholder activism are controversial and without a clear resolution. Gillan and Starks (2007) conduct a comprehensive literature review and conclude that shareholder activism seems to increase shareholder value in the short term under some circumstances. Most analyzed studies, however, fail to show proof of an improvement of long-term operations or stock-market performance of the targeted companies. This is contrasted by Brav et al. (2008) who focus on hedge fund activism, a specific subsample of shareholder activism, to analyze short- and long-term effects of activist investments and show that hedge fund activism also creates long-term value by reducing leverage and free cash flow-related agency problems in the year after the announcement. These results are further supported by Bebchuk et al. (2015) who point out that markets accurately incorporate the long-term effects of activism events and Brav et al. (2015a) who show that hedge fund activism *inter alia* creates long-term shareholder value by improving production efficiency.

Besides analyzing short- and long-term benefits, research has foremost focused on trying to explain which companies are targeted by shareholder activists. While specific antecedents are still controversially discussed and vary in significance and direction between studies, most studies have focused on two areas of antecedents: firm fundamentals/performance and governance. Specific antecedents with regard to firm fundamentals are thereby *inter alia* prior market-adjusted stock returns (Bebchuk et al., 2015; Brav et al., 2008), return on assets (Boyson & Mooradian, 2011; Brav et al., 2008; Klein & Zur, 2009, 2011), sales growth (Boyson & Mooradian, 2011; Brav et al., 2008), leverage (Boyson & Mooradian, 2011; Brav et al., 2008; Klein & Zur, 2009, 2011), firm size (Boyson &

¹² See Jensen and Meckling (1976) for a detailed definition of agency conflicts and the resulting costs for shareholders, managers, and companies.

¹³ See, e.g., Klein and Zur (2009) who show that activist hedge funds tend to increase dividend payments to alleviate agency costs resulting from Jensen's (1986) free cash flow theory.

Mooradian, 2011; Klein & Zur, 2009, 2011), cash flow/cash (Brav et al., 2008), dividend yield (Brav et al., 2008; Klein & Zur, 2009), and research and development expenditures (Boyson & Mooradian, 2011; Brav et al., 2008; Klein & Zur, 2009). Governance factors identified by prior research to play a role in shareholder target selection, on the other hand, are institutional ownership (Boyson et al., 2017; Brav et al., 2008), ownership concentration (Brav et al., 2015b; Souha et al., 2016), and board size (Cai & Walkling, 2011).

Two of the few studies that have explored other potential types of antecedents of shareholder activism besides firm fundamentals and governance characteristics are conducted by Francis et al. (2021) and Gupta et al. (2018). Gupta et al. (2018) find that female CEOs are significantly more likely to be targeted by activists than their male counterparts thereby indicating that management characteristics play a role in shareholder activist target selection. They also show that firms with female CEOs not only have a higher probability of being targeted by a shareholder activist in any given year but are also more frequently targeted per year. This is confirmed by Francis et al. (2021) who show that hedge funds perceive firms led by female CEOs as preferred targets. The authors also ascertain that this is not because hedge funds regard such firms as more poorly managed than firms led by male CEOs, but rather because firms led by female CEOs are more likely to communicate, negotiate, and, finally, cooperate with hedge funds than firms led by male CEOs.

2.2.3. Hypotheses development

The findings of Gupta et al. (2018) and Francis et al. (2021) show that management characteristics seem to play a role in the target selection of shareholder activists. The findings also indicate that shareholder activists not only take underperformance and improvement opportunities into account when selecting a target but also make an initial judgment of how likely they will reach an agreement with the executives of the target company. While their analyses focus on CEOs, it is likely that the tendency to choose a target according to the expected negotiation behavior of its CEO also extends to the respective target's CFO given that the CFO usually takes responsibility for a major part of the communication with activists. In a 2019 survey among North American CFOs conducted by the audit firm Deloitte 80% of respondents stated that they regularly present activist views as well as assessments of a company's attractiveness for shareholder activists to the board underlining that "addressing activism appears to be a significant focus for CFOs" (Ruggeri & Beine, 2019, p. 3). While research has yet to confirm the findings of Francis et al. (2021) for CFOs, adjacent research fields such as psychology and linguistics show that characteristics such as executive biases are at least similarly

important factors in determining the likelihood of a successful negotiation as gender. Caputo (2013), for example, finds that most behavioral biases strongly impact negotiation behavior. He also asserts that particularly overconfidence of one or more negotiation participants significantly decreases the likelihood that an agreement is reached in a negotiation.

Existing literature hence gives room for three distinct hypotheses: Firstly, if activist investors prefer target firms with female CEOs due to a higher likelihood that a female CEO reacts more openly to shareholder demands in a potential negotiation process, it is likely that the preference for firms with executives which signal a higher likelihood for negotiation success also extends to CFOs. This is especially true given the important role that CFOs play in communication and negotiations with shareholder activists. Moreover, if shareholder activists indeed implicitly assess the probability to reach an agreement with a target firm's executives before taking an investment decision, it can be expected that this assessment also factors in other executive characteristics which signal a higher likelihood of successful negotiations. Caputo (2013) shows that overconfidence of one or more negotiation participants significantly decreases the likelihood of an agreement in a negotiation and thereby the likelihood that shareholder activists are successful with their demands. Given that lengthy negotiations are often a key cost driver for shareholder activists¹⁴, shareholder activists should, *ceteris paribus*, prefer executives with characteristics that increase the probability of negotiation success. This would imply that CFO overconfidence decreases the probability of a firm to be targeted by an activist.

H1a: CFO overconfidence decreases the likelihood of a company to be targeted by a shareholder activist.

Secondly, academics have already shown that while a certain degree of overconfidence can be beneficial with regard to investment and financing choices, a too high degree of overconfidence is detrimental and leads to investment decisions that increase agency costs and decrease shareholder value. Following this hypothesis, a higher degree of overconfidence should indicate a lower negotiation willingness which would, in turn, result in an even stronger negative relationship between shareholder activist target selection and CFO overconfidence.

H1b: The higher the degree of overconfidence the lower the likelihood of a company to be targeted by a shareholder activist.

¹⁴ Gantchev (2013) shows that activist campaigns that require the use of more aggressive negotiation tactics (e.g., proxy contests) incur average costs of USD 10.7m.

Thirdly, based on the findings of Brav et al. (2008), Greenwood and Schor (2009), and Klein and Zur (2009) who show positive market reactions to shareholder activism (particularly hedge fund activism) we would also expect significant positive abnormal returns upon the initiation of a shareholder activism investment for our analyses. As Gantchev (2013) further shows that lengthy negotiations with shareholder activists typically incur significant costs to both activist and target company, it can further be expected that investments in firms with a higher likelihood for prolonged negotiations should lead to less positive market reactions. Consequently, if the first two hypotheses (particularly *H1a*) hold true, we would expect market participants to react significantly less positively to the initiation of an activist investment if the CFO of a company is overconfident.

H2: Investments of shareholder activists in firms with an overconfident CFO at the time of investment exhibit less positive abnormal market reactions upon the initiation of the investment than their peers.

2.3. Data sample selection and research design

2.3.1. Data sources and sample selection

The sample analyzed in this paper contains all constituents of the Standard & Poor's Composite 1500 (S&P 1500) index, which covers 90% of U.S. market capitalization (Standard & Poor's, 2019), during the years 2003 to 2017. Accounting data and data on board composition and executive compensation have been collected from Standard and Poor's (S&P) databases Compustat Industrial Annual (Compustat), Thomson Reuters, and ExecuComp, and stock price data has been obtained from the Center for Research in Security Prices (CRSP). Following Aktas et al. (2019), firms from the financial (Standard Industrial Classification (SIC) codes 6000-6999) and utility (SIC codes 4900-4999) industries have been excluded.¹⁵ The initial sample consists of 16,470 firm-year observations.¹⁶

2.3.2. Measuring CFO overconfidence

The most common approach in behavioral finance research to measure overconfidence is based on so-called "revealed beliefs" of the respective executive and analyzes the financial decisions that the executive is taking regarding her personal portfolio of company stock options. The approach has first been developed by Malmendier and Tate (2005, 2008) and has been further adapted by Malmendier and Tate (2015). Its logic is based on the recent development that companies tend to shift a significant

¹⁵ All regressions have also been conducted including firms from financial and utility industries. Results remain qualitatively and directionally similar.

¹⁶ Sample sizes of individual analyses vary depending on the availability of utilized variables.

portion of an executive's pay to option-based forms of payment (Cesari & Ozkan, 2015). This corporate payout policy often leaves an executive under-diversified with significant company-specific risk unless the executive is regularly rebalancing her portfolio by selling a share of the stock options that she has received as part of her salary. While a private investor could sell some of her options or accumulate correspondent short positions, company executives are comparably limited in their ability to mitigate this risk due to vesting schedules and the prohibition of short positions. Hence, the only realistic possibility to address imminent under-diversification for a rational executive is to execute her stock options at some point between the end of their vesting schedule and the expiration date of the options (usually after ten years).¹⁷ Irrational, overconfident executives often overestimate the future development of their company (i.e., they believe their company to be currently undervalued by shareholders) and are, hence, more inclined to hold their stock options for a longer period expecting future stock price appreciation and ignoring rational exercise timing considerations. Malmendier and Tate (2005, 2008) use these "revealed beliefs" and the systematic tendency to hold stock options substantially longer than what is required by respective vesting schedules and considered rational by the aforementioned criteria as a basis for their main overconfidence measure. They thereby calculate their overconfidence measure (also called *Longholder* measure) using two different data sources: Thomson Reuters and ExecuComp. Both measures will also be used for our paper. Additionally, we refer to the *Holder67* measure as defined by Humphery-Jenner et al. (2016) for an assessment of the degree of overconfidence of an executive.

2.3.2.1. *Thomson Reuters Longholder Measure*

Since 1996 the Securities and Exchange Commission (SEC) requires every director, officer, or owner of more than 10% of equity securities of a company listed on a U.S. stock exchange to file what is called "Form 4" whenever she undertakes a transaction that changes her ownership. These filings are stored in the SEC's Electronic Data Gathering, Analysis, and Retrieval (EDGAR) database and are accessible by the public. Derivative transactions can be retrieved from Table 2 of "Form 4" and have been extracted for all executives that were CEO or CFO at the time of the respective transaction between January 2002 and December 2017.¹⁸ All transactions that have been significantly amended by

¹⁷ An executive could of course also invest a proportional amount in all other holdings of her portfolio to offset the idiosyncratic risk caused by the option payment. For the purposes of this paper this possibility is not further considered as it would likely require a substantial amount of money for most executives and would lead to a significant increase of an executive's overall portfolio value.

¹⁸ Option transactions in 2002 were also considered as all independent variables and controls are lagged by one year.

Thomson Reuters or that are marked as incomplete have been eliminated from the sample.¹⁹ Additionally, all transactions have been excluded for which either the type of derivative could not be determined (derivative type unknown) or which did not provide any or inaccurate information for the transaction date, expiration date, or the strike price of the stock option.²⁰ Lastly, all transactions that were not related to exercises of call options have been removed.²¹ The resulting records were then matched with stock price data from CRSP and Compustat using fuzzy name matching for each CEO and CFO. Records for which stock prices could neither be obtained from CRSP nor from Compustat have been deleted. For a transaction to be considered as an indicator for overconfidence, it needs to fulfill the following two criteria: a) the option exercise occurred within one calendar year of option expiration and b) the stock price exactly one calendar year before expiration is at least 40% above the indicated strike price of the option.²²

All records were subsequently translated into a firm-year panel for all companies that were included in the S&P 1500 index during the years 2003 to 2017 using constituent data from ExecuComp. Besides information on the CEO and CFO of each constituent, the database also contains information on aggregate company stock and option holdings of the respective executives. Companies were only considered for the final sample for the time they were part of the S&P 1500. The overconfidence measure is included as a binary variable (*Longholder*) that is coded as one if someone working as a CEO or CFO exercised an option meeting the two criteria and zero otherwise. This approach is particularly conservative given that the subsample of executives who have not revealed their beliefs through option exercise behavior might include overconfident executives (e.g., executives in firms that do not contribute options as part of executive compensation packages). Following Aktas et al. (2019) and Malmendier and Tate (2015), overconfidence classifications have been backfilled for the entire tenure

¹⁹ Thomson Reuters provides a Cleanse Indicator which signals whether a transaction has been modified by Thomson Reuters or has been incomplete. Only transactions with a Cleanse Indicator of R, H, L, I, and C signaling that the data has been verified or appropriately modified with high confidence by Thomson Reuters have been retained (see Thomson Reuters (2012) for an explanation of the respective Cleanse Indicators).

²⁰ Examples of inaccurate information, for example, include option transactions in which the transaction date has been after the expiration date or records that indicate a time to expiration of 100 years and longer from the transaction date.

²¹ Transactions with transaction codes D, F, A, 8, Q, P, E, or G have been excluded (see Thomson Reuters (2012) for an explanation of the respective transaction codes).

²² Stock prices for the next business day have been used for all records for which the day one calendar year before option expiration has been a weekend day or national holiday. The 40% threshold is based on a calibration of the rational option exercise behavior model developed by Hall and Murphy (2002). The threshold is based on the assumptions that an executive holds two thirds of her total wealth in company stock and has a constant relative risk aversion of three (corresponds to the risk preferences of an average investor).

of the executive assuming that the trading behavior demonstrating overconfidence is habitual and non-time-sensitive.

2.3.2.2. *ExecuComp Longholder Measure*

The second *Longholder* measure is calculated following Malmendier and Tate (2015) and is based on grant-level compensation data provided by the ExecuComp database. Like the Thomson Reuters-based *Longholder* measure this measure is a binary variable that is equal to one if an executive holds stock options until the final year before expiration that are at least 40% in the money in their final year before expiration.²³ The ExecuComp based *Longholder* measure is thereby calculated following a similar approach used for the Thomson Reuters-based *Longholder* measure and is coded as a binary variable equal to one if an executive's option grants fulfill the following two criteria: a) the executive holds option grants that are in their final year before expiration and b) the stock price exactly one calendar year before expiration is at least 40% above the indicated strike price of the option.

2.3.2.3. *Holder67 Measure*

The *Holder67* measure is based on the same principle as both *Longholder* measures and has been developed by Malmendier and Tate (2008, 2015) and further refined by Humphery-Jenner et al. (2016). This measure is based on ExecuComp's *Outstanding Equity Awards* database which inter alia contains all compensation-relevant stock option grants that an executive holds at the end of a fiscal year. In contrast to the *Longholder* measure of Malmendier and Tate (2008, 2015) the measure focuses on option holdings of an executive in the earliest year after the end of the vesting schedule (typically year five for most stock options issued by U.S. companies). An executive is classified as overconfident if she continues to hold stock options that are at least 67% in the money five years before expiration. The in-the-money threshold of 67% is again based on the Hall-Murphy model of rational option exercise behavior (Hall & Murphy, 2002). The measure *Holder67* is binary and equal to one once an executive's option holdings include options following these criteria for the rest of the executive's tenure. Humphery-Jenner et al. (2016) further refine the *Holder67* measure in two ways. Firstly, they introduce variations of the threshold required to be classified as overconfident (30% to also capture moderately overconfident executives and 100% to only capture strongly overconfident executives). Secondly, they calculate the measure independently from the option's remaining time until expiration by classifying

²³ Stock prices for the next business day have been used for all records for which the day one calendar year before option expiration has been a weekend day or national holiday.

an executive as overconfident if she holds vested in-the-money options that fulfill the required thresholds at least twice during the executive's tenure. Overconfidence is proxied using a continuous variable that is calculated as follows:

$$CONF = \frac{AVAL}{AVXRP} \quad (1)$$

where,

$$AVAL = \frac{VAL_{VESTED\ UNEXER\ OPTIONS}}{NUM_{VESTED\ UNEXER\ OPTIONS}}$$

and

$$AVXRP = PRCCF - AVAL$$

where *CONF* describes the continuous confidence measure, *AVAL* is the average value of an executive's option grant, and *AVXRP* is the average strike price of the grant. *VAL_{VESTED UNEXER OPTIONS}* is the value of all vested unexercised options of an executive as provided by ExecuComp, *NUM_{VESTED UNEXER OPTIONS}* describes the number of all vested unexercised options as provided by ExecuComp, and *PRCCF* is the firm's stock price at the end of the respective fiscal year. The *Holder67* measure of overconfidence is then defined as a binary variable that is equal to one for all executives for which the confidence measure is at least 67% on at minimum two occasions during the tenure of the executive from the first occasion that the executive's confidence measure is at least 67% (30% and 100% respectively for the variations introduced by Humphery-Jenner et al. (2016)).

2.3.3. Measuring shareholder activism

Following Bebchuk et al. (2020), Boyson and Mooradian (2011), and Klein and Zur (2009), we identified data on activism campaigns using Schedule 13D filings. The SEC requires investors who acquire beneficial ownership of more than 5% of any security registered under Schedule 12 of the Securities Exchange Act of 1934 (i.e., all publicly traded U.S. companies) to clarify the intent of their investment within ten days after reaching the 5% threshold. Investors can do so by either filing a Schedule 13G filing in which case they must remain passive investors or a Schedule 13D filing which allows investors to actively influence a firm's strategy, for example, by proxy contests (Schedule 13D, 1934/2019). While the filing of a Schedule 13D does not necessarily imply that a shareholder will actively try to interfere with the firm's management, it is often a clear indicator of a potential activist investment (Brav et al., 2015b). Following Brav et al. (2008), Schedule 13D filings have been obtained

using the SEC's EDGAR database and were subsequently reduced to filings undertaken by hedge funds based on the Center For International Securities And Derivatives Markets (CISDM)-Morningstar database and the respective fund registrations with the SEC. The remaining sample of 4,194 Schedule 13D filings filed between January 2003 and December 2017 has then been remerged with the initial sample of all firms that have been included in the S&P 1500. Following Bebchuk et al. (2020), shareholder activism is measured with a binary variable that is equal to one for all firms with at least one Schedule 13D filing in a given year.²⁴

Table 2-1 contains an overview of the development of activism events and CFO overconfidence between 2003 and 2017. For reference, we have also included an overview on CEO overconfidence and executive gender. Similar to prior research (Brav et al., 2008; Francis et al., 2021), shareholder activist activity in S&P 1500 companies seems to follow a cyclical pattern with the highest activity reached just before the financial crisis in 2007 when ~5.1% of all S&P 1500 companies were approached by an activist. In contrast to Brav et al. (2015b), Table 2-1 only includes initial Schedule 13D filings meaning that a company targeted by more than one activist or more than once by a specific activist will only be counted once in the respective year. Consistent with Francis et al. (2021) and further research on the importance of board diversity regarding gender, historic underrepresentation of women in corporate boards seems to alleviate in recent years with a clear upward trend of the share of female executives among CEOs and CFOs. Regarding overconfidence Table 2-1 shows that the share of overconfident CEOs and CFOs first increased steadily from 2003 to 2010 when ~52.1% of all CEOs and ~35.8% of all CFOs could be classified as overconfident and since then decreased significantly to ~37.8% and ~23.4% respectively.²⁵

²⁴ This approach is in line with prior research (e.g., Clifford (2008); Gupta et al. (2018); Klein and Zur (2009)). It should be noted though that due to the required threshold of 5% the sample could be biased towards smaller firms (shareholder activists, particularly hedge funds, sometimes do not reach the 5% threshold when targeting larger companies due to the associated capital requirements). We try to account for this potential bias by repeating our analyses with an enriched sample using proxy filings as an additional source to detect activism events (see Section 2.4.6. Robustness Checks).

²⁵ Although overconfidence measures are calculated using option transactions until December 31, 2018, the observed decrease in later sample years may be attributed to a sample bias. Recently appointed executives have fewer years to manifest a measurable preference for overconfidence due to vesting schedules.

Table 2-1: Distribution of activism events, CEO/CFO overconfidence, and CEO/CFO gender

Year	Firms	Activism Events	in %	Overconfidence				Gender			
				CEOs	in %	CFOs	in %	CEOs	in %	CFOs	in %
2003	1110	19	1.7%	502	45.2%	245	22.1%	21	1.9%	69	6.2%
2004	1101	22	2.0%	511	46.4%	263	23.9%	19	1.7%	84	7.6%
2005	1081	34	3.1%	525	48.6%	287	26.5%	25	2.3%	86	8.0%
2006	1109	51	4.6%	553	49.9%	354	31.9%	28	2.5%	102	9.2%
2007	1110	57	5.1%	551	49.6%	382	34.4%	34	3.1%	101	9.1%
2008	1109	53	4.8%	566	51.0%	381	34.4%	35	3.2%	99	8.9%
2009	1113	15	1.3%	564	50.7%	389	35.0%	40	3.6%	97	8.7%
2010	1105	33	3.0%	576	52.1%	396	35.8%	42	3.8%	95	8.6%
2011	1111	39	3.5%	578	52.0%	390	35.1%	40	3.6%	108	9.7%
2012	1110	35	3.2%	557	50.2%	389	35.0%	46	4.1%	120	10.8%
2013	1097	32	2.9%	532	48.5%	374	34.1%	50	4.6%	125	11.4%
2014	1085	42	3.9%	515	47.5%	356	32.8%	50	4.6%	127	11.7%
2015	1072	33	3.1%	491	45.8%	327	30.5%	49	4.6%	141	13.2%
2016	1079	24	2.2%	463	42.9%	285	26.4%	55	5.1%	139	12.9%
2017	1078	17	1.6%	408	37.8%	252	23.4%	51	4.7%	137	12.7%
Total	16,470	506	3.1%	7,892	47.9%	5,070	30.8%	585	3.6%	1,630	9.9%

This table provides an overview of the distribution of activism events, CEO/CFO overconfidence (as proxied by the Thomson Reuters *Longholder* measure), and CEO/CFO gender for S&P 1500 constituents during the sample period 2003 to 2017. Activism events are defined as initial 13D-filings undertaken by a hedge fund (based on the CISDM-Morningstar database and respective fund registrations with the SEC) for an S&P 1500 constituent in a respective year.

2.3.4. Measuring the impact of CFO characteristics on the likelihood to get targeted

Following Brav et al. (2015b) and Gupta et al. (2018), the relationship between CFO characteristics and shareholder activism has been analyzed using logit regressions with the dummy variable for shareholder activism as the dependent variable. All regressions except for the base regression include controls for four different factors: other CFO characteristics, CEO characteristics, firm fundamentals, and corporate governance characteristics. Following Malmendier and Tate (2005), all regressions account for time- and industry-fixed effects using the twelve industry classification developed by Fama and French (1997). All continuous variables have also been winsorized at the 1st and 99th percentiles.²⁶

²⁶ Regression results remain qualitatively similar without winsorization or with different winsorization thresholds.

More specifically, the following regression is estimated:

$$P(SHA)_{i,t} = \alpha + \beta_1 CFO\ OC_{i,t-1} + ControlsCFO_{i,t-1} + Controls\ CEO_{i,t-1} + Controls\ FUND_{i,t-1} + Controls\ GOV_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

where $P(SHA)_{i,t}$ is the probability of firm i to be targeted in year t , $CFO\ OC_{i,t-1}$ is the respective proxy for CFO overconfidence for the CFO of firm i in year $t-1$, and $ControlsCFO_{i,t-1}$ entail other CFO-related controls. $ControlsCEO_{i,t-1}$ encompasses all control variables regarding CEO characteristics, $Controls\ FUND_{i,t-1}$ all control variables with regard to firm fundamentals, and $Controls\ GOV_{i,t-1}$ all control variables with regard to governance factors for firm i in year $t-1$.

$ControlsCFO_{i,t-1}$ thereby primarily accounts for CFO gender and age. Francis et al. (2021) and Gupta et al. (2018) show that shareholder activists, ceteris paribus, prefer female CEOs of target firms. Thus, assuming that this preference also exists for CFOs, a binary variable that is equal to one if the CFO is female has been added as a control. Additionally, following a 2015 study undertaken by the Investor Responsibility Research Center (IRRC) in cooperation with Institutional Shareholder Services (ISS), one of the largest proxy advisors in the United States, which has shown that activist-imposed changes to boards of target companies led to a decrease in average director age and tenure (Borek et al., 2017), CFO age has been added as a second CFO characteristic.

Concerning CEO-related control variables ($ControlsCEO_{i,t-1}$), prior literature suggests that activists are more likely to target companies with female CEOs (Francis et al., 2021; Gupta et al., 2018) and tend to focus on directors that are closer to retirement and longer-tenured when it comes to settlement-induced board turnover (Bebchuk et al., 2020). As for CFOs, a dummy that is equal to one if a CEO is female and a measure for the CEO's age have been added. Finally, to isolate the effect of CFO overconfidence, we also add a dummy for CEO overconfidence (based on the same proxies as CFO overconfidence).

Regarding firm fundamentals-related motives of shareholder activist target selection ($Controls\ FUND_{i,t-1}$), Boyson and Mooradian (2011) show that shareholder activist targets tend to be smaller in size and have lower Tobin's Q, sales growth, payout ratios, and dividend yield compared to industry/size/book-to-market matched firms. Hence, controls have been included for a company's market value, Tobin's Q, sales growth, and payout ratio. Following Brav et al. (2015b), leverage and profitability have been included as further controls – Brav et al. (2015b) show that target firms tend to

have higher leverage and lower profitability. In line with Francis et al. (2021), we have also included a firm's research and development expenditures (R&D) and tangibility ratio as further controls.

Finally, prior literature suggests controlling for governance-related antecedents of activist target selection (*Controls GOV_{i,t-1}*) and shows that target firms tend to have significantly higher institutional ownership than non-targeted peers (Brav et al., 2015b; Cai & Walkling, 2011). With regard to ownership concentration research has shown that it seems to play a significant role for shareholder activist target selection but with, at first glance, controversial results regarding its direction. Judge et al. (2010) show for a sample of ten different countries that ownership concentration is negatively related to the probability of a shareholder activist investment thereby supporting Fama and Jensen's (1983) hypothesis that concentrated owners are in a better position and more motivated to closely monitor a company's management. Cziraki et al. (2010), on the other hand, find across multiple European countries that institutional ownership concentration is actually positively related to the probability to receive a shareholder proxy proposal. They argue that these results might be linked to the idea that voting coalitions are easier to build when ownership concentration is higher and that activists are often minority shareholders and hence would be rather inclined to protect their interests with shareholder proposals in the presence of large blockholders. It should be noted though that Cziraki et al. (2010) do not analyze antecedents of shareholder activism making their results difficult to compare to the results of Judge et al. (2010). Hence, both, the share of institutional ownership and a firm's institutional ownership concentration (proxied by the Herfindahl-Hirschman-Index (HHI-Index)) have been included as further controls (detailed descriptions of all key variables as well as calculation methods can also be found in Table 2-8 of Appendix 1).²⁷

2.4. Results

2.4.1. Summary statistics

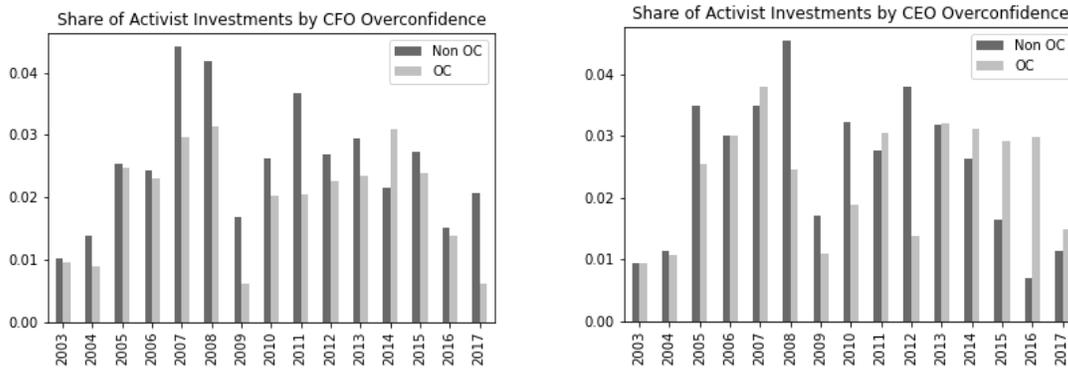
Table 2-9 of Appendix 2 entails summary statistics for all key variables of the base regression. Panel A in Table 2-9 thereby compares the two subsamples of target firms and non-target firms while Panel B in Table 2-9 reduces the sample to targeted firms and compares firms with overconfident CFOs with firms with non-overconfident CFOs. In line with prior research (Boyson et al., 2017; Brav et al., 2008; Clifford, 2008; Greenwood & Schor, 2009), the results in Panel A indicate that target firms tend to be

²⁷ We have checked all variables of our base regression for multicollinearity using variance inflation factors and do not find any evidence that variables are excessively correlated (all variance inflation factors are below two).

smaller in size, have lower profitability (measured by return on assets), and are traded at comparatively cheaper levels (proxied by a firm's Tobin's Q). Target firms also exhibit lower payout yields and higher leverage (though differences are not statistically significant), potentially indicating agency conflicts. Consistent with the findings of Francis et al. (2021) and Gupta et al. (2018), we also find that firms targeted by activist hedge funds are also more likely to have a female CEO and/or a female CFO (although differences are insignificant regarding CEO gender). Finally, target firms are also significantly less likely to have an overconfident CEO and/or CFO. While the difference in CFO overconfidence is a first indication that shareholder activists might consider firms with non-overconfident CFOs as more attractive for an investment, concerns that a higher propensity to target firms with non-overconfident CFOs is related to differences in firm fundamentals remain. The results of Panel B alleviate these concerns to some extent by showing that while target firms exhibit significant differences from non-target firms, firms with non-overconfident CFOs are quite similar to firms with overconfident CFOs. Firms only exhibit significant differences with regard to profitability, R&D, and institutional ownership/ concentration. More precisely, we find that firms with non-overconfident CFOs tend to have lower profitability, lower R&D expenditures, a lower share of institutional ownership, and a higher degree of institutional ownership concentration, but are comparably similar with regard to market values, Tobin's Q, and leverage which are all considered as key antecedents of activist investments (Brav et al., 2008). In line with the results of Malmendier et al. (2020), targeted firms with an overconfident CFO are also significantly more likely to also have an overconfident CEO.

The lower likelihood of a target firm to have an overconfident CFO also manifest in Figure 2-1. Figure 2-1 contains a comparison of the share of S&P 1500 firms that were targeted by hedge fund activists in a year differentiated by whether the firm had an overconfident CFO (left subplot) and differentiated by whether the firm had an overconfident CEO (right subplot). The figure indicates that there seem to be substantial differences between both firm types with firms with non-overconfident CFOs being targeted significantly more often than firms with overconfident CFOs. This effect seems to be particularly strong between 2007 and 2011 (i.e., around the financial crisis of 2007/2008). Differences are of smaller magnitude regarding CEO overconfidence and only observable during the period between 2007 and 2011 thereby further reinforcing our focus on CFO overconfidence.

Figure 2-1: Share of activist investments by CEO/CFO overconfidence



This figure shows the annual share of firms that were targeted by activist hedge funds split by firms that had an overconfident CEO/CFO in that respective year. The sample consists of all companies that were part of the S&P 1500 index in the respective year. Overconfidence is proxied by our Thomson Reuters-based *Longholder* measure while shareholder activism events are defined as initial 13D filings undertaken by a hedge fund (based on the CISDM-Morningstar database and respective fund registrations with the SEC) in a respective year. The left subplot contains a comparison of shareholder activist events by CFO overconfidence and the right subplot by CEO overconfidence.

2.4.2. Impact of CFO overconfidence on the likelihood to get targeted

To analyze whether there exists a significant relationship between CFO overconfidence and a shareholder activist's choice to target a company, multiple logit regressions have been conducted each using one of the *Longholder* measures for CFO overconfidence while accounting for academically acknowledged factors that also affect target selection of shareholder activists. The results are depicted in Table 2-2. Column [1] entails the results of a base regression in which only CFO characteristics are included as independent variables. Column [2] shows the results of the base regression including all CFO- and firm-related controls (i.e., no CEO controls), and column [3] depicts the results of the full model. Regressions [1]-[3] are conducted using the Thomson Reuters-based overconfidence proxy. All regressions were also conducted using the ExecuComp-based overconfidence proxy yielding very similar results. For brevity, however, only the results of the full model are reported in column [4].

The results of the base model in columns [1] and [2] in Table 2-2 indicate that there exists a significant relationship between CFO characteristics and shareholder activist target selection that persists even after controlling for time- and industry-fixed effects. The results support *H1a* and indicate a significant negative relationship between CFO overconfidence and the probability to get targeted by a shareholder activist. Neither CFO age nor CFO gender appears to play a significant role in shareholder activist target selection. The directional relationship between CFO overconfidence and

target selection persists even after controlling for CEO characteristics, firm fundamentals, and governance factors (column [3]) as well as for different measures of CFO overconfidence based on ExecuComp (column [4] and untabulated results of regressions [1]-[3]). More specifically, a firm is around 1.41 to 1.76 times less likely to be targeted by shareholder activists if the firm has an overconfident CFO which in turn highlights the high relevance of the CFO for shareholder activists.

Hsieh et al. (2018) show that adverse effects of overconfidence are often stronger when both, CEO and CFO, are overconfident. To address the concern that our results are predominantly driven by firms that have an overconfident CEO and CFO, we rerun our main regression (column [3]) including an interaction variable between CEO and CFO overconfidence. The results in column [5] and particularly the insignificant coefficient of the interaction variable indicate that our findings are predominantly driven by overconfident CFOs.

Regarding further controls the results are mixed but in line with related literature. Our results do not allow any conclusions on the impact of executive gender on shareholder target selection when including data on executive overconfidence. While our results are similar in direction and magnitude, effects are insignificant at conventional significance levels and, hence, neither confirm nor disprove the results of Francis et al. (2021) and Gupta et al. (2018). Results for our other CEO and CFO characteristics are inconclusive indicating that neither CEO and CFO age nor CEO overconfidence have a significant effect on shareholder activist target selection for the given sample. Coefficients vary regarding strength and significance across all regression specifications making a sensible interpretation impossible. Unsurprisingly, firm fundamentals, on the other hand, play a decisive role in shareholder activist target selection. In line with Boyson and Mooradian (2011) and Brav et al. (2015b), target firms of shareholder activists seem to be smaller in size with a lower return on assets, lower Tobin's Q (i.e., comparably undervalued firms), and comparably low payouts to shareholders (as measured by dividends per share). They also have higher leverage and tend to be more financially stable (as proxied by a firm's tangibility ratio) than their peers not targeted by shareholder activists. Similar to the results of Brav et al. (2015b) and Cai and Walkling (2011), target firms also seem to have higher institutional ownership. In contrast to prior research, sales growth and ownership concentration (measured by HHI) provide inconclusive results regarding the direction of the effect and its significance.

Table 2-2: Regression results on the influence of CFO overconfidence on shareholder activist target selection with different overconfidence proxies

Cluster	Variable	[1]	[2]	[3]	[4]	[5]
		Target (TR)	Target (TR)	Target (TR)	Target (EC)	Target (TR)
CFO overconfidence	CFO Overconfidence	-0.544*** (0.000)	-0.382*** (0.004)	-0.342** (0.011)	-0.341** (0.017)	-0.512** (0.018)
Other CFO characteristics	CFO Gender	0.248 (0.134)	0.280 (0.105)	0.274 (0.113)	0.283 (0.103)	0.275 (0.112)
	CFO Age	-0.010 (0.267)	-0.010 (0.269)	-0.011 (0.222)	-0.011 (0.200)	-0.011 (0.220)
CEO characteristics	CEO Overconfidence			-0.151 (0.221)	-0.014 (0.911)	-0.226 (0.114)
	CEO Gender			0.024 (0.938)	0.020 (0.949)	0.030 (0.924)
	CEO Age			0.006 (0.492)	0.006 (0.474)	0.006 (0.457)
CFO/CEO Interaction	CFO Overconfidence##CEO Overconfidence					0.292 (0.301)
Firm fundamentals	Market Cap		-0.206*** (0.000)	-0.202*** (0.000)	-0.212*** (0.000)	-0.202*** (0.000)
	Tobin's Q		-0.400*** (0.000)	-0.395*** (0.000)	-0.396*** (0.000)	-0.395*** (0.000)
	Leverage		0.441 (0.240)	0.435 (0.247)	0.468 (0.219)	0.432 (0.252)
	Dividends per Share		1.198 (0.731)	1.050 (0.765)	1.123 (0.749)	1.056 (0.764)
	ROA		-1.079* (0.093)	-1.053 (0.102)	-1.164* (0.068)	-1.038 (0.107)
	Sales Growth		-0.091 (0.776)	-0.085 (0.789)	-0.088 (0.784)	-0.088 (0.784)
	R&D		2.642 (0.148)	2.741 (0.133)	2.564 (0.162)	2.767 (0.130)
	Tangibility		0.324** (0.049)	0.313* (0.056)	0.311* (0.059)	0.313* (0.057)
Governance	Inst Ownership		0.631* (0.093)	0.641* (0.089)	0.616 (0.104)	0.644* (0.087)
	Inst Ownership HHI		-0.148 (0.894)	-0.149 (0.893)	-0.150 (0.892)	-0.133 (0.905)
<i>Observations</i>		14,060	12,814	12,811	12,813	12,813
<i>Wald X²</i>		100.76	193.23	193.68	184.87	199.24
<i>Time- and Industry-fixed effects</i>		YES	YES	YES	YES	YES
<i>Clustered Standard Errors</i>		YES	YES	YES	YES	YES

This table contains the results of multiple logit regressions to estimate the impact of CFO overconfidence on shareholder activist target selection. The full sample consists of 16,470 firm-year observations over the period from 2003 to 2017. The sample contains all firms in the S&P 1500 with available observations in the ExecuComp, CRSP, and Compustat databases.

Additionally, firms from the financial (SIC 6000-6999) and utility (SIC 4900-4999) industries have been excluded. Overconfidence classifications are based on the *Longholder* methodology developed by Malmendier and Tate (2015). Following Brav et al. (2008), a firm is considered as a target of a shareholder activist if it received a Schedule 13D filing by a hedge fund in a given year. All independent variables are lagged by one year and continuous variables are winsorized at the 1% and 99% percentile. Detailed variable descriptions can be found in Appendix 1. Standard errors are adjusted for heteroskedasticity and firm clustering. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels.

While there seems to exist a significant negative relationship between CFO overconfidence and the likelihood of a company to be targeted by a shareholder activist, it is still unclear whether the decision of a shareholder activist is influenced by the presence of overconfidence alone or rather the degree of overconfidence. To further analyze this relationship, the minimum in-the-money thresholds required to classify option transactions and corresponding executives as overconfident have been varied following Humphery-Jenner et al. (2016) and their *Holder67* measure. To test *H1b* whether shareholder activists react to the degree of shareholder overconfidence, the regressions of the base model are rerun with varying degrees of overconfidence using a variation of Malmendier and Tate's *Longholder* measure developed by Humphery-Jenner et al. (2016).

Table 2-3 depicts the results of two additional regressions based on Humphery-Jenner et al.'s (2016) *Holder67* measure. Regression [1] with *Holder67* as the main independent variable is conducted to confirm that the significant negative relationship between CFO overconfidence found in the previous section also persists when relaxing the requirement originally imposed by Malmendier and Tate (2005) that an option needs to be held until the final year of expiration to classify an executive as overconfident. Regression [2] introduces a segmentation of overconfident CFOs across three overconfidence clusters thereby testing whether the degree of overconfidence affects shareholder activist target selection. If the decision of an activist shareholder is not only driven by the presence but also by the degree of overconfidence, it should be expected that the negative effect of CFO overconfidence is particularly strong for CFOs with comparably high overconfidence (i.e., who would only be classified as overconfident following a stricter moneyiness threshold such as, e.g., 100%). The first overconfidence cluster thereby captures predominantly CFOs with low to medium overconfidence and is reflected by a binary variable (*Holder30-Holder67*) that is equal to one for all executives that are overconfident based on a 30% moneyiness threshold but not a 67% moneyiness threshold. The second overconfidence cluster captures CFOs with medium to high overconfidence and is reflected by a binary variable (*Holder67-Holder100*) that is equal to one for all executives that are overconfident based on a 67% moneyiness threshold but not a 100% threshold. The third

overconfidence cluster captures CFOs with high overconfidence that can still be classified as overconfident when applying a moneyness threshold of 100%.

Table 2-3: Regression results regarding the influence of the strength of overconfidence on shareholder activist target selection

Cluster	Variable	Segmentation based on strength of overconfidence	
		Holder67 [1]	[2]
CFO Overconfidence	Holder67	-0.445*** (0.001)	
	Holder30-Holder67		-0.077 (0.616)
	Holder67-Holder100		-0.384* (0.050)
	Holder100		-0.563*** (0.001)
Other CFO Characteristics	CFO Gender	0.295* (0.087)	0.293* (0.090)
	CFO Age	-0.008 (0.350)	-0.008 (0.386)
CEO characteristics	Holder67	-0.010 (0.940)	
	Holder30-Holder67		-0.068 (0.676)
	Holder67-Holder100		-0.284 (0.205)
	Holder100		0.075 (0.635)
	CEO Gender	0.064 (0.836)	0.033 (0.916)
	CEO Age	0.006 (0.470)	0.005 (0.509)
	Firm fundamentals	Market Cap	-0.212*** (0.000)
Tobin's Q		-0.352*** (0.001)	-0.358*** (0.000)
Leverage		0.442 (0.239)	0.435 (0.246)
Dividends per Share		0.319 (0.928)	0.449 (0.900)
ROA		-1.083* (0.092)	-1.056 (0.101)
Sales Growth		-0.050 (0.876)	-0.047 (0.883)
R&D		2.388 (0.189)	2.382 (0.189)
Tangibility		0.308* (0.061)	0.307* (0.061)
Governance	Inst Ownership	0.662* (0.080)	0.687* (0.070)
	Inst Ownership HHI	0.030 (0.979)	0.080 (0.942)
<i>Observations</i>		12,813	12,813
<i>Wald X²</i>		192.02	196.42
<i>Time- and Industry-fixed effects</i>		YES	YES
<i>Clustered Standard Errors</i>		YES	YES

This table contains the results of multiple logit regressions to estimate the impact of CFO characteristics such as overconfidence and gender on shareholder activist target selection. The full sample consists of 16,470 firm-year

observations over the period from 2003 to 2017. The sample contains all firms in the S&P with available observations in the ExecuComp, CRSP, and Compustat databases. Additionally, firms from the financial (SIC 6000-6999) and utility (SIC 4900-4999) industries have been excluded. CFO overconfidence classifications are based on the *Holder67* methodology developed by Malmendier and Tate (2005, 2008) and refined by Humphery-Jenner et al. (2016). Following Brav et al. (2008), a firm is considered as a target of a shareholder activist if it received a Schedule 13D filing by a hedge fund in a given year. All independent variables are lagged by one year and continuous variables are winsorized at the 1% and 99% percentile. Detailed variable descriptions can be found in Appendix 1. Standard errors are adjusted for heteroskedasticity and firm clustering. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels.

The results in Table 2-3 further corroborate previous findings and allow additional conclusions with regard to *H1a* and *H1b*. Firstly, regression [1] provides further support for *H1a*. Effect magnitude and direction of the CFO overconfidence proxy *Holder67* and controls are in line with previous findings and indicate that the probability to get targeted by shareholder activists decreases with the presence of an overconfident CFO. The results of regression [2], on the other hand, indeed indicate that the negative impact of CFO overconfidence on the probability to get targeted by an activist is particularly driven by CFOs with a comparably high degree of overconfidence thereby supporting *H1b*. Our results indicate that the negative effect of CFO overconfidence on the likelihood to get targeted increases with an increasing degree of CFO overconfidence. More precisely, firms with highly overconfident CFOs (i.e., CFOs that can still be classified as overconfident even when applying a moneyiness threshold of 100%) are ~1.76 times less likely to get targeted than companies with less overconfident or rational CFOs (highly significant at a 1% level). CFOs with medium to high levels of overconfidence are ~1.47 times less likely to be targeted by a shareholder activist (significant at a 10% level). While still negative, the effects for the CFO cluster with low to medium levels of overconfidence are statistically insignificant at conventional significance levels and of lower magnitude. Interestingly, using the *Holder67* overconfidence proxy our results furthermore provide supporting evidence for the findings of Francis et al. (2021) and Gupta et al. (2018) by indicating that CFO gender impacts shareholder activist target selection across both regressions with female CFOs being more likely to get targeted than their male counterparts. Results for CEO characteristics and executive age, on the other hand, remain inconclusive. Taken together, these results indicate that CFO characteristics, foremost overconfidence, seem to play a more decisive role for shareholder activist target selection than CEO characteristics thereby further supporting the importance of the CFO for activists.

2.4.3. Impact of CFO transition on the likelihood to get targeted

Both multivariate regression analyses indicate a relationship between the likelihood to get targeted by a shareholder activist and CFO overconfidence. The results are thereby generally in line with the

findings of Francis et al. (2021) that shareholder activists prefer executives with a higher negotiation willingness and extend their findings from CEOs to CFOs. If activists do indeed favor firms with executives whose characteristics indicate a higher negotiation willingness, we would expect the likelihood of being targeted by a shareholder activist to increase for firms that transition from an overconfident to a non-overconfident CFO and vice versa. We analyze whether this is the case using a difference-in-differences (DiD) approach. Specifically, we examine whether firms that switch from an overconfident to a non-overconfident CFO are more likely to get targeted than firms that remained with a non-overconfident CFO using the following regression model:

$$\begin{aligned}
 P(SHAI)_{i,t} = & \alpha + \beta_1 \text{Transition}_{i,t} + \beta_2 \text{Transition to NOC}_{i,t} \\
 & + \beta_3 \text{Transition}_{i,t} \times \text{Transition to NOC}_{i,t} + \text{Controls CXO}_{i,t-1} \\
 & + \text{Controls FUND}_{i,t-1} + \text{Controls GOV}_{i,t-1} + \varepsilon_{i,t}
 \end{aligned} \tag{3}$$

where *Transition* is a dummy variable equal to one if a year follows a CFO transition and *Transition to NOC_{i,t}* is a dummy variable equal to one for firms with a transition from an overconfident to a non-overconfident CFO and zero otherwise. *Transition_{i,t} x Transition to NOC_{i,t}* is the interaction term of both variables and our main variable of interest. As in our base regression models, we have included controls for further CFO and CEO characteristics (*Controls CXO_{i,t-1}*) as well as for firm (*Controls FUND_{i,t-1}*) and governance characteristics (*Controls GOV_{i,t-1}*). We have also accounted for time- and industry-fixed effects and clustered standard errors at the firm level. All variables are indexed to firm *i* and year *t* (or in some cases *t-1*) respectively. Similar to Francis et al. (2021), we have run our regressions for two time windows: a five-year window that includes the transition year as well as two years before and after the transition and a seven-year window that includes the transition year as well as three years before and after the transition. We require each firm to have at least five (seven) observations to remain in the sample.

Table 2-4 contains the results of the two DiD regression models. Column [1] shows the results for the time window including two years before and after a transition and column [2] shows the results for the time window including three years before and after a transition. The results only partially confirm that shareholder activists seem to prefer non-overconfident CFOs. While the relevant interaction dummy between the transition period and the treatment variable is positive for both time windows, it is only significant (at a 5% level) for the longer time window.

Table 2-4: Regression results of a difference-in-differences (DID) design to isolate the impact of CFO changes

Cluster	Variable	CFO OC to Non-OC (t-2 to t+2)	CFO OC to Non-OC (t-3 to t+3)
		[1]	[2]
CFO characteristics	CFO Transition	-0.552* (0.091)	-0.511 (0.129)
	CFO Transition to Non-OC	-0.466 (0.444)	-1.841** (0.043)
	Interaction	0.502 (0.429)	1.736** (0.046)
Other CFO characteristics	CFO Gender	0.283 (0.500)	0.501 (0.224)
	CFO Age	-0.029 (0.152)	-0.032 (0.161)
CEO characteristics	CEO Overconfidence	-0.107 (0.708)	-0.216 (0.449)
	CEO Gender	0.500 (0.481)	0.323 (0.705)
	CEO Age	0.013 (0.559)	0.007 (0.698)
Firm fundamentals	Market Cap	-0.149 (0.185)	-0.230* (0.066)
	Tobin's Q	-0.541** (0.011)	-0.481** (0.035)
	Leverage	0.484 (0.564)	0.747 (0.421)
	Dividends per Share	-4.170 (0.661)	-6.637 (0.557)
	ROA	-2.258 (0.117)	-1.183 (0.560)
	Sales Growth	-0.475 (0.469)	0.212 (0.785)
	R&D	0.716 (0.873)	0.854 (0.879)
	Tangibility	0.610 (0.128)	0.156 (0.704)
Governance	Inst Ownership	0.385 (0.626)	0.441 (0.552)
	Inst Ownership HHI	2.482 (0.234)	2.540 (0.163)
<i>Observations</i>		1,944	2,007
<i>Wald X²</i>		86.81	96.91
<i>Time- and Industry-fixed effects</i>		YES	YES
<i>Clustered Standard Errors</i>		YES	YES

This table contains the results of different difference-in-differences (DID) models to identify the impact of CFO changes on the likelihood to get targeted by an activist. The dependent variable is a dummy variable that equals one if there was at least one Schedule 13-D filing filed by a hedge fund in a given year and zero otherwise. The base sample is reduced to firms that switched from an overconfident CFO to a non-overconfident CFO (treated sample) and firms that switched CFOs but remained with an overconfident CFO (control group). *CFO transition* is a dummy variable that equals one for all years after a CFO transition and zero otherwise. *CFO transition to non-OC* is a dummy variable that equals one if a firm is in the treated group and zero otherwise. Column [1] shows the results for a five-year window spanning the transition year as well as two years before and after a year with a CFO transition and column [2] the results for a seven-year window spanning the transition year as well as three years before and after a year with a CFO transition. A CFO needs to be in office for the full window after the CFO transition to be considered for the sample (i.e., two respectively three years). Coefficients are reported with z-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels.

For the longer time window, our results indicate that the odds to get targeted by a shareholder activist in the three years after a CFO transition are ~ 5.67 times higher after a transition from an overconfident to a non-overconfident CFO. The drastically increasing magnitude of the effect from the first to the second time window as well as the change in the significance of the results could be related to the fact that overconfidence may not be immediately observable from options transactions for a new CFO and might, hence, only become a relevant factor for the decision to target a firm after a longer time in the office of a CFO. Although our consideration of CFO overconfidence as a parametric personality trait alleviates this concern to some extent²⁸, further analyses with longer time windows would be required to validate this hypothesis.

2.4.4. Impact of CFO overconfidence on negotiation willingness

As outlined before, research indicates that overconfident executives tend to be less willing to engage in friendly negotiations and more likely to resist suggestions of hedge fund activists. Gantchev (2013) depicts hedge fund activism as a three-step sequential decision model with the stages demand negotiation, board representation, and proxy contest, with the latter being the most costly negotiation tactic at an average cost of around USD 10.7m. As hedge funds typically maximize returns, we can expect that hedge funds will only revert to the more aggressive negotiation stages such as proxy contests when absolutely necessary to achieve their goals and most likely endogenously choose their tactics in response to the negotiation willingness of the respective target's management. If overconfident CFOs are less likely to openly negotiate with hedge fund activists, we would thus expect that activist hedge funds would need to revert to more hostile negotiation tactics such as proxy fights and open letters to the board more frequently for these firms and vice versa. In this case, we would expect that firms with non-overconfident CFOs exhibit a lower likelihood to be targeted by a contested proxy filing after an activist hedge fund investment in the respective firm. To examine this hypothesis, we enrich our dataset with data on proxy filings. Following Gantchev (2013) we have collected data on proxy contests using all preliminary and definitive proxy forms filed by management and non-management in connection to a solicited proxy context (DFAN14A and DEFN14A as well as PREC14A and PREN14A) from SEC's EDGAR database for all S&P 1500 companies between 2003 and 2017. We have thereby restricted all filings to filings filed by hedge funds to create a dummy

²⁸ CFOs are classified as overconfident if they exhibit overconfident option trading behavior at any point in their career and can hence signal overconfidence already at earlier career stages before their transition to CFO (many newly appointed executives have already received a share of their compensation in stock options before their transition to the executive level)

variable that is equal to one if a firm is targeted by a proxy filing after an activist hedge fund investment and zero otherwise.

In columns [1] and [2] of Table 2-5, we report the results of further logit regressions which regress CFO characteristics, foremost CFO overconfidence, on the dummy variable for proxy filings using the control variables of our base model and controlling for industry- and time-fixed effects. The sample is thereby limited to firms that are targeted by activist hedge funds at least once during the sample period as well as to the years after an initial Schedule 13D filing for the respective firm. While we find that CFO overconfidence exhibit a positive relationship with the likelihood to get targeted by a proxy filing, the relationship is insignificant at conventional significance levels making a sensible interpretation regarding the impact of CFO overconfidence on the probability to face a proxy filing impossible. Interestingly, our controls regarding CEO overconfidence indicate that the probability to be targeted by a proxy filing seems to increase if the firm is led by an overconfident CEO with a firm with an overconfident CEO being ~2.70 times more likely to receive a proxy filing than its peers governed by non-overconfident CEOs (significant at a 5% level). While less relevant for the initial decision to target a firm, CEO characteristics might hence be a more decisive factor for the choice of more aggressive negotiation tactics at later stages of the campaign (at least regarding contested proxy filings).

Results with respect to CFO gender, on the other hand, suggest that female CFOs are more likely to be targeted by proxy filings by activist hedge funds which somewhat contradicts our hypothesis that activist hedge funds engage in fewer proxy filings in negotiations with target firms with female CFOs. These results also at least partially contradict the findings of Francis et al. (2021) who find that hedge funds tend to engage in less hostile tactics with targets led by female CEOs. While the analyses undertaken by Francis et al. (2021) are focused on CEOs and not CFOs and based on data from Factset's Sharkwatch (and hence encompass a more granular analysis of non-hostile and hostile events than solely proxy filings), this apparent contradiction warrants the need for additional research.

Table 2-5: Effect of CFO overconfidence on probability to face a contested proxy filing

Cluster	Variable	Contested Proxy Filings	
		[1]	[2]
CFO overconfidence	CFO Overconfidence	0.270 (0.535)	0.093 (0.851)
Other CFO characteristics	CFO Gender	1.237** (0.013)	1.443*** (0.006)
	CFO Age	0.019 (0.551)	0.028 (0.396)
CEO characteristics	CEO Overconfidence		0.922** (0.028)
	CEO Gender		0.864 (0.293)
	CEO Age		-0.0732** (0.030)
Firm fundamentals	Market Cap	0.098 (0.619)	0.111 (0.585)
	Tobin's Q	-0.629 (0.120)	-0.675* (0.098)
	Leverage	-0.206 (0.874)	0.009 (0.995)
	Dividends per Share	-4.076 (0.635)	-2.137 (0.794)
	ROA	0.657 (0.686)	0.248 (0.881)
	Sales Growth	-1.434 (0.206)	-1.387 (0.243)
	R&D	3.466 (0.480)	3.569 (0.452)
	Tangibility	0.920 (0.148)	1.076 (0.118)
	Governance	Inst Ownership	-1.932 (0.144)
Inst Ownership HHI		-3.105 (0.436)	-2.706 (0.504)
<i>Observations</i>		1,476	1,475
<i>Wald X²</i>		68.87	76.84
<i>Time- and Industry-fixed effects</i>		YES	YES
<i>Clustered Standard Errors</i>		YES	YES

This table contains the results of multiple logit regressions analyzing the effect of CFO characteristics on the probability that a hedge fund targets the respective firm with a contested proxy filing (for all firms that are at least targeted once by an activist during the sample period). Following Gantchev (2013) the sample contains all SEC filings of the forms PREC14A, PREN14A, DFAN14A, and DEFN14A undertaken by hedge funds for S&P 1500 firms from 2003 to 2017. The sample only contains the initial filing for a firm in a year. The dependent variable is a dummy variable equal to one if a firm was targeted with a contested proxy filing by a shareholder activist hedge fund in a given year and zero otherwise. Firms from the financial (SIC 6000-6999) and utility (SIC 4900-4999) industries have been excluded. CFO and CEO overconfidence classifications are based on the *Longholder* methodology developed by Malmendier and Tate (2015). All continuous variables are winsorized at the 1% and 99% percentile and multivariate regressions are adjusted for time- and industry-fixed effects.

Detailed variable descriptions can be found in Appendix 1. Standard errors are adjusted for heteroskedasticity and firm clustering with p-values in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels.

2.4.5. Short term market reactions

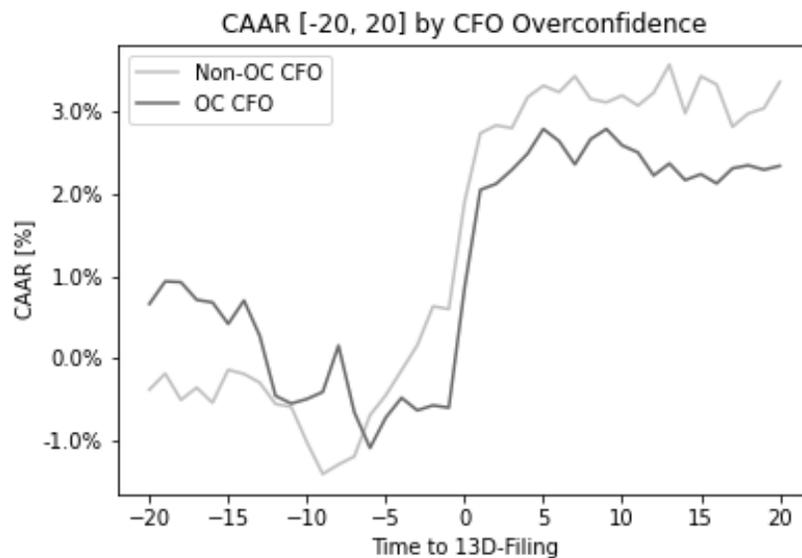
Although our previous analysis provides inconclusive results regarding the impact of CFO overconfidence on the probability of contested proxy filings, CFO overconfidence and a concomitant lower degree of negotiation willingness could still manifest in a prolonged, more costly negotiation process (e.g., via public voice). Prior research shows that activist campaigns which require the use of hostile, more aggressive activism tactics also tend to have a lower success rate in implementing demands of the activist campaign (Brav et al., 2008; Gantchev, 2013). Thus, a higher possibility to face a hostile campaign or a prolonged negotiation process as, for example, indicated by CFO overconfidence, should, *ceteris paribus*, lead to lower expected returns for hedge funds and firms. If this holds true, the announcement of an activist investment (i.e., a Schedule 13D filing) in a target with an overconfident CFO should lead to more negative/less positive market reactions. To further test this hypothesis, we study the short-term market reactions to activist investment announcements using a standard event study methodology following Brown and Warner (1980) and MacKinlay (1997).

In Figure 2-2, we first plot cumulative average abnormal returns (CAARs) in excess of returns implied by the market model for a [-20; 20] window surrounding the filing of Schedule 13D for firms with overconfident CFOs compared to CAARs for firms with non-overconfident CFOs. Following MacKinlay (1997), we use an ordinary-least-squares (OLS) regression-based approach for an estimation window of [-270; -21] before the respective filing date of a Schedule 13D taking the S&P 1500 as a reference market index to estimate parameters required for the calculation of abnormal returns. Figure 2-2 shows that firms with non-overconfident CFOs exhibit higher CAARs than firms with overconfident CFOs. This observation is particularly pronounced for the days directly surrounding the filing of a Schedule 13D. Additionally, the CAARs depicted in Figure 2-2 suggest, on average, a positive abnormal market reaction to Schedule 13D filings. Untabulated regression results confirm significant positive CAARs of between 1.5% (for event window [0]) and 4.7% (for event window [-20, 20]) which are robust to a range of parametric and non-parametric tests.²⁹ These findings are generally in line, though lower in magnitude, with the findings of Brav et al. (2008) who find significant positive abnormal returns of around 7%. When splitting abnormal returns by CFO

²⁹ We, *inter alia*, test our results for significance using a standard student's t-test, the Boehmer-Musumeci-Poulsen (BMP)-test following Boehmer et al. (1991), and the non-parametric Rank test following Corrado and Zivney (1992).

overconfidence we observe less positive returns for firms with overconfident CFOs across various event windows; for example, at $\sim 1.8\%$ for an event window of $[-20, 20]$ and $\sim 2.4\%$ for an event window of $[-1, 1]$ compared to returns of $\sim 4.9\%$ and $\sim 2.6\%$ for non-overconfident CFOs. The resulting differences in abnormal returns ($\sim 3.1\%$ and $\sim 0.2\%$ for the two exemplary event windows) are, however, only significant for longer event windows (particularly for the $[-10, 10]$ and $[-20, 20]$ windows) thereby providing some support for *H2*. Similar but less pronounced results can also be observed for CEO overconfidence and executive gender.

Figure 2-2: Effect of CFO overconfidence on short-term market reactions to 13D filings



This figure provides a comparison of CAARs 20 days before to 20 days after the filing of a Schedule 13D split by whether a firm has an overconfident CFO at the time of the filing. The sample consists of all Schedule 13D filings filed by hedge funds (based on the CISDM-Morningstar database and respective fund registrations with the SEC) for active members of the S&P 1500 between 2003 and 2017 (506 events in total). Overconfidence has been proxied using the Thomson Reuters *Longholder* measure following Malmendier and Tate (2015).

The observed differences in short-term market reactions to Schedule 13D filings could, however, be at least partially explained by differences in firm fundamentals (it could, for example, be theoretically possible that firms with non-overconfident CFOs also have more attractive firm fundamentals for shareholder activists or are a more attractive investment for shareholder activists due to other reasons). We have hence estimated a multivariate OLS regression model to address this concern in which we have regressed CFO overconfidence as well as all controls of our base regression model on cumulative abnormal returns (CARs) of different event windows. All models control for industry- and time-fixed effects. The results for these regressions can be found in Table 2-6.

Table 2-6: Impact of CFO overconfidence on short-term market reactions to shareholder activist investments

Cluster	Variable	CAAR	CAAR	CAAR
		[-20; 20]	[-10; 10]	[-1; 1]
		[1]	[2]	[3]
CFO characteristics	CFO Overconfidence	-2.556 (0.338)	-0.528 (0.781)	-0.388 (0.617)
	CFO Gender	-4.464 (0.134)	-2.079 (0.327)	-0.537 (0.536)
	CFO Age	0.145 (0.356)	0.127 (0.257)	0.035 (0.440)
CEO characteristics	CEO Overconfidence	-1.800 (0.411)	-2.731* (0.080)	-0.742 (0.245)
	CEO Gender	2.998 (0.585)	3.437 (0.379)	2.042 (0.202)
	CEO Age	0.093 (0.520)	0.101 (0.326)	0.003 (0.950)
Firm fundamentals	Market Cap	0.552 (0.522)	0.382 (0.533)	0.283 (0.261)
	Tobin's Q	0.663 (0.664)	0.336 (0.757)	0.213 (0.632)
	Leverage	-10.994* (0.068)	-0.273 (0.949)	1.000 (0.568)
	Dividends per Share	0.426 (0.986)	12.588 (0.458)	0.611 (0.930)
	ROA	-2.680 (0.692)	-1.125 (0.815)	-0.713 (0.718)
	Sales Growth	-1.321 (0.783)	-1.374 (0.687)	-0.220 (0.875)
	R&D	-5.731 (0.783)	-1.905 (0.898)	5.768 (0.342)
	Tangibility	0.160 (0.958)	1.314 (0.543)	-0.315 (0.721)
Governance	Inst Ownership	-0.803 (0.902)	1.079 (0.816)	2.831 (0.136)
	Inst Ownership HHI	-10.560 (0.620)	6.196 (0.683)	-0.488 (0.937)
<i>Observations</i>		436	436	436
<i>Adjusted R-Squared</i>		0.006	0.014	0.047
<i>Time- and Industry-fixed effects</i>		YES	YES	YES

This table contains the results of multiple OLS regressions to estimate the impact of CFO characteristics such as overconfidence and gender on the market reaction to Schedule 13D filings. Columns [1] to [3] contain results with CAARs for the event windows [-20, 20], [-10, 10], and [-1, 1]. The full sample consists of 506 unique Schedule 13D filings. Firms from the financial (SIC 6000-6999) and utility (SIC 4900-4999) industries are excluded. CFO and CEO overconfidence classifications are based on the *Longholder* methodology developed by Malmendier and Tate (2015). All continuous variables are winsorized at the 1% and 99% percentile and regressions are adjusted for time- and industry-fixed effects. Detailed variable descriptions can be found in Appendix 1. Heteroskedasticity-robust p-values are in the parentheses. ***, ** and * denote statistical significance at the 1%, 5%, and 10% levels.

The results exhibited in Table 2-6 do not allow any conclusions regarding the relationship between CFO overconfidence and CARs around a shareholder activist investment. Columns [1] to [3] show the results of our analyses using CARs as the dependent variable for the event windows [-20, 20], [-10, 10], and [-1, 1]. As expected, CFO overconfidence exhibit a negative, albeit insignificant relationship with a firm's cumulative abnormal returns around an activist investment across all event windows. Similarly, results concerning CEO overconfidence suggest that investors, if at all, react more negatively to investments of shareholder activists in companies with overconfident CEOs (though results are only significant for the [-10, 10] window). Results for executive gender remain directionally inconclusive with considerable differences regarding direction and magnitude across event windows and variables.

While our findings with regard to CEO gender are directionally in line with Francis et al. (2021) who show a significant positive relationship between female CEOs and buy-and-hold-abnormal returns (BHARs) for event windows [-10, 10] and [-20, 20], our findings indicate that executive gender does not seem to matter with regard to CARs for our sample.³⁰

2.4.6. Robustness checks

2.4.6.1. Exclusion of executives without an observed option transaction

The classification of executives without option transactions as non-overconfident that has been assumed for the calculation of both *Longholder* measures potentially raises a sample selection bias. To test for this sample selection bias, all regressions have been rerun excluding executives without a qualifying option transaction. The results can be found in Table 2-10 in Appendix 3 and remain similar regarding magnitude, direction, and significance across all main regressions.

2.4.6.2. Non-backfilling of overconfidence measures

A baseline assumption for all analyses involving the two *Longholder* measures following Malmendier and Tate (2005) is that overconfidence is a parametric personality trait that does not change over time. Overconfidence scores have hence been backfilled for the entire tenure of an executive if the executive has had at least one option transaction fulfilling the required criteria for overconfidence. To test whether the assumption that overconfidence is a time-insensitive personality trait drives our results, we rerun our analyses with a sample for which overconfidence classifications have not been backfilled. For this sample, executives are only classified as overconfident from the year onwards in which their

³⁰ As a robustness check we have also repeated our analyses using BHARs instead of CAARs. Results remain qualitatively and directionally similar.

options trading behavior first indicates overconfidence until the end of their tenure. Results can be found in Table 2-11 in Appendix 3 and remain very similar concerning the statistical significance and magnitude of the effects.³¹

2.4.6.3. *Inclusion of additional activism events using proxy filings*

Investors are only required to file a Schedule 13D filing upon reaching an ownership position of 5% or more. Our sample could hence be biased towards smaller firms as activists hedge funds often only accumulate positions below 5% in larger companies to avoid cluster risks by allocating a too large share of their portfolio towards one investment (Brav et al., 2008). Following Greenwood and Schor (2009), we account for this bias by adding all definitive proxy statements filed by non-management (DFAN14A) that are filed for a firm that has not received a Schedule 13D filing in a given year as further activism events. A DFAN14A may be filed with the SEC by any investor who considers engaging in a proxy fight with a firm's management team and may be filed with ownership positions below 5%. We have subsequently rerun our analyses using the DFAN14A-enriched sample. Results again remain very similar regarding direction and significance and can be found in Table 2-12 in Appendix 3.

2.4.6.4. *Placebo test with Schedule 13G filings*

It is possible that inherent, unobserved firm characteristics instead of CFO overconfidence drive our results. To rule out this possibility, we have repeated our base regression analyses with Schedule 13G filings instead of Schedule 13D filings as our dependent variable. When surpassing the threshold of 5% ownership, investors may opt to file a Schedule 13G filing instead of a Schedule 13D filing. In contrast to a Schedule 13D filing, this filing prohibits the filer to become an active investor and, hence, engage in shareholder activism. As Schedule 13G filings indicate passive investment strategies without interactions between shareholders and firm management, CFO overconfidence should not have an impact on the likelihood of Schedule 13G filings. As shown in Table 2-7, we find no consistent preference for non-overconfident CFOs for our sample indicating that CFO overconfidence indeed drives the results of our previous analyses

³¹ Due to limited availability of grant-level data for the ExecuComp measure (ExecuComp compensation data is only available from 2006 onwards) we have only repeated the base analyses using the *Longholder* and *Holder67* proxies for overconfidence.

Table 2-7: Regression results on the impact of CFO overconfidence on the likelihood to receive a Schedule 13G filing

Cluster	Variable	Target (TR)	Target (TR)	Target (TR)	Target (EC)
		[1]	[2]	[3]	[4]
CFO overconfidence	CFO Overconfidence	-0.089 (0.155)	-0.044 (0.486)	-0.055 (0.397)	-0.082 (0.209)
Other CFO characteristics	CFO Gender	0.067 (0.480)	0.063 (0.527)	0.064 (0.523)	0.059 (0.560)
	CFO Age	-0.001 (0.886)	0.004 (0.325)	0.004 (0.317)	0.004 (0.326)
CEO characteristics	CEO Overconfidence			0.041 (0.508)	0.004 (0.955)
	CEO Gender			-0.282* (0.061)	-0.288* (0.057)
	CEO Age			-0.003 (0.478)	-0.003 (0.509)
Firm fundamentals	Market Cap		-0.226*** (0.000)	-0.226*** (0.000)	-0.226*** (0.000)
	Tobin's Q		-0.039 (0.237)	-0.040 (0.225)	-0.039 (0.237)
	Leverage		0.117 (0.537)	0.102 (0.591)	0.100 (0.598)
	Dividends per Share		0.093 (0.957)	0.161 (0.924)	0.120 (0.944)
	ROA		-0.118 (0.719)	-0.131 (0.691)	-0.130 (0.692)
	Sales Growth		-0.496*** (0.000)	-0.497*** (0.000)	-0.497*** (0.000)
	R&D		0.032 (0.972)	-0.010 (0.991)	-0.034 (0.970)
	Tangibility		0.022 (0.820)	0.032 (0.742)	0.026 (0.786)
Governance	Inst Ownership		2.097*** (0.000)	2.092*** (0.000)	2.086*** (0.000)
	Inst Ownership HHI		3.403*** (0.000)	3.418*** (0.000)	3.401*** (0.000)
<i>Observations</i>		14,056	12,809	12,808	12,808
<i>Wald X²</i>		435.77	677.55	682.33	682.04
<i>Time- and Industry-fixed effects</i>		YES	YES	YES	YES
<i>Clustered Standard Errors</i>		YES	YES	YES	YES

This table presents the results of multiple logit regressions to estimate the impact of CFO overconfidence on the probability of a Schedule 13G filing. The full sample consists of 16,470 firm-year observations over the period from 2003 to 2017. The sample contains all firms in the S&P 1500 with available observations in the ExecuComp, CRSP, and Compustat databases. Additionally, firms from the financial (SIC 6000-6999) and utility (SIC 4900-4999) industries have been excluded. CFO and CEO overconfidence classifications are based on the *Longholder* methodology developed by Malmendier and Tate (2015). A firm is considered as a target of a shareholder activist if it received a Schedule 13G filing by a hedge fund in a given year. All independent variables are lagged by one year and continuous variables are winsorized at the 1% and 99% percentile. Detailed variable descriptions can be found in Appendix 1. Standard errors are adjusted for heteroskedasticity and firm clustering. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels.

2.5. Conclusion

This study analyzes the relationship between CFO overconfidence and the likelihood of a company to get targeted by an activist hedge fund. Shareholder activism has become an important topic for senior executives in recent years steering executive focus away from day-to-day business towards shareholder management. While the criteria used by shareholder activists to target a particular company remain a subject of intense debate in academic literature, executives are increasingly concerned with preempting activist attacks in the first place making it even more important to fully understand the key motivations of shareholder activists. Given that a major part of shareholder activism relies on addressing shareholder concerns in successful negotiations with a target company's senior leadership, shareholder activists should, *ceteris paribus*, prefer counterparts that are open to negotiate and provide a higher likelihood for negotiation success. This should be particularly true for the CFO who is a key counterpart of shareholder activists in negotiations and responsible for the implementation of many core demands of shareholder activists.

Indeed, the findings of our study show that CFO overconfidence, a characteristic that particularly impacts the likelihood of negotiation willingness and, ultimately, negotiation success, plays an important role for shareholder activist target selection across the S&P 1500. More precisely, the results show that having an overconfident CFO significantly decreases the likelihood of a shareholder activist investment. Furthermore, the results indicate that the negative impact of CFO overconfidence on the likelihood to get targeted increases with the strength of a CFO's overconfidence. These results persist when we control for CEO overconfidence with results suggesting that CFO overconfidence plays a more significant role for shareholder activists than CEO overconfidence. Further analyses support these findings by showing that firms that switched from overconfident to non-overconfident CFOs are more likely to get targeted by shareholder activists than their peers that remained with an overconfident CFO in the three years after a CFO transition. Following Brav et al. (2008), we further show that Schedule 13D filings by activist hedge funds lead to significant positive CAARs of between 1.5% and 4.7% depending on the analyzed event window. Filings that are filed for firms with overconfident CFOs thereby exhibit significantly less positive market reactions than their peers indicating that investors acknowledge a lower likelihood of negotiation success and thus a higher risk of prolonged, more costly negotiations for investments in firms with overconfident CFOs. Besides corroborating the notion that shareholder activists incorporate assumptions on the likelihood of negotiation success based on CFO overconfidence when targeting a firm, we also show that our

findings at least partially extend to CEOs as well as CEO/CFO gender (with firms with female executives exhibiting a lower likelihood to get targeted by shareholder activists than their peers in some analyses settings). Our results remain robust across multiple alternative explanations and model specifications.

Besides implications for regulators and investors in capital markets, we believe that the findings of this study have several implications for shareholder activism research. While academics have originally predominantly focused on firm fundamentals and governance practices as antecedents of shareholder activist investments, this study shows that executive characteristics play a decisive role in the decision process of a shareholder activist. The findings of this study also indicate that shareholder activists not only seem to care about improvement opportunities in potential target companies but also at least indirectly assess the likelihood that their demands are met with open ears by the respective executives. More importantly, our findings also indicate that CFOs seem to play an at least similarly important role for shareholder activists as CEOs thereby warranting the need for additional research regarding the relationship between CFO characteristics and shareholder activism.

Appendix I

Appendix 1. Explanation of key variables

Table 2-8: Explanation of key variables

Category	Variable Name	Description
Shareholder Activism	Target	Dummy variable that equals one if a firm has been approached by one or more shareholder activist hedge funds in a given year (based on Schedule 13D filings).
Overconfidence Measures	Overconfidence (TR)	This <i>Longholder</i> measure is computed following the same procedure as in Malmendier and Tate (2015) and is based on individual option transactions of executives declared in "Form 4" of Table 2 and extracted from the Thomson Reuters Insider Trading database. It is a binary variable that is equal to one if an executive has at least one option transaction that fulfills the following two criteria: a) the option is in its final year before expiration and b) the option has been at least 40% in the money one year before expiration. The variable is calculated in the same way for CEOs and CFOs.
	Overconfidence (EC)	This <i>Longholder</i> measure is computed following the same procedure as in Malmendier and Tate (2015) and is based on grant-level option holdings of executives extracted from ExecuComp. It is a binary variable that is equal to one if an executive has at least one option grant in her portfolio that fulfills the following two criteria: a) the option grant is in its final year before expiration and b) the option grant has been at least 40% in the money one year before expiration. The variable is calculated in the same way for CEOs and CFOs.
	Holder67	The <i>Holder67</i> measure is computed following the same procedure as in Humphery-Jenner et al. (2016). It is based on a continuous <i>Confidence</i> measure for an executive's overconfidence level that is defined as the "value per vested option" divided by the average strike price of the option. The "value per vested option" is thereby defined as the total value of vested unexercised options (<i>opt_unex_exer_est_val</i> in ExecuComp) divided by the total number of vested unexercised options (<i>opt_unex_exer_num</i> in ExecuComp) and the average strike price is determined by subtracting the "value per vested option" from the stock price at the time the option value is determined (<i>prc_f</i> in CRSP). The calculation is based on the assumption that the value of an option is the current market price subtracted by the strike price of the option. <i>Holder67</i> is then defined as a binary variable that is equal to one for all firm-year observations during an executive's tenure if an executive's <i>Confidence</i> measure is higher than 67% at least twice during the sample period. The variable is calculated in the same way for CEOs and CFOs.
	Holder30	A binary variable that is calculated in the same way as the <i>Holder67</i> variable but requires an executive's <i>Confidence</i> measure to be at least 30% twice instead of 67% during the sample period to classify her as overconfident. The variable is calculated in the same way for CEOs and CFOs.
	Holder100	A binary variable that is calculated in the same way as the <i>Holder67</i> variable but requires an executive's <i>Confidence</i> measure to be at least 100% twice instead of 67% during the sample period to classify her as overconfident. The variable is calculated in the same way for CEOs and CFOs.
	Holder30-Holder67	A binary variable that is equal to one for all executives who are classified as overconfident following the <i>Holder30</i> definition of overconfidence but not the <i>Holder67</i> definition of overconfidence. The variable is calculated in the same way for CEOs and CFOs.
	Holder67-Holder100	A binary variable that is equal to one for all executives who are classified as overconfident following the <i>Holder67</i> definition of overconfidence but not the <i>Holder100</i> definition of overconfidence. The variable is calculated in the same way for CEOs and CFOs.

Executive Characteristics	Gender	A binary variable that is equal to one if an executive is female. The variable is calculated in the same way for CEOs and CFOs.
	Age	A discrete variable that is equal to the executive's age in year t. The variable is calculated in the same way for CEOs and CFOs.
Firm Fundamentals	Market Cap	The natural log of the firm's market capitalization (<i>prcc_f*csbo</i> in Compustat).
	Tobin's Q	The firm's Tobin's Q (a measure for relative undervaluation) defined as a firm's total assets (<i>at</i> in Compustat) plus a firm's market capitalization subtracted by a firm's equity (<i>ceq</i> in Compustat) scaled by the firm's total assets (<i>at</i> in Compustat).
	Leverage	A measure for the firm's leverage defined by the firm's long-term debt obligations (<i>dltt</i> in Compustat) plus the firm's short-term debt obligations (<i>dlc</i> in Compustat) scaled by the firm's total assets (<i>at</i> in Compustat).
	Payout Yield	The firm's annual payout yield defined as its annual preferred dividends (<i>dvp</i> in Compustat) plus its common dividends (<i>dvc</i> in Compustat) scaled by a firm's market cap (as defined above) and its total preferred equity (<i>pske</i> in Compustat).
	ROA	The firm's return on assets defined by the firm's EBITDA in year t (<i>ebitda</i> in Compustat) scaled by the firm's assets in year t (<i>at</i> in Compustat).
	Sales Growth	The firm's sales growth defined by the firm's total sales in year t scaled by the firm's total sales in year t-1 (<i>sale</i> in Compustat).
	Tangibility	A firm's tangibility ratio (a measure for the financial strength of a firm) defined as a firm's property, plant, and equipment (<i>ppegt</i> in Compustat) divided by its total assets (<i>at</i> in Compustat).
	R&D	A firm's research and development expenses (<i>xrd</i> in Compustat) scaled by its assets (<i>at</i> in Compustat). Following Francis et al. (2021) all missing values are set to zero.
Governance characteristics	Inst Ownership	The firm's institutional ownership percentage (<i>InstOwn_Perc</i> in ExecuComp).
	Inst Ownership HHI	The firm's institutional ownership concentration (<i>InstOwn_HHI</i> in ExecuComp).

Appendix 2. Descriptive statistics

Table 2-9: Descriptive statistics

Panel A - Target sample vs. non-target sample								
	Target sample			Non-target sample			Diff. (Target - non-target)	
	Mean	Median	SD	Mean	Median	SD	Mean	Median
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Target	1.000	1.000	0.000	0.000	0.000	0.000	1.000***	1.000***
CFO Overconfidence (TR)	0.238	0.000	0.426	0.332	0.000	0.471	-0.095***	0.000***
CFO Overconfidence (EC)	0.190	0.000	0.393	0.255	0.000	0.436	-0.065***	0.000***
CFO Gender	0.125	0.000	0.331	0.100	0.000	0.300	0.025*	0.000*
CFO Age	49.102	49.000	6.954	49.867	50.000	6.521	-0.765**	-1.000**
CEO Overconfidence (TR)	0.411	0.000	0.493	0.497	0.000	0.500	-0.086***	0.000***
CEO Overconfidence (EC)	0.336	0.000	0.473	0.381	0.000	0.486	-0.045**	0.000*
CEO Gender	0.039	0.000	0.193	0.033	0.000	0.177	0.006	0.000
CEO Age	55.086	55.000	7.396	54.808	55.000	7.293	0.278	0.000
Market Cap	3,759	1,278	8,516	10,845	2,151	32,743	-7,085***	-873***
Tobin's Q	1.587	1.446	0.677	1.983	1.620	1.220	-0.397***	-0.174***
Sales Growth	0.060	0.057	0.199	0.087	0.067	0.232	-0.027**	-0.011*
ROA	0.046	0.052	0.114	0.083	0.083	0.124	-0.036***	-0.031***
Leverage	0.218	0.210	0.182	0.211	0.198	0.181	0.006	0.011
Payout Yield	0.011	0.000	0.026	0.012	0.005	0.028	-0.001	-0.005***
R&D	0.033	0.000	0.061	0.029	0.003	0.051	0.003	-0.003
Tangibility	0.543	0.472	0.402	0.510	0.401	0.391	0.033*	0.072**
Inst Ownership	0.828	0.853	0.207	0.797	0.833	0.210	0.031***	0.020**
Inst Ownership HHI	0.059	0.045	0.060	0.058	0.042	0.078	0.001	0.003***

Panel B - Targets with overconfident CFOs vs targets with non-overconfident CFOs								
	Overconfident CFO			Non-overconfident CFO			Diff. (OC - non-OC)	
	Mean	Median	SD	Mean	Median	SD	Mean	Median
Target	1.000	1.000	0.000	1.000	1.000	0.000	N/A	N/A
CFO Overconfidence (TR)	1.000	1.000	0.000	0.000	0.000	0.000	N/A	N/A
CFO Overconfidence (EC)	0.543	1.000	0.501	0.080	0.000	0.501	0.463***	1.000***
CFO Gender	0.125	0.000	0.332	0.125	0.000	0.332	0.000	0.000
CFO Age	49.406	50.000	7.139	49.006	49.000	7.139	0.400	1.000
CEO Overconfidence (TR)	0.676	1.000	0.470	0.329	0.000	0.470	0.347***	1.000***
CEO Overconfidence (EC)	0.495	0.000	0.502	0.300	0.000	0.502	0.196***	0.000***
CEO Gender	0.029	0.000	0.167	0.045	0.000	0.167	-0.016	0.000
CEO Age	55.295	56.000	7.510	54.884	54.000	7.510	0.411	2.000
Market Cap	4,414	1,726	9,071	3,684	1,218	9,071	730	508
Tobin's Q	1.588	1.372	0.813	1.574	1.444	0.813	0.014	-0.072
Sales Growth	0.060	0.045	0.186	0.059	0.057	0.186	0.001	-0.012
ROA	0.062	0.055	0.107	0.039	0.047	0.107	0.023*	0.008
Leverage	0.215	0.199	0.159	0.220	0.215	0.159	-0.005	-0.016

Payout Yield	0.012	0.004	0.019	0.011	0.000	0.019	0.000	0.004
R&D	0.023	0.000	0.051	0.036	0.005	0.051	-0.013*	-0.005**
Tangibility	0.576	0.511	0.411	0.533	0.464	0.411	0.043	0.047
Inst Ownership	0.885	0.905	0.173	0.811	0.842	0.173	0.074***	0.063***
Inst Ownership HHI	0.050	0.042	0.046	0.062	0.046	0.046	-0.012*	-0.004

This table summarizes descriptive statistics of all S&P 1500 companies from 2003 to 2017. Panel A splits the sample into firms that faced a shareholder activist investment in a given year and firms that have not faced a shareholder activist investment while Panel B focuses on shareholder activist targets only and splits the sample into target firms with overconfident CFOs and target firms with non-overconfident CFOs. The full sample contains 16,470 firm-year observations and 506 hedge fund activism events. All variables (except for *Target*) are lagged by one year. Columns [1] to [3] of Panels A (Panel B) contain mean, median, and standard deviation for the target sample (target firms with overconfident CFOs). Columns [4] to [6] contain mean, median, and standard deviation for the non-target sample (target firms with non-overconfident CFOs). Columns [7] and [8] show differences between median and means. Means have been tested for significance using a two-sample t-test for equal means following Snedecor and Cochran (1989) and medians have been tested for significance using Mood's median test. ***, **, * denote significance at the 1%, 5%, and 10% level respectively. All variables are defined in more detail in Appendix 1.

Appendix 3. Robustness checks

Appendix 3.1. Exclusion of executives without observed overconfidence signal

Table 2-10: Regression results of base regressions when excluding executives without observed overconfidence signal

Cluster	Variable	[1]	[2]	[3]	[4]	[5]	[6]
		Target (TR)	Target (TR)	Target (TR)	Target (EC)	Target (TR)	Target (H67)
CFO overconfidence	CFO Overconfidence	-0.443*** (0.003)	-0.326** (0.030)	-0.260 (0.102)	-0.279* (0.055)	-0.552** (0.049)	-0.445*** (0.001)
Other CFO characteristics	CFO Gender	0.313 (0.127)	0.350 (0.105)	0.232 (0.309)	0.220 (0.224)	0.238 (0.297)	0.295* (0.087)
	CFO Age	-0.0248** (0.034)	-0.0224* (0.053)	-0.0232* (0.063)	-0.013 (0.164)	-0.0240* (0.058)	-0.008 (0.350)
CEO characteristics	CEO Overconfidence			-0.276 (0.103)	0.032 (0.807)	-0.448** (0.043)	-0.010 (0.940)
	CEO Gender			0.509 (0.238)	0.047 (0.883)	0.539 (0.214)	0.064 (0.836)
	CEO Age			0.012 (0.291)	0.008 (0.347)	0.013 (0.268)	0.006 (0.470)
CFO/CEO Interaction	CFO Overconfidence## CEO Overconfidence					0.458 (0.194)	-0.212*** (0.000)
Firm fundamentals	Market Cap		-0.193*** (0.001)	-0.160*** (0.009)	-0.186*** (0.000)	-0.156** (0.011)	-0.352*** (0.001)
	Tobin's Q		-0.336*** (0.002)	-0.364*** (0.005)	-0.436*** (0.000)	-0.363*** (0.005)	0.442 (0.239)
	Leverage		0.487 (0.317)	0.569 (0.285)	0.464 (0.220)	0.554 (0.296)	0.319 (0.928)
	Dividends per Share		5.254 (0.202)	3.070 (0.550)	2.232 (0.533)	3.070 (0.552)	-1.083* (0.092)
	ROA		-2.060*** (0.007)	-1.843** (0.039)	-1.201* (0.081)	-1.841** (0.040)	-0.050 (0.876)
	Sales Growth		-0.127 (0.747)	-0.196 (0.632)	-0.002 (0.995)	-0.197 (0.630)	-0.050 (0.876)
	R&D		1.208 (0.636)	2.224 (0.431)	3.632* (0.054)	2.233 (0.428)	2.388 (0.189)
	Tangibility		0.372* (0.082)	0.426** (0.047)	0.305* (0.068)	0.429** (0.046)	0.308* (0.061)
Governance	Inst Ownership		0.858 (0.114)	1.006* (0.086)	0.335 (0.394)	1.008* (0.086)	0.662* (0.080)
	Inst Ownership HHI		-0.403 (0.788)	0.488 (0.760)	-0.687 (0.558)	0.562 (0.726)	0.030 (0.979)
<i>Observations</i>		9,686	8,862	7,553	11,802	7,553	12,813
<i>Wald X²</i>		79.92	157.12	140.38	162.05	146.23	192.02
<i>Time- and Industry-fixed effects</i>		YES	YES	YES	YES	YES	YES
<i>Clustered Standard Errors</i>		YES	YES	YES	YES	YES	YES

This table contains the results of multiple logit regressions to estimate the impact of CFO overconfidence on shareholder activist target selection. The full sample consists of 16,470 firm-year observations over the period from 2003 to 2017. The sample contains all firms in the S&P 1500 with available observations in the ExecuComp, CRSP, and Compustat databases. Additionally, firms from the financial (SIC 6000-6999) and utility (SIC 4900-4999) industries have been excluded. Overconfidence classifications are based on the *Longholder* methodology developed by Malmendier and Tate (2015). Similar to Aktas et al. (2019), all executives for which no observation with regard to overconfidence have been observed are excluded from the sample. Following Brav et al. (2008), a firm is considered as a target of a shareholder activist if it received a Schedule 13D filing by a hedge fund in a given year. All independent variables are lagged by one year and continuous variables are winsorized at the 1% and 99% percentile. Detailed variable descriptions can be found in Appendix 1. Standard errors are adjusted for heteroskedasticity and firm clustering. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels.

Appendix 3.2. No backfilling of overconfidence classification

Table 2-11: Regression results of base regressions with no backfilling of overconfidence

Cluster	Variable	[1]	[2]	[3]	[4]	[5]
		Target (TR)	Target (TR)	Target (TR)	Target (TR)	Target (H67)
CFO overconfidence	CFO Overconfidence	-0.585*** (0.000)	-0.467*** (0.003)	-0.493*** (0.002)	-0.698*** (0.005)	-0.328*** (0.009)
Other CFO characteristics	CFO Gender	0.250 (0.131)	0.305* (0.058)	0.303* (0.061)	0.300* (0.064)	0.304* (0.061)
	CFO Age	-0.008 (0.399)	-0.005 (0.539)	-0.006 (0.462)	-0.006 (0.460)	-0.007 (0.441)
CEO characteristics	CEO Overconfidence			0.077 (0.529)	0.021 (0.879)	0.017 (0.887)
	CEO Gender			0.178 (0.518)	0.175 (0.522)	0.183 (0.506)
	CEO Age			0.009 (0.243)	0.009 (0.235)	0.010 (0.205)
CFO/CEO Interaction	CFO Overconfidence##CEO Overconfidence				0.351 (0.262)	
Firm fundamentals	Market Cap		-0.233*** (0.000)	-0.233*** (0.000)	-0.233*** (0.000)	-0.238*** (0.000)
	Tobin's Q		-0.202*** (0.000)	-0.195*** (0.001)	-0.197*** (0.001)	-0.180*** (0.002)
	Leverage		0.382 (0.275)	0.395 (0.260)	0.389 (0.268)	0.394 (0.261)
	Dividends per Share		0.381 (0.908)	0.314 (0.925)	0.302 (0.927)	-0.288 (0.932)
	ROA		-1.796*** (0.001)	-1.798*** (0.001)	-1.783*** (0.001)	-1.725*** (0.002)
	Sales Growth		-0.215 (0.493)	-0.225 (0.475)	-0.227 (0.471)	-0.179 (0.571)
	R&D		1.012 (0.548)	1.111 (0.507)	1.154 (0.490)	1.090 (0.520)
	Tangibility		0.300* (0.053)	0.300* (0.054)	0.296* (0.057)	0.283* (0.069)
Governance	Inst Ownership		0.231 (0.483)	0.254 (0.445)	0.252 (0.448)	0.263 (0.439)
	Inst Ownership HHI		-0.974 (0.360)	-0.927 (0.389)	-0.926 (0.390)	-0.891 (0.413)
<i>Observations</i>		14,060	14,060	14,057	14,057	14,057
<i>Wald X²</i>		93.31	202.66	204.49	205.07	202.33
<i>Time- and Industry-fixed effects</i>		YES	YES	YES	YES	YES
<i>Clustered Standard Errors</i>		YES	YES	YES	YES	YES

This table contains the results of multiple logit regressions to estimate the impact of CFO overconfidence on shareholder activist target selection. The full sample consists of 16,470 firm-year observations over the period from 2003 to 2017. The

sample contains all firms in the S&P 1500 with available observations in the ExecuComp, CRSP, and Compustat databases. Additionally, firms from the financial (SIC 6000-6999) and utility (SIC 4900-4999) industries have been excluded. Overconfidence classifications are based on the *Longholder* methodology developed by Malmendier and Tate (2015). An executive is thereby only classified as overconfident from the first year onwards in which she signals overconfidence. Following Brav et al. (2008), a firm is considered as a target of a shareholder activist if it received a Schedule 13D filing by a hedge fund in a given year. All independent variables are lagged by one year and continuous variables are winsorized at the 1% and 99% percentile. Detailed variable descriptions can be found in Appendix 1. Standard errors are adjusted for heteroskedasticity and firm clustering. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels.

Appendix 3.3. Inclusion of additional activism events using contested proxy filings

Table 2-12: Regression results of base regressions with an enriched sample including contested proxy filings (DFAN14A)

Cluster	Variable	[1]	[2]	[3]	[4]	[5]
		Target (TR)	Target (TR)	Target (TR)	Target (TR)	Target (H67)
CFO overconfidence	CFO Overconfidence	-0.519*** (0.000)	-0.373*** (0.006)	-0.316** (0.020)	-0.459** (0.028)	-0.453*** (0.001)
Other CFO characteristics	CFO Gender	0.249 (0.151)	0.303* (0.095)	0.292 (0.106)	0.294 (0.105)	0.317* (0.079)
	CFO Age	-0.002 (0.799)	-0.003 (0.720)	-0.004 (0.680)	-0.004 (0.677)	-0.001 (0.919)
CEO characteristics	CEO Overconfidence			-0.209 (0.104)	-0.278* (0.069)	-0.025 (0.846)
	CEO Gender			0.312 (0.257)	0.320 (0.245)	0.340 (0.215)
	CEO Age			0.004 (0.609)	0.005 (0.580)	0.004 (0.584)
CFO/CEO Interaction	CFO Overconfidence##CEO Overconfidence				0.252 (0.383)	
Firm fundamentals	Market Cap		-0.160*** (0.002)	-0.156*** (0.003)	-0.155*** (0.003)	-0.167*** (0.001)
	Tobin's Q		-0.506*** (0.000)	-0.498*** (0.000)	-0.498*** (0.000)	-0.455*** (0.000)
	Leverage		0.167 (0.664)	0.179 (0.641)	0.177 (0.644)	0.186 (0.628)
	Dividends per Share		-0.470 (0.894)	-0.639 (0.857)	-0.623 (0.861)	-1.371 (0.704)
	ROA		-1.028 (0.101)	-0.999 (0.111)	-0.989 (0.114)	-1.024 (0.104)
	Sales Growth		-0.115 (0.707)	-0.105 (0.729)	-0.108 (0.723)	-0.071 (0.816)
	R&D		2.596 (0.163)	2.699 (0.147)	2.711 (0.146)	2.318 (0.211)
	Tangibility		0.396** (0.020)	0.376** (0.028)	0.375** (0.028)	0.373** (0.029)
Governance	Inst Ownership		0.383 (0.331)	0.396 (0.310)	0.400 (0.306)	0.414 (0.296)
	Inst Ownership HHI		-0.796 (0.448)	-0.822 (0.438)	-0.806 (0.447)	-0.645 (0.539)
<i>Observations</i>		14,060	12,814	12,813	12,813	12,813
<i>Wald X²</i>		95.87	173.97	179.98	182.99	186.12
<i>Time- and Industry-fixed effects</i>		YES	YES	YES	YES	YES
<i>Clustered Standard Errors</i>		YES	YES	YES	YES	YES

This table contains the results of multiple logit regressions to estimate the impact of CFO overconfidence on shareholder activist target selection. The full sample consists of 16,470 firm-year observations over the period from 2003 to 2017. The sample contains all firms in the S&P 1500 with available observations in the ExecuComp, CRSP, and Compustat databases. Additionally, firms from the financial (SIC 6000-6999) and utility (SIC 4900-4999) industries have been excluded. Overconfidence classifications are based on the *Longholder* methodology developed by Malmendier and Tate (2015). Following Greenwood and Schor (2009), a firm is considered as a target of a shareholder activist if it either received a Schedule 13D filing or a DFAN14A filing by a hedge fund in a given year. All independent variables are lagged by one year and continuous variables are winsorized at the 1% and 99% percentile. Detailed variable descriptions can be found in Appendix 1. Standard errors are adjusted for heteroskedasticity and firm clustering. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels.

Chapter 3

STOCK MARKET PERCEPTION OF C-LEVEL OVERCONFIDENCE³²

Empirical evidence from directors' dealings during the COVID-19 outbreak

In this chapter, we examine how directors' dealings are perceived by the stock market during the financial turmoil following the outbreak of COVID-19. Especially, we investigate whether investors value information signals provided by directors' dealings differently conditional on executive characteristics. We find that purchases by overconfident executives provoke a more negative market reaction in the aftermath of the outbreak of COVID-19 than purchases by their non-overconfident peers indicating a lack of trust in the signaling capability of these executives. By showing that the stock market reaction is more pronounced to transactions by female executives than to transactions of their male counterparts, we also find evidence supporting previous findings with regard to gender stereotyping.

³² This chapter is largely based on a working paper co-authored with Dirk Schiereck, Florian Kiesel, and Marc Berninger.

3.1. Introduction

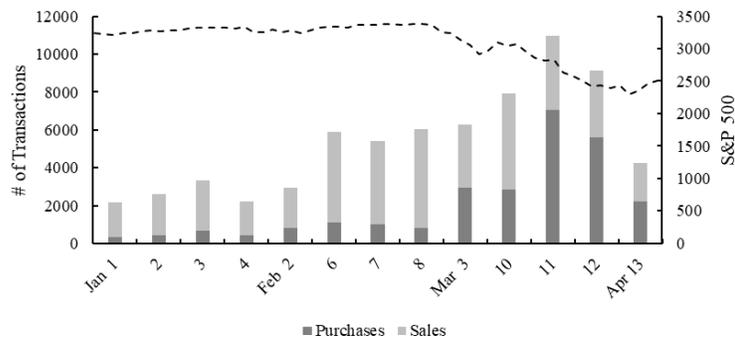
Key executives usually possess superior information about the prospects of their company than (outside) shareholders and convey this superior information to the general public through directors' dealings (i.e., transactions in shares of their own company) (Damodaran & Liu, 1993). Directors' dealings typically increase the informational value of stock prices and provide signals about the prospects of the company to the public (Leland, 1992).³³ Following Gangopadhyay et al. (2009), this kind of signal can be particularly valuable in times of high market volatility and uncertainty as, for example, in the aftermath of the outbreak of COVID-19. Declared a global pandemic by the World Health Organization (WHO) on March 11 (International Monetary Fund, 2020) the virus has wreaked havoc on the world leading to a near-cataclysmic collapse of stock prices and volatility levels last seen during the financial crisis of 2008 and the Great Depression of the early 1930s (Baker et al., 2020).

In this paper, we test how directors' dealings are perceived by stock market participants during this time of global uncertainty as well as which factors directly influence investor reactions during COVID-19. This is particularly relevant since although the stock market turmoil following COVID-19 (in the case of the S&P 500 a -27% drop within the first three weeks) has significantly hurt the performance of most investor portfolios, directors who are particularly confident in their own firm's prospects might have perceived their company as undervalued during the peak of the COVID-19-related stock crash. They may therefore have taken the opportunity to buy additional shares of their company indicating a positive signal of an imminent recovery to the market. Indeed, an assessment of directors' dealings activity for the first thirteen trading weeks of 2020 indicates a significant uptick in directors' dealings after the outbreak of COVID-19 in March and April 2020. Figure 3-1 compares the S&P 500 index (dashed line, right scale) with the weekly number of purchase and sale insider transactions (bars, left scale) published on Form 4 by the SEC and shows that insider transactions more than tripled from an average of 2,586 weekly transactions in January 2020 to an average of 8,081 transactions in March 2020.

Interestingly, while transactions by insiders were predominantly sale transactions in January and February 2020, the significant uptick in trading activity after the onset of COVID-19 seems to be particularly driven by purchase transactions of corporate insiders.

³³ Note that directors' dealings are not necessarily always based on private information (directors' dealings can, e.g., also be related to pre-timed stock transactions, vesting schedules, or liquidity needs of the seller). Furthermore, such transactions are in most countries limited by related insider trading regulations.

Figure 3-1: Weekly number of published directors' dealings and the S&P 500 during the first quarter of 2020



This figure compares the S&P 500 index (dashed line, right scale) with the weekly number of purchase and sale insider transactions (bars, left scale) published on Form 4 by the SEC for the first thirteen trading weeks of 2020 (beginning of January to beginning of April).

These findings are also confirmed by McCabe (2020) who finds more than USD 1.19 bn in insider purchases in March 2020 – the third highest on a dollar basis since 1988. The significant shift from sale to purchase transactions in directors' dealings further corroborates the notion that directors might have perceived their companies as undervalued during the stock market turmoil following the outbreak of COVID-19 and rather perceived the pandemic as an opportunity to signal confidence to the stock market. Prior research shows that purchase transactions of corporate insiders which signal confidence in the prospects of their company are typically followed by a positive market reaction (Bettis et al., 1997; Friederich et al., 2002; Lakonishok & Lee, 2001; Seyhun, 1986). However, anecdotal evidence suggests that this signaling function might have failed during the outbreak of COVID-19. This gives room to the hypothesis that investors do not take the typical signal of confidence of a share purchase of an insider at face value.³⁴

One explanation for this lack of trust from investors could be that they fear that insiders are too overconfident about the prospects of their companies and, hence, engage in purchase transactions at a too early stage of the crisis. The literature has indeed shown that overconfident CEOs are particularly inclined to perceive their company as undervalued by the stock market and are likely to base their decision-making on this assessment of relative undervaluation (Hirshleifer et al., 2012; Malmendier &

³⁴ Lowe CEO Marvin Ellison's purchase transaction published on March 10 was, for example, followed by another drop of -6 % and -11 % of the stock on the subsequent days which further illustrates the potential lack of signaling capabilities during the outbreak of COVID-19.

Tate, 2005, 2015). These findings thereby persist over time and are independent of the general market environment. A period of high volatility and extreme declines in share prices might, however, further exacerbate the tendency to perceive their own company as undervalued leading to an increase in purchase transactions undertaken by overconfident executives. If this is indeed the case, market participants could discount the signaling value of transactions undertaken by overconfident executives leading to a negative initial market reaction.

Using a variation of the overconfidence proxy initially developed by Malmendier and Tate (2005) and later redefined by Humphery-Jenner et al. (2016), we examine in this paper whether stock market investors react differently to directors' dealings based on executive characteristics during times of higher uncertainty. For a sample of 1,271 directors' dealing transactions of CEOs and CFOs of firms listed in the S&P 1500 during the peak of COVID-19 in March 2020, we show that purchases undertaken by overconfident executives provoke a more negative market reaction than purchases undertaken by their non-overconfident peers. Interestingly, these differences only manifest for purchase and not for sale transactions which further supports the hypothesis of reduced signaling capabilities of insider transactions by overconfident executives. Additionally, we control for executive and firm characteristics and observe that transactions executed by female executives are associated with more negative market reactions than those executed by male executives. We thereby extend the findings of Gregory et al. (2013) and show that their results also hold true to some extent during times of high market uncertainty and informational asymmetries as observed during the outbreak of COVID-19.

We contribute to the literature on directors' dealings in several ways: Prior research has shown that investors at least implicitly assess the overconfidence of executives when reacting to, for example, merger announcements (Billett & Qian, 2008; Malmendier & Tate, 2008), announcements of dividend changes (Deshmukh et al., 2013), or the issuances of executive earnings forecasts (Hilary & Hsu, 2011). However, while existing research already indicates that investors take certain executive characteristics such as gender into account when reacting to directors' dealings (see, e.g., Bharath et al., 2009; Gregory et al., 2013; Hillier et al., 2015), we provide novel evidence on the impact of executive overconfidence on the market assessment of the informational value and credibility of directors' dealings during COVID-19.

The rest of this paper is structured as follows: The next section provides an overview of related literature and our hypotheses. This is followed by an explanation of our methodology and a description

of our sample selection process in section 3.3. Our results as well as a discussion of implications, limitations, and avenues for further research follow in sections 3.4 and 3.5. Section 3.6 concludes.

3.2. Literature review and hypotheses development

3.2.1. Literature review

Despite the comparatively short period since the COVID-19 outbreak, research on the effects of COVID-19 on financial markets is already manifold. While some studies analyze the consequences of COVID-19 in the broader context of pandemics and global crises and over a longer sample period (Hassan et al., 2020; Schoenfeld, 2020), most papers focus on the months directly after the outbreak of COVID-19 and how it affected firms, investors, and financial markets. Ding et al. (2020), for example, examine whether firm characteristics affected how well firms reacted to the outbreak of the pandemic. Their results suggest that firms with stronger pre-2020 fundamentals, less supply chain exposure, less entrenched executives, and more Corporate Social Responsibility (CSR)-related activities coped with the effects of COVID-19 considerably better than their peers. This is complemented by Gourinchas et al. (2020) who estimate a large increase in the bankruptcy rate of small- and medium-sized businesses with food services, accommodation, entertainment and recreation, and education being among the most affected sectors. Davis et al. (2020) further expand these findings by showing that bad news about COVID-19 differently affected firms' market returns in the wake of COVID-19 depending on the risk factors provided in their 10K-filings (firms with higher exposures to travel, traditional retail, and energy supply, e.g., exhibited significantly lower returns following bad COVID-19 news). Finally, Zhang et al. (2020) analyze country-specific patterns of risk in global financial markets across multiple countries and to what extent COVID-19 impacted global stock market linkages and volatility spillovers. They find considerable volatility spikes immediately after the outbreak as well as significant differences between stock market linkages regarding risk between before and after the outbreak. Concerning the United States, they show that while the U.S. government's measures of quantitative easing initially calmed financial markets, market volatility remained high due to quantitative easing-induced additional uncertainty and information asymmetries.

In light of the aforementioned volatility spikes and information asymmetries around the outbreak of COVID-19, it is to some extent surprising that research has not yet focused on the impact of COVID-19 on the capability of market participants to process indirect information provided by, for example, a firm's top executives. This is all the more surprising in light of the findings of Rost and

Osterloh (2010). The authors show that, for the financial crisis of 2008, a high degree of uncertainty and market volatility significantly impacted the quality of information processing, and thus the quality of information signals, by executives (particularly financial experts (e.g., CFOs) and men).

A key aspect of information signaling by top executives are directors' dealings. One of the first studies analyzing the information content of published insider transactions is conducted by Jaffe (1974). He finds that insider transactions are indeed informative and contain information on future stock prices. Therefore, mimicking insider transactions by outsiders can lead to abnormal returns. This pattern is in general confirmed by several subsequent studies (Bettis et al., 1997; Friederich et al., 2002; Lakonishok & Lee, 2001; Seyhun, 1986). Nevertheless, recent studies indicate that personal characteristics of executives such as gender are linked with the stock market reactions following their directors' dealings (Bharath et al., 2009; Hillier et al., 2015) and, therefore, the information content might be interpreted differently conditional on which type of executive is trading. Gregory et al. (2013) document that there is a divergence between the signaling capabilities of female executives and the real information value of their insider transactions. In their study, they analyze short-run market reactions following directors' trades and long-run returns of investments based on these trades. While they observe no gender-related differences for long-term holding periods of up to twelve months after the transactions, the authors document lower initial market reactions after directors' dealings of female executives. Due to the identical long-term performance the authors, therefore, conclude that female executives are not informationally disadvantaged, but are rather only to a lower extent able to signal this information to stock market participants.

In their aforementioned study on volatility and uncertainty during the financial crisis of 2008 Rost and Osterloh (2010) further argue that the lower quality information processing of men and financial experts is at least partially linked to a higher degree of overconfidence of this particular subgroup. Research has mostly focused on value-destructive consequences of executive overconfidence, although some studies found positive returns to executive overconfidence. Most studies thereby base their argumentation on the assumption that executives perceive their firms as undervalued which in turn leads to biased decision-making under certain conditions. Findings concerning the negative consequences of executive overconfidence range from sub-optimal financing structure (Malmendier et al. (2011), for example, show that overconfident CEOs tend to issue less equity and are more reluctant to use external financing to avoid being dependent on valuations by capital markets) over an excessive acquisition frequency (Malmendier & Tate, 2008) to a tendency to overinvest in times of

abundant internal resources and high free cash flows (Malmendier & Tate, 2005). Hirshleifer et al. (2012), on the other hand, provide one of the few examples of positive consequences of CEO overconfidence by showing that overconfident CEOs are more successful innovators given the right circumstances, invest more in research and development, claim more patents, and have higher return volatility than their peers with rational CEOs. Most of the aforementioned papers thereby base their measure of executive overconfidence on an executive's options trading behavior and assume that overconfidence is a parametric personality trait that is not limited to specific areas of corporate decision-making. Thus, it is likely that overconfidence also impacts an executive's decision-making capabilities with regard to optimally timing voluntary non-option-based insider transactions.

3.2.2. Hypotheses development

Although research is yet to link executive overconfidence to insider trading activity of executives, it would be conceivable that the tendency of overconfident executives to perceive their firm as undervalued also extends to their non-option-based insider trading behavior which could, in turn, lead to premature share purchases in the direct aftermath of the COVID-19 outbreak. Taken together with the findings of Barber and Odean (2000) who show that investor overconfidence leads to excessive trading activity, this might indicate that the uptick in insider trading activity observed in Figure 3-1 as well as the initial negative market reactions to various announcements of executive share purchases during the aftermath of the outbreak of COVID-19 might, at least partially, be driven by overconfident executives. Gregory et al. (2013) already show that market participants take executive characteristics such as gender into account when reacting to directors' dealings leading to significantly lower market reactions to trades undertaken by females compared to trades by their male peers. Taken together with the findings of Bharath et al. (2009) who show that markets perceive trades undertaken by females as less informative of a firm's future performance we would expect that similar signals that cast doubt on the informational value of trades of certain executives would lead to a similarly negative market reaction to the respective trades.

As outlined before, overconfident executives tend to base their decision-making on the hypothesis that their firm is undervalued which could lead to biased decision-making. Previous research has already shown that overconfidence is linked to sub-optimal trading behavior with regard to execution-timing of an executive's stock options (Malmendier & Tate, 2005, 2008). Based on the assumption that overconfidence is indeed a parametric personality trait, we would expect that this trading behavior also extends to some extent to non-option-based trading activities of such executives. Insider trades

undertaken by such executives should, *ceteris paribus*, have a lower informational value than trades undertaken by their more rational peers. If this is indeed the case, following efficient market theory it can be expected that market participants discount the informational value of directors' dealings undertaken by overconfident executives which would, in turn, induce more negative market reactions to such insider trades. Given the high degree of uncertainty during COVID-19 and following the findings of Rost and Osterloh (2010) this effect should be particularly pronounced during the direct aftermath of COVID-19. This leads to the following hypothesis:

H1a: Directors' dealings undertaken by overconfident executives induce a more negative stock market reaction than trades by their more rational peers after the outbreak of COVID-19.

We would also expect that the effects of executive overconfidence are particularly strong for purchase transactions. Purchase decisions by overconfident executives are much more likely than sale transactions to be driven by an unwarranted sense of undervaluation in the wake of COVID-19 induced market selloffs than purely by a firm's fundamentals and financial prospects:

H1b: Purchase transactions undertaken by overconfident executives induce a more negative market reaction than sale transactions of overconfident executives after the outbreak of COVID-19.

It is likely that the high degree of uncertainty-linked informational asymmetries immediately after the outbreak of COVID-19 exacerbates the tendency of investors to initially misevaluate the informational value of trades undertaken by female executives found by Gregory et al. (2013). We would therefore further expect that the findings of Gregory et al. (2013) also hold true for our sample period leading to more negative market reactions to directors' dealings undertaken by female executives. This leads to our second hypothesis:

H2: Directors' dealings undertaken by female executives induce a more negative market reaction than trades by their male peers after the outbreak of COVID-19.

3.3. Sample construction and methodology

3.3.1. Sample construction

To measure the information value of directors' dealings during the stock market turmoil following the COVID-19 outbreak, we construct a unique and comprehensive sample of all insider transactions published by the SEC (Form 4 filings) in March 2020. As outlined before, the S&P 500 exhibited an extraordinary phase of high volatility during March 2020 rapidly losing 28% from the first trading day of the month on March 2 to its preliminary low on March 23 and comparably quickly recovered with

gains of 19% between March 23 and the begin of the first full trading week in April 2020 (April 6) with reduced market volatility thereafter. We hence restrict our sample to the month of March 2020 to focus on the immediate effects of COVID-19. We also focus on firms listed in the S&P 1500 to ensure sufficient liquidity of the stocks for the subsequent event study analyses. We finally limit our sample to trades conducted by CEOs and CFOs as previous studies indicate that lower hierarchical positions of corporate insiders might limit their access to value-relevant information and, therefore, the information content of their trades is on average assumed lower (J.-C. Lin & Howe, 1990; Ravina & Sapienza, 2010; Seyhun, 1986). This leads us to a final sample of 1,271 transactions, consisting of 760 purchases and 511 sales. Table 3-1 illustrates our sample selection procedure.

Table 3-1: Sample selection procedure

SEC Form 4 filings 03-2020	73,826
Less non-purchases or -sales	-40,991
Less double entries	-25,928
Less non-CEO/-CFO	-5,157
CEO/CFO director dealings	1,750
Less missing Data	-479
Final Sample	1,271

3.3.2. Measuring overconfidence

Numerous studies analyzing the impact of executive overconfidence on managerial actions and stock market reactions use a variation of the overconfidence proxy developed by Malmendier and Tate (2005, 2015). The approach thereby draws on an executive’s options trading behavior to infer her “revealed beliefs” about the future development of her company. Its logic is based on the recent development that companies tend to shift a significant portion of an executive's pay to option-based forms of payment (Cesari & Ozkan, 2015). This corporate payout policy often leaves an executive under-diversified with significant company-specific risk unless the executive is regularly rebalancing her portfolio by selling a share of the stock options that she has received as part of her salary. According to Malmendier and Tate (2005, 2015), irrational, overconfident executives often overestimate the future development of their company (i.e., they believe their company to be currently undervalued by shareholders) and are, hence, more inclined to hold their stock options for a longer period expecting future stock price appreciation and ignoring rational exercise timing considerations. Besides ignoring

their under-diversification problem, executives are thereby basically taking a long-term bet on the prospects of their company's market value.

For our analyses, we use a variation of the *Longholder* measure which is called *Holder67* and was originally developed by Malmendier and Tate (2005) and then further refined by Humphery-Jenner et al. (2016). For this proxy, an executive is classified as overconfident if she continues to hold stock options that are at least 67% in the money five years before expiration. The in-the-money threshold of 67% is based on the Hall-Murphy model of rational option exercise behavior (Hall & Murphy, 2002). Overconfidence is thereby proxied using a continuous variable that is calculated as follows:

$$CONF = \frac{AVAL}{AVXRP} \quad (4)$$

where,

$$AVAL = \frac{VAL_{VESTED\ UNEXER\ OPTIONS}}{NUM_{VESTED\ UNEXER\ OPTIONS}}$$

and

$$AVXRP = PRCCF - AVAL$$

where *CONF* describes the continuous confidence measure, *AVAL* is the average value of an executive's option grant, *AVXRP* is the average strike price of the option grant, *VAL_{VESTED UNEXER OPTIONS}* is the value of all vested unexercised options of an executive, *NUM_{VESTED UNEXER OPTIONS}* describes the number of all vested unexercised options, and *PRCCF* is the company's stock price at the end of the respective fiscal year. We obtain all necessary data from S&P's CapitalIQ database which contains detailed data on executive compensation and stock holdings. Finally, the overconfidence measure is then defined as a binary variable that is equal to one for all executives for which the continuous confidence measure *CONF* is at least 67% on at minimum two occasions during the tenure of the executive.

3.3.3. Methodology

To assess the market impact of the directors' dealings during the COVID-19 outbreak, we employ the market model event study methodology. The abnormal returns (ARs) of a transaction of executive *i* in stock *j* at time *t* are calculated as follows:

$$AR_{it} = R_{jt} - (\hat{\alpha} - \hat{\beta} \times R_{mt}) \quad (5)$$

where R_{it} is the stock return of firm j on day t , R_{mt} is the return of the S&P 500 benchmark index on day t , and $\hat{\alpha}$ and $\hat{\beta}$ are the regression estimates from an OLS regression using a 250-trading-day (one year) estimation period that ends ten days before the announcement of the transaction. CARs for stock i are then calculated by adding daily abnormal returns (AR_{it}) from day τ_1 to τ_2 :

$$CAR_{[\tau_1, \tau_2], i} = \sum_{\tau_1}^{\tau_2} AR_{it} \quad (6)$$

where i describes the respective executive. CARs are calculated for a three- and a six-day event window ($[\tau_1, \tau_2] \in [0; 2]$ and $[0; 5]$) following the publication of the transaction. As markets were characterized by a high degree of volatility after the global outbreak of COVID-19, we further apply the BMP-test, a parametric test statistic that is robust to event-induced variance developed by Boehmer et al. (1991) to test whether the CARs are significantly different from zero. All stock market data is obtained from Refinitiv.

The observed abnormal reactions following directors' dealings may be driven by more factors than just the overconfidence of the key executives. To account for these factors, we run several regressions to determine the impact of executive overconfidence on our results. The cross-sectional regression follows the form:

$$CAR_{[t_1, t_2], i} = \beta_0 + \beta_1 OVERCONFIDENT_i + \beta_2 FEMALE_i + \beta_3 MCAP_i + \beta_4 MTB_i + \beta_5 \#ANALYSTS_i + \beta_6 FREEFLOAT_i + \beta_7 TRADESIZE_i + \varepsilon_i \quad (7)$$

where the dependent variable is the CAR for event window $[t_1, t_2]$. *OVERCONFIDENT* is calculated as described in the previous section; *FEMALE* is a binary variable equal to one if the gender is a female, which is determined based on the first name of the insider applying the database *genderize.io*. In a second step, we manually check the gender of all executives who are not classified to a specific gender with a probability of at least 90 % (e.g., based on the director's resume). By including the variable *MCAP*, we control for the firm's market capitalization (in million dollars), since a larger firm is usually associated with more publicly available information (J. Elliott et al., 1984; Lang & Lundholm, 1993) and, therefore, lower levels of information asymmetry. This reduces the need to rely on published insider transactions as an additional information source. Previous studies show that a higher market capitalization is negatively associated with the absolute market reaction after published insider transactions (Betzer & Theissen, 2009). We further control for the firm's market-to-book ratio (*MTB*) since Betzer and Theissen (2009) additionally demonstrate that undervalued stocks show higher

abnormal returns following directors' dealings. This pattern is attributed to the trust in a positive outlook on future earnings which can be signaled by share purchases conducted by executives. The variable *#ANALYSTS* controls for the number of analysts covering firm *i*, due to the important role analysts play in reducing information asymmetries in the capital market (Botosan, 1997; Lys & Sohn, 1990). Previous studies show that each additional analyst covering a firm considerably contributes to a reduction in the information asymmetry between insiders and outsiders (Frankel & Li, 2004; Hong et al., 2000). Since several previous studies (Betzer & Theissen, 2009; Fidrmuc et al., 2006) show that the market reaction to the announcement of insider transactions and the insider profits also depend on a firm's ownership structure, we further include the variable *FREEFLOAT*. It is defined as the percentage of shares available to the public for trading and thereby proxies the level of management autonomy. Finally, we control for the *TRADESIZE* of a transaction. This variable is calculated by the number of shares traded relative to the total number of outstanding shares for firm *i*. This approach follows the rationale of Bettis et al. (1997) who argue that larger transactions have a more pronounced signaling effect on the stock market. A larger trading volume signals trust in the underlying purchase or sell decision and therefore increases its credibility for outsiders. Since the outbreak of COVID-19 might have affected individual industries to different degrees, we further control for industry fixed effects by including Fama-French 48 industry dummies in the regression models (Fama & French, 1997). The data for all control variables are obtained from Thomson Reuters' Worldscope database.

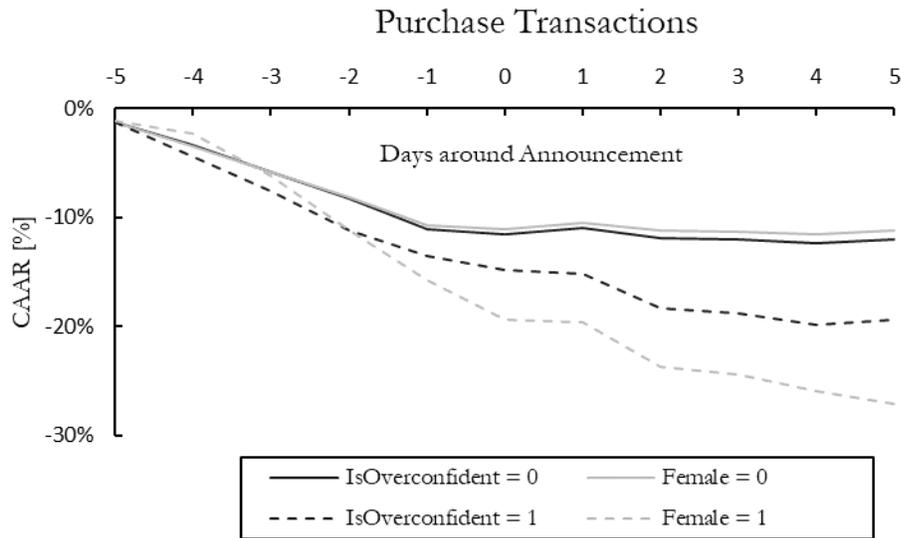
3.4. Results

Figure 3-2 and Figure 3-3 provide a detailed view of the stock market performance around the publication of insider transactions in March 2020. The figures show the [-5; 5] event windows around the announcement of the individual purchase or sale transaction. The results are split into subgroups of overconfident and non-overconfident as well as female and male executives.

The pronounced downward pressure in the capital market becomes particularly apparent for the subsample of purchase transactions in Figure 3-2. As previously emphasized, a published purchase transaction of a corporate insider can be interpreted as a positive signal and indicate confidence in the firm's prospects. In Figure 3-2, the downward movement indeed comes to an end around the day of publication which is principally in line with the theory on information asymmetry. However, not all insiders are able to credibly signal their confidence in their firm's prospects. Instead, contrary to theory,

stock prices keep falling after transactions conducted by both overconfident and female executives are published.

Figure 3-2: CAARs around the publication of insider purchase transactions during March 2020



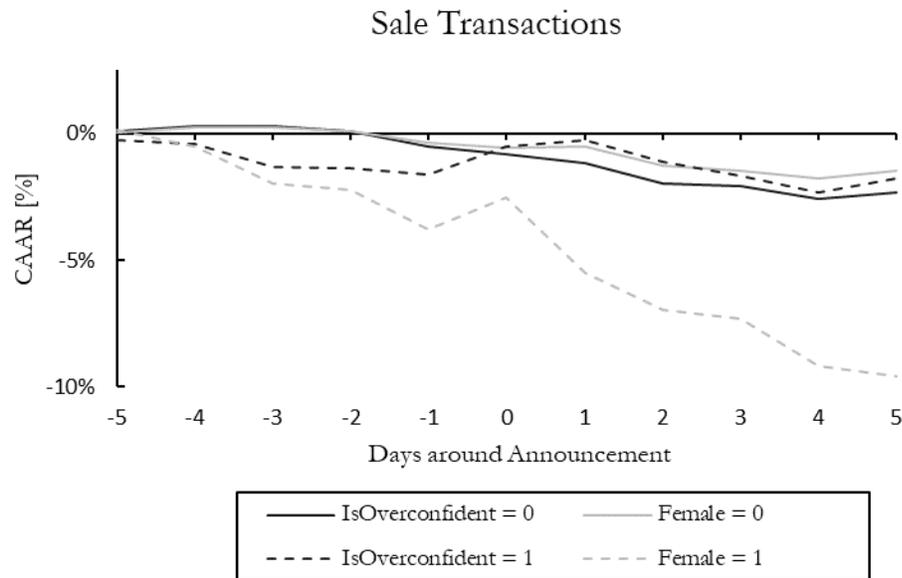
This figure contains a comparison of investor reactions to purchase transactions of corporate insiders (CEOs and CFOs) in March 2020 directly after the outbreak of COVID-19. The sample is split by whether the executive executing the purchase transaction is overconfident and by whether the executive is a female. Market reactions are measured as CAARs for the event window [-5, 5].

A roughly comparable pattern can be observed in Figure 3-3 for sale transactions. The market reaction is again negative for all analyzed subsamples, which can be expected for sale transactions. Nevertheless, the magnitude of the abnormal returns is relatively low, which indicates that sales in times of high market volatility and concomitant downward price pressure are not very surprising and investors take only little notice of them.

Since our analyses are only qualitative so far, we perform several empirical checks in the next section. Table 3-2 provides the quantitative results of the event study analyzing the impact of personal attributes of corporate insiders on the market reaction following directors' dealings during March 2020. Panel A summarizes the findings for the full sample. Overall, the stock market reaction is highly significant for both purchase and sale transactions. Contrary to previous literature focusing on "normal" market phases (Betzer & Theissen, 2009; Gregory et al., 2013; Lakonishok & Lee, 2001), purchase transactions are followed by negative abnormal returns. This indicates that outsider market participants were in doubt about a quick recovery of stock prices and skeptical about the information

content of top management transactions during the COVID-19 outbreak. In contrast, investors might presume that purchases during these times cannot be based on rational expectations but shall only serve to soothe the markets.

Figure 3-3: CAARs around the publication of insider sale transactions during March 2020



This figure contains a comparison of investor reactions to sale transactions of corporate insiders (CEOs and CFOs) in March 2020 directly after the outbreak of COVID-19. The sample is split by whether the executive executing the sale transaction is overconfident and by whether the executive is a female. Market reactions are measured as CAARs for the event window [-5, 5].

Splitting the sample reveals that this lack of trust in the signaling capability of published transactions highly depends on personal characteristics of the executive. Panel B of Table 3-2 indicates that transactions of overconfident insiders were followed by significantly more negative abnormal returns, leading to the conclusion that in times of crisis (as in March 2020) the ability of overconfident directors to signal confidence in the future stock performance towards outsider investors is very limited. The same rationale appears to be applicable for the group of female corporate insiders, as shown in Panel C of Table 3-2.

Table 3-3 provides the results of the subsequent regression analyses. The dependent variable in all models is the abnormal return in the [0; 5] event window.³⁵ Models 1-3 focus on purchase transactions while models 4-6 analyze the abnormal returns after sale transactions as the dependent variables. Models 1 and 4 use both variables of interest, overconfidence and gender, of the insiders purchasing

³⁵ Results are qualitatively similar for the [0; 2] event window and for reasons of brevity not shown in the paper.

or selling stocks. Models 2 and 5 focus on the *OVERCONFIDENCE* variable while models 3 and 6 only apply the binary variable *FEMALE*.

Table 3-2: Event study results for the different subgroups

	Purchases (n = 760)		Sales (n = 511)	
	(CAARs in %)		(CAARs in %)	
	[0; 2]	[0; 5]	[0; 2]	[0; 5]
<i>Panel A: Overall sample</i>	-1.161***	-1.353***	-1.154**	-1.564***
<i>Panel B: Overconfidence</i>				
IsOverconfident = 0	-0.866**	-0.984**	-1.480**	-1.839***
IsOverconfident = 1	-4.759*	-5.859**	0.497	-0.172
Δ CAAR (%)	3.893	4.875	-1.977	-1.667
<i>Panel C: Female</i>				
Female = 0	-0.457	-0.386	-0.935	-1.107*
Female = 1	-7.954**	-11.346***	-3.172**	-5.780***
Δ CAAR (%)	6.891**	10.971**	2.237	4.673**

This table shows the stock market reactions to published insider purchases and sales for S&P 1500 listed firms during March 2020. The CARs are estimated over multiple event windows. Daily abnormal returns are calculated using the standard market model. CARs are tested for statistical significance using the parametric BMP-test by Boehmer et al. (1991). To test the difference for statistical significance between the subsamples (Panels B and C), the parametric two-sample t-test is applied. *, **, *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

For purchase transactions, we find that our variable of interest *OVERCONFIDENT* has a significant impact in all regressions, even after controlling for other variables such as firm characteristics and industry effects. This finding indicates that when markets are in turmoil and company prospects are uncertain, investors discount the information content of purchase transactions undertaken by executives with these characteristics and seem to be less interested in such insider trades. This supports our hypothesis *H1a*.

Interestingly, these differences in the signaling function of directors' dealings are not present for the subgroup of sale transactions (Models 4-6). In this case, investors might interpret insider transactions regardless of personal attributes. This finding is in line with our hypothesis *H1b*, stating that insider purchase transactions are more likely to be driven by an unwarranted sense of undervaluation of overconfident executives during market selloffs. The result might also be linked to the asymmetrical loss aversion of investors described by Weber and Camerer (1998). Furthermore, we also find a negative and significant impact of the coefficient for the variable *FEMALE*. Therefore, our hypothesis *H2* regarding gender stereotyping is supported in both univariate and multivariate regression analysis.

Table 3-3: Results of the cross-sectional regression analyses

VARIABLES	Purchases			Sales		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>OVERCONFIDENT</i>	-0.068* (0.036)	-0.066* (0.036)		0.008 (0.020)	0.007 (0.020)	
<i>FEMALE</i>	-0.085** (0.041)		-0.087** (0.041)	-0.022 (0.027)		-0.021 (0.027)
<i>MCAP</i>	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
<i>MTB</i>	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
<i>#ANALYSTS</i>	-0.010*** (0.002)	-0.010*** (0.002)	-0.009*** (0.002)	0.003*** (0.001)	0.003*** (0.001)	0.003*** (0.001)
<i>FREEFLOAT</i>	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
<i>TRADESIZE</i>	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)
Industry FE	YES	YES	YES	YES	YES	YES
Observations	760	760	760	511	511	511
Adj. R ²	0.057	0.052	0.051	0.067	0.066	0.067

This table shows the results of multiple cross-sectional regression analyses analyzing the impact of executive characteristics on market reactions to directors' dealings directly after the outbreak of COVID-19 in March 2020 for S&P 1500 listed firms. The dependent variable in all models is the abnormal return in the [0; 5] event window. Models 1-3 focus on purchase transactions while models 4-6 analyze abnormal returns after sale transactions as the dependent variables. Models 1 and 4 use both variables of interest, overconfidence and gender, of the insiders purchasing or selling stocks. Models 2 and 5 focus on the *OVERCONFIDENCE* variable while models 3 and 6 only apply the binary variable *FEMALE*. Robust standard errors are in parentheses. All regressions include Fama-French 48 industries dummies and a constant. *, **, *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

This is overall in line with current research. Our findings particularly extend the results of Gregory et al. (2013) who show that investors react more negatively to directors' dealings of female executives. The authors further suggest that these differences are likely related to gender stereotyping as, in the longer run, directors' dealings are informative about future corporate performance for both male and female executives. Interestingly, our analysis not only provides supporting evidence for these short-term abnormal return differences but suggests that these differences are even more pronounced in times of high market volatility and uncertainty in the aftermath of the outbreak of COVID-19.

For both transaction subsamples, most of the control variables that are associated with other factors determining the market perception of directors' dealings remain insignificant. We only find that the variable *#ANALYSTS* has a highly significant influence in all models indicating that a higher analyst

coverage leads to an attenuation of abnormal returns. This is generally in line with existing research³⁶ and is usually explained by the effect that analysts help to reduce information asymmetries (Botosan, 1997). However, given that the sample size is rather limited as we focus in particular on the outbreak of the pandemic in the United States, further research is needed whether our findings also extend to a larger sample (e.g., a sample focused on the months following the peak of the outbreak).

In a further robustness check, we split the data sample and repeat all analyses to test whether the market reactions differ before and after March 11. While COVID-19 was already spreading across much of the world by early March 2020 (e.g., in China, Italy, and some parts of the U.S.), the WHO did not officially declare the virus a pandemic until March 11. We therefore independently analyze the subsample of events that only occurred after this day. This is further reducing the sample size, but the results largely confirm our prior findings. We again find that the signaling capabilities of both female and overconfident executives were very limited regarding their published insider stock purchases during this market phase. The afore-described univariate and multivariate results indicate an even more distinct tendency for the second half of March 2020.³⁷

3.5. Limitations and avenues for further research

While our results are robust to variations of multiple control variables, different measures of overconfidence, and various event windows, the research design exhibits a range of potential limitations that warrant the need for further research.

Firstly, we limit our sample to the first full month of trading after the outbreak of COVID-19 (March 2020). While this approach makes sense to capture the immediate effects of COVID-19 and the period is the one with the highest uncertainty, it only provides initial evidence that there is indeed an effect of director characteristics on investor reactions. To further analyze whether this effect persists over time as well as over the entire duration of the COVID-19 pandemic, it would be beneficial to extend the timeframe until the end of the pandemic. However, as the pandemic is still ongoing, this research gap cannot be addressed for the time being. In this context, it would also be interesting to see whether the initial market reactions to executive overconfidence and particularly gender reverse in the medium or long term. Gregory et al. (2013) find that investors typically tend to react less positively to transactions undertaken by female executives (gender stereotyping), but that this effect reverses in the

³⁶ See, e.g., Frankel and Li (2004) who find similar results during normal market conditions.

³⁷ For reasons of brevity, the results are not reported in the paper but are available upon request.

long term. Interestingly, the magnitude of the negative market reaction is even more pronounced in our findings which could indicate that the gender stereotyping found by Gregory et al. (2013) is more prevalent in times of high market uncertainty. The notion of gender stereotyping would, however, require that the initial differences in the market reaction based on the gender of the executive reverse in the long term. Additionally, while we already address possible distortions due to event-induced variance as a consequence of the extreme volatility levels observed in the direct aftermath of COVID-19 with the appropriate test statistics, a longer-term sample timeframe would allow to further assess whether our results persist in less volatile market environments after the outbreak of COVID-19.

Secondly, since the outbreak of a global pandemic such as COVID-19 is unprecedented in recent history, it would also be theoretically possible that the observed effects are a direct effect of the high level of general market uncertainty across all industries and would not occur during previous crises that were rather limited to specific sectors (e.g., the dot-com crash in 2000 or the financial crisis of 2008). Hence, we would recommend extending our analyses to previous crises (e.g., the global financial crisis in 2008) to further analyze whether the negative effects of overconfidence can also be observed in the direct aftermath of previous market crashes. As part of a longer-term panel setting, it would also be interesting to analyze whether executive characteristics, in particular managerial overconfidence, also impact investor reactions to directors' dealings independent of market crises and times of high market volatility.

Finally, the effect of overconfidence and gender on the market reaction to directors' dealings is only prevalent for purchase transactions in our sample and not for sale transactions. While this effect makes sense from an economic viewpoint (investors might expect that overconfident executives exhibit too much confidence in their company too early in times of high market volatility), further analyses are needed to identify the reasons for this discrepancy.

3.6. Conclusion

This paper contributes to the expanding literature of two strands of research: directors' dealings and executive overconfidence. To the best of our knowledge, we are the first who offer evidence that market participants take executive characteristics and biases into account when assessing the informational value of insider transactions. By analyzing the surge of insider transactions in the wake of the outbreak of COVID-19 in March 2020, we show that investors react significantly more negatively to purchase transactions by overconfident executives than by their more rational peers.

Investors also seem to react more negatively to purchase transactions undertaken by female executives thereby supporting previous findings by Bharath et al. (2009) and Gregory et al. (2013).

The implications of our findings are twofold: Firstly, as trading on insider transactions is a popular investment strategy, private investors need to explicitly assess the implications of executive characteristics for the signaling value of insider transactions before taking an investment decision. As already discussed in more detail by Samuelson (1988), investors can thereby not necessarily rely on interpreting general market reactions to directors' dealings since market reactions following published insider transactions do not necessarily reflect the objective value relevance of the revealed information, but also the subjective value investors attribute to the signal. This caution seems particularly advisable during times of high market volatility and uncertainty. Secondly, we provide investors with further food for thought whether they correctly assess the signaling effect of directors' dealings undertaken by female executives or whether their reaction could indeed be driven by gender stereotyping and the implicit, often false, assumption that female executives have worse information-gathering capabilities than their male counterparts.

Chapter 4

A BEAUTIFUL GAME ON HOLD³⁸

Impact of COVID-19 on football stocks

COVID-19 put the fairytale-like growth of European football to a sudden halt and revealed substantial differences in financial stability between clubs. This study seeks to analyze how listed football clubs were impacted by COVID-19 and whether clubs that exhibited a higher exposure to COVID-19 reacted more significantly to the outbreak of COVID-19 than their peers. Using an event study methodology specifically adapted for illiquid stocks, we analyze the impact of COVID-19 on 22 European football stocks. Our analyses show significant negative abnormal returns after the announcement of the first national European lockdown in Italy (March 9, 2020) and the respective announcement of league suspensions for each club. Clubs that were still competing in international cup competitions and, hence, had a comparably high risk of non-recoupable revenue shortfalls were thereby significantly more affected than their peers. We find no such effect for other measures of a club's exposure to COVID-19 indicating that abnormal return differences are mainly driven by a higher exposure of internationally competing clubs to international travel restrictions. A subsequent analysis of trading volumes supports these results by showing that clubs still competing internationally exhibited significantly higher trading volumes after the outbreak of COVID-19 signaling a lower degree of investor confidence in the respective stocks.

³⁸ This chapter is largely based on a working paper co-authored with Dirk Schiereck.

4.1. Introduction

In the past decade, sport has turned into an important pillar of global economic growth. According to the business magazine *Forbes*, the ten most valuable sports franchises in the world have more than tripled in value between 2010 and 2020 reaching a combined value of USD 44 bn in 2020 up from USD 14 bn in 2010 (Badenhausen, 2010, 2020). The fairytale-like economic development of professional sports can be particularly well examined in European association football. The annual benchmarking report of the Union of European Football Associations (UEFA) points out that revenues of European football teams, mainly driven by ever-increasing broadcasting deals, have on average grown by nearly 7% between 2009 and 2018 substantially outgrowing European gross domestic product (1% annual growth as proxied by the European Union (EU)) (The World Bank, 2020; UEFA, 2020). However, as Dietl et al. (2008) and Franck (2014) point out this development has mostly been limited to top-line growth and rather led to an overinvestment environment in which clubs primarily compete based on their financial means. By reinvesting a significant share of available funds into their team, many clubs failed to establish a self-sustaining business model often fueling their success with debt, investments by external investors, or other external capital. In fact, the 2018 financial year marked only the second time since 2008 that European clubs on aggregate achieved a net profit; a result mainly driven by record-breaking new media rights deals in the United Kingdom and Germany (UEFA, 2020).

While high reinvestment rates worked well for most clubs in times of ever-increasing revenues from sponsorships and media rights, the outbreak of COVID-19, a highly infectious new type of the virus SARS-CoV-2, at the end of 2019 and in early 2020 exposed the fragility of the sports ecosystem. The outbreak of COVID-19 led to significant revenue losses for clubs, marginalizing some clubs to the brink of insolvency and increasing the pressure for external financing. Declared a global pandemic by the WHO on March 11, 2020, the virus has wreaked havoc on the world with many countries going into complete lockdown significantly restricting the public and private lives of their citizens. During COVID-19 many international and domestic sports events and competitions have either been canceled or postponed until further notice. While most major leagues have developed a clear path to a continuation behind closed doors (except for France's Ligue 1, which was canceled on April 28, all of the Big Five European football leagues³⁹ have resumed play by June 20, 2020), many smaller leagues have had their seasons canceled with no indication for a quick recovery. According to KPMG (2020a), the European Club Association

³⁹ The Big Five European football leagues are the five largest European football leagues by revenue – United Kingdom's Premier League, Spain's La Liga, Germany's Bundesliga, Italy's Serie A, and France's Ligue 1.

(ECA)⁴⁰ expects a revenue drop of approximately EUR 4 bn for its member clubs over the two years following the outbreak. Although a continuation behind closed doors at least guarantees the pay-out of a significant part of the pre-agreed media rights and sponsoring tranches, severe financial consequences remain due to the loss of game-day revenues and reduced merchandising sales. As many of the financial repercussions imposed by COVID-19 are expected to remain for the short- to medium-term (e.g., foregone matchday revenues and lower sponsorship, advertising, and media revenues), COVID-19 might further reinforce the need for football clubs to grow more resilient to revenue fluctuations and adopt a more sustainable business model.

Investor reactions during the initial phase of the outbreak of COVID-19 now provide a unique setting to infer the market's assessment of a firm's resilience to COVID-19. While there are already numerous studies analyzing the impact of COVID-19 on stock prices and the effect of specific firm characteristics on stock price reactions (Ding et al., 2020; Hassan et al., 2020), there is little research concerning the impact of COVID-19 on football clubs (Fühner et al. (2021), e.g., show that football clubs with more diversified operations exhibit more positive stock price reactions during COVID-19). Using a variation of the standard event study methodology that accounts for thin-trading often imminent with football stocks and a sample of 22 European stock-listed football clubs, we show that clubs, on average, exhibited significant negative CAARs of up to -9.0% on several key dates during the outbreak of COVID-19. Clubs that were still competing internationally were thereby particularly severely affected and exhibited up to 7.9% lower abnormal returns than their non-internationally competing peers in our sub-sample and regression analyses with differences being particularly pronounced for earlier event dates. The significant differences in abnormal returns thereby do not seem to be related to more general differences in a club's exposure to COVID-19 as other measures of a club's exposure such as the share of revenues from match-day operations in total revenue as well as a club's personnel expenses in relation to its total revenue remain insignificant at conventional levels with varying degrees of magnitude and direction. In subsequent analyses, we further show that trading volumes exhibited similar differences around our analyzed event dates with stocks of internationally competing clubs being traded more than seven times more than their non-internationally competing peers (after standardizing trading volumes by their 200-day moving average to account for differences in market size and general popularity across the clubs in our sample). Although the results could be at least partially explained by the high degree of uncertainty and volatility of the market environment at the time, a robustness check on stocks of the travel and hospitality industry, an industry similarly affected by COVID-19,

⁴⁰ The ECA is an independent body that represents professional European football clubs in the international football landscape and acts as the "voice" of its over 230 member clubs (ECA, 2021).

reveals significant differences regarding how stocks of both industries reacted to the analyzed events.

The rest of the paper is organized as follows: Section 4.2 gives an overview of related literature. Section 4.3 outlines the data sample and describes the methodology. Section 4.4 summarizes the results and examines whether football stocks were particularly severely affected by COVID-19 and whether club characteristics dictate how a club's investors reacted to the outbreak of COVID-19. A conclusion and an overview of the implications of our results conclude in section 4.5.

4.2. Literature review

We contribute to two vividly discussed topics of literature: the impact of COVID-19 on particularly affected stocks and, foremost, the analyses of trading behavior and financing characteristics of sports clubs. While both strands of empirical finance research have been thoroughly analyzed in recent years, to our knowledge this paper is one of the first to analyze the impact of COVID-19 on football stocks.

Extant research exists on the effects of economic crises on stock markets. A particularly well-documented finding is that in times of crises investors typically move towards more liquid, higher-quality assets resulting in higher volumes and negative returns for lower-quality stocks (also known as flight-for-quality or flight-for-liquidity phenomenon; see, for example, Beber et al. (2009) for an explanation of this phenomenon). While this finding is well documented for previous crises such as the financial crisis of 2007-2008 and the dot-com crisis in the early 2000s, to our knowledge no such analysis yet exists regarding COVID-19. Research on the impact of COVID-19 is so far predominantly focused on the assessment of the financial, social, and economic implications of the pandemic. Baker et al. (2020), for example, find that COVID-19 has impacted the U.S. stock market as directly and forcefully as no other pandemic before. By analyzing market reactions to specific newspaper articles, the authors show that the unprecedented stock market reaction to COVID-19 cannot be explained solely by the lethality or contagiousness of the virus, but rather by the unprecedented restrictions that were imposed by the government. The extraordinarily significant effect of COVID-19 on the U.S. stock market is further supported by Ramelli and Wagner (2020) who document significant differences in stock market performance during COVID-19 between companies from different industries but also between companies within the same industry. They further identify corporate debt and cash holdings as important value drivers during the development of the pandemic. Ding et al. (2020) go one step further and examine whether firm characteristics affected how well firms reacted to the outbreak of the pandemic. Their results suggest that firms with stronger pre-2020 fundamentals, less supply chain exposure, less entrenched

executives, and more CSR activities coped with the effects of COVID-19 considerably better than their peers. Glossner et al. (2020) support these findings by showing that institutional investors moved towards stocks with stronger financials (low debt and large cash holdings) indicating that the flight-for-quality phenomenon found by Beber et al. (2009) could have also played a role during the fire sales of the COVID-19 pandemic. Interestingly, retail investors exhibited opposite trading patterns preferring high-leverage companies with low cash positions.

While research has identified that the impact of COVID-19 on stock markets has significantly differed across industries, only a few studies concentrate on the impact of COVID-19 on specific industries and, to the authors' knowledge, only one study focuses on the impact of COVID-19 on football club stocks (Fühner et al. (2021) analyze whether more diversified clubs were less affected by COVID-19). This is particularly surprising given that football stocks provide a peculiar research setting in two ways: Firstly, football stocks have been particularly affected by the pandemic and, secondly, as Tiscini and Strologo (2016) show football stocks are often not only held for financial motives but also at least to some extent because of private or socio-economic benefits expected by the shareholder (see also Schaffer (2011) and Huth (2019)). This could lead to shareholders exerting an irrationally high asset stickiness in times of extraordinary market volatility and uncertainty.

In general, research regarding stock-listed football clubs is comparably limited and centers around the relationship between sporting performance and stock market returns. Almost all studies thereby show some kind of influence of matchday results on stock market prices of the respective teams (see, e.g., Gimet and Montchaud (2016) for a literature overview), although some findings suggest that stock prices are foremost impacted by draws and losses and less so by wins (Benkraiem et al., 2011; Bernile & Lyandres, 2011; Demir & Danis, 2011). Castellani et al. (2015) further find that the influence of sporting performance on stock prices seems to be amplified in cases of unexpected victories or defeats (as measured by betting odds). The relationship between sporting performance and stock prices of football clubs is not only confirmed for European club samples (Baur & McKeating, 2011; Gimet & Montchaud, 2016), but also for samples limited to specific countries such as Italy (Botoc et al., 2019), England (Bell et al., 2013), Portugal (Duque & Ferreira), and Turkey (Demir & Danis, 2011), and club rivalries (Demir & Rigoni, 2017). Allouche and Soulez (2005) further extend this research by considering how human resource variables impact stock returns. Besides showing that coach appointments (dismissals) negatively (positively) impact stock prices of the respective team, their findings also indicate that investors seem to value cash outflows from player sales more than the human capital loss by the transferred player (reflected in a positive market reaction to sales of players and a negative reaction to new signings). Research on the impact of COVID-19 on football clubs is still comparably sparse. Fühner et al. (2021), for example, show

that more diversified clubs with regard to product diversification exhibited less negative market reactions to the outbreak of COVID-19 than their non-diversified peers. Geographic diversification, on the other hand, seems to have a moderate negative effect on abnormal returns during COVID-19. Hammerschmidt et al. (2021) expand these findings and interview ten football club CEOs to examine how football clubs reacted to the outbreak of COVID-19. They find that while all clubs were significantly affected financially with two of their main revenue streams, media rights and matchday revenues, breaking away seemingly overnight, COVID-19 also stresses the importance of active stakeholder management and continued innovation.

Our study seeks to build on the research of Fühner et al. (2021), Hammerschmidt et al. (2021), and Ding et al. (2020). As Ding et al. (2020) show, companies with higher supply chain exposure to COVID-19 experienced significantly more negative abnormal returns than their peers. Since the football industry seems to be particularly affected by COVID-19, we would expect to find significant negative abnormal returns of the entire football industry compared to the rest of the market. Given that COVID-19 particularly impacted international travel and following the results of Hammerschmidt et al. (2021) that clubs were particularly financially affected due to the sudden drop in media and matchday revenues, we would also expect clubs that were still competing internationally at the time to exhibit significantly lower abnormal returns than their peers.

4.3. Data sample selection and research design

The data sample consists of 22 listed European football clubs and includes 20 of the 22 constituents of the STOXX Europe Football Index (Teteks Tetovo and Ruch Chorzow have been excluded due to a lack of trading activity). Additionally, with Manchester United PLC and SpVgg Unterhaching, two further clubs not included in the STOXX Europe Football Index have been added. Data on stock prices, trading activity, and company fundamentals are obtained from Refinitiv and further enriched with hand-collected data on non-financial club characteristics (e.g., a club's performance in international competition). Further details on the clubs contained in the sample and descriptive statistics regarding size and sportive success can be found in Table 4-1.

To quantify the impact of a series of events on a class of stocks, research commonly uses the event study methodology developed by Ball and Brown (1968) and Fama et al. (1969). This series of analyses relies on the semi-strong form of the efficient market hypothesis developed by Fama (Fama, 1970; 1991) that stock prices reflect all publicly available information immediately and correctly upon dissemination. Any abnormal movement in stock prices observable upon the dissemination of specific event-related news in excess of what is implied by market-wide price movements can therefore be directly attributed to the dissemination itself. The event study

methodology has been extensively described by Brown and Warner (1980) and MacKinlay (1997) and requires an event-specific selection of event dates, the event study window, estimation window, and the model to assess the magnitude and significance of abnormal stock returns surrounding the analyzed event.

The rapid escalation of events during the outbreak of COVID-19 in Europe leaves many questions unanswered as to when market participants began to incorporate risks of significant impairments to the business model of football clubs in stock prices. A natural inclination would be to assume that the most severe negative effects on stock prices came after the suspension of the respective leagues of each club. However, markets could also have already partially priced in the risk of local league suspensions upon the announcement of the first lockdown of a major European country (Italy on March 9, 2020) or even after the first suspension of football games of a major European league⁴¹ (Italy's Serie A on February 22, 2020). To further analyze how investors incorporated the risk of substantial impairments to the business model of football clubs, we have thus chosen the following three event dates for further analysis:

- 1) The first temporary suspension of a major European football league (Italy's Serie A temporarily suspended four Serie A matches in the particularly affected areas Lombardy and Veneto on February 22, 2020 (Marca, 2020)). As February 22 was a Saturday, the first subsequent trading day (February 24) serves as the event date.
- 2) The announcement of the first lockdown of a major European country (Italy, March 9).
- 3) The announcement of the suspension of the respective club's football association/league (announcement date differs by club, see Table 4-1 for details).

Data on the aforementioned events is obtained for each country and football association from the WHO's daily situation report (WHO, 2020) and the respective association's homepage. Following MacKinlay (1997), if a stock exchange was closed during an event date (e.g., on weekends or during holidays), the following trading day is chosen. Table 4-1 shows all relevant events for the sample's 22 football clubs, their respective football associations as well as further information regarding league affiliation, sporting success, and size. Stocks were subsequently checked for confounding events and excluded for specific analyses in case of stock-related confounding events during the respective event window (e.g., the announcement of financial results or the elimination from national or international cup competition).

MacKinlay (1997) and Ricci (2015) recommend using one full trading year (252 trading days) as the estimation window. However, taking 252 trading days as the estimation window would further

⁴¹ Defined as a league of the Big Five European football leagues.

reduce the sample as SpVgg Unterhaching only went public on July 26, 2019, less than one year before the first event date. Hence, the maximum estimation window length that still allows us to include SpVgg Unterhaching was chosen (150 days; ending with the last day before the start of the longest event window).⁴² McWilliams and Siegel (1997) argue that event windows should be kept as short as possible because long event windows reduce the power of many common test statistics and are difficult to reconcile with the efficient market theory. Nonetheless, although most of our analyses focus on shorter event windows ranging from one to three days, we also verify our results using longer event windows of up to eleven days $([-5, 5])$ to account for potential disturbances.⁴³

Following Brown and Warner (1985) and MacKinlay (1997), we use the market model to quantify abnormal stock returns.⁴⁴ Scholes and Williams (1977) show that a capital asset pricing model (CAPM)-based estimation of betas can lead to biased beta estimators in cases of thin trading. The data as well as previous research indicate that football stocks often have days with very little or no trading activity and exhibit comparably low liquidity (Ferreira et al., 2017). We therefore use the beta estimation model developed by Scholes and Williams (1977) that allows estimating betas from thinly traded stocks with non-synchronous data. The Scholes-Williams-Beta is estimated based on the following model:

$$\beta_{i,sw} = \frac{\beta_{i,1} + \beta_{i,2} + \beta_{i,3}}{1 + 2\rho} \quad (8)$$

for which $\beta_{i,k}$ is estimated based on the following three OLS regression models:

$$R_{i,t} = \alpha_{i,1} + \beta_{i,1}R_{m,t} + \varepsilon_{1,t} \quad (9)$$

$$R_{i,t} = \alpha_{i,2} + \beta_{i,1}R_{m,t+1} + \varepsilon_{2,t} \quad (10)$$

$$R_{i,t} = \alpha_{i,3} + \beta_{i,1}R_{m,t-1} + \varepsilon_{3,t} \quad (11)$$

⁴² We repeat our analyses as robustness check with a longer estimation window (i.e., excluding SpVgg Unterhaching) and arrive at similar results.

⁴³ For brevity we will only report results for the event windows $[-1, 1]$, $[-1, 0]$, and $[0, 1]$. Results remain qualitatively and directionally similar for longer event windows $([-2, 2], [-5, 5])$.

⁴⁴ As Campbell et al. (1997, pp. 155–156) point out, the benefits of more complicated statistical models than the market model are often limited in practice, and variations of the beta estimation process often sufficiently reduce noise.

Table 4-1: Background details for all clubs contained in the sample

Club	Country	Market Index	Club Details						Event Dates			
			League (as of March 2020)	Division (as of March 2020)	UEFA Coefficient (Position)	Market Cap (in EUR mn, as of 31/12/2019)	Ownership Category	Social Media Followership (in mn followers)	First Game Suspension (Serie A)	First National Lockdown (Italy)	National Lockdown	League Suspension
				[4]	[5]	[6]		[8]		[10]		
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	
Aalborg BK	Denmark	OMX C20	Danish Superliga	1	377	3.06	n/a	0.12	24.02.2020	09.03.2020	11.03.2020	12.03.2020
AFC Ajax Amsterdam	Netherlands	AEX	Eredivisie	1	21	392.33	Club	13.51	24.02.2020	09.03.2020	16.03.2020	12.03.2020
Aarhus GF	Denmark	OMX C20	Danish Superliga	1	379	18.71	Free Float	0.09	24.02.2020	09.03.2020	11.03.2020	12.03.2020
AIK Fotboll	Sweden	OMX S30	Allsvenskan	1	157	3.73	n/a	0.42	24.02.2020	09.03.2020	n/a	n/a
AS Roma	Italy	FTSE MIB	Serie A	1	15	427.64	Individual	16.06	24.02.2020	09.03.2020	09.03.2020	09.03.2020
Besiktas J.K.	Turkey	BIST 100	Süper Lig	1	28	88.80	Club	15.08	24.02.2020	09.03.2020	03.04.2020	19.03.2020
BVB Borussia Dortmund	Germany	DAX 30	Bundesliga	1	12	800.86	Free Float	35.33	24.02.2020	09.03.2020	16.03.2020	13.03.2020
Brøndby IF	Denmark	OMX C20	Danish Superliga	1	138	21.08	Individual	0.30	24.02.2020	09.03.2020	11.03.2020	12.03.2020
Celtic Glasgow	United Kingdom	FTSE 100	Scottish Premiership	1	45	1.81	Individual	3.49	24.02.2020	09.03.2020	23.03.2020	12.03.2020
Fenerbahce S.K.	Turkey	BIST 100	Süper Lig	1	52	214.79	Club	25.62	24.02.2020	09.03.2020	03.04.2020	19.03.2020
FC Porto	Portugal	PSI 20	Primeira Liga	1	19	14.62	Club	7.74	24.02.2020	09.03.2020	18.03.2020	12.03.2020
Galatasaray S.K.	Turkey	BIST 100	Süper Lig	1	64	162.00	Club	33.79	24.02.2020	09.03.2020	03.04.2020	19.03.2020
Juventus F.C.	Italy	FTSE MIB	Serie A	1	5	1,648.92	Individual	108.86	24.02.2020	09.03.2020	09.03.2020	09.03.2020
Manchester United F.C.	United Kingdom	FTSE 100	Premier League	1	9	2,925.18	Individual	145.08	24.02.2020	09.03.2020	23.03.2020	12.03.2020
Olympique Lyon	France	CAC 40	Ligue 1	1	17	178.08	Individual	8.27	24.02.2020	09.03.2020	17.03.2020	13.03.2020
FC København	Denmark	OMX C20	Danish Superliga	1	39	132.13	Individual	0.50	24.02.2020	09.03.2020	11.03.2020	12.03.2020
Silkeborg IF	Denmark	OMX C20	Danish Superliga	1	383	19.90	Club	0.04	24.02.2020	09.03.2020	11.03.2020	12.03.2020
SpVgg Unterhaching	Germany	DAX 30	3. Liga	3	n/a	9.11	n/a	0.05	24.02.2020	09.03.2020	16.03.2020	13.03.2020
Sporting CP	Portugal	PSI 20	Primeira Liga	1	30	51.26	n/a	4.57	24.02.2020	09.03.2020	18.03.2020	12.03.2020
S.L. Benfica	Portugal	PSI 20	Primeira Liga	1	20	104.88	Club	7.26	24.02.2020	09.03.2020	18.03.2020	12.03.2020
S.S. Lazio	Italy	FTSE MIB	Serie A	1	36	102.69	Individual	2.39	24.02.2020	09.03.2020	09.03.2020	09.03.2020
Trabzonspor	Turkey	BIST 100	Süper Lig	1	170	75.65	Club	3.85	24.02.2020	09.03.2020	03.04.2020	19.03.2020

This table contains background information on the 22 clubs contained in our sample. The UEFA coefficient is provided by the UEFA and based on international results of the respective club in the previous five years and has been collected as of August 10, 2020. Market cap is calculated as the number of shares outstanding multiplied by the current share price as of December 31, 2019 and is based on data from Refinitiv. Ownership categories were derived from ownership data from Refinitiv with club ownership assumed for all clubs without an individual or institutional anchor investor. Social media followership includes followers on Instagram, Facebook, Twitter, TikTok, and YouTube. Event dates are based on news research. There is no date for the suspension of the league for Sweden as the Swedish League had not yet started in February 2020 and was thus never officially suspended.

where $\beta_{i,SW}$ denotes the estimated Scholes-Williams beta for security i , $\beta_{i,k}$ describes the estimated OLS-coefficient for $k = 1, 2, 3$ for stock i (based on a lagged, a leading, and a contemporaneous market model), and ρ denotes the first-order autocorrelation of the market return $R_{m,t}$ for market index m in time t . Finally, $R_{m,t+1}$ and $R_{m,t-1}$ describe the return on the respective market index m in time $t+1$ and $t-1$ respectively, $R_{i,t}$ is the return of stock i in time t , and $\varepsilon_{i,t}$ is the residual of stock i during period t . The market index is the respective national market index of a club.⁴⁵

The corresponding Scholes-Williams intercept, $\alpha_{i,SW}$ is subsequently estimated as follows:

$$\alpha_{i,SW} = \frac{1}{T-2} \left[\sum_{t=2}^{T-1} R_{i,t} - \beta_{i,SW} \sum_{t=2}^{T-1} R_{m,t} \right] \quad (12)$$

Finally, abnormal returns are then calculated based on the conditional expected returns in the estimation window that are derived from the following OLS regression and a subsequent subtraction of expected returns from actual returns:

$$E(R_{i,t}|R_{m,t}) = \alpha_{i,SW} + \beta_{i,SW}R_{m,t} + \varepsilon_{i,t} \quad (13)$$

$$AR_{i,t} = R_{i,t} - E(R_{i,t}|R_{m,t}) \quad (14)$$

where $AR_{i,t}$ is the abnormal return of stock i during period t , $R_{i,t}$ is the actual return of stock i in period t , and $R_{m,t}$ is the market return for market m during period t . The abnormal returns are aggregated to CARs for each event window (with t_1 as the start date and t_2 as the end date) following formula (15):

$$CAR_{i,[t_1,t_2]} = \sum_{t=t_1}^{t_2} AR_{i,t} \quad (15)$$

For some analyses, CAARs are calculated in addition to the CARs by averaging the CAR across all stock-event combinations using formula (16):

$$CAAR_{t_1,t_2} = \frac{1}{N} \sum_{i=1}^N CAR_{i,[t_1,t_2]} \quad (16)$$

where N is the number of stock-event combinations.

Following Mentz and Schiereck (2008) and Ricci (2015), who analyzes a setting with a similarly volatile market environment, CARs are tested for significance using the BMP-test statistic developed by Boehmer et al. (1991) in addition to the student's t-test and an adjusted Patell z-test based on Koları and Pynnönen (2010). Our results are further checked for robustness using the

⁴⁵ An overview of the corresponding market index for each club can be found in Table 4-1.

rank-test developed by Corrado (1989) and Corrado and Zivney (1992) and the generalized sign-test by Cowan (1992).

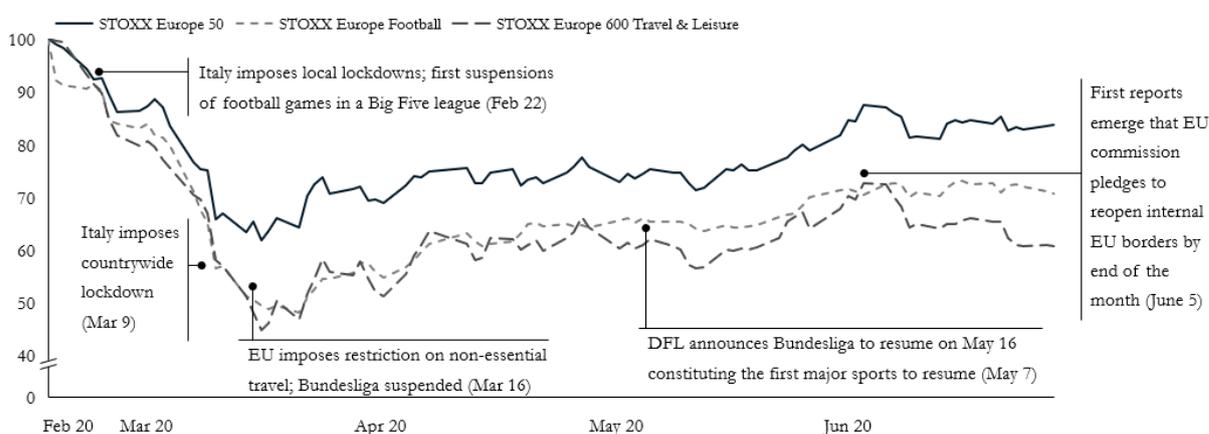
4.4. Results

4.4.1. Stock price effects

4.4.1.1. *Analyses of abnormal returns*

Figure 4-1 shows a comparison of the development of the STOXX Europe Football Index that contains 20 of the 22 stocks of our sample with the broader STOXX Europe 50 Index and the STOXX Europe 600 Travel & Leisure index, a stock index of the similarly affect travel and leisure industry, around our event dates.⁴⁶ The stock price development already indicates that clubs seem to react particularly drastically to the announcement of the first national lockdown in Italy on March 9. The comparison with the broader STOXX Europe 50 Index thereby indicates that football clubs seem to be significantly more severely hit than the overall European stock market. More precisely, the STOXX Europe Football Index lost more than 50% of its value after reaching an all-time high of EUR 167.20 on February 19 during the immediate aftermath of the COVID-19 outbreak in Europe between February 19, 2020, and March 23, 2020 (compared to a stock price decrease of 35% for the STOXX Europe 50 Index in the same period).

Figure 4-1: Development of different stock indices upon the outbreak of COVID-19



This figure shows the development of the STOXX Europe 50 index, the STOXX Europe Football index, and the STOXX Europe 600 Travel & Leisure index since the beginning of the stock market turmoil on Feb 19, 2020. The data is indexed to 100% on Feb 19, 2020. Selected stock-market relevant events as well as the two overarching event dates of our analyses are highlighted. Stock price data is obtained from Refinitiv.

Table 4-2 shows average and median cumulative abnormal returns, minimum and maximum values, and test statistics for all football clubs in the sample for each of the three analyzed event

⁴⁶ For brevity we cannot highlight the different suspension dates for the various leagues in our sample and, hence, only show the first two event dates.

dates. While stock market participants did not react to the first suspension of games of a Big Five league in Italy's Serie A on February 22 (there were no significant abnormal returns with a CAAR of 0.17% for the event window [0, 1]), we observe significant negative CAARs upon the announcement of the Italian lockdown on March 9 across all event windows. The strongest effect is observed for the event window [-1, 1] with a CAAR of -9.03%. The magnitude of the CAARs is even more striking when taking into account that global stock markets witnessed one of the worst trading days since the 2008 financial crisis on March 9 (The New York Times, 2020). Although the suspension of Serie A games due to COVID-19 should have already indicated the risk of additional suspensions in other leagues, investors did not seem to perceive the threat of a spillover of COVID-19 consequences to other European markets and football leagues as likely at the time of the first game suspensions in Italy. Markets yet again reacted negatively at a similar magnitude across all event windows to the final announcement of suspensions of the respective local leagues (-8.72% for the event window [-1, 1] compared to -9.03% for the Italian lockdown) even though some of the risks seem to have already been priced-in following the announcement of the Italian lockdown on March 9.

4.4.1.2. *Analysis of particularly affected football clubs*

The high dispersion between median and mean CAARs across all event windows and events as well as the substantial differences between minimum and maximum CARs indicate that not all clubs were affected in a similar magnitude by the respective events. As indicated by the descriptive statistics in Table 4-1, findings show that the clubs in the sample particularly exhibit significant differences regarding size and sporting success. Capital market theory suggests that abnormal returns should be more negative for clubs with higher exposure to COVID-19. Ding et al. (2020) show that firms with particularly high supply chain exposure to COVID-19 exhibit significantly more negative abnormal returns than their peers. As Hammerschmidt et al. (2021) show, clubs were particularly affected due to the sudden drop in media and matchday revenues. Interestingly, they also find that clubs that were still competing internationally had, on the one hand, even higher exposure to COVID-19 on the revenue side, but were, on the other hand, also provided with more flexibility after competition resumed to make up for losses incurred during COVID-19. As COVID-19 furthermore significantly impaired international travel and thus also international cup competitions, we would expect those clubs that were still competing internationally at the time to incur more negative CARs than their peers.

Table 4-2: Event study results for key football-related event dates around the outbreak of COVID-19 for a sample of 22 football clubs

	Descriptive Statistics					Parametric Tests			Non-parametric Tests		
	CAAR	Median CAR	Min CAR	Max CAR	% Negative	Sample	T-test	Patell	BMP-test	Corrado	Generalized Sign
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
First national suspension (Serie A, Feb 24)											
[0]	-0.12%	-2.20%	-12.03%	18.58%	57%	21	-0.070	-2.744***	-0.987	-1.220	-0.509
[-1; 0]	-0.84%	-2.20%	-13.62%	13.82%	62%	21	-0.594	-2.570**	-1.409	-1.476	-0.946
[0; 1]	0.17%	-1.30%	-13.92%	31.35%	57%	21	0.086	-1.042	-0.520	-0.674	-0.509
[-1; 1]	-0.54%	-1.39%	-15.51%	26.59%	71%	21	-0.305	-1.365	-0.869	-1.077	-1.819*
First national lockdown (Italy, Mar 9)											
[0]	-5.99%	-5.37%	-20.63%	8.15%	86%	22	-4.422***	-10.615***	-4.435***	-4.074***	-3.182***
[-1; 0]	-6.77%	-5.72%	-25.45%	5.30%	82%	22	-4.218***	-8.884***	-3.771***	-3.229***	-2.755***
[0; 1]	-8.25%	-4.84%	-30.57%	3.70%	82%	22	-3.925***	-7.610***	-4.335***	-2.703***	-2.755***
[-1; 1]	-9.03%	-7.66%	-32.55%	7.87%	82%	22	-3.955***	-7.339***	-3.960***	-2.784***	-2.755***
League suspension (various)											
[0]	-5.73%	-4.16%	-20.63%	2.69%	86%	22	-4.507***	-9.082***	-5.605***	-4.724***	-3.243***
[-1; 0]	-7.61%	-6.00%	-26.50%	7.41%	91%	22	-4.494***	-8.952***	-5.078***	-4.370***	-3.669***
[0; 1]	-6.83%	-7.10%	-22.66%	21.67%	91%	22	-2.900***	-9.221***	-2.982***	-4.314***	-3.669***
[-1; 1]	-8.72%	-8.59%	-32.24%	22.72%	86%	22	-3.630***	-9.595***	-4.019***	-4.522***	-3.243***

This table contains descriptive statistics and test statistics of the cumulative abnormal and cumulative average abnormal returns for all listed European football clubs. The sample consists of 22 stocks. Abnormal returns are generated using the thin-trading adjusted market model as proposed by Scholes and Williams (1977) and for three different events: (1) the first suspension of football games in a major European football league (defined as the Big Five leagues), (2) the first nationally imposed lockdown of a major European country, and (3) the national suspension of the respective league of each club. The test statistics are defined as outlined in Section 4.3 with t- and z-values in parentheses. ***, **, * denote that estimates are statistically significant at the 1%, 5%, and 10% levels.

To obtain a first indication of whether this is indeed the case, the sample is split into two sub-samples: one sub-sample with clubs still competing in international competitions and one sub-sample with clubs that had already been eliminated or were not qualified for international cup competitions in the 2019/2020 season. Table 4-3 shows the results across our three event dates and for two exemplary event windows.

Table 4-3: Comparison of abnormal returns by participation in international cup competitions

	First national suspension (Serie A, Feb 24) (CAARs in %)		First national lockdown (Mar 9) (CAARs in %)		League suspensions (various) (CAARs in %)	
	[-1; 1]	[0; 1]	[-1; 1]	[0; 1]	[-1; 1]	[0; 1]
<i>Panel A: Overall sample</i>						
	-0.005	0.002	-0.090***	-0.082***	-0.087***	-0.068***
<i>Panel B: International</i>						
International = 0	0.029	0.043	-0.109***	-0.092***	-0.086**	-0.059*
International = 1	-0.037***	-0.036**	-0.042	-0.058	-0.091**	-0.099*
ΔCAAR (%)	-0.067**	-0.079**	0.067	0.034	-0.005	-0.039

This table shows the stock market reactions to three different events: (1) the first suspension of football games in a major European football league (defined as the Big Five leagues), (2) the first nationally imposed lockdown of a major European country, and (3) the national suspension of the respective league of each club. CAARs are estimated over multiple event windows. Daily abnormal returns are calculated using the standard market model adjusted for thin trading following Scholes and Williams (1977). The sample is split based on whether a club was still competing internationally (i.e., in one of UEFA's two club competitions) at the time of the event. CAARs are tested for statistical significance using a standard t-test of means. To test the differences between international and non-international clubs for statistical significance, the parametric two-sample t-test is applied. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

The results presented in Table 4-3 provide mixed findings. More precisely, internationally competing clubs indeed exhibit lower CAARs for both football-related events with highly significant differences of up to 7.90% for our first event, the first suspension of games in a Big Five league. For our only non-football-related event, the Italian Lockdown on March 9, however, internationally competing clubs seem to incur higher CAARs than their only nationally competing peers, though differences are not significant at conventional levels. Interestingly, while CAARs were insignificant and around zero for the entire sample for the first event window, the fact that we observe significant return differences when splitting the sample according to a club's presence in an international cup competition indicates that markets already incorporated the possibility of first suspensions of international games upon the first suspensions of games in Italy's Serie A (and concomitant announcements of local travel restrictions). This could also be an explanation why we do not find any significant return differences for the other two event windows.

To further analyze whether the presence of clubs in international cup competitions is indeed a driver of CARs, we subsequently conduct a multivariate regression in which we regress a club's CARs on a binary variable (*International*) that is equal to one if a club is still competing in an international competition and zero otherwise. Following Fühner et al. (2021), we also control for differences in firm size by incorporating the natural logarithm of a club's revenues in the 2018/19 season. Results of the regressions can be found in Table 4-4.

Table 4-4: Results of different regressions concerning the influence of participation in an international cup competition on CARs

Variable	First National Suspension (Serie A, Feb 24)		First national lockdown (Mar 9)		League suspensions (various)	
	$CAR_{i[-1,+1]}$	$CAR_{i[0,+1]}$	$CAR_{i[-1,+1]}$	$CAR_{i[0,+1]}$	$CAR_{i[-1,+1]}$	$CAR_{i[0,+1]}$
	[1]	[2]	[3]	[4]	[5]	[6]
International	-0.067*	-0.080**	0.085	0.052	-0.013	-0.044
	(0.063)	(0.048)	(0.120)	(0.303)	(0.832)	(0.474)
Net Sales (Season 2018/19)	-0.008 (0.715)	-0.008 (0.754)	-0.020 (0.252)	-0.020 (0.217)	0.010 (0.832)	0.006 (0.756)
<i>Observations</i>	21	21	22	22	22	22
<i>Adjusted R²</i>	0.090	0.112	0.054	0.007	-0.0887	-0.074

The sample contains regression results for all listed 22 European football clubs (21 clubs for the first event date as SpVgg Unterhaching did not provide enough data points with trading volume for the estimation window) for the event windows [-1, 1] and [0, 1] for our three event dates. The main independent variable is a binary variable that is equal to one if a club is still competing in an international competition at the time of the event. Abnormal returns are generated using the thin-trading adjusted market model as proposed by Scholes and Williams (1977). P-values are in parentheses and ***, **, and * denote that estimates are statistically significant at the 1, 5, and 10% levels.

The results in Table 4-4 confirm the findings of our t-test of means by showing that there indeed exists a significant negative relationship between the presence of a club in international cup competition and CARs for the first event date. More precisely, a club still competing internationally on February 22 on average exhibited up to 8.0% more negative CARs than its peers. The results are significant for both observed event windows.⁴⁷ For both other events, direction and magnitude are again comparable to the results of our t-test of means, albeit insignificant at conventional levels.

While an increased exposure to the effects of COVID-19 could be a possible explanation why clubs still competing in international cup competitions react more significantly to the outbreak of COVID-19, one could also argue that the differences in CARs for internationally competing clubs are predominantly driven by a high likelihood of restrictions to international travel and, hence, international cup competition. If the observed return differences stem from a higher overall exposure, we should see similar results when we analyze whether CARs are also driven by other club characteristics that signal a higher exposure to COVID-19. According to the interviewees of

⁴⁷ In untabulated results we show that the observed effect also persists for longer event windows.

Hammerschmidt et al. (2021) clubs were particularly struggling because of the sudden decrease in revenues from media rights and matchday operations while still having to pay player salaries. We therefore repeat our base regression with three further controls: a club's matchday revenue as a share of total revenue (*Matchday*) for the 2018/19 season, a club's personnel expenses as a share of total revenue (*Wages*) for the 2018/19 season, and the natural logarithm of a club's total revenue (*NetSales*). We hence estimate the following regression model:

$$CAR_{i,[t_1,t_2]} = International_{i,t} + Matchday_{i,t} + Wages_{i,t} + \ln(NetSales_{i,t}) + \varepsilon_{i,t} \quad (17)$$

with $CAR_{i,[t_1,t_2]}$ being the cumulative abnormal return for club i and event window $[t_1, t_2]$. All other variables are indexed to club i and time t . The results of this regression model are shown in Table 4-5 with columns [1]-[2] containing the results for the first event date (cancellation of Serie A games on February 24) and the event windows $[-1, 1]$ and $[0, 1]$, columns [3]-[4] the results for the second event date (lockdown of Italy on March 9), and columns [5]-[6] the results for the third event date (suspension of a club's respective league) for the same event windows. Given our small sample of only 22 football clubs and concomitant overspecification concerns for a regression model with four independent variables, the results of our regression analyses must be interpreted with caution and are hence primarily exploratory.

The results in Table 4-5 show that in contrast to other industries negative abnormal returns of football clubs do not seem to be driven by a high exposure to COVID-19. Regression variables are insignificant across all regressions except two and mostly have a negative adjusted R-squared signaling a low explanatory power. Confirming our previous analyses, we observe a negative, significant effect of our binary variable regarding international competition for both event windows of our first event with clubs still competing in international club competitions exhibiting up to 7.8% more negative abnormal returns. Taken together, our results indicate that abnormal return differences for internationally competing clubs are most likely less driven by a club's overall exposure to COVID-19, but rather by investor concerns about the likely impact of COVID-19 on international travel and, hence, international competition. Additionally, investors might have initially believed in a limited, temporary impact of COVID-19 on national competition and hence in the ability of clubs to recoup short-term reductions in matchday revenues in the long-term as well as to negotiate short-term salary waivers with players. Revenues from international competition, on the other hand, are potentially foregone for the season (e.g., in case of a premature ending of the cup competition) and are highly dependent on international travel (which was already

restricted at a comparably early stage of the COVID-19 outbreak) as well as on future sportive performance.⁴⁸

Table 4-5: Results of different regressions concerning the influence of different measures for exposure to the effects of COVID-19 on CARs

Category	Variable	First National Suspension (Serie A, Feb 24)		First national lockdown (Mar 9)		League suspensions (various)	
		CAR _{i,t} [-1; +1]	CAR _{i,t} [0; +1]	CAR _{i,t} [-1; +1]	CAR _{i,t} [0; +1]	CAR _{i,t} [-1; +1]	CAR _{i,t} [0; +1]
		[1]	[2]	[3]	[4]	[5]	[6]
Exposure	International Competition	-0.0648* (0.093)	-0.0782* (0.065)	0.074 (0.197)	0.052 (0.340)	-0.023 (0.722)	-0.050 (0.450)
	Matchday	0.062	0.113	-0.140	0.007	-0.035	-0.088
	Revenues	(0.648)	(0.447)	(0.408)	(0.967)	(0.851)	(0.640)
	Personnel	-0.010	0.088	0.073	0.018	0.202	0.002
	Expenses	(0.946)	(0.595)	(0.649)	(0.907)	(0.264)	(0.992)
Controls	Net Sales	-0.005 (0.856)	0.005 (0.871)	-0.023 (0.218)	-0.021 (0.249)	0.004 (0.847)	0.005 (0.804)
<i>Observations</i>		21	21	22	22	22	22
<i>Adj. R-Squared</i>		-0.008	0.046	-0.003	-0.109	-0.127	-0.185

This table contains the results of different regressions with CARs as the dependent variable for all listed 22 European football clubs (21 clubs for the first event date as SpVgg Unterhaching did not provide enough data points with trading volume for the estimation window) for the event windows [-1; 1] and [0; 1] for our three event dates. The main independent variables are three variables measuring a club's exposure to the adverse effects of COVID-19. Abnormal returns are generated using the thin-trading adjusted market model as proposed by Scholes and Williams (1977). P-values are in parentheses and ***, **, and * denote that estimates are statistically significant at the 1, 5, and 10% levels.

4.4.1.3. Robustness checks

The immediate weeks after the outbreak of COVID-19 in Europe were characterized by a period of extreme market volatility and high uncertainty about the future development of the general economy. One explanation for the significant negative stock price reactions observed for football stocks could hence be that market participants were overreacting to all negative news resulting in abnormal return patterns during the stock market turmoil between February 19 and March 16. If this is indeed the case, investors in similarly COVID-19-impaired firms should react similarly to the afore-tested events, including the suspension of national football leagues and games which are events that should only be relevant for football clubs.

Table 4-6 documents the results of the same event study analyses already conducted in Section 4.4.1.1. using all 14 non-leisure constituents of the STOXX Europe 600 Travel & Leisure Index as the sample. To ensure that we only include stocks that are similarly affected by the outbreak of COVID-19, we excluded the two leisure constituents of the index (Flutter and Evolution Gaming Group) which both profited significantly from the stay-at-home orders imposed to contain the

⁴⁸ See, e.g., interview results of Hammerschmidt et al. (2021) which indicate that club owners see revenues from international competitions as an unplanned surplus which, to some extent, depends on sportive luck.

virus.⁴⁹ The remaining travel and hospitality stocks are among the stocks that were affected most severely by travel bans and social distancing measures imposed during the peak of the outbreak and should provide an appropriate comparison group that is similarly affected by COVID-19 as football clubs.⁵⁰ The results of Table 4-6 indicate that travel and hospitality stocks exhibit a nearly diametral reaction to the events. Investors in travel and hospitality stocks did not react significantly to the football-specific event of league suspensions. This indicates that the significant negative abnormal returns for football stocks for this event are most likely not caused by general market volatility and general abnormal trading patterns but are rather peculiar to the event date itself and the football clubs' business model.

The results of the other two event dates are at first glance counterintuitive. While football stocks remained flat after the suspension of the first Serie A games on February 22 (i.e., on the first trading day thereafter on February 24), travel and hospitality stocks exhibit significant negative abnormal returns of up to -4.92%. This is most likely a direct reaction to the local lockdowns that Italy's government imposed on the particularly impacted regions Lombardy and Veneto on February 22 which saw the first comprehensive outbreak of COVID-19 in Europe. While risks of a slowdown of travel and hospitality demand from the Asia-Pacific region had indeed already been priced in before these events, the drastic reaction of travel and hospitality stocks likely reflects the spreading fear of an accelerated spillover of COVID-19-related impairments to the travel and hospitality sector already observed in China to Europe (Hancock, 2020; Somayaji & Hirtenstein, 2020). Additionally, starting February 24 multiple countries announced that they would restrict immigration for Italian citizens and first cases of planes, trains, and buses coming from Italy that were blocked from immigration by local authorities emerged (Costa et al., 2020).

The announcement of the Italian lockdown on March 9 resulted in significant positive abnormal returns of up to 6.23%. Considering that most global stock markets have seen the largest losses in a day since 2008, one possible explanation of this conundrum is that the positive abnormal returns are predominantly driven by the market reactions on the event day itself. This hypothesis draws on support from two arguments: Firstly, in contrast to other industries, investors in travel and hospitality stocks likely had already priced in the risk of further impairments after the first travel bans in China and Italy in February and March which would have led to a less negative reaction of travel and hospitality stocks compared to the general stock market on March 9.

⁴⁹ Results remain qualitatively and directionally similar when we rerun the analyses using all 16 components of the STOXX Europe 600 Travel & Leisure Index.

⁵⁰ An overview of all 14 stocks of the sample, the two excluded leisure stocks, and the corresponding event dates can be found in Table 4-7 of Appendix 4.

Table 4-6: Event study results for football-related key event dates around the outbreak of COVID-19 for a sample of 14 travel and hospitality

stocks

	Descriptive Statistics						Parametric Tests			Non-parametric Tests	
	CAAR	Median CAR	Min CAR	Max CAR	Negative	Sample	T-test	Patell	BMP-test	Corrado	Generalized Sign
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
First national suspension (Serie A, Feb 24)											
[0]	-3.95%	-3.02%	-16.82%	0.83%	93%	14	-3.19***	-7.894***	-3.895***	2.270**	-3.374***
[-1; 0]	-3.96%	-2.60%	-17.38%	1.42%	86%	14	-2.975**	-5.656***	-3.642***	-1.934*	-2.839***
[0; 1]	-4.90%	-4.18%	-19.65%	1.06%	86%	14	-3.370***	-7.195***	-4.157***	-2.688***	-2.839***
[-1; 1]	-4.92%	-3.88%	-20.21%	2.76%	86%	14	-3.167***	-5.936***	-3.941***	-2.34**	-2.839***
First national lockdown (Italy, Mar 9)											
[0]	3.63%	3.18%	-4.36%	11.87%	21%	14	3.069***	6.507***	3.075***	-1.997**	-2.014**
[-1; 0]	5.99%	4.56%	-5.88%	20.60%	21%	14	3.059***	8.312***	3.228***	2.328**	-2.014**
[0; 1]	3.87%	4.07%	-5.19%	12.50%	29%	14	2.466**	4.696***	2.346**	1.207	-1.480
[-1; 1]	6.23%	3.62%	-6.70%	20.79%	29%	14	2.742**	6.864***	2.773***	1.921*	-1.480
League suspension (various)											
[0]	1.40%	2.38%	-12.97%	7.51%	36%	14	0.946	2.706***	1.113	-1.339	-0.832
[-1; 0]	-0.36%	1.41%	-18.86%	11.05%	43%	14	-0.175	-0.794	-0.173	-0.603	-0.296
[0; 1]	-3.53%	-4.26%	-24.81%	10.48%	57%	14	-1.278	-5.277***	-1.065	-0.712	0.775
[-1; 1]	-5.29%	-8.56%	-30.69%	11.33%	64%	14	-1.633	-6.519***	-1.523	-1.665*	1.310

This table contains descriptive statistics and test statistics of the cumulative abnormal and cumulative average abnormal returns for all constituents of the STOXX Europe 600 Travel & Leisure Index. The sample consists of 14 stocks across the travel and hospitality industry. Abnormal returns are generated using the thin-trading adjusted market model as proposed by Scholes and Williams (1977) and for three different events: (1) the first suspension of football games in a major European football league (defined as the Big Five leagues), (2) the first nationally imposed lockdown of a major European country, and (3) the suspension of the respective firm's national football league. The test statistics are defined as outlined in Section 4.3. ***, **, and * denote that estimates are statistically significant at the 1, 5, and 10% levels.

Secondly, it is likely that the immediate consequences of the Italian lockdown for travel and hospitality companies only became clear upon the various announcement of flight cancellations and schedule changes during the days following March 9. Untabulated analyses of event windows focused on the days immediately after March 9 (e.g., [0; 2] and [0; 5]) as well as the significantly lower abnormal returns of the only tabulated event window focusing exclusively on the event day and the period thereafter ([0,1]) support this hypothesis.

In addition to general global market volatility, results could also be skewed by individual volatility patterns of specific national stock markets. We have hence also rerun our analyses using an overarching market index (Euro STOXX 600) instead of individual national market indices. Results remained qualitatively and directionally similar (more detailed results can be found in Appendix 5).

Finally, standard errors of our analyses regarding the Italian lockdown on March 9 could be biased because of event-date clustering. Although the rank-test developed by Corrado (1989) and Corrado and Zivney (1992) already accounts for event-date clustering, we have further tested our results for robustness using the respective national lockdown dates instead of the Italian lockdown on March 9 as the event date. Results remain qualitatively similar concerning magnitude and direction of abnormal returns.

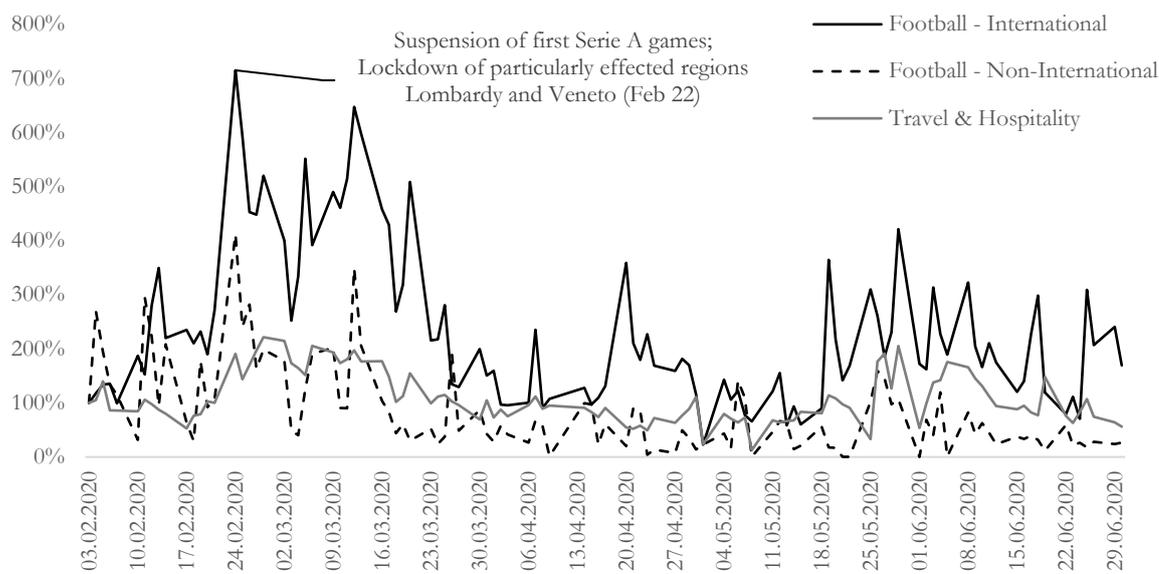
4.4.2. Trading volume effects

As has been outlined by Rösch and Kaserer (2013), investors tend to move from illiquid lower quality stocks to liquid higher-quality stocks during times of high market volatility. Following this "flight-to-liquidity" one would expect a significant uptick in trading volumes for illiquid stocks such as football stocks. However, the finding of Huth (2019) that investors of football stocks are more emotionally invested than traditional investors could also indicate that investors of football stocks do not involve in this "flight-to-liquidity" holding the stock longer than other investors. In this case, volumes would most likely still increase due to general market volatility (driven by institutional investors moving out of the respective stocks) but should not spike substantially and should hence exhibit similar trading volume patterns as other similarly affected stocks such as travel and hospitality stocks.

Figure 4-2 shows the aggregated trading volume (by value in Euro) for all 18 non-Turkish football clubs of our sample during the peak of the COVID-19 outbreak standardized by its moving 200-day average (data has been compiled from the first trading day of February (February

3) to the last trading day in June (June 30)).⁵¹ The data is indexed to the standardized volume of February 3 and split by whether a club still competed internationally at the time of the first event (February 22). To compare the trading volume of football stocks with the trading volume of other similarly COVID-19 affected stocks, the figure also contains the indexed standardized volume of the 14 travel and hospitality constituents of the STOXX Europe 600 Travel & Leisure Index.

Figure 4-2: Aggregated trading volume (by value in Euro)



This figure contains aggregated trading volumes (by value in Euro) for all constituents of the STOXX Football Europe Index (except for Ruch Chorzow and Teteks Tetovo) as well as SpVgg Unterhaching and Manchester United standardized by its moving 200-day average. The sample is split by a club's participation in an international cup competition at the time of the first event (February 24, 2020). For comparison, the figure also includes the standardized trading volume for the 14 travel and hospitality constituents of the STOXX Europe 600 Travel & Leisure Index. Turkish football clubs have been excluded as they exhibited abnormally high trading volumes in mid-February distorting overall volumes (trading volumes were significantly larger than trading volumes of all other football stocks combined on the respective days). A replication of this analysis including all Turkish stocks yields similar results and can be found in Figure 4-3 of Appendix 6. The resulting samples consist of 18 clubs for the European football club sample and 14 companies for the travel and hospitality sample. Standardized trading volume has been compiled for the time frame centered around the peak of the COVID-19 outbreak from the first trading day in February (February 3) to the last trading day in June (June 30) and has been indexed to February 3.

The comparison between the three stock groups indicates that football stocks exhibited significantly higher trading volumes during the peak outbreak of COVID-19 than similarly affected travel and hospitality stocks. Volume differences are thereby particularly driven by clubs that were still competing in international cup competitions. More precisely, after the suspension of the first Serie A games on February 2, stocks of the respective clubs were traded around seven times more

⁵¹ Turkish football clubs have been excluded as they exhibited abnormally high trading volumes in mid-February distorting overall volumes (trading volumes were significantly larger than trading volumes of all other football stocks combined on the respective days). A replication of this analysis including all Turkish stocks yields similar results and can be found in Figure 4-3 of Appendix 6.

than before the outbreak of COVID-19 at the beginning of February (715%). As this constitutes an increase nearly twice as high as what is observed with clubs that were not competing internationally at the time (412%) and nearly four times higher than travel and hospitality stocks (191%), the results are consistent with the findings of the event study and multivariate regressions. Although the significant increase in volume during the peak of the pandemic in March might have been predominantly driven by institutional investors, the magnitude of the trading volume difference indicates that retail investors might have joined the clearance of lower quality illiquid stocks as part of a more comprehensive portfolio liquidation. The results are also in line with Rösch and Kaserer (2013) who document a “flight-to-liquidity” during times of extraordinary market volatility.

4.5. Discussion of results and conclusion

This study analyzes the stock price impact of COVID-19 on a comprehensive sample of European football clubs. COVID-19 has caused major disruptions across countries and industries leading to unprecedented stock market losses in all major stock markets. One of the industries that are particularly affected is the football industry which was forced to suspend competition for more than two months between March and May 2020 leading to significant revenue losses and increased financial difficulties for many clubs. Using an event study methodology specifically adapted for thinly traded illiquid stocks we show that investors in football stocks particularly reacted to the national lockdown imposed by Italy on March 9 and the suspension of a club’s respective league thereby exhibiting CAARs as low as -9.03% in some event windows. Given that all leagues in the sample were, if at all, only suspended a considerable time after Italy’s lockdown this indicates that football investors have already anticipated the risk of a further impairment of club operations and revenue streams following the outbreak of COVID-19 at least to some degree following the lockdown of Italy on March 9. Furthermore, football stocks that were still competing in international cup competitions at the time of the respective event exhibited significantly more negative abnormal returns, particularly after the first suspension of football games in a Big Five league in Europe on February 22. This finding indicates that investors acknowledged that clubs still competing in international competitions have a higher share of non-recoupable revenues at risk in case of a premature cancellation of international competition. Indeed, further analyses show that the observed return differences are most likely driven by a higher risk of impairments to international cup competitions compared to national competitions due to international travel restrictions and only to a lesser extent by the overall exposure of a club to the effects of COVID-19. More precisely, we show that other metrics signaling a high exposure to COVID-19 such as the share of matchday revenues in total revenues as well as the overall personnel expenses of a club

compared to its revenues do not impact abnormal returns for any of the observed events. In contrast to the findings of Ding et al. (2020) who show that stocks across 58 economies exhibited significant differences in abnormal returns after the outbreak of COVID-19 depending on their supply chain exposure to COVID-19, football clubs only exhibit such differences with respect to their presence in international cup competitions. Further analyses support our findings by showing that football clubs exhibited significantly more negative abnormal returns than similarly COVID-19 affected firms from the travel and hospitality industry and that these differences also manifest in trading volumes around the outbreak of COVID-19. Football stocks, and particularly stocks of internationally competing football clubs, thereby exhibited significantly higher trading volumes around the outbreak of COVID-19 than comparable European firms from the travel and hospitality industry.

The implications of our results are twofold. Firstly, our results suggest that investors initially overreacted to the outbreak of COVID-19 and reacted significantly more strongly to the outbreak of COVID-19 than investors in similarly affected travel and hospitality stocks. Our volume analyses as well as the development of the overall stock market, however, show that investor confidence seemed to have returned comparably fast even though high uncertainties around the further evolvement of COVID-19 remain and lasting impairments to the revenue base of football clubs are likely. The STOXX Football Europe Index, for example, already reached 2019 levels at the beginning of the 2020/21 season in August 2020 even despite many of its constituents incurring record losses. Borussia Dortmund, one of the clubs in our sample, for example, announced net losses for the first time in ten years with EUR 43.9 m for the 2019/20 season followed by even higher losses of EUR 75.0 m for the 2020/21 season (Borussia Dortmund, 2021). Given the aforementioned emotionality of football investors, clubs might hence want to seize the recent recovery of the stock market by engaging in Initial Public Offerings (IPOs) or SEOs to cover financial holes caused in the wake of COVID-19. Indeed, Juventus Turin announced that it considers a capital increase of EUR 400.0 m (Reuters, Wed, 2021), and Atletico Madrid, although not publicly listed, successfully completed a capital increase of EUR 181.8 m in June 2021 (Club Atlético de Madrid, 2021). Secondly, the significant reactions to COVID-19 observed in our event study and volume analysis generally support the results of Rösch and Kaserer (2013) who document a “flight-to-liquidity” during crises and hence provide further evidence against the notion of “fan” investors who stick to their club’s stock even despite financial turmoil. It should be noted though that our sample is comparably small and observed effects need to be interpreted cautiously (particularly of our regression analyses). Thus, further analyses with larger datasets (potentially also

comprising stocks from other sports and regions) are required to analyze whether our results also hold true for previous crises (e.g., the financial crisis in 2008).

Appendix II.

Appendix 4. Background details for travel & hospitality stocks

Table 4-7: Background details for all companies contained in the STOXX Europe 600

Travel & Leisure index

Company	Country	Market Index	Company Details			Event Dates	
			Sector	Market Cap (in EUR mn, as of 31/12/2019)	Free Float (% of shares, as of 31/12/2019)	League Suspension	National Lockdown
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Accor	France	CAC 40	Hospitality	11,300.60	71%	13.03.2020	17.03.2020
Carnival Corporation & plc	United Kingdom	FTSE 100	Travel	6,736.21	100%	12.03.2020	23.03.2020
Compass Group	United Kingdom	FTSE 100	Food services	35,413.87	90%	12.03.2020	23.03.2020
Deutsche Lufthansa AG	Germany	DAX 30	Travel	7,847.16	100%	13.03.2020	16.03.2020
easyJet	United Kingdom	FTSE 100	Travel	6,677.07	66%	12.03.2020	23.03.2020
Evolution Gaming Group ⁵²	Sweden	OMX S20	Leisure	4,874.76	60%	06.05.2020	n/a
Flutter Entertainment ⁵²	Ireland	ISEQ Overall	Leisure	8,347.24	78%	12.03.2020	27.03.2020
GVC Holdings plc	United Kingdom	FTSE 100	Gambling	6,073.72	77%	12.03.2020	23.03.2020
InterContinental Hotels Group plc	United Kingdom	FTSE 100	Hospitality	11,187.75	77%	12.03.2020	23.03.2020
International Airlines Group	United Kingdom	FTSE 100	Travel	14,644.36	78%	12.03.2020	23.03.2020
La Française des Jeux	France	CAC 40	Gambling	4,550.58	69%	13.03.2020	17.03.2020
Ryanair Holdings plc	Ireland	ISEQ Overall	Travel	16,136.45	100%	12.03.2020	27.03.2020
Sodexo Group	France	FTSE MIB	Food services	15,578.62	58%	13.03.2020	17.03.2020
trainline	United Kingdom	FTSE 100	Travel	2,874.47	73%	12.03.2020	23.03.2020
Tui	United Kingdom	FTSE 100	Travel	6,632.37	75%	12.03.2020	23.03.2020
Whitbread plc	United Kingdom	FTSE 100	Hospitality	6,568.73	94%	12.03.2020	23.03.2020

This table contains background details for all companies contained in the STOXX Europe 600 Travel & Leisure Index. Market cap is calculated as number of shares outstanding multiplied by the current share price as of December 31, 2019 and is based on data from Refinitiv. The event dates are based on news research. For brevity, only event dates that are individual per company have been included in the table (the first suspension of games of a Big Five league (Feb 22) and the Italian lockdown (Mar 9) are the same for all companies).

⁵² Beneficiary of the COVID-19 pandemic; excluded for further analyses.

Appendix 5. Key analyses with Euro STOXX 600 as an overarching market index

Appendix 5.1. Core event study

Table 4-8: Event study results for football-related key event dates around the outbreak of COVID-19 for a sample of 22 football clubs

	Descriptive Statistics					Parametric Tests			Non-parametric Tests		
	CAAR	Median CAR	Min CAR	Max CAR	% Negative	Sample	T-test	Patell	BMP-test	Corrado	Generalized Sign
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
First national suspension (Serie A, Feb 24)											
[0]	0.19%	-0.82%	-12.40%	15.90%	55%	20	0.112	-2.270**	-0.854	-0.748	-0.298
[-1; 0]	-0.76%	-2.06%	-13.89%	11.25%	60%	20	-0.508	-2.643***	-1.366	-1.384	-0.746*
[0; 1]	0.78%	-0.85%	-14.41%	27.56%	60%	20	0.404	-0.322	-0.208	0.098	-0.746*
[-1; 1]	-0.17%	-1.24%	-15.91%	22.92%	65%	20	-0.0955	-1.111	-0.726	-0.610	-1.193
First national lockdown (Italy, Mar 9)											
[0]	-5.90%	-0.82%	-22.75%	9.01%	80%	20	-3.514***	-9.808***	-3.729***	-3.451**	-2.451***
[-1; 0]	-6.41%	-2.06%	-28.32%	5.85%	75%	20	-3.040***	-7.998***	-3.166***	-2.695**	-2.003***
[0; 1]	-8.69%	-0.85%	-40.09%	4.25%	70%	20	-3.401***	-7.343***	-3.624***	-2.576	-1.555***
[-1; 1]	-9.19%	-1.24%	-45.66%	8.20%	75%	20	-3.206***	-6.864***	-3.289**	-2.501**	-2.003**
League suspension (various)											
[0]	-6.73%	-0.82%	-21.10%	3.19%	85%	20	-4.157***	-8.790***	-4.557***	-4.149***	-2.954***
[-1; 0]	-7.25%	-2.06%	-22.58%	7.98%	85%	20	-3.903***	-7.577***	-4.337***	-3.342***	-2.954***
[0; 1]	-7.36%	-0.85%	-31.74%	25.18%	80%	20	-2.541**	-8.047***	-2.608***	-4.144**	-2.506***
[-1; 1]	-7.88%	-1.24%	-35.51%	23.14%	85%	20	-3.049***	-7.682***	-3.386***	-3.843***	-2.954***

This table contains descriptive statistics and test statistics of the cumulative abnormal and cumulative average abnormal returns for all listed European football clubs. The sample consists of 22 stocks. Abnormal returns are generated using the thin-trading adjusted market model as proposed by Scholes and Williams (1977) and for three different events: (1) the first suspension of football games in a major European football league (defined as the Big Five leagues), (2) the first nationally imposed lockdown of a major European country, and (3) the national suspension of the respective league of each club. The test statistics are defined as outlined in Section 4.3 with t- and z-values in parentheses. ***, **, and * denote that estimates are statistically significant at the 1%, 5%, and 10% levels.

Appendix 5.2. Comparison of clubs regarding the degree of revenue exposure

Table 4-9: Comparison of abnormal returns by participation in international cup competition (Euro STOXX 600)

	First national suspension (Serie A, Feb 24)		First national lockdown (Mar 9)		League suspensions (various)	
	(CAARs in %)		(CAARs in %)		(CAARs in %)	
	[-1; +1]	[0; +1]	[-1; +1]	[0; +1]	[-1; +1]	[0; +1]
<i>Panel A: Overall sample</i>						
	-0.002	0.008	-0.092***	-0.087***	-0.079***	-0.074**
<i>Panel B: International</i>						
International = 0	0.032	0.044	-0.105**	-0.091**	-0.074*	-0.064*
International = 1	-0.035***	-0.029**	-0.053	-0.065	-0.094**	-0.101*
$\Delta CAAR$ (%)	-0.067**	-0.073**	0.053	0.017	-0.020	-0.037

This table contains descriptive statistics and test statistics of the cumulative abnormal and cumulative average abnormal returns for all listed European football clubs split by participation in international cup competitions for our three event dates. Panel A consists of all stocks, Panel B splits all stocks according to their participation in international competition. Abnormal returns are generated using the thin-trading adjusted market model as proposed by Scholes and Williams (1977) and with the day of the announcement of the suspension of the respective club's league as the event date. The test statistics are defined as outlined in Section 4.3. ***, **, and * denote that estimates are statistically significant at the 1, 5, and 10% levels.

Appendix 5.3. Robustness check with travel & hospitality stocks

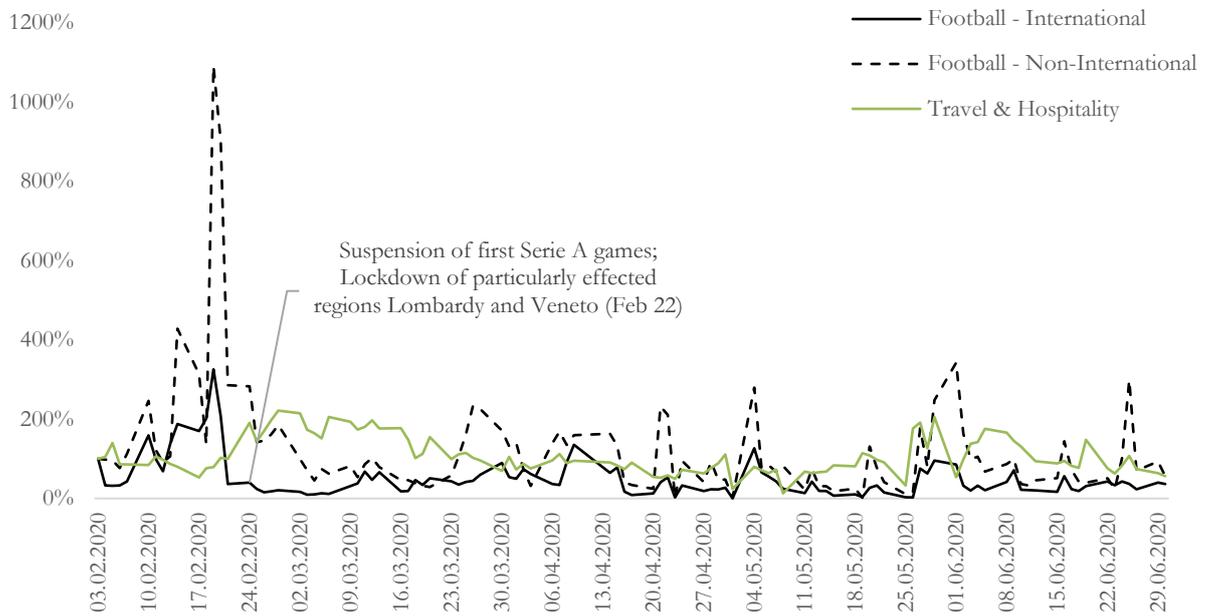
Table 4-10: Event study results for football-related key event dates around the outbreak of COVID-19 for a sample of 14 travel and hospitality stocks (Euro STOXX 600)

	Descriptive Statistics						Parametric Tests			Non-parametric Tests	
	CAAR	Median CAR	Min CAR	Max CAR	% Negative	Sample	T-test	Patell	BMP-test	Corrado	Generalized Sign
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
First national suspension (Serie A, Feb 24)											
[0]	-3.15%	-2.31%	-13.47%	2.93%	86%	14	-2.730**	-6.286***	-3.134***	1.767*	2.817***
[-1; 0]	-2.97%	-1.77%	-13.52%	3.87%	86%	14	-2.439**	-4.211***	-2.865***	-1.376	2.817***
[0; 1]	-3.92%	-2.85%	-14.90%	3.37%	86%	14	-3.007**	-5.879***	-3.531***	-2.229**	2.817***
[-1; 1]	-3.74%	-2.65%	-14.95%	4.31%	86%	14	-2.722**	-4.609***	-3.287***	-1.768*	2.817***
First national lockdown Italy, Mar 9											
[0]	3.38%	3.04%	-4.54%	12.87%	29%	14	2.534**	5.643***	2.408**	-1.566	-1.529
[-1; 0]	5.91%	4.65%	-5.80%	22.49%	36%	14	2.726**	7.749***	2.737***	1.991**	-0.994
[0; 1]	4.59%	3.14%	-3.60%	15.55%	36%	14	2.493**	5.430***	2.321**	1.339	-0.994
[-1; 1]	7.12%	4.21%	-4.87%	24.99%	29%	14	2.730**	7.503***	2.683***	1.984**	-1.529
League suspension various											
[0]	2.28%	3.11%	-13.19%	9.59%	43%	14	1.427	3.549***	1.484	-1.269	-0.414*
[-1; 0]	-0.36%	0.23%	-19.64%	9.37%	43%	14	-0.180	-1.552	-0.333	-0.957	-0.414*
[0; 1]	-2.00%	-1.09%	-24.02%	10.38%	50%	14	-0.718	-3.958***	-0.731	-0.611	0.121*
[-1; 1]	-4.64%	-4.92%	-30.48%	9.31%	64%	14	-1.482	-6.548***	-1.499*	-1.847*	1.191

This table contains descriptive statistics and test statistics of the cumulative abnormal and cumulative average abnormal returns for all constituents of the STOXX Europe 600 Travel & Leisure Index. The sample consists of 14 stocks across the travel and hospitality industry. Abnormal returns are generated using the thin-trading adjusted market model as proposed by Scholes and Williams (1977) and for three different events: (1) the first suspension of football games in a major European football league (defined as the Big Five leagues), (2) the first nationally imposed lockdown of a major European country, and (3) the suspension of the respective firm's national football league. The test statistics are defined as outlined in Section 4.3 with t- and z-values in parentheses. ***, **, and * denote that estimates are statistically significant at the 1, 5, and 10% levels.

Appendix 6. Volume analysis with Turkish clubs

Figure 4-3: Aggregated trading volume (by value in Euro) including all Turkish clubs



This figure shows aggregated trading volume (by value in Euro) for all but two constituents of the STOXX Football Europe Index as well as SpVgg Unterhaching and Manchester United standardized by its moving 200-day average. As a comparison, it also includes the standardized trading volume for all 14 travel and hospitality constituents of the STOXX Europe 600 Travel & Leisure Index. The samples consist of 22 clubs for the European football club sample and 14 companies for the travel and hospitality sample. The football stock sample is further split into two subsamples according to whether a team was still competing internationally at the time of the first event date (February 22). Standardized trading volume has been compiled for the time frame centered around the peak of the COVID-19 outbreak from the first trading day in February (February 3) to the last trading day in June (June 30) and has been indexed to February 3.

Chapter 5

INFORMATION CONTENT OF ESG DISCLOSURES AND PUBLIC PERCEPTION OF CREDIT RISK⁵³

Environmental, social, and governance (ESG) topics are becoming omnipresent in capital markets. Despite the increasing importance of ESG-related risks, markets still exhibit a high degree of information asymmetry due to the mostly qualitative nature of ESG-related information. Using natural language processing and 2,309 annual reports of S&P 1500 firms, we examine how ESG-related content affects the market's credit risk perception. We find that market participants integrate the tone of ESG information and the provision of numerical ESG-related information into their credit risk assessment. Additional evidence suggests that executives engage in strategic impression management, particularly thematic manipulation and manipulation through numerical information, in their presentation of ESG content in annual reports to improve the market's perception of a firm's ESG activities and thus to positively influence the public perception of a firm's credit risk.

⁵³ This chapter is largely based on a paper co-authored with Florian Kiesel and Historei Bariz which has been published as "The Information Content of ESG Disclosures and the Public Perception of Credit Risk" (2021). ICIS 2021 Proceedings. 10. https://aisel.aisnet.org/icis2021/is_sustain/is_sustain/10.

5.1. Introduction

Corporate commitment to strict ESG guidelines and measures is becoming an important topic in global financial markets and is increasingly driving investment decisions. Estimations predict that global ESG assets will exceed USD 53 tn by 2025 or over a third of the USD 141 tn projected global assets under management in 2025 (Bloomberg, 2021). Meanwhile, inflows into sustainability-related exchange-traded funds (ETF) overtook those in all other non-sustainability-related ETFs for the first time in the first quarter of 2021 (Johnson, 2021). Given the increasing interest of investors in ESG, several financial institutions started to integrate ESG ratings by linking interest rates, lending decisions, and credit ratings to the adherence to predefined ESG standards or external ESG ratings. Moody's, one of the most important credit rating agencies, for example, cited ESG issues in a third of their rating actions in 2019 and thereby particularly often referred to actions impacting climate change as a major driver for rating changes (Mutua, 2020). S&P, a close competitor to Moody's, went one step further and acquired the ESG ratings business of RobecoSAM making them publicly available in February 2020 to "increase transparency of corporate sustainability performance" (S&P Global, 2021).

Due to the growing interest of investors in ESG, stricter disclosure requirements, and more frequent voluntary disclosures on ESG, firms have increasingly shifted focus to ESG engagement and respective disclosures over the past years.⁵⁴ According to KPMG (2020b), more than 80% of companies worldwide have reported in some way on sustainability in 2019 and 76% of the largest 250 companies of the world have included sustainability in their annual reports. Unfortunately, while there already exist manifold external agencies which provide ratings, reports, and certifications on the adherence to ESG standards, there is still a large degree of information asymmetries regarding the quality of ESG-related information. A lack of robust data as the basis for ESG ratings as well as a large variety of different rating methodologies often lead to drastically different ESG assessments which makes an outside-in assessment of the ESG activities of a firm increasingly difficult (Berg et al., 2020). Consequently, investors often need to rely on the information directly provided by a respective firm (e.g., in annual reports) to obtain a firm's ESG activities. This is particularly relevant for annual reports and their dissemination through the SEC's Form 10K given that firms must adhere to a well-known set of standards for reporting quality defined by independent accounting bodies. The readability and unbiased presentation of ESG-

⁵⁴ Firms have been analyzed regarding social responsibility long before the term ESG was coined in 2004 under the umbrella of CSR. However, due to the recent intensification of the debate around climate change and concomitant governance requirements, ESG has increasingly overtaken CSR to judge a firm's societal and environmental footprint (see Gillan et al. (2021) for a more thorough discussion of differences and similarities between ESG and CSR).

related information in annual reports are hence critical for firms to ensure an effective communication of market-relevant information to the readers of their financial statements and for investors to draw reliable conclusions. This especially true for those sections of an annual report that are to some degree dependent on a firm's executives (i.e., foremost Item 1 with the description of the business and its risks and Item 7 with the Management's Discussion and Analyses (MD&A)). The comprehensive unbiased dissemination of information becomes even more important considering findings that more complex, less readable financial reports are associated with lower trading volume (Miller, 2010) and lower earnings (Feng Li, 2008) and that some firms seem to use environmental disclosure as a legitimizing tool to make-up for poorer environmental performance (Cho & Patten, 2007). Recent results also suggest that corporate executives tend to strategically engage in impression management through the selective provision of information (Leung et al., 2015), presentational and graphical enhancements (Falschlunger et al., 2015), or the strategic management of tone and readability (Melloni, 2015; Merkl-Davies & Brennan, 2007).

While prior research has shown that readability and framing (e.g., tone and vocabulary) of annual reports are indeed closely linked to market reactions following the dissemination of the annual report⁵⁵, there is little research on how readability and framing of ESG-related content in annual reports affect the market's risk assessment of the respective firm. This is surprising given the high degree of information asymmetry related to a firm's ESG activities and the fact that many investors as well as key analysts and rating agencies cite ESG-related risks as growing in importance and as a core part of their assessment of a respective firm (Morningstar, Inc., 2021; Mutua, 2020).

Using information systems-related methodologies, we examine whether the framing and readability of ESG-related content in a firm's annual report indeed impact the market's risk assessment of the respective firm. We focus on the firm's CDS spreads as a proxy for the perceived riskiness by investors. A CDS is linked to a reference corporate bond and insures the buyer against a default of the bond. CDS are traded on OTC markets and the CDS market is one of the largest OTC markets. CDS spreads are particularly suitable as a risk measure as they are highly standardized, reflect debt-related news and signals of changes in creditworthiness more quickly than credit ratings, and are traded with a higher frequency than corporate bonds (Finnerty et al., 2013; Hull et al., 2004). Closely related to our paper is Hu et al. (2018) who show that there is a significant negative relationship between the readability of annual reports and CDS spreads with respect to the entire MD&A section of a firm's annual report.

⁵⁵ Lower readability is, e.g., associated with greater analyst dispersion (Lehavy et al., 2011), lower investment efficiency (Biddle et al., 2009), and higher stock price crash risk (C. Kim et al., 2019) while a higher proportion of uncertain and weak-modal words leads to higher costs of borrowing (Ertugrul et al., 2017).

Our contribution to the literature on ESG-related information is threefold. Firstly, by using textual analyses we examine how various measures of strategic impression management regarding the ESG-related content in a 10-K filing's business and risk section – namely the share of ESG-related content as well as its readability, tone, and the provision of quantitative information – affect CDS spreads and the implied risk of a firm's corporate bonds. The findings indicate that investor risk perception does not seem to be driven by the share of ESG-related information, but rather by its subcategories (particularly environment and governance). We find that a higher degree of environment- (governance-) related information leads to a tightening (widening) of CDS spreads indicating that information related to these potentially tail risk-prone topics seem to be particularly relevant for investors. We further find evidence that especially thematic manipulation and partly also the amount of numerical information in 10K-filings are being used as a proxy for the assumed default risk of the underlying firm by market participants. Secondly, we study whether executives engage in strategic impression management by analyzing whether the aforementioned measures of strategic impression management depend on the previous year's ESG scores (as measured by Refinitiv) of a respective firm. If executives engage in strategic impression management, it can be expected that executives of firms with subpar ESG scores would try to improve a firm's external perception regarding ESG by strategically framing a firm's annual report. Our results indicate that the ESG-content of annual reports of firms with subpar ESG scores exhibits a significantly more positive overall tone and a higher degree of quantitative ESG information. This provides first evidence that executives engage in impression management by strategically framing ESG-related information. Thirdly, we provide an open-source approach that individual investors can leverage to capture the informational quality of ESG disclosure and its impact on the market.

The remainder of our paper is organized as follows. Section 5.2. outlines the theoretical background on CDS spreads, the dissemination of ESG-related information as well as readability and strategic impression management of annual reports. Section 5.3. describes our data sample and the methodology. Section 5.4. presents our results, while Section 5.5. provides several robustness tests and further analyses. Section 5.6. provides a discussion and the limitations of our analyses. Section 5.7. concludes.

5.2. Theoretical background

5.2.1. Literature review

The intersection between information systems and finance and accounting literature has long provided room for extensive research, such as the application of various methods to forecast stock prices such as neural networks (Baba & Kozaki, 1992), text mining (Schumaker & Chen, 2009), or

most recently social media sentiment (Nofer & Hinz, 2015). Although Offermann et al. (2010) argue that data mining techniques such as content and sentiment analyses can be considered information technology (IT) artifacts, the analysis of financial documents such as corporate financial disclosures has only more recently become a more intensely discussed topic in information systems literature after the rise of more complex natural language processing models such as the Latent Dirichlet Allocation (LDA) developed by Blei et al. (2003). Feuerriegel and Pröllochs (2021), for example, use LDA to evaluate the impact of corporate disclosure on financial markets by categorizing the content of corporate financial filings into different financial topics. Huang and Li (2011) go one step further and develop a multilabel text classification algorithm to identify 25 specific types of risk factors mentioned in the business and risk section of 10K-reports of S&P 1500 firms.

Despite extensive research on corporate disclosures in the finance and accounting literature, research has only lately begun to make a distinction between quantity and quality of disclosure by focusing not only on what is disclosed in financial reports but also on how the information is conveyed to the general public (Ben-Amar & Belgacem, 2018; Burgstahler & Eames, 2006; Tetlock, 2007). Loughran and McDonald (2014) show that finance-related annual report disclosures are becoming longer and contain more complex tables and graphics. While one could argue that an increased focus on textual explanations and information benefits market participants by reducing information asymmetries, there is a growing strand of research that argues that a higher text share provides opportunistic managers with more opportunities to frame information beneficially for themselves and their respective firm (Guay et al., 2016). The latter school of thought can be subsumed under strategic impression management and assumes that executives opportunistically engage in impression management to manipulate market participants and their reactions to corporate disclosures and assumes that market participants are unable to correctly assess managerial biases in the short term (Merkl-Davies & Brennan, 2007). This theory stands in stark contrast to the idea of efficient capital markets in which market participants are capable to detect reporting bias and any concomitant incremental information and react accordingly. Recent research, however, shows that market participants are not necessarily rational (Hirshleifer, 2015) and are often incapable of incorporating managerial biases in their market reactions.

While Merkl-Davies and Brennan (2007) provide an initial framework with different impression management strategies, research of both schools of thought (impression management and incremental information) predominantly focuses on three different measures of impression management: *(i)* reading ease, *(ii)* thematic manipulation (tone), and *(iii)* performance comparisons. Although many researchers concentrate on measuring market reactions to varying proxies for the

informational quality of annual reports (Biddle et al., 2009; C. Kim et al., 2019; Lehavy et al., 2011; Loughran & McDonald, 2011), there is growing evidence on intentional impression management by executives. Lo et al. (2017) show that firms that engage in earnings management tend to use more complex language indicating managerial obfuscation. These findings are expanded by Leung et al. (2015) who find that firms with weak financials and a higher probability of financial distress are more likely to utilize impression management tactics and tend to reduce voluntary disclosures to a minimum. Falschlunger et al. (2015) show that firms tend to exaggerate positive trends by selectively disclosing graphical information and Hribar et al. (2017) provide evidence that managerial sentiment can lead to more biased accrual estimates and therefore biased financial disclosures for U.S. banks. Finally, Loughran et al. (2009) show that firms that are particularly outspoken about their “ethical” activities likely engage in systemic impression management thereby misleading the general public.

Research indicates that the application of impression management strategies to actively influence the perception of market participants can lead to information asymmetries in terms of perceived risk. O. Kim and Verrecchia (1994) point out that information asymmetries might increase after corporate financial disclosures such as earnings announcements as not all investors may be able to correctly interpret or verify the published information. The risk of information asymmetry and its potential effect on returns are particularly high for ESG-related disclosures for two reasons. Firstly, ESG-related information is often qualitative and might hence be interpreted differently by different investors and rating agencies (Berg et al., 2020), and secondly, the rising sustainability awareness among investors, regulators, and consumers can result in unforeseen ESG risks for firms. ESG-related activities can thereby have both positive and negative effects on companies. On the one hand, an improvement in ESG performance can mitigate firm risk by generating higher and/or less volatile cash flows, leading to improved risk-adjusted returns and a decreased cost of capital (Cheng et al., 2014; Eccles et al., 2014; Goss & Roberts, 2011; Verheyden et al., 2016). Socially responsible companies might be less vulnerable to spillover risks arising from natural disasters or changes in the regulatory environment (Renneboog et al., 2008). In addition, improved stakeholder relationships and the introduction of long-term approaches reward firms that integrate ESG factors into their corporate strategy as they face lower risks (Eccles et al., 2014). Cheng et al. (2014) and Verheyden et al. (2016) provide empirical evidence that the consideration of ESG in corporate strategy reduces idiosyncratic risks of companies in the long term. The positive impact of ESG disclosure is also supported by Reber et al. (2021) who find a positive effect of voluntary ESG disclosure and positive ESG ratings on downside tail risk and idiosyncratic volatility for U.S. firms around their IPO. Yi Li (2017) further supports these findings and shows that

voluntary disclosure incentives regarding environmental technology increase the efficacy of environmental regulation. On the other hand, overinvesting in ESG can be seen as value-destroying and a waste of scarce resources, resulting in lower and/or more volatile cash flows, and thus higher corporate risk (Goss & Roberts, 2011). Concerning debt markets, existing literature focusing on corporate bond yields and credit ratings of U.S. firms primarily finds empirical evidence for the risk mitigation view which implies that higher ESG activity is associated with lower credit risk and improved credit ratings (Attig et al., 2013; Ge & Liu, 2015; Oikonomou et al., 2014).

Although ESG-related information is becoming increasingly important in financial disclosures, research on the dissemination of this information in annual reports and its consequences on equity and debt markets is still quite limited and mainly focused on dedicated sustainability/CSR reports. Findings thereby, *inter alia*, suggest that firms with stronger CSR performance are more likely to exhibit a higher degree of CSR report readability (Wang et al., 2018) and MD&A sections with a higher degree of textual complexity (Ben-Amar & Belgacem, 2018). This indicates that managers may opportunistically engage in impression management by using narrative disclosures in accordance with their CSR performance. Mallin et al. (2014) provide further evidence for this notion as they find a positive relationship between financial performance and CSR disclosure for Islamic banks and provide initial evidence that the level of CSR disclosure is determined by a bank's financial performance. These findings are further complemented by Du and Yu (2020) who find that a more positively framed and more readable CSR report indicates a better future CSR performance. The authors also provide evidence that investors tend to react more positively to CSR reports that are written with a higher degree of readability and in a more positive tone.

While equity markets provide an interesting perspective regarding the market's assessment of a firm's financial prospects, ESG-related information is even more important for debt markets as well as for a market's assessment of a firm's risk.⁵⁶ A lack of robust data that could serve as the basis for ESG ratings and a large variety of different rating methodologies, however, drastically complicate an unbiased outside-in assessment of a firm's ESG risk making participants in risk markets particularly susceptible to a biased dissemination of information by executives (Feifei Li & Polychronopoulos, 2020). Liquid risk markets should, hence, react particularly strongly to signs of impression management such as readability and tone.

While studies have traditionally focused on corporate debt spreads, research has increasingly transitioned to CDS spreads due to a higher degree of liquidity leading to more rapid updates of spreads to new information. CDS are insurance-like contracts that provide the buyer with

⁵⁶ Debt investors are significantly more dependent on an accurate external risk assessment (e.g., credit ratings) given that an individual assessment of credit risk is often too costly for an investor.

protection against losses when a bond defaults. Because of their protective nature CDS are predominantly used for hedging purposes by financial institutions and institutional investors. The price at which CDS are traded (also called premium or spread) in turn signals the implied riskiness of a corporate bond and serves as a proxy for the assumed default risk of a firm. While most studies focus on financial determinants of CDS spreads, Hu et al. (2018) show that less readable financial reports are penalized by market participants resulting in higher CDS spreads. Hu et al. (2018) thereby provide initial evidence that investors also take informational quality into account when assessing a firm's risk. This effect is more concentrated among firms with high information asymmetries and investment-grade ratings. Naumer and Yurtoglu (2020), on the other hand, find that market participants consider ESG-related information in their risk assessment on CDS markets. More precisely, they show that more positive (negative) ESG-related news is associated with tighter (wider) CDS spreads. These findings are supported by Drago et al. (2019) who find that upgrades in CSR ratings lead to tighter CDS spreads. Given the high degree of information asymmetry regarding ESG risks, it is conceivable that market participants also integrate the readability and framing of ESG-related information in a firm's annual reports to some extent in their risk assessment of a firm.

5.2.2. Hypotheses development

We investigate whether market participants take the informational quality of ESG-related information into account when assessing a firm's credit risk and analyze whether firms actively engage in strategic impression management. Naumer and Yurtoglu (2020) show that investors in CDS markets seem to incorporate ESG-related information in their risk assessment. In combination with the findings of Yiwei Li et al. (2018) who show that a higher degree of ESG-related information disclosure leads to higher firm values, we would expect that a higher degree of ESG-related information disclosure leads to tighter CDS spreads. We therefore propose the following hypothesis:

Hypothesis 1a: Firms with a higher share of ESG-related information in 10Ks experience tighter CDS spreads.

With regard to the impact of each of the sub-topics of ESG – environment, social, and governance – research provides mixed indications on their relationship with CDS spreads with regard to environment and governance, but no indication regarding social. Drago et al. (2019) show that CDS markets react particularly sensitively to changes in environmental ratings with environment score upgrades leading to significantly tighter CDS spreads. Hence, we would expect that CDS market participants also react positively to the disclosure of environment-related information. We state the following hypothesis:

Hypothesis 1b: Firms with a higher share of environment-related information in 10Ks experience tighter CDS spreads.

Duarte et al. (2008) find that firms with good governance tend to exhibit higher information asymmetries between traders and CDS dealers leading to wider CDS spreads of well-governed firms. If we take the amount of governance-related information as a proxy for a firm's governance, we expect that firms with a higher share of governance-related information also face wider CDS spreads and state the hypothesis:

Hypothesis 1c: Firms with a higher share of governance-related information in 10Ks experience wider CDS spreads.

Given that there already exists a significant negative relationship between the readability of annual reports and CDS spreads with regard to the MD&A section of a firm's annual report (Hu et al., 2018), this should be particularly true for any specifically risk-related information in an annual report. As outlined before, ESG-related risks constitute an increasingly important risk factor for firms. We would hence expect that the findings of Hu et al. (2018) also extend to a subset of ESG-related information in an annual report and its subcategories environment, social, and governance. This leads to our second main hypothesis:

Hypothesis 2: Firms with less readable ESG-related information in 10Ks experience wider CDS spreads.

We further extend the existing literature by investigating additional measures of strategic impression management (disclosure tone and the amount of quantitative information) regarding ESG-related content on CDS spreads. We expect that a more positive framing of ESG-related content leads to tighter CDS spreads. Our third hypothesis is thus:

Hypothesis 3a: Firms with more positively framed ESG-related information in 10Ks experience tighter CDS spreads.

Further, we expect that a higher degree of quantitative (and hence verifiable) information is, ceteris paribus, indicative of lower information risk and therefore leads to tighter CDS spreads:

Hypothesis 3b: Firms with more quantitative information regarding ESG-related information in annual reports experience lower CDS spreads.

Merkel-Davies and Brennan (2007) argue that impression management measures can also be a signal for opportunistic behavior of corporate executives which try to manipulate market perceptions of value-relevant information. Therefore, our last hypothesis concerns the question of whether corporate executives engage in strategic impression management. We analyze whether

these measures of impression management depend on the previous year's ESG scores of a respective firm and hypothesize that if executives engage in strategic impression management, we would expect that executives of firms with subpar ESG scores try to improve a firm's external perception regarding ESG by strategically framing a firm's annual report and state the hypothesis:

Hypothesis 4: Firms with lower ESG scores use better readability, a more positive tone, and a higher amount of quantitative ESG-related information in subsequent annual reports.

5.3. Methodology and data

5.3.1. Research design

To analyze whether market participants integrate readability and framing of ESG-related information in annual reports into their risk assessment, we focus on 10K-filings of U.S. firms with available CDS spreads during the period 2003 to 2016. We specifically focus on the discussion of the business and risk factors in Item 1 (business and risk section) of the 10K-filing to capture the direct effects of executives on impression management.⁵⁷ The text contained in a firm's business and risk section of each 10K-filing has subsequently been filtered to ESG-relevant content and further analyzed regarding readability, tone, and other measures of impression management (detailed definitions of these measures can be found in the next section). 10K-filings are crawled from the SEC's EDGAR database and merged with accounting data from Refinitiv and I/B/E/S.

CDS spreads are retrieved from Refinitiv for all 5-year CDS contracts written on senior unsecured obligations of U.S. reference entities between January 1, 2003, and December 31, 2016. We restrict our sample to firms with CDS spread data available at the release of their annual report/10K-filing for at least one firm-year observation which leaves us at 262 unique underlying firms with 3,300 firm-year observations with CDS spread data. Following Hu et al. (2018), we convert daily CDS spreads to match annual financial data by taking the average of all non-missing CDS spreads within a year. As some of the 10K-filings are too short or do not have a business and risk section of sufficient length we exclude these years. This leaves us with a final sample of 2,309 firm-year observations and 262 underlying firms.

5.3.2. Data analysis methods

We employ a three-step structure. Firstly, we extract and filter 10K-filings to ESG-related content. Secondly, we analyze whether secondary risk markets react to incremental information provided

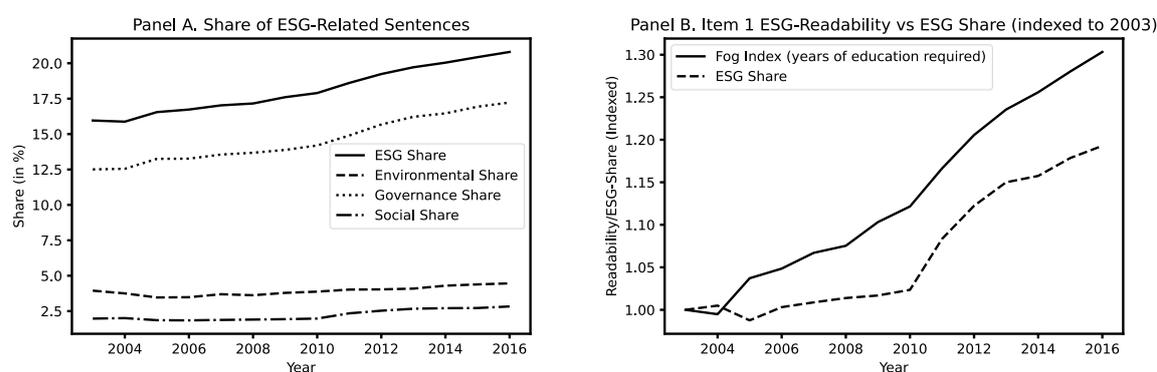
⁵⁷ Cho et al. (2010) show that the SEC mandates disclosure of ESG-related information in Section 1, Section 3, and Section 7 of a 10K-filing and argue that Section 1 provides management with the highest degree of discretionary control regarding tone (and concomitant regarding impression management) as Section 3 focuses primarily on legal issues warranting a precautionary framing and Section 7 predominantly summarizes items from Section 1.

by how ESG-related information is presented in annual reports. Thirdly, we analyze whether there are indications for strategic impression management by executives depending on the external assessments of a firm's ESG activities.

5.3.2.1. *Extracting ESG-related content*

Following Loughran and McDonald (2016), we use a thematic word list to isolate references to ESG topics within the business and risk section (Item 1) of a firm's 10K-filing. We thereby build our analyses on the ESG word list developed by Baier et al. (2020) who have identified 482 ESG-related items commonly used in annual reports across 40 subcategories specifically geared towards 10K-filings and proxy statements. More specifically, using textual analysis we extract all sentences in the business and risk section of a firm's 10K-filing that contain at least one ESG-related word as per the definition of Baier et al. (2020). Following this approach, we arrive at an overall share of ESG-related words of ~1.2% with ~20.0% of all sentences containing at least one ESG-related word (see Appendix 7 for an example of our extraction methodology for ESG-related sentences).⁵⁸

Figure 5-1: Share of sentences related to environment, social, or governance topics in and readability of a firm's business and risk section



This figure shows the development of the share of ESG-related sentences (including its subcategories) in a firm's business and risk section (Panel A) and plots it against the readability (proxied by the Fog Index) of the section (Panel B) over the sample period of 2003 to 2016. The sample for the entire text consists of 262 unique firms and 2,309 firm-year observations. ESG-related sentences are defined as sentences that include at least one word from the wordlist of Baier et al. (2020) (see Appendix 7 for an example of how we extract ESG-related sentences). Following Bellstam et al. (2020), sentences consisting only of stop words and digits have been removed before calculating ESG shares.

Figure 5-1 shows the development of the share of sentences that contain at least one ESG-related word over the sample period (Panel A) and compares the overall share of ESG-related sentences with the readability of ESG-related information (proxied by the Fog Index; Panel B) in

⁵⁸ Baier et al. (2020) find that 10Ks contain on average 4% ESG-related words. However, as they focus on reports published by the 25 largest companies in the S&P 100 index and analyze all items of an annual report, this discrepancy might be driven by a higher degree of public scrutiny on larger corporations with respect to ESG activities leading to a higher share of ESG-related content in financial publications of such firms.

a firm's business and risk section. As can be seen from Panel A of Figure 5-1 the overall share of ESG-related words increases slightly between 2003 and 2016 from 16.0% to around 21.8%. This increase seems to be particularly driven by an increase in governance-related sentences over the sample period (governance-related information also seems to account for the majority of ESG-related information in a firm's business and risk section among the three components of ESG). Panel B of Figure 5-1, on the other hand, indicates that while the overall ESG-share has increased substantially since 2003, business and risk sections have simultaneously become significantly less readable (particularly after 2010) requiring 15% more years of formal education (equates to approximately three years of additional education) to understand its text in 2016 than in 2003.

5.3.2.2. *Measuring how ESG-Information is provided*

To capture how ESG-related information is provided in annual reports, we follow the impression management framework proposed by Merkl-Davies and Brennan (2007). We focus on three particularly important strategies for impression management: reading ease manipulation, thematic manipulation, and performance comparisons. Firstly, to measure reading ease manipulation, we follow the approach of Franco et al. (2015) and Hu et al. (2018) and use the Fog Index to measure readability.⁵⁹ The Fog Index is one of the most frequently used measures to assess readability in academic research and has been quoted by the SEC's chairman Christopher Cox in 2007 as a valuable tool to assess compliance with the SEC's plain English rules (Cox, 2007). It measures the level of education a reader needs to have to understand a text and is calculated as follows:

$$\text{Fog} = (\text{mean of words per sentence} + \text{percent of complex words}) * 0.4 \quad (18)$$

A complex word is thereby defined as having three syllables or more. The Fog Index indicates how many years of formal education are required to understand the text on the first reading and is typically grouped into five categories based on its value: unreadable (18 or higher), difficult (14 to 18), ideal (12 to 14), acceptable (10 to 12), and childish (8 to 10).

Secondly, to measure thematic manipulation, we rely on the sentiment of the ESG-related parts of a firm's Item 1. We thereby focus on the net tone measure (*LMD Compound*) developed by Loughran and McDonald (2011) and calculate the measure for all sentences that contain at least one ESG-related word. We base our calculation of *LMD Compound* on an updated version of the same financial dictionary used by Loughran and McDonald (2011). This dictionary is specifically

⁵⁹ Franco et al. (2015), e.g., also use the Flesh Reading Ease as well as the Flesch-Kincaid Grade Level index whereas Hu et al. (2018) further supplement their analyses with the share of table space in annual reports. To ensure robustness to other measures of readability, we have repeated our analyses using Flesch-Kincaid, the Flesch Reading Ease, and the SMOG index following Mc Laughlin (1969). Untabulated results remain qualitatively and directionally similar.

constructed for financial publications and contains multiple lists of words that are traditionally associated with a certain context or sentiment (e.g., positive, negative, uncertainty). Given that the dictionary is constructed based on 10K-filings and updated regularly it seems particularly fitting for our analyses. More specifically, *LMD Compound* is calculated based on the following formula:

$$LMD\ Compound = \frac{(\# Positive\ Words - \# Negative\ Words - \# Negated\ Positive\ Words)}{\# of\ Total\ Words} \quad (19)$$

where *# Positive Words* is calculated by counting all words in the ESG-related parts of a firm's Item 1 which are contained in Loughran and McDonald's Fin-Pos word list and *# Negative Words* by counting all words in the Fin-Neg word list, respectively. Following Loughran and McDonald (2011), we subtract all positive words that are preceded by a simple negation (*no, not, none, neither, never, nobody*) within three words before the respective word.

Lastly, prior literature suggests that quantitative voluntary disclosures are considered more relevant by investors (Beretta et al., 2019; Bozzolan et al., 2003; Melloni, 2015). While prior literature has mainly focused on the impact of impression management regarding the disclosure of intellectual capital, Toms (2002) argues that quantitative disclosures with regard to CSR generally signal higher quality to investors than purely qualitative information. Hutton et al. (2003) show that investors react more positively to good news if this news is supplemented with verifiable quantitative information. Following Melloni (2015) and Beretta et al. (2019), we add the provision of quantifiable information as a third impression management measure. Our measure *Quant Info* is thereby calculated as the share of numbers in the number of overall stop word-adjusted words in the ESG-related part of a firm's Item 1 (stop words are, e.g., *for, and, of, are*).

5.3.2.3. *Measuring the impact of impression management on CDS spreads*

Our methodology to infer whether incremental information conveyed by the way ESG-related content is presented impacts CDS spreads is twofold. Firstly, we establish whether CDS spreads react to ESG-related content in 10K-filings and follow the approach of Hu et al. (2018) by estimating a multivariate regression model. We thereby use the annual mean CDS mid-point spreads as the dependent variable and the share of ESG-related content in a firm's business and risk section of the annual report as well as multiple controls as independent variables. In this step, we also analyze whether our measures for impression management play a significant role regarding the overall text of a firm's Item 1. Secondly, we reduce our sample to all ESG-related sentences and re-run a similar regression using our measures for impression management to infer whether the incremental information provided by the way ESG-related content is provided leads to appropriate adjustments of the market's risk assessment as proxied by CDS spreads.

For the analysis of whether annual mean CDS mid-point spreads react to the share of ESG-related information in the business and risk section of a firm’s 10K-filing, we estimate the following regression model.

$$\log(CDS_{i,t}) = \beta_0 + \beta_1 ESG - share_{i,t} + \beta_2 Firm_controls_{i,t} + \beta_3 Macroeconomic_controls_t + \beta_4 Credit_rating_{i,t} + firm_fixed_effects + time_fixed_effects + \varepsilon_{i,t} \quad (20)$$

where $\log(CDS_{i,t})$ is the natural logarithm of the annual mean CDS mid-point spread and $ESG - share_{i,t}$ is the percentage share of ESG-related words (i.e., words contained in the word list developed by Baier et al. (2020) in a firm’s Item 1). $Firm_controls_{i,t}$, $Macroeconomic_controls_t$, and $Credit_rating_{i,t}$ are vectors with different controls related to firm characteristics, external macroeconomic factors, and a firm’s credit rating following previous literature (Das et al., 2009; Hu et al., 2018). We also control for firm- and time-fixed effects.

The $Firm_controls_{i,t}$ vector includes *Leverage*, the logarithm of a firm’s assets ($Log(Assets)$), *Profitability*, *Quick Ratio*, *Volatility*, *Cash-to-Assets*, *Sales Growth*, and *Analyst Coverage*. Besides firm fundamentals, we have also included a firm’s credit rating ($Credit_rating_{i,t}$) in the respective year to account for the impact of credit rating changes on CDS spreads. Macroeconomic factors include *Market Return*, *T-Bill Rate*, and *Term Spreads*. A detailed overview of all variables and calculation methods can be found in Table 5-7 in Appendix 8. Descriptive statistics can be found in Table 5-1.

As mentioned before, we subsequently reduce the sample to sentences conveying ESG-related information and run an adjusted version of our base regression using different measures for incremental information and informational quality subsumed under impression management as key independent variables. More specifically, we run the following regression model:

$$\log(CDS_{i,t}) = \beta_0 + \beta_1 Impression_management_{i,t} + \beta_2 Firm_controls_{i,t} + \beta_3 Macroeconomic_controls_t + \beta_4 Credit_rating_{i,t} + firm_fixed_effects + time_fixed_effects + \varepsilon_{i,t} \quad (21)$$

where $\log(CDS_{i,t})$ is the natural logarithm of the annual mean CDS mid-point spread and $Impression_management_{i,t}$ is a vector of our independent variables to measure impression management. $Firm_controls_{i,t}$, $Macroeconomic_controls_t$, and $Credit_rating_{i,t}$ are the same vectors with controls related to firm characteristics, external macroeconomic factors, and a firm’s credit rating as in our base regression. The regression is also repeated for the three subsets of ESG-related information (environment, social, and governance).

Table 5-1: Descriptive statistics

Panel A. Descriptive statistics for CDS spreads, ESG-related information, and for the determinants of readability, tone, and quantitative information

Variable	N	Mean	SD	P25	Median	P75
<i>10K's Business and Risk Section</i>						
CDS spreads	2309	4.44	1.00	3.78	4.34	5.06
ESG Share	2309	1.15	.47	.91	1.19	1.44
Env Share	2309	.21	.20	.05	.15	.32
Soc Share	2309	.10	.11	.03	.07	.13
Gov Share	2309	.85	.37	.64	.86	1.07
Fog Index	2309	14.72	2.70	13.27	14.2	15.76
LMD Compound	2309	-1.21	.97	-1.87	-1.31	-.59
Quant Info	2309	2.72	2.11	1.54	2.32	3.42
<i>10K's Business and Risk Section filtered to ESG-related information</i>						
CDS spreads	1911	4.43	1.02	3.73	4.31	5.04
Fog Index	1911	20.18	3.78	17.63	19.32	22.06
LMD Compound	1911	-1.51	1.26	-2.31	-1.53	-.79
Quant Info	1911	1.75	1.49	.88	1.35	2.12
<i>10K's Business and Risk Section filtered to environment-related information</i>						
CDS spreads	1921	4.45	1.04	3.74	4.30	5.08
Fog Index	1921	24.77	10.45	18.96	21.97	27.06
LMD Compound	1921	-2.29	2.48	-3.55	-2.09	-.63
Quant Info	1921	1.21	1.89	.11	.70	1.56
<i>10K's Business and Risk Section filtered to social-related information</i>						
CDS spreads	1831	4.47	1.01	3.78	4.35	5.09
Fog Index	1831	25.50	10.67	19.27	22.85	28.28
LMD Compound	1831	-2.49	3.32	-4.33	-1.96	0
Quant Info	1831	1.76	2.83	0	.80	1.97
<i>10K's Business and Risk Section filtered to governance-related information</i>						
CDS spreads	1675	4.54	1.08	3.77	4.42	5.21
Fog Index	1675	20.69	4.28	17.87	19.83	22.59
LMD Compound	1675	-1.33	1.24	-2.13	-1.35	-.57
Quant Info	1675	1.86	1.67	.87	1.39	2.35

Panel B. Descriptive statistics for control variables and ESG as well as E, S, and G Scores

Variable	N	Mean	SD	P25	Median	P75
ESG Score	2309	46.20	17.98	32.99	44.96	59.52
Env Score	2309	43.24	28.67	19.47	44.72	67.31
Soc Score	2309	51.59	23.42	32.71	51.11	70.04
Gov Score	2309	57.05	21.19	40.98	58.84	73.94
<i>Firm controls</i>						
Profitability (ROA)	2309	6.65	7.18	3.86	6.63	10.11
Leverage	2309	111.60	1767.74	40.68	71.75	131.1
EBIT/Sales	2309	.11	.21	.063	.12	.18
Log(Assets)	2309	16.52	1.13	15.68	16.45	17.32
Cash to Assets	2309	27.79	19.21	12.80	23.56	39
Quick Ratio	2309	1.00	.63	.59	.87	1.23
Analyst	2309	18.24	7.97	13	17	23
Sales Growth	2309	3.09	78.28	-2.85	4.09	10.09
Volatility	2309	.00	.00	-.00	.00	.00
Market to Book ratio	2309	3.21	44.92	1.53	2.39	3.90
<i>Macro controls</i>						
Market Return	2309	.00	.00	.00	.00	.00
T-Bill Rate	2309	.92	1.51	.08	.15	.94
Term Spreads	2309	1.57	.81	1.05	1.64	2.27
<i>Credit rating</i>	2309	4.05	.99	4.00	4.00	5.00

This table reports descriptive statistics for our sample. Panel A reports descriptive statistics for all variables related to CDS spreads, ESG-related information, and each ESG dimension for a firm's business and risk section while Panel B contains descriptive statistics for our control variables and ESG, environment, social, and governance scores (based on Refinitiv). Panel A also shows descriptive statistics for the determinants of readability, tone, and quantitative information for a firm's business and risk section as well as for the business and risk section filtered to environment, social, and governance-related information. The sample for the entire text consists of 262 unique firms and 2,309 firm-year observations from 2003 to 2016. We convert Moody's long-term issuer credit ratings into a numerical scale from 1 (Aaa), 2 (Aa1, Aa2, Aa3), 3 (A1, A2, A3) to 9 (C). The definitions of the variables are provided in Table 5-7 in Appendix 8.

5.4. Empirical results

5.4.1. Base regressions

Table 5-2 reports the results of our base regression in which we analyze whether market participants react to the share of ESG-related information in a firm's business and risk section by adjusting CDS spreads. Column (1) shows the results with the ESG share as our main independent variable to test *H1a* and column (2) provides the results of our base regression with shares of environment-, social-, and governance-related information as the main independent variables to test our hypotheses *H1b* and *H1c*.

The coefficient of *ESG share* in column (1) is highly significant and positive, indicating that a higher ESG share leads to wider CDS spreads and, hence, contradicts our first hypothesis *H1a*. More precisely, for each percentage point increase of *ESG share* in a 10K's business and risk section CDS spreads widen by approximately 9.6%. While this apparent contradiction indicates that more ESG-related information is associated with higher risks by market participants, it might also suggest that reactions to CDS spreads are rather driven by informational quality and content and less by the overall quantity of ESG-related information. Either way, we find no support for hypothesis *H1a*. The results of column (2), on the other hand, provide support for our hypotheses *H1b* and *H1c*. Results reveal that a higher share of environment-related information (*Env Share*) leads to a tightening of CDS spreads. The effect is significantly greater in magnitude than the effect of the overall ESG share (one percentage point increase in the share of environmental-related information leads to a tightening of CDS spreads of approximately 23.1%). Additionally, the results show that a higher degree of governance-related information leads to a widening in CDS spreads. More precisely, an increase of one percentage point in the share of governance-related information in the business and risk section of the annual report (*Gov Share*) leads to a widening of CDS spreads of 18.4%.

Table 5-2: Impact of the share of ESG-related content in a 10K's Item 1 on CDS spreads

Log(CDS)	All text (1) (n=2,309)	All text (2) (n=2,309)
ESG Share	0.096*** (0.034)	-
Env Share	-	-0.231** (0.099)
Soc Share	-	0.097 (0.166)
Gov Share	-	0.184*** (0.044)
ESG Score	-0.000 (0.074)	0.016 (0.074)
Profitability (ROA)	-0.018*** (0.002)	-0.018*** (0.002)
Leverage	-0.000 (0.000)	-0.000 (0.000)
EBIT/Sales	0.112** (0.054)	0.109** (0.054)
Log(Assets)	0.006 (0.031)	0.003 (0.031)
Cash to Assets	0.002*** (0.001)	0.002** (0.001)
Quick Ratio	-0.100*** (0.026)	-0.100*** (0.026)
Analyst	0.004 (0.002)	0.004* (0.002)
Sales Growth	-0.000 (0.000)	-0.000 (0.000)
Volatility	-3.214 (7.137)	-3.534 (7.123)
Market to Book ratio	-0.000 (0.000)	-0.000 (0.000)
Market Return	-6.595 (26.942)	-8.144 (26.878)
T-Bill Rate	-0.100** (0.041)	-0.087** (0.041)
Term Spreads	-0.059 (0.047)	-0.056 (0.047)
Credit rating	-0.418*** (0.020)	-0.414*** (0.020)
Constant	5.863*** (0.509)	5.873*** (0.508)
Firm-fixed effects	Yes	Yes
Time-fixed effects	Yes	Yes
R ²	0.601	0.603

This table shows the results of our base regression in which we analyze whether market participants react to the share of ESG-related information in a firm's business and risk section by adjusting CDS spreads. Column 1 contains our base regression with the share of ESG in a firm's business and risk section as the main independent variable while column 2 contains the results of our base regression with the three sub-dimensions of ESG as the main independent variables. The dependent variable for both regressions is the natural logarithm of the average annual CDS spreads of a firm. The share is thereby calculated as the number of ESG (E, S, G)-related words in total stop word adjusted words in a firm's business and risk section. We control for a variety of different firm-related, macroeconomic, and credit-related characteristics as defined in Table 5-7 in Appendix 8 and account for firm- and time-fixed effects. The standard errors are corrected for heteroskedasticity and given in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Interestingly, given that governance-related information accounts for around 73% of overall ESG-related information in our sample (environment-related information accounts for 18% and social-related information for 9%), the positive relationship between the overall ESG-share and CDS spreads might be driven by the significant positive relationship between the share of governance-related information and CDS spreads. The results regarding our controls are mostly in line with prior literature and indicate that CDS spreads tighten with higher profitability, higher quick ratios, and a better credit rating but widen with higher analyst coverage, higher cash-to-asset ratios, and lower T-bill rates.

The results of our base regressions indicate that there indeed exists a relationship between the share of ESG-related information, particularly of environment- and governance-related information, and CDS spreads. It is hence conceivable that investors in CDS markets also incorporate the informational quality of ESG-related information in their investment decisions. We therefore first repeat both regressions of Table 5-2 with our measures for informational quality as key independent variables. We then repeat our analyses only using ESG-related text (without the variable *ESG share* and its respective E, S, G splits) to examine whether potential effects also persist for ESG-related information. The results of these regressions are provided in columns (1) to (3) of Table 5-3.

The coefficient *LMD Compound* in columns (1) to (3) of Table 5-3 is statistically significant and positive at the 1% level. This provides initial evidence that market participants consider the tone of the information provided in a firm's Item 1 in annual reports as a proxy for informational quality and adjust CDS spreads accordingly. More precisely, we find that a more positive tone of the information provided in a firm's Item 1 leads to significantly tighter CDS spreads with an increase of the net tone measure *LMD Compound* by one absolute percentage point leading to a tightening of CDS spreads by around 10%. This effect also persists, albeit to a smaller extent, when filtering Item 1 to ESG-related content thereby supporting hypothesis *H3a*. Results regarding the readability and the amount of quantitative information provided in a firm's Item 1, on the other hand, remain inconclusive for the entire text. For the ESG-related part in a firm's Item 1, we observe that in contrast to our expectation a higher degree of quantitative information leads to a widening of CDS spreads. We thus have to, at least for the overall sample of ESG-related information, reject hypothesis *H3b*. Interestingly, while the significant positive (negative) relationship between the share of governance- (environment-) related information remains stable even after controlling for informational quality, the results in column (1) indicate that the positive effect of the share of ESG-related information in a firm's Item 1 on CDS spreads does not persist when controlling for informational quality.

Table 5-3: Impact of readability, tone, and quant information within ESG-related content in Item 1 of a firm's 10K on CDS spreads

Log(CDS)	Alltext (1) (n=2,309)	Alltext (2) (n=2,309)	ESG (n=1,911)
ESG Share	0.012 (0.037)	-	-
Env Share	-	-0.322*** (0.100)	-
Soc Share	-	0.154 (0.166)	-
Gov Share	-	0.084* (0.047)	-
Fog Index	-0.003 (0.005)	-0.004 (0.005)	0.003 (0.004)
LMD Compound	-0.102*** (0.018)	-0.104*** (0.018)	-0.047*** (0.013)
Quant Info	0.005 (0.007)	0.005 (0.007)	0.017** (0.008)
ESG Score	-0.000 (0.001)	0.001 (0.073)	0.000 (0.001)
Profitability (ROA)	-0.017*** (0.002)	-0.017*** (0.002)	-0.015*** (0.002)
Leverage	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
EBIT/Sales	0.101* (0.054)	0.100* (0.054)	0.008 (0.008)
Log(Assets)	0.014 (0.031)	0.009 (0.031)	0.055 (0.034)
Cash to Assets	0.003*** (0.001)	0.003*** (0.001)	0.003*** (0.001)
Quick Ratio	-0.107*** (0.026)	-0.107*** (0.026)	-0.131*** (0.028)
Analyst	0.004 (0.002)	0.004 (0.002)	0.004 (0.003)
Sales Growth	-0.000 (0.000)	-0.000 (0.000)	-0.001** (0.000)
Volatility	-1.001 (7.097)	-1.426 (7.081)	2.793 (7.598)
Market to Book ratio	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Market Return	-8.329 (26.747)	-9.909 (26.680)	-2.194 (28.494)
T-Bill Rate	-0.099** (0.040)	-0.086** (0.040)	-0.113*** (0.044)
Term Spreads	-0.059 (0.046)	-0.055 (0.046)	-0.047 (0.050)
Credit rating	-0.411*** (0.020)	-0.406*** (0.020)	-0.418*** (0.022)
Constant	5.810*** (0.508)	5.844*** (0.507)	5.010*** (0.559)
Firm-fixed effects	Yes	Yes	Yes
Time-fixed effects	Yes	Yes	Yes
R ²	0.608	0.610	0.612

In this table, we analyze whether the informational quality of ESG-related information and of the entire text of a firm's business and risk section has an impact on CDS spreads. Columns 1 and 2 contain both regressions of Table 5-2 but with our three impression management variables (*Fog Index*, *LMD Compound*, *Quant Info*) as further independent variables. Column 3 shows the result of the same regression model used for column 1 but with a firm's business and risk section filtered to ESG-related text only (and hence does not include the ESG share as an independent variable).

The dependent variable for all regressions is the natural logarithm of the average annual CDS spreads of a firm. *ESG Share* is calculated as the number of ESG (E, S, G)-related words in total stop word adjusted words in a firm's business and risk section. We control for a variety of different firm-related, macroeconomic, and credit-related characteristics as defined in Table 5-7 in Appendix 8 and account for firm- and time-fixed effects. The standard errors are corrected for heteroskedasticity and given in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

In untabulated analyses, we further examine whether our results are impacted by a firm's industry focus using an interaction variable between our main variable *LMD Compound* and the Fama and French twelve industry classification (Fama & French, 1997) as the sentiment of ESG-related information may be more relevant for firms in industries with higher exposure to ESG-related risks and/or public perception. As expected, we find that for firms in the energy sector, a sector particularly exposed to ESG-risks, a more positive tone of the information provided in a firm's Item 1 filtered to ESG-related content leads to significantly tighter CDS spreads by around 13% which is higher than for firms outside the energy sector. Interestingly, the same holds true for firms from the business equipment and computer sectors and the consumer durables industry. To further expand these results to the IT sector, we supplement our analyses with The Refinitiv Business Classification (TRBC) which provides a more granular industry split than the Fama and French industry classification.⁶⁰ We again find that a more positive tone of the information provided in a firm's Item 1 leads to significantly tighter CDS spreads with an increase of the net tone measure *LMD Compound* by one absolute percentage point leading to a tightening of CDS spreads by around 10% for firms in the IT sector. However, this effect does not persist when filtering a firm's Item 1 to ESG-related content.

5.4.2. Sub-regressions for environment, social, and governance

While we indeed find a clear directional effect of the tone in which (ESG-) information is provided to the market that persists across all regressions, we only find inconsistent evidence regarding the effect of readability and quantitative information of ESG-related information on CDS markets. However, as indicated by the results of our base analyses, both measures may play a bigger role for the three sub-segments of ESG - environment, social, and governance. We expect that the provision of quantitative information might be particularly valuable for information related to environmental or social topics where firms must often adhere to clear, measurable performance indicators and regulations. We hence split all ESG-related information into three sub-samples and subsequently repeat our regression analyses. Results of these analyses can be found in Table 5-4 with column (1) showing the results for the environment-focused subset, column (2) the results for the social-focused subset, and column (3) the results for the governance-focused subset.

⁶⁰ The Fama and French industry classification does not provide a precise IT-sector classification.

Table 5-4: Impact of readability, tone, and quantitative information within a 10K's Item 1 filtered to environment-, social-, and governance-related information on CDS spreads

Log (CDS)	Env (n=1,921)	Soc (n=1,831)	Gov (n=1,675)
Fog Index	0.001 (0.001)	0.000 (0.001)	-0.001 (0.003)
LMD comp	-0.016** (0.007)	-0.001 (0.004)	-0.050*** (0.014)
Quant Info	-0.016** (0.007)	0.004 (0.005)	-0.000 (0.008)
Env Score	-0.059 (0.063)		
Soc Score		-0.056 (0.078)	
Gov Score			0.094* (0.055)
Constant	5.001*** (0.549)	4.634*** (0.595)	5.411*** (0.639)
Firm controls	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Macro. controls	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Credit Rating	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Firm-fixed	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Time-fixed	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
R ²	0.610	0.595	0.588

In this table, we analyze whether the informational quality of environment-, social-, and governance-related topics in a firm's business and risk section have an impact on CDS spreads. We thus split all ESG-related information into three sub-samples and subsequently repeat regression (3) of Table 5-3 for each ESG dimension: a sample only containing environment-related information, a second sample containing only social-related information, and a third sample containing only governance-related information. The ESG score used as a firm-specific control in our previous regressions is replaced by the respective dimension score in each regression. The dependent variable for all regressions is the natural logarithm of the average annual CDS spreads of a firm while our three impression management variables (*Fog Index*, *LMD Compound*, *Quant Info*) serve as our key independent variables. We control for a variety of different firm-related, macroeconomic, and credit-related characteristics as defined in Table 5-7 in Appendix 8 and account for firm- and time-fixed effects. The standard errors are corrected for heteroskedasticity and given in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The results reveal that while readability still does not seem to play a considerable role for CDS market participants, a higher degree of quantitative environmental information leads to a tightening of CDS spreads. More precisely, for 10K-filings filtered to environment-related content, our results indicate that firms that use more quantitative information (*Quant Info*) when providing environment-related information also experience reduced perceived default risk (significant at the 5% level). Consequently, although hypothesis *H3b* does not apply to the entire sample of ESG-related information, our results provide initial supporting evidence that *H3b* might still hold true for information that is related to topics in which verifiability and measurability are particularly important to assess firm-inherent risks such as environment-related information. Note that the observed effect is comparably small (a one percentage point increase in the share of numbers used for environment-related information only leads to a 1.6% tightening of CDS spreads). In addition, our results suggest that how information is provided, measured by its tone, is not only relevant

with respect to the entire set of ESG-related information but also for two out of the three subsets (environment and governance).

These results do not only provide support to hypothesis *H3a* but further suggest that the negative relationship between the tone of ESG-related information and CDS spreads is predominantly driven by environment- and governance-related information (which account for a combined share of 91% of overall ESG-related content in our sample). While these results may be explained by the notion that environment- and governance-related information are more relevant for corporate financial performance and investors, further analyses are needed why neither the share of social-related information nor its tone seems to be relevant for CDS market participants.

5.4.3. Regressions on impression management

Measures for informational quality and impression management do not only impact perceived risk but could theoretically be also used by executives to influence investor perceptions of credit risk to their own benefit. If this is the case, we expect that informational quality regarding ESG is to some extent dependent on the actual ESG performance. Firms that perform comparatively poorly regarding ESG could, for example, be inclined to frame their ESG-related information more positively and/or utilize more verifiable quantitative information on ESG in subsequent annual reports. We therefore analyze whether our measures for informational quality are used for impression management and regress these measures (measured for the ESG-related parts of a firm's Item 1) on an external ESG benchmark (the Refinitiv ESG score).

Table 5-5: Impact of a previous year's ESG score on readability, tone, and quantitative information of ESG-related information in Item 1 of a firm's 10K

	Fog Index (n=2,112)	LMD Comp (n=2,135)	Quant Info (n=2,112)
ESG Score	-0.003 (0.005)	-0.005*** (0.001)	-0.005** (0.002)
Firm controls	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Macro. controls	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Credit Rating	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Firm-fixed effects	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Time-fixed effects	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
R ²	0.243	0.390	0.156
Constant	15.938*** (3.284)	-1.370 (0.939)	0.666 (1.452)

In this table, we analyze whether our measures for informational quality are used for impression management and regress these measures (measured for a firm's business and risk section filtered to ESG-related information) on an external ESG benchmark (the Refinitiv ESG score). Each of the three variables we use to measure informational quality (*Fog Index*, *LMD Compound*, *Quant Info*) thereby serves as a dependent variable for one of the regressions. We use the same firm-related, macroeconomic, and credit-related controls as for our previous regressions (defined in Table 5-7 in Appendix 8) and account for firm- and time-fixed effects. The standard errors are corrected for heteroskedasticity and given in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The results of these analyses are shown in Table 5-5 with column (1) containing results regarding readability, column (2) containing results regarding tone, and column (3) containing results on quantitative information. We find that firms with particularly low ESG scores exhibit a more positive net tone than their peers (significant at the 1% level) and utilize more quantitative information (significant at the 5% level). While these results provide some support for hypothesis *H4* regarding quantitative information and tone, we again do not find a statistically significant effect for readability. Taken together with the results of the previous analyses, we thus have to reject *H2*.

The results suggest that firms (and presumably their executives) engage to some extent in impression management by adjusting the tone and content of their firm's annual reports. Firms might, however, not only react to external ratings by adjusting informational quality, but also by adjusting which type of information they show. Firms might, for example, increase the overall share of ESG-related information if a previous year's ESG rating has been particularly negative (or positive if the respective firm wants to build on the momentum). To test whether this is the case, we repeat the regression of Table 5-5 with four different dependent variables: a firm's share of ESG-related information in the firm's Item 1 and the share of environment-, social-, and governance-related information. For the latter three analyses, we use the respective sub-score of the Refinitiv ESG score.

Table 5-6: Impact of a previous year's ESG, Env, Soc, and Gov Score on ESG-, Env-, Soc-, and Gov-related content in Item 1 of a firm's 10K

	ESG Share (n=2,309)	Env Share (n=2,309)	Soc Share (n=2,309)	Gov Share (n=2,309)
ESG Score	0.077 (0.050)	-	-	-
Env Score	-	0.030** (0.013)	-	-
Soc Score	-	-	0.022** (0.008)	-
Gov Score	-	-	-	-0.024 (0.028)
Constant	0.779** (0.307)	0.229** (0.105)	0.065 (0.057)	0.523** (0.243)
Firm controls	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Macro. controls	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Credit Rating	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Firm-fixed	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Time-fixed	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
R ²	0.110	0.035	0.094	0.094

In this table, we analyze whether the overall ESG-score (and its sub-scores) affect the share of ESG-related (and each ESG-dimension-related) information in a firm's annual report in a subsequent year. Column 1 contains the results using a firm's ESG score as a dependent variable and the share of ESG-related information in a firm's business and risk section as our independent variable while columns 2-4 contain the results for each of the three dimensions of ESG and the respective ESG sub-scores. We use the same firm-related, macroeconomic, and credit-related controls as for our previous regressions (defined in Table 5-7 in Appendix 8) and account for firm- and time-fixed effects. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The results provided in Table 5-6 indicate that while the overall ESG-score does not seem to affect the share of ESG-related information in a firm's business and risk section in a subsequent year, firms with high social and environment scores seem to increase the respective shares in subsequent reports. While the overall effect is comparably small, our results suggest that firms do not only adjust the informational quality of an annual report depending on the firm's ESG score in the previous year but also curate which type of content is shared in an annual report accordingly. Taken together with the results of Table 5-5, we conclude that firms tend to strategically engage in impression management through the selective provision of information to influence the default risk perception of their firm by credit market investors.

5.5. Robustness checks

In this section we describe the results of multiple robustness checks to validate our main results. The section can be divided into three parts: (i) the alternative selection of ESG-related content, (ii) alternative sentiment measures, and (iii) alternative measures of thematic manipulation.⁶¹

5.5.1. Alternative selection of ESG-related content

Due to its more qualitative nature, ESG-related information often requires a more detailed explanation than pure financial information. It could thus be conceivable that we ignore important information by focusing our analyses only on sentences that include ESG-related words. To avoid an implicit selection bias, we have repeated our analyses using a second sample that includes not only ESG-related sentences but also the sentences immediately preceding and following these sentences. Results remain qualitatively and quantitatively similar for all main variables.

5.5.2. Alternative sentiment measures

Following Kraaijeveld and Smedt (2020) and Möller and Reichmann (2021), we repeat our analyses with a more advanced sentiment score (*VADER Compound*) following the Valence Aware Dictionary for Sentiment Reasoning (VADER) model developed by Hutto and Gilbert (2014). While our *VADER Compound* measure is based on a similar method of netting positive and negative words as the *LMD Compound* measure, it also takes sentence structure, meaning, and adjacent words into account. The VADER method is based on a sample of social media messages and identifies a range of heuristics that humans use to infer sentiment from written natural language. We implement the VADER methodology using the Loughran-McDonald Financial Dictionary instead of the social media-based dictionary used by Hutto and Gilbert (2014) to infer positive (negative) meaning. To calculate our *VADER Compound* measure, we assign all positive (negative) words in

⁶¹ For reasons of brevity, we do not report the results of the robustness checks. The results are available upon request.

all ESG-related information in a firm's business and risk section with the value +1 (-1). These values are subsequently adjusted (i.e., attenuated or intensified) based on the sentiment heuristics developed by Hutto and Gilbert (2014) and aggregated for each text segment. The result of the robustness check shows that our analyses are robust to this alternative measure of sentiment and are very similar in magnitude, direction, and significance. Given that the VADER methodology used for our *Vader Compound* measure has been developed based on a sample of tweets (i.e., short sentences from social media) which might contain more emotional and informal language than what can typically be found in financial reports, our results must be interpreted carefully. As Möller and Reichmann (2021) point out, however, the VADER methodology still contains three heuristics that are generalizable to the language used in financial publications: intensifiers (words that increase sentiment intensity), contrastive conjunctions (conjunctions that shift contrasts the meaning of different parts of a sentence such as "but"), and negations (words that flip the sentiment of a sentence or particular words in that sentence).⁶²

5.5.3. Alternative measures of thematic manipulation

While the analysis of disclosure tone is particularly popular in finance and accounting research, the tone of a disclosure might not be the best proxy for thematic manipulation regarding the risk assessment of investors. Investors might be far more concerned about an increasing usage of words that signal uncertainty or indecisiveness related to corporate actions. We further verify our analyses with different measures for thematic manipulation and repeat all analyses with the share of words signaling uncertainty and the share of weak modal words following the dictionary proposed by Loughran and McDonald (2011) instead of our sentiment proxies. Results again remain qualitatively and quantitatively similar in the sense that a higher degree of uncertainty leads to significantly wider CDS spreads.

5.6. Discussion

5.6.1. Implications

Our results provide empirical evidence that CDS market participants react to the way information is provided by firms and adapt their risk assessment accordingly. Investors thereby foremost consider the share of particularly risk-relevant information regarding environment- and governance-related topics in the business and risk section of a firm's 10K-filing as well as its tone in their assessment of a firm's credit risk. More precisely, we find that issuers of CDS contracts

⁶² Hutto and Gilbert (2014) further use two other heuristics, punctuation (e.g., exclamation marks) and capitalization (e.g., all-caps words), which are less relevant for our analyses and should not further influence our results.

charge a higher premium for CDS contracts linked to bonds of firms with more negatively framed ESG-related information as well as for firms with annual reports with less (more) information on environment- (governance-) related topics in their annual reports leading to, *ceteris paribus*, higher costs for creditors. Although prior studies already show that ESG activities of firms can affect firm risk, our study is the first to find empirical evidence that informational quality and the share of ESG-related information in annual reports also affect the market's perception of a firm's default risk. Our results consequently have important implications for guiding management in preparing their financial reports and making them aware of impression management measures that could be used as proxies for credit risk by market participants. By creating awareness of these additional credit risk proxies, our findings help executives to mitigate information asymmetry as well as market participants to better judge the informational content of ESG-related information in annual reports.

While our findings might be at least partially driven by the nature of ESG-related information (e.g., ESG risks are more likely to be complex and associated with a higher degree of uncertainty than financial information), they indicate that executives might actively use ESG-related information asymmetries to their advantage by adapting how ESG-related information is portrayed in annual reports. More specifically, we show that executives adapt their framing of ESG-related information based on a company's historic ESG ratings and, for example, frame ESG-information more positively when a firm's previous year's ESG rating has been particularly low. Our study consequently indicates that even ESG information directly provided by firms through their annual reports is not unbiased and hence cannot ensure an effective communication of market-relevant information to stakeholders. Investors should thus specifically take a firm's previous year's ESG ratings into account when interpreting the framing and presentation of ESG-related information. Our findings also provide important implications for rating agencies who need to monitor impression management biases when interpreting qualitative ESG-related disclosures. Through the application of sentiment analyses and data mining, we find evidence of the previously described economic benefits to executives, market participants, and investors due to the mitigation of ESG-related information asymmetries and thus contribute to research on green information systems which *inter alia* includes the improvement of the flow and management of environmental-related information (Sarkis et al., 2013).

Further, as the market is a black box concerning how (ESG) information is processed in automated trading algorithms, we provide an open-source automated mechanism to capture the informational quality of ESG disclosure and its impact on investors. Therefore, our approach is in the public interest as it provides a freely available mechanism to document how financial markets

react to firms' disclosures of ESG actions and policies as well as how this information is provided to investors. Investors could subsequently better interpret and anticipate how markets react to such disclosures.

5.6.2. Limitations

There are four major limitations in this study that need to be addressed in future research. First, our results indicate that measures for informational quality and the framing of ESG-related information are integrated into the market's risk assessment. While our findings provide a first indication that executives use impression management tactics to influence the perception of a firm's ESG activities, further research is needed to infer a true causal relationship. Second, we focus on the U.S. market only, as this is the most important and liquid CDS market. Further research should analyze whether our findings also hold true for other geographies with less prominent (i.e., smaller) OTC markets. Third, we only focus on CDS spreads as a proxy for a firm's perceived credit risk in our analyses. While CDS markets are among the most liquid and price-efficient credit markets, further research regarding different measures of corporate risk (e.g., corporate bond spreads) is needed to confirm that our results are not limited to CDS markets but also extend to a more thorough approach to risk assessment by investors. Lastly, as Loughran and McDonald (2016) point out net sentiment scores such as the *LMD Compound* and *Vader Compound* we use for our analyses are potentially biased as negations of positive words occur significantly more frequently than negations of negative words. While we partially account for this by a search for preceding negating words within three words before a positive word and the use of the VADER methodology, negations are often far more complex than what can be accounted for by simple computational methods.

5.7. Conclusion

There is only little research on how the readability and framing of ESG-related content in annual reports affect the market's risk assessment of the respective firm. The primary purpose of our paper is thus to examine whether market participants consider various measures of strategic impression management regarding ESG-related content when assessing a firm's credit risk. Given the increasing importance of ESG activities and the high degree of information asymmetries still persistent regarding information on ESG, we further analyze whether executives actively engage in strategic impression management to improve a firm's external perception by strategically framing a firm's ESG-related information.

We find empirical evidence that CDS market participants take informational quality and impression management measures into account. More precisely, CDS markets react positively to a

more positive tone regarding ESG-related content in a firm's business and risk section resulting in tighter CDS spreads. Further analyses regarding the three components of ESG suggest that markets particularly focus on environment-related (governance-related) content with a higher share of such information in annual reports leading to tighter (wider) CDS spreads. For environment-related content, our findings furthermore suggest that companies that use more quantitative information experience a lower perceived credit risk. This indicates that more quantitative (i.e., verifiable) information on environmental risks provides further confidence in an assessment of a firm's credit risk. Taken together, market participants seem to take disclosure tone as well as a higher propensity to provide numerical information into account when assessing a firm's credit risk indicating that both factors could be additional determinants of CDS spreads, and thus credit risk. In light of the increasing relevance of sustainability and of our findings that market participants integrate impression management measures and the framing of ESG activities into their risk assessment, executives could be tempted to engage in strategic impression management to actively influence the perception of a firm's ESG activities. We find empirical evidence that firms with lower ESG scores use impression management strategies – particularly thematic manipulation (tone) and manipulation through numerical information – for the ESG content of annual reports to improve a firm's perception of their ESG activities. Therefore, our findings provide initial evidence that firms might use biased language to their own benefit and thus strategically engage in impression management through the selective framing of information.

Taken together with our contribution to the green information systems and ESG-related literature, we further hope that our approach and its results enable investors to better interpret corporate disclosures and to decipher potential signals that executives engage in impression management. Investors could thereby not only try to anticipate likely market reactions to ESG-related disclosures but also partially decrease information asymmetries and the informational advantage of hedge funds and large-scale institutional investors.

Appendix III

Appendix 7. Examples for ESG-related information.

Following Loughran and McDonald (2016), we use a thematic word list to isolate references to ESG topics within a firm's business and risk section. To filter a firm's business and risk section (Item 1) to ESG-related information, we use the ESG word list developed by Baier et al. (2020) who have identified 482 ESG-related items commonly used in annual reports across 40 subcategories specifically geared towards 10K-filings and proxy statements. More specifically, using textual analysis we extract all sentences in Item 1 of a firm's 10K-filing that contain at least one ESG-related word as per the definition of Baier et al. (2020). In the following, we provide examples from the business and risk section of Chevron's (CVX-US) 2014 10K-filing (Chevron Corporation, 2015). The first paragraph contains an original text segment from the 10K with all words related to ESG in **bold** which is then reduced to ESG-related sentences for the second paragraph.

Paragraph 1 – Original text

“The company's operations have inherent risks and hazards that require significant and continuous oversight: Chevron's results depend on its ability to identify and mitigate the risks and hazards inherent to operating in the crude oil and natural gas industry. The company seeks to minimize these operational risks by carefully designing and building its facilities and conducting its operations in a safe and reliable manner. However, failure to manage these risks effectively could result in unexpected incidents, including releases, explosions or mechanical failures resulting in personal **injury**, loss of life, **environmental** damage, loss of revenues, legal liability and/or disruption to operations. Chevron has implemented and maintains a system of corporate policies, behaviors and **compliance** mechanisms to manage **safety, health, environmental**, reliability and efficiency risks; to verify **compliance** with applicable laws and policies; and to respond to and learn from unexpected incidents. In certain situations where Chevron is not the operator, the company may have limited influence and control over third parties, which may limit its ability to manage and control such risks.

Chevron's business subjects the company to liability risks from litigation or government action: The company produces, transports, refines and markets materials with potential **toxicity**, and it purchases, handles and disposes of other potentially **toxic** materials in the course of its business. Chevron's operations also produce byproducts, which may be considered **pollutants**. Often these operations are conducted through joint ventures over which the company may have limited influence and control. Any of these activities could result in liability or significant delays in operations arising from private litigation or government action, either as a result of an accidental, unlawful discharge or as a result of new conclusions about the effects of the company's operations on **human health** or the **environment**. In addition, to the extent that **societal** pressures or political or other factors are involved, it is possible that such liability could be imposed without regard to the company's causation of or contribution to the asserted damage, or to other mitigating factors.”

Paragraph 2 – Reduced text

“However, failure to manage these risks effectively could result in unexpected incidents, including releases, explosions or mechanical failures resulting in personal **injury**, loss of life, **environmental** damage, loss of revenues, legal liability and/or disruption to operations. Chevron has implemented and maintains a system of corporate policies, behaviors and **compliance** mechanisms to manage **safety, health, environmental**, reliability and efficiency risks; to verify **compliance** with applicable laws and policies; and to respond to and learn from unexpected incidents Chevron's business subjects the company to liability risks from litigation or government action: The company produces, transports, refines and markets materials with potential **toxicity**, and it purchases, handles and disposes of other potentially **toxic** materials in the course of its business. Chevron's operations also produce byproducts, which may be considered **pollutants**. Any of these activities could result in liability or significant delays in operations arising from private litigation or government action, either as a result of an accidental, unlawful discharge or as a result of new conclusions about the effects of the company's operations on **human health** or the **environment**. In addition, to the extent that **societal** pressures or political or other factors are involved, it is possible that such liability could be imposed without regard to the company's causation of or contribution to the asserted damage, or to other mitigating factors.”

Appendix 8. Variable definitions

Table 5-7: Variable definitions

Variable	Definition	Source
CDS Spreads	Average yearly CDS spreads in basis points by equally weighting all daily spreads within a given year	Refinitiv
Fog Index	Readability measure calculated as the mean of words per sentence plus the share of complex words times 0.4	10k-filings (EDGAR)
ESG Share	Percentage of ESG-related words within Item 1 of a 10k-filing	10k-filings (EDGAR)
Env Share	Percentage of environment-related words within Item 1 of a 10k-filing	10k-filings (EDGAR)
Soc Share	Percentage of social-related words within Item 1 of 10k-filings	10k-filings (EDGAR)
Gov Share	Percentage of governance-related words within Item 1 of 10k-filings	10k-filings (EDGAR)
ESG Score	Overall company score based on the self-reported information in the environmental, social, and corporate governance pillars divided by 100	Refinitiv
Env Score	Overall company score based on information in the environmental pillar divided by 100	Refinitiv
Soc Score	Overall company score based on information in the social pillar divided by 100	Refinitiv
Gov Score	Overall company score based on information in the corporate governance pillar divided by 100	Refinitiv
LMD comp	Net positive-negative sentiment score as defined in section 3.2.2.	10k-filings (EDGAR)
Quant Info	Total number of numbers divided by the total number of words	10k-filings (EDGAR)
<i>Firm controls</i>		
Profitability	Return on assets (net income divided by average total assets in a year)	Refinitiv
Leverage	Total debt as a percentage of common equity	Refinitiv
EBIT/Sales	EBIT divided by net sales	Refinitiv
Log(Assets)	Natural logarithm of total assets	Refinitiv
Cash to Assets	Ratio of total cash and cash equivalents to the total asset value of a firm	Refinitiv
Quick Ratio	Current assets minus inventories divided by current liabilities	Refinitiv
Analyst	Number of analysts issuing forecasts in the 90 days before the announcement date of a year's annual report	I/B/E/S
Sales Growth	Trailing four-quarter average of quarterly net sales growth	Refinitiv
Volatility	Previous 12 months volatility of equity returns	Refinitiv
Market to Book ratio	Market cap scaled by the book value of equity	Refinitiv
<i>Macro controls</i>		
Market Return	Rolling average return of the S&P 1500 stock index based on the previous 252 trading days	Refinitiv
T-Bill Rate	3-month U.S. treasury yield	Refinitiv
Term Spreads	Difference between 10-year treasury yield and 2-year treasury yield	Refinitiv
Credit rating	Moody's long-term issuer credit ratings converted into a numerical scale from 1 (Aaa), 2 (Aa1, Aa2, Aa3), 3 (A1, A2, A3) to 9 (C)	Refinitiv

Chapter 6

OVERALL CONCLUSION AND CONTRIBUTION

This chapter concludes my dissertation with an overview of the main findings and a recap of how these findings address the initial research questions posed in the first chapter. Additionally, I highlight how the results of each of the four main chapters contribute to academic research as well as which practical implications they have. Finally, I also provide potential avenues for further research in the intersection between behavioral finance and information processing in financial markets.

6.1. Main findings

The goal of this dissertation is to provide a holistic view of the interplay between information provision and processing in financial markets, on the one hand, and behavioral biases on the other hand. In four self-standing studies, I set out to answer a series of eight overarching research questions introduced in Table 1-1 in Chapter 1. In this chapter, I provide a short summary of the findings of each chapter and how they address the aforementioned research questions. For reference, Table 6-1 contains an overview of these eight research questions and in which chapter they have been addressed.

Table 6-1: Overview of main research questions and findings

Research Question	Addressed in...
RQ1-1: Do shareholder activists consider information on executive (behavioral) characteristics in their investment decision?	Chapter 2
RQ1-2: What role does the CFO play for shareholder activists?	Chapter 2
RQ2-1: Do investors consider CEO/CFO behavioral characteristics when assessing the information content of directors' dealings?	Chapter 3
RQ2-2: How do investors react to directors' dealings during COVID-19?	Chapter 3
RQ3-1: How did the outbreak of COVID-19 affect investors in football stocks?	Chapter 4
RQ3-2: Which clubs were affected most severely by the outbreak of COVID-19?	Chapter 4
RQ4-1: How does the informational quality of ESG disclosures affect a firm's perceived risk by investors?	Chapter 5
RQ4-2: Do executives engage in strategic impression management regarding ESG?	Chapter 5

6.1.1. Chapter 2 – CFO overconfidence and shareholder activism

Based on a sample of 16,470 firm-year observations and 506 activist investments in S&P 1500 firms between 2003 and 2017, I show that activist investors incorporate behavioral characteristics of executives in their investment decisions. I thereby provide initial evidence affirming the first research question, RQ1-1, and show that activists particularly react to behavioral biases of the CFO (in this case overconfidence). More precisely, the results suggest that the presence of overconfident CFOs leads to a significantly lower likelihood of a firm to face an activist investment. Further analyses indicate that these findings are potentially related to a reduced likelihood of negotiation success for activist investments in firms with overconfident CFOs which would, in turn, lead to more lengthy and costly negotiations if activists invest in the firm. Consistent with this notion, other investors react significantly less positively to activist investments in firms with overconfident CFOs than to investments in firms with non-overconfident CFOs. Concerning the second research question, RQ1-2, I thus provide empirical evidence that investors seem to consider the CFO as sufficiently relevant for negotiation success that they incorporate behavioral biases and

characteristics of the CFO in their investment decisions. The findings of the empirical analyses in Chapter 2 persist for different overconfident proxies and across multiple logit regression models controlling for other CFO characteristics, CEO characteristics, governance factors, and firm fundamentals.

6.1.2. Chapter 3 – Market perception of C-level overconfidence

In Chapter 3, I expand the findings of Chapter 2 by showing that the tendency to take behavioral characteristics of executives into account also extends from sophisticated investors to investors in general. More precisely, based on a sample of 1,271 directors' dealings undertaken by CEOs and CFOs in the direct aftermath of the outbreak of COVID-19 in March 2020, I show that investors react significantly more negatively to purchase decisions undertaken by overconfident executives than to purchases undertaken by non-overconfident executives. With respect to the third research question, RQ2-1, I thus provide empirical evidence that investors indeed incorporate behavioral characteristics of executives in their investment decisions when reacting to directors' dealings. Given that purchases undertaken by executives are normally considered as a sign of confidence in the prospects of the respective firm (Bettis et al., 1997; Lakonishok & Lee, 2001), this indicates that investors devalue the information content of purchase decisions undertaken by overconfident executives. This seems to be particularly true in times of the high uncertainty and concomitant information overflow, such as during the COVID-19 pandemic. Regarding the fourth research question, RQ2-2, my results further suggest that investors, on average, react negatively to purchase decisions of directors during COVID-19 indicating that directors were not able to credibly provide confidence signals to investors. Finally, I provide initial evidence that investors also react more negatively to purchase decisions undertaken by female executives thereby supporting the findings of gender stereotyping by Gregory et al. (2013).

6.1.3. Chapter 4 – A beautiful game on hold

In Chapter 4, I analyze the behavior of investors in football stocks, a particularly emotionally charged subsample of stocks, during the outbreak of COVID-19. Based on a sample of 22 stock-listed football clubs and using an event study methodology specifically adapted for thinly traded stocks, I show that football stocks exhibit significant negative abnormal returns after a series of football-related events in the immediate aftermath of the outbreak of the COVID-19 pandemic. I further show that these reactions are particularly prevalent among investors in football stocks as investors in stocks of the similarly adversely affected travel and hospitality industry do not exhibit such negative reactions for the chosen events (RQ3-1). The aforementioned negative investor reaction is thereby particularly pronounced for clubs still competing in international cup competitions. Further analyses do not reveal any significant investor reactions to other factors

signaling a high overall exposure of a club to the adverse effects of COVID-19. I thus conclude that these negative market reactions are most likely related to the high revenue exposure to international business contingent on unrestricted international travel of those clubs and only to a lesser extent to a higher general exposure to the negative effects of COVID-19 (RQ3-2).⁶³ In subsequent analyses of trading volumes, I further show that although investors seemingly overreact to COVID-19 causing significant negative abnormal returns and high stock turnover, investor confidence returns comparably quickly.

6.1.4. Chapter 5 – Information content of ESG disclosures and public perception of credit risk

Finally, in Chapter 5, I expand the findings of the first three studies which show that investors react to information signals provided by executives as well as to exogenous shocks by analyzing whether executives strategically adapt the informational quality of corporate disclosures to elicit beneficial market reactions by investors. I also analyze whether investors incorporate signals on informational quality for disclosures related to particularly risk-related ESG information into their risk assessment of a firm. Based on a sample of 2,309 business and risk sections of annual reports of S&P 1500 firms, I show that investors indeed react to signals of higher informational quality regarding ESG-information (RQ4-1). More precisely, I provide evidence that CDS spreads narrow after particularly positively framed ESG-disclosures. This finding is particularly strong for disclosures related to more tail risk-related ESG topics such as environmental disclosures. For environmental disclosures, spreads also narrow if the respective information contains a particularly high share of numerical information. Furthermore, with respect to RQ4-2, I also provide empirical evidence indicating that executives are aware of these market reactions. More precisely, I show that executives strategically adapt the share of particularly tail risk-related topics, such as environment-related disclosures, and the tone in which these are presented in accordance with the firm's ESG-rating in the previous year (i.e., the worse the ESG rating the more positive the tone in which ESG-related information is presented).

6.2. Contribution to academic research and practical implications

The research findings outlined in the previous section have multiple important contributions to academic research and practitioners in financial markets. Altogether, the four studies reaffirm the notion that biases of both, investors and corporate executives, play an important role in financial markets. While many studies in behavioral finance focus on how biases impact decision-making

⁶³ Investors might have, for example, considered international competitions as more likely to be irreversibly canceled in the wake of COVID-19 than national competitions due to travel restrictions.

processes and outcomes of biased actors, this dissertation provides an additional perspective on how information on behavioral biases is incorporated by other, non-biased market participants. The following paragraphs further outline the academic and practical contributions of each of the four self-standing empirical studies of this dissertation.

In Chapter 2, I show that shareholder activists, a particularly sophisticated subgroup of institutional investors, incorporate information on executive biases (namely overconfidence) in their decision-making. Shareholder activists thereby predominantly focus on behavioral characteristics of the CFO with shareholder activists being, *ceteris paribus*, significantly more likely to invest in a firm with a non-overconfident CFO. The academic contribution of my findings is threefold. Firstly, I confirm initial anecdotal evidence that sophisticated institutional investors, in this case shareholder activists, indeed incorporate behavioral biases in their investment decisions thereby linking the two so far disjunct research strands of behavioral finance and shareholder activism. Secondly, the results of my analyses suggest that behavioral biases of CFOs are similarly important for investors as biases of CEOs, given the right context. This constitutes a novel perspective for behavioral finance research as most previous studies of the effects of overconfidence focus on CEO overconfidence thereby neglecting the potential effects of other C-level executives. Thirdly, I reaffirm and expand previous findings by Francis et al. (2021) and Gupta et al. (2018) that activists prefer investments in firms with executives whose characteristics signal a higher likelihood of negotiation success from CEOs to CFOs and from gender to overconfidence. Regarding practical implications, my findings emphasize the importance of a regular and comprehensive self-assessment of a firm's attractiveness to shareholder activists. While firms are already undertaking comprehensive self-assessments, these assessments are often focused on firm fundamentals and governance factors but neglect softer factors such as (behavioral) characteristics of executives (Ruggeri & Beine, 2019). However, the results of this study show that if firms want to holistically reduce a firm's exposure to activism, they should also manage how information on behavioral characteristics of all relevant executives (i.e., not only the CEO) is portrayed to the public.

In Chapter 3, I extend the findings of Chapter 2 from sophisticated investors to investors in general. By showing that investors react more negatively to directors' dealings undertaken by overconfident executives during COVID-19, I provide empirical evidence that investors, in general, take behavioral biases into account in their investment decisions. This finding has two implications for academic research. Firstly, by showing that markets incorporate qualifiers such as behavioral biases and characteristics of executives when assessing the value of an information signal such as directors' dealings, I demonstrate that investors incorporate informational quality in

addition to the information itself in their investment decisions. I thereby connect two so far separate research strands, namely research on the impact of behavioral biases and research on directors' dealings, and extend the findings of Gregory et al. (2013) who show that investors consider the gender of executives when reacting to directors' dealings. Secondly, I provide novel evidence on how COVID-19 affected the informational value of directors' dealings as a signal of confidence of executives in the prospect of a firm and thereby contribute to a growing strand of research on the effects of COVID-19 on financial markets. From a practical perspective, my results are of high interest to both executives and investors. More precisely, my results indicate that purchase decisions undertaken by executives are not always perceived as a signal of confidence in a firm's stock when undertaken by overconfident executives. When intending to provide a signal of confidence to the market, executives should thus not only rely on directors' dealings but also provide further, more explicit confidence signals to the market (e.g., in press conferences). This is true for both overconfident and non-overconfident executives as market participants do not necessarily correctly categorize an executive's overconfidence. With respect to investors, my results indicate that investors need to properly assess the informational value of trading signals provided by insiders when reacting to directors' dealings. This is particularly important given that mirroring directors' dealings constitutes a popular trading strategy.

In Chapter 4, I analyze how investors in football stocks, a particularly emotionally charged subgroup of stocks, react to an exogenous shock such as COVID-19. By showing that football stocks exhibit significant negative abnormal returns upon the outbreak of COVID-19, I thereby help to shed light on the impact of COVID-19 on particularly affected industries such as the football industry. The theoretical contribution of my findings is twofold. Firstly, the significant abnormal returns of football stocks as well as the results of the subsequent volume analyses provide further evidence regarding the notion of "fan" investors. More precisely, by indicating that investors initially overreacted to the outbreak of COVID-19, but relatively quickly recovered their trust in football stocks, the results support the findings of Rösch and Kaserer (2013) who find a tendency to "flight for liquidity" in times of crisis by investors. Secondly, by showing that stocks of clubs still competing internationally react particularly negatively to the studied event dates, I expand the findings of Ding et al. (2020) regarding factors that firms with a particularly negative stock-market reaction to COVID-19 have in common. The results also have implications for clubs and investors in football stocks. The results of the trading volume analyses indicate that investor confidence in football stocks returned comparably quickly. However, given that COVID-19 most likely has a lasting impact on the revenue base of many clubs, this return of investor confidence might be premature. Stock-listed clubs are hence advised to seize this, at least partially unwarranted,

high level of investor confidence by, for example, offering additional equity to investors (e.g., in SEOs). Investors in football stocks, on the other hand, are well-advised to monitor the exposure of a club to adverse effects of subsequent crises as well as the level of professionalism of a club regarding the management of its finances when taking an investment decision.

In Chapter 5, I extend the findings of the previous three chapters by shifting the focus from how investors react to information to how executives anticipate market reactions to the information signals they provide to financial markets. By showing that executives anticipate changes in CDS spreads after disclosures regarding ESG and strategically adapt how and what information is provided to elicit beneficial market reactions, I thereby expand academic literature in three ways. Firstly, the results of this study expand previous findings by Reber et al. (2021) that risk markets incorporate ESG-related information from bond markets to CDS markets and provide evidence that investors also react to the way how information is provided and not only to the information itself. Secondly, I provide initial evidence that investors in risk markets do not react in a similar way to all ESG-related information. More precisely, the results suggest that investors react particularly sensitively to how information on especially tail-risk prone ESG-disclosures on the environment is provided in corporate disclosures. Investors thereby exhibit a particular preference for numerical information in these disclosures and react favorably to more positively framed information. Lastly, the results of Chapter 5 provide further support for the theory of Merkl-Davies and Brennan (2007) that executives strategically manage which and how information is provided to investors. More precisely, I show that executives indeed engage in strategic impression management by positively framing ESG information depending on a firm's ESG rating in the previous year. These findings are, again, particularly pronounced regarding information related to the environment. Taken together, these results have important implications for executives, regulators, and investors. Since my analyses indicate that investors respond favorably to quantifiable information on environmental activities, executives are advised to especially provide numerical information if they want to soothe risk markets. This is particularly true if executives intend to decrease information asymmetries with these disclosures. Furthermore, the finding that executives strategically manage how information is provided to improve the external perception of ESG activities indicates that executives try to manipulate investors in certain contexts. This should thus motivate regulators to particularly analyze how ESG-related disclosures are provided in annual reports and, if necessary, take measures to curb strategic impression management by executives. Concerning investors, the results further indicate that information provided by executives in annual reports regarding ESG is not unbiased and thus cannot ensure an effective communication of market-relevant ESG information to stakeholders. Investors should consequently only interpret a

firm's ESG-related disclosures in the context of a firm's external perception regarding ESG and particularly a firm's ESG ratings in previous years. Finally, the approach used for the textual analyses in this study and the extraction of ESG-related information from annual reports could serve as an open-source blueprint to help investors interpret how information is provided in annual reports.

6.3. Avenues for future research

The theoretical implications outlined in the previous section illustrate that the four empirical studies in this dissertation address a series of important research gaps in (behavioral) corporate finance literature. Taken together, the insights and results provided in each of the studies form a fertile basis for future research across a range of different topics. In the following, I outline three exemplary avenues for potential further research.

Further analysis of the importance and role of the CFO. The results of the first two studies indicate that CFOs play a similarly important role for investors than CEOs in some contexts. In Chapter 2, I further show that shareholder activists react more sensitively to behavioral characteristics of the CFO than to those of the CEO for the investments analyzed in our sample. Given that shareholder activist negotiations are a key responsibility of the CFO, my results indicate that the behavioral characteristics of the CFO (in this case overconfidence) might be more relevant for investors and third parties than those of the CEO for decisions and tasks that lie in the CFO's core area of expertise. Research, however, predominantly focuses on the role of the CEO for corporate decision-making and mostly neglects the role of the CFO. Surprisingly, this is also the case for corporate decisions which belong to the core responsibilities of the CFO. More precisely, while there exists research on the role of CEO characteristics for decisions on topics such as cash management (Aktas et al., 2019), leverage (Korkeamäki et al., 2017), or dividend policies (Deshmukh et al., 2013), research on the role of CFO characteristics for corporate decision-making is mainly limited to tax evasion practices (Hsieh et al., 2018). Extending research on the impact of CEO characteristics on corporate decision-making to CFOs could thus provide valuable insights particularly for those decisions which are, in reality, primarily driven by the CFO. Besides the aforementioned decisions on share buybacks, leverage, and dividend policies, these decisions could, for example, include valuations and premiums paid in mergers and acquisitions, corporate divestitures, and share repurchases. In this context, it would furthermore be interesting to expand the analysis to characteristics other than gender (e.g., an executive's network or prior education) and biases other than overconfidence (e.g., executive myopia, confirmation biases, or herding).

Role of third parties in information processing in financial markets. The four empirical studies of my dissertation cover extensively how investors react to information provided by executives or by exogenous shocks and how executives make use of these reactions. The results of Chapter 3 and Chapter 5 also provide evidence that investors and executives also incorporate information provided by third parties (in this case financial analysts and rating agencies) in their investment decisions. Since market participants such as financial analysts, rating agencies, and specialized news outlets are often more capable of assessing and synthesizing relevant information than the average investor, sophisticated third parties should, in theory, also react to executive biases and to how information is provided by executives. Research in this regard, however, remains sparse and is primarily limited to the impact of managerial biases (foremost overconfidence) on analyst reports (Kramer & Liao, 2016; M.-C. Lin et al., 2019). By providing transparency whether third parties accurately reflect managerial biases and characteristics in their assessment of a firm, research could thus help investors to assess whether they can at least partially base their judgment of the informational quality of a firm's disclosures on assessments of third parties. In this context, it would be particularly valuable to further understand not only if but also how investors incorporate information provided by third parties in their investment decisions. Information in this regard could, for example, help investors identify in advance circumstances that foster the emergence of the short-term herding behavior observed during the aforementioned price spikes of GameStop, AMC Entertainment, and Dogecoin (see Chapter 1) in which some investors seemingly ignored fundamental information provided by firms and more sophisticated third parties.

Comprehensive analysis of strategic impression management. The studies in my dissertation indicate that investors react to both the informational quality of information signals by executives and the information itself. The fourth study further shows that executives anticipate these reactions and hence try to strategically manage how information is provided to elicit investor reactions for their own benefit. However, this study only focuses on a select subset of strategic impression management tactics and only on information provided in the context of ESG activities. Such a narrow approach is common in academic research on impression management (Falschlunger et al., 2015; Hribar et al., 2017; Lo et al., 2017) and leads to a scattered selection of different insights on the use of impression management tactics. As a consequence, research still lacks a comprehensive analysis regarding when and in which context executives make use of strategic impression management across all tactics outlined by Merkl-Davies and Brennan (2007). A comprehensive analysis of potential warning signs that indicate an increased likelihood that executives make use of a specific impression management tactic, however, would significantly help investors to assess and incorporate the informational quality of corporate disclosures in their

investment analyses. While the analyses in Chapter 5 of this dissertation focus on corporate disclosures and particularly the business and risk section of an annual report, such analysis could also incorporate information provided in other sections of a firm's annual report as well as information provided in a more unstructured way (e.g., verbally in earnings calls and press statements). Given that biases such as overconfidence significantly influence an executive's assessment of a firm's perception by the public (Heaton, 2002), it would further be interesting to analyze whether biases such as overconfidence have an impact on the tendency of an executive to make use of strategic impression management tactics. This is especially true since Heaton (2002) shows that overconfident executives perceive their companies as undervalued. If the value of a firm indeed responds to changes in ESG ratings (Cheng et al., 2014; Verheyden et al., 2016), it could thus be conceivable that overconfident executives are more inclined than their non-overconfident peers to correct for negative ESG ratings by strategically manipulating the information provided in ESG-related disclosures.

REFERENCES

- Agnew, J. R., & Szykman, L. R. (2005). Asset Allocation and Information Overload: The Influence of Information Display, Asset Choice, and Investor Experience. *Journal of Behavioral Finance*, 6(2), 57–70. https://doi.org/10.1207/s15427579jpfm0602_2
- Akerlof, G. A. (1970). The Market for "Lemons": Quality Uncertainty and the Market Mechanism. *The Quarterly Journal of Economics*, 84(3), 488. <https://doi.org/10.2307/1879431>
- Aktas, N., Louca, C., & Petmezas, D. (2019). CEO overconfidence and the value of corporate cash holdings. *Journal of Corporate Finance*, 54, 85–106. <https://doi.org/10.1016/j.jcorpfin.2018.11.006>
- Albert Bridge Capital. (2021, September 22). *Blending behaviour & fundamentals at Albert Bridge Capital*. <https://www.albertbridgecapital.com/press/drew-dickson-blending-behaviour-and-fundamentals-at-albert-bridge-capital>
- Allouche, J., & Soulez, S. (2005). La cotation des clubs de football anglais. Une analyse différenciée des facteurs explicatifs de fluctuations de cours [Stock-listed soccer clubs. A differentiated analysis of the explanatory factors of stock price fluctuations.]. *Les Cahiers de Recherche du GREGOR*, 4, 3–38.
- Attig, N., El Ghouli, S., Guedhami, O., & Suh, J. (2013). Corporate Social Responsibility and Credit Ratings. *Journal of Business Ethics*, 117(4), 679–694. <https://doi.org/10.1007/s10551-013-1714-2>
- Baba, N., & Kozaki, M. (1992). An intelligent forecasting system of stock price using neural networks [Proceedings 1992] *IJCNN International Joint Conference on Neural Networks*. <http://ieeexplore.ieee.org/servlet/opac?punumber=632>
- Badenhausen, K. (2010, July 20). The World's Most Valuable Teams and Athletes. *Forbes*. <https://www.forbes.com/2010/07/20/most-valuable-athletes-and-teams-business-sports-sportsmoney-fifty-fifty.html#1e2a38bb1973>
- Badenhausen, K. (2020, July 31). The World's Most Valuable Sports Teams 2020. *Forbes*. <https://www.forbes.com/sites/kurtbadenhausen/2020/07/31/the-worlds-most-valuable-sports-teams-2020/#141a51da3c74>
- Baier, P., Berninger, M., & Kiesel, F. (2020). Environmental, social and governance reporting in annual reports: A textual analysis. *Financial Markets, Institutions & Instruments*, 29(3), 93–118. <https://doi.org/10.1111/fmii.12132>
- Baker, S., Bloom, N., Davis, S., Kost, K., Sammon, M., & Viratyosin, T. (2020). *The Unprecedented Stock Market Impact of COVID-19*. Cambridge, MA. <https://doi.org/10.3386/w26945>
- Ball, R., & Brown, P. (1968). An Empirical Evaluation of Accounting Income Numbers. *Journal of Accounting Research*, 6(2), 159. <https://doi.org/10.2307/2490232>
- Barber, B. M., & Odean, T. (2000). Trading Is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors. *The Journal of Finance*, 55(2), 773–806. <https://doi.org/10.1111/0022-1082.00226>
- Baur, D. G., & McKeating, C. (2011). Do Football Clubs Benefit from Initial Public Offerings? *International Journal of Sport Finance*, 6(1), 40–59.

- Bebchuk, L. A., Brav, A. P., & Jiang, W. (2015). The Long-Term Effects of Hedge Fund Activism. *Columbia Law Review*, *115*, 1085–1156. <https://doi.org/10.2139/ssrn.2291577>
- Bebchuk, L. A., Brav, A., Jiang, W., & Keusch, T. (2020). Dancing with Activists. *Journal of Financial Economics*, *137*(1), 1–41. <https://doi.org/10.2139/ssrn.2948869>
- Beber, A., Brandt, M. W., & Kavajecz, K. A. (2009). Flight-to-Quality or Flight-to-Liquidity? Evidence from the Euro-Area Bond Market. *The Review of Financial Studies*, *22*(3), 925–957. <https://doi.org/10.1093/rfs/hhm088>
- Bell, A., Brooks, C., & Markham, T. (2013). The performance of football club managers: skill or luck? *Economics & Finance Research*, *1*(1), 19–30. <https://doi.org/10.1080/21649480.2013.768829>
- Bellstam, G., Bhagat, S., & Cookson, J. A. (2020). A Text-Based Analysis of Corporate Innovation. *Management Science*. Advance online publication. <https://doi.org/10.1287/mnsc.2020.3682>
- Ben-Amar, W., & Belgacem, I. (2018). Do socially responsible firms provide more readable disclosures in annual reports? *Corporate Social Responsibility and Environmental Management*, *25*(5), 1009–1018. <https://doi.org/10.1002/csr.1517>
- Benkraiem, R., Le Roy, F., & Louhichi, W. (2011). Sporting Performances and the Volatility of Listed Football Clubs. *International Journal of Sport Finance*, *6*(4), 283–297.
- Beretta, V., Demartini, C., & Trucco, S. (2019). Does environmental, social and governance performance influence intellectual capital disclosure tone in integrated reporting? *Journal of Intellectual Capital*, *20*(1), 100–124. <https://doi.org/10.1108/JIC-02-2018-0049>
- Berg, F., Kölbel, J., & Rigobon, R. (2020). Aggregate confusion: The divergence of ESG ratings. *SSRN Electronic Journal*. Advance online publication. <https://doi.org/10.2139/ssrn.3438533>
- Bernile, G., & Lyandres, E. (2011). Understanding Investor Sentiment: The Case of Soccer. *Financial Management*, *40*(2), 357–380. <https://doi.org/10.1111/j.1755-053X.2011.01145.x>
- Bettis, C., Vickrey, D., & Vickrey, D. W. (1997). Mimickers of Corporate Insiders Who Make Large-Volume Trades. *Financial Analysts Journal*, *53*(5), 57–66. <http://www.jstor.org/stable/4480027>
- Betzler, A., & Theissen, E. (2009). Insider Trading and Corporate Governance: The Case of Germany. *European Financial Management*, *15*(2), 402–429. <https://doi.org/10.1111/j.1468-036X.2007.00422.x>
- Bharath, S. T., Narayanan, M. P., & Seyhun, H. N. (2009). Are Women Executives Disadvantaged? *SSRN Electronic Journal*. Advance online publication. <https://doi.org/10.2139/ssrn.1276064>
- Biddle, G. C., Hilary, G., & Verdi, R. S. (2009). How does financial reporting quality relate to investment efficiency? *Journal of Accounting and Economics*, *48*(2-3), 112–131. <https://doi.org/10.1016/j.jacceco.2009.09.001>
- Billett, M. T., & Qian, Y. (2008). Are Overconfident CEOs Born or Made? Evidence of Self-Attribution Bias from Frequent Acquirers. *Management Science*, *54*(6), 1037–1051. <https://doi.org/10.1287/MNSC.1070.0830>

- Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent dirichlet allocation. *Journal of Machine Learnings Research*, 3, 993–1022.
https://www.jmlr.org/papers/volume3/blei03a/blei03a.pdf?tb_iframe=true&width=370.8&height=658.8
- Bloomberg (2021, March 23). ESG assets may hit \$53 trillion by 2025, a third of global AUM. Bloomberg. <https://www.bloomberg.com/professional/blog/esg-assets-may-hit-53-trillion-by-2025-a-third-of-global-aum/>
- Boehmer, E., Masumeci, J., & Poulsen, A. B. (1991). Event-study methodology under conditions of event-induced variance. *Journal of Financial Economics*, 30(2), 253–272.
[https://doi.org/10.1016/0304-405X\(91\)90032-F](https://doi.org/10.1016/0304-405X(91)90032-F)
- Borek, A., Friesner, Z., & McGurn, P. (2017). *The Impact of Shareholder Activism on Board Refreshment Trends at S&P 1500 Firms*. New York City. Investor Responsibility Research Center Institute. <https://www.issgovernance.com/file/publications/Activism-and-Board-Refreshment-Trends-Report-Aug-2017.pdf?elqTrackId=bf7986320504c60ba322c4696920776&elq=3e415d83aee842f09f5e48855918d1d3&elqaid=732&elqat=1&elqCampaignId=>
- Borussia Dortmund. (2021, July 12). *Borussia Dortmund gibt Ausblick auf die Ergebnisse für das Geschäftsjahr 2020/2021 / Ad-Hoc News / IR News / BVB Aktie*. <https://aktie.bvb.de/IR-News/Ad-Hoc-News/Borussia-Dortmund-gibt-Ausblick-auf-die-Ergebnisse-fuer-das-Geschaeftsjahr-2020-2021>
- Botoc, C., Mihancea, E., & Molcut, A. (2019). Football and Stock Market Performance Correlation: Evidence from Italy. *Scientific Annals of Economics and Business*, 66(4), 525–539.
- Botosan, C. A. (1997). Disclosure level and the cost of equity capital. *The Accounting Review*, 72(3), 323–349. <http://www.jstor.org/stable/248475>
- Boyson, N. M., Gantchev, N., & Shivdasani, A. (2017). Activism mergers. *Journal of Financial Economics*, 126(1), 54–73. <https://doi.org/10.1016/j.jfineco.2017.06.008>
- Boyson, N. M., & Mooradian, R. M. (2011). Corporate governance and hedge fund activism. *Review of Derivatives Research*, 14(2), 169–204. <https://doi.org/10.1007/s11147-011-9065-6>
- Bozzolan, S., Favotto, F., & Ricceri, F. (2003). Italian annual intellectual capital disclosure. *Journal of Intellectual Capital*, 4(4), 543–558. <https://doi.org/10.1108/14691930310504554>
- Brav, A., Jiang, W., & Kim, H. (2015a). The Real Effects of Hedge Fund Activism: Productivity, Asset Allocation, and Labor Outcomes. *The Review of Financial Studies*, 28(10), 2723–2769. <https://doi.org/10.1093/rfs/hhv037>
- Brav, A., Jiang, W., & Kim, H. (2015b). Recent Advances in Research on Hedge Fund Activism: Value Creation and Identification. *Annual Review of Financial Economics*, 7(1), 579–595. <https://doi.org/10.1146/annurev-financial-111914-041751>
- Brav, A., Jiang, W., Partnoy, F., & Thomas, R. (2008). Hedge Fund Activism, Corporate Governance, and Firm Performance. *The Journal of Finance*, 63(4), 1729–1775. <https://doi.org/10.1111/j.1540-6261.2008.01373.x>
- Brown, S. J., & Warner, J. B. (1980). Measuring security price performance. *Journal of Financial Economics*, 8(3), 205–258. [https://doi.org/10.1016/0304-405X\(80\)90002-1](https://doi.org/10.1016/0304-405X(80)90002-1)

- Brown, S. J., & Warner, J. B. (1985). Using daily stock returns. *Journal of Financial Economics*, 14(1), 3–31. [https://doi.org/10.1016/0304-405X\(85\)90042-X](https://doi.org/10.1016/0304-405X(85)90042-X)
- Buffet, W. E. (2015, October 13). Interview by K. Bellstrom.
- Burgstahler, D., & Eames, M. (2006). Management of earnings and analysts' forecasts to achieve zero and small positive earnings surprises. *Journal of Business Finance & Accounting*, 33(5-6), 633–652. <https://doi.org/10.1111/j.1468-5957.2006.00630.x>
- Cai, J., & Walkling, R. A. (2011). Shareholders' Say on Pay: Does It Create Value? *Journal of Financial and Quantitative Analysis*, 46(02), 299–339. <https://doi.org/10.1017/S0022109010000803>
- Campbell, J. Y., Lo, A. W., & MacKinlay, A. C. (1997). *The econometrics of financial markets*. Princeton University Press.
- Caputo, A. (2013). A literature review of cognitive biases in negotiation processes. *International Journal of Conflict Management*, 24(4), 374–398. <https://doi.org/10.1108/IJCMA-08-2012-0064>
- Castellani, M., Pattitoni, P., & Patuelli, R. (2015). Abnormal Returns of Soccer Teams. *Journal of Sports Economics*, 16(7), 735–759. <https://doi.org/10.1177/1527002513505285>
- Cesari, A. de, & Ozkan, N. (2015). Executive incentives and payout policy: Empirical evidence from Europe. *Journal of Banking & Finance*, 55, 70–91. <https://doi.org/10.1016/j.jbankfin.2014.12.011>
- Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*, 35(1), 1–23. <https://doi.org/10.1002/smj.2131>
- Chevron Corporation. (2015). *Form 10-K: Chevron Corporation*. Securities and Exchange Commission. <https://www.sec.gov/Archives/edgar/data/93410/000009341015000010/cvx-123114x10kdoc.htm>
- Cho, C. H., & Patten, D. M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. *Accounting, Organizations and Society*, 32(7-8), 639–647. <https://doi.org/10.1016/j.aos.2006.09.009>
- Cho, C. H., Roberts, R. W., & Patten, D. M. (2010). The language of US corporate environmental disclosure. *Accounting, Organizations and Society*, 35(4), 431–443. <https://doi.org/10.1016/j.aos.2009.10.002>
- Cisco. (2011, January 24). *Visual Networking Index IP Traffic Chart*. https://www.cisco.com/cdc_content_elements/networking_solutions/service_provider/visual_networking_ip_traffic_chart.html
- Clifford, C. P. (2008). Value creation or destruction? Hedge funds as shareholder activists. *Journal of Corporate Finance*, 14(4), 323–336. <https://doi.org/10.1016/j.jcorpfin.2008.04.007>
- Club Atlético de Madrid. (2021, July 12). *Club Atlético de Madrid - Club Atlético de Madrid General Meeting unanimously agrees 181.8 million euro capital increase*. <https://en.atleticodemadrid.com/noticias/club-atletico-de-madrid-general-meeting-agrees-181-8-million-euro-capital-increase>

- Corrado, C. J. (1989). A nonparametric test for abnormal security-price performance in event studies. *Journal of Financial Economics*, 23(2), 385–395. [https://doi.org/10.1016/0304-405X\(89\)90064-0](https://doi.org/10.1016/0304-405X(89)90064-0)
- Corrado, C. J., & Zivney, T. L. (1992). The Specification and Power of the Sign Test in Event Study Hypothesis Tests Using Daily Stock Returns. *Journal of Financial and Quantitative Analysis*, 27(3), 465. <https://doi.org/10.2307/2331331>
- Costa, G., Haver, F., & Salvia, L. (2020, February 24). Coronavirus, volo Alitalia con 300 persone a bordo fermo a Mauritius [Coronavirus: Alitalia flight with 300 people on board stranded in Mauritius]. *Corriere Della Sera*. https://www.corriere.it/cronache/20_febbraio_24/coronavirus-volo-alitalia-fermo-mauritius-quarantena-o-rimpatrio-aa38bc60-56e5-11ea-b89d-a5ca249e9e1e.shtml
- Cowan, A. R. (1992). Nonparametric event study tests. *Review of Quantitative Finance and Accounting*, 2(4), 343–358. <https://doi.org/10.1007/BF00939016>
- Cox, C. (2007, March 23). *Closing remarks to the second annual corporate governance summit; Paris, France: March 23, 2007*. Securities and Exchange Commission. USC Marshall School of Business. <https://www.sec.gov/news/speech/2007/spch032307cc.htm>
- Cremers, M., Giambona, E., Sepe, S. M., & Wang, Y. (2018). Hedge Fund Activism, Firm Valuation and Stock Returns. *SSRN Electronic Journal*. Advance online publication. <https://doi.org/10.2139/ssrn.2693231>
- Cziraki, P., Renneboog, L., & Szilagyi, P. G. (2010). Shareholder Activism through Proxy Proposals: The European Perspective. *European Financial Management*, 16(5), 738–777. <https://doi.org/10.1111/j.1468-036X.2010.00559.x>
- Damodaran, A., & Liu, C. H. (1993). Insider Trading as a Signal of Private Information. *The Review of Financial Studies*, 6(1), 79–119. <https://doi.org/10.1093/rfs/6.1.79>
- Das, S. R., Hanouna, P., & Sarin, A. (2009). Accounting-based versus market-based cross-sectional models of CDS spreads. *Journal of Banking & Finance*, 33(4), 719–730. <https://doi.org/10.1016/j.jbankfin.2008.11.003>
- Davey, J. (2021, May 5). Britain's Tesco concedes to activist shareholders on health targets. *Reuters*. <https://www.reuters.com/world/uk/britains-tesco-concedes-activist-shareholders-health-targets-2021-05-04/>
- Davis, S., Hansen, S., & Seminario-Amez, C. (2020). Firm-Level Risk Exposures and Stock Returns in the Wake of COVID-19. *National Bureau of Economic Research*. Advance online publication. <https://doi.org/10.3386/w27867>
- DeAngelo, H., DeAngelo, L., & Stulz, R. M. (2010). Seasoned equity offerings, market timing, and the corporate lifecycle. *Journal of Financial Economics*, 95(3), 275–295. <https://doi.org/10.1016/j.jfineco.2009.11.002>
- Demir, E., & Danis, H. (2011). The Effect of Performance of Soccer Clubs on Their Stock Prices: Evidence from Turkey. *Emerging Markets Finance and Trade*, 47(sup4), 58–70. <https://doi.org/10.2753/REE1540-496X4705S404>
- Demir, E., & Rigoni, U. (2017). You Lose, I Feel Better. *Journal of Sports Economics*, 18(1), 58–76. <https://doi.org/10.1177/1527002514551801>

- Denes, M. R., Karpoff, J. M., & McWilliams, V. B. (2017). Thirty years of shareholder activism: A survey of empirical research. *Journal of Corporate Finance*, 44, 405–424. <https://doi.org/10.1016/j.jcorpfin.2016.03.005>
- Deshmukh, S., Goel, A. M., & Howe, K. M. (2013). CEO overconfidence and dividend policy. *Journal of Financial Intermediation*, 22(3), 440–463. <https://doi.org/10.1016/J.JFI.2013.02.003>
- Dietl, H. M., Franck, E., & Lang, M [Markus] (2008). Overinvestment in Team Sports Leagues: A Contest Theory Model. *Scottish Journal of Political Economy*, 55(3), 353–368. <https://doi.org/10.1111/j.1467-9485.2008.00457.x>
- Ding, W., Levine, R. E., Lin, C., & Xie, W. (2020). Corporate Immunity to the COVID-19 Pandemic. *SSRN Electronic Journal*. Advance online publication. <https://doi.org/10.2139/ssrn.3578585>
- Drago, D., Carnevale, C., & Gallo, R. (2019). Do corporate social responsibility ratings affect credit default swap spreads? *Corporate Social Responsibility and Environmental Management*, 26(3), 644–652. <https://doi.org/10.1002/csr.1709>
- Du, S., & Yu, K. (2020). Do corporate social responsibility reports convey value relevant information? Evidence from report readability and tone. *Journal of Business Ethics*, 1–22. <https://doi.org/10.1007/s10551-020-04496-3>
- Duarte, J., Yu, F., & Young, L. A. (2008). Why does corporate governance explain credit spreads? *SSRN Electronic Journal*. Advance online publication. <https://doi.org/10.2139/ssrn.1108705>
- Duque, J. L., & Ferreira, N. A. *Explaining Share Price Performance of Football Clubs Listed on the Euronext Lisbon* (ISEG - Universidade Tecnica de Lisboa Business Administration Working Paper No. 05-01). <https://doi.org/10.2139/ssrn.675633>
- ECA. (2021). *About ECA*. <https://www.ecaeurope.com/about-eca/>
- Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. *Management Science*, 60(11), 2835–2857. <https://doi.org/10.1287/mnsc.2014.1984>
- Edmans, A., García, D., & Norli, Ø. (2007). Sports Sentiment and Stock Returns. *The Journal of Finance*, 62(4), 1967–1998. <https://doi.org/10.1111/j.1540-6261.2007.01262.x>
- Elliott, J., Morse, D., & Richardson, G. (1984). The Association between Insider Trading and Information Announcements. *RAND Journal of Economics*, 15(4), 521–536. <https://EconPapers.repec.org/RePEc:rje:randje:v:15:y:1984:i:winter:p:521-536>
- Elliott, R. (2020, August 3). Marathon Petroleum to Sell Gas-Station Chain to 7-Eleven Owners for \$21 Billion. *The Wall Street Journal*. <https://www.wsj.com/articles/marathon-petroleum-to-sell-gas-station-chain-to-7-eleven-owners-for-21-billion-11596409261>
- Ertugrul, M., Lei, J., Qiu, J., & Wan, C. (2017). Annual report readability, tone ambiguity, and the cost of borrowing. *The Journal of Financial and Quantitative Analysis*, 52(2), 811–836. <https://doi.org/10.1017/S0022109017000187>

- Falschlunger, L. M., Eisl, C., Losbichler, H., & Greil, A. M. (2015). Impression management in annual reports of the largest European companies. *Journal of Applied Accounting Research*, 16(3), 383–399. <https://doi.org/10.1108/JAAR-10-2014-0109>
- Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 25(2), 383. <https://doi.org/10.2307/2325486>
- Fama, E. F. (1991). Efficient Capital Markets: II. *The Journal of Finance*, 46(5), 1575–1617. <https://doi.org/10.1111/j.1540-6261.1991.tb04636.x>
- Fama, E. F., Fisher, L., Jensen, M. C., & Roll, R. (1969). The Adjustment of Stock Prices to New Information. *International Economic Review*, 10(1), 1. <https://doi.org/10.2307/2525569>
- Fama, E. F., & French, K. R. (1997). Industry costs of equity. *Journal of Financial Economics*, 43(2), 153–193. [https://doi.org/10.1016/S0304-405X\(96\)00896-3](https://doi.org/10.1016/S0304-405X(96)00896-3)
- Fama, E. F., & Jensen, M. C. (1983). Separation of Ownership and Control. *The Journal of Law and Economics*, 26(2), 301–325. <https://doi.org/10.1086/467037>
- Ferreira, P., Loures, L., Nunes, J. R., & Dionísio, A. (2017). The behaviour of share returns of football clubs: An econophysics approach. *Physica a: Statistical Mechanics and Its Applications*, 472, 136–144. <https://doi.org/10.1016/j.physa.2017.01.022>
- Feuerriegel, S., & Pröllochs, N. (2021). Investor Reaction to Financial Disclosures across Topics: An Application of Latent Dirichlet Allocation *Decision Sciences*, 52(3), 608–628. <https://doi.org/10.1111/dec.12346>
- Fidrmuc, J. P., Goergen, M., & Renneboog, L. U. (2006). Insider Trading, News Releases, and Ownership Concentration. *The Journal of Finance*, 61(6), 2931–2973. <https://doi.org/10.1111/j.1540-6261.2006.01008.x>
- Finnerty, J. D., Miller, C. D., & Chen, R.-R. (2013). The impact of credit rating announcements on credit default swap spreads. *Journal of Banking & Finance*, 37(6), 2011–2030. <https://doi.org/10.1016/j.jbankfin.2013.01.028>
- Fishman, M. J., & Hagerty, K. M. (1992). Insider Trading and the Efficiency of Stock Prices. *The RAND Journal of Economics*, 23(1), 106. <https://doi.org/10.2307/2555435>
- Francis, B., Shen, Y., & Wu, Q. (2021). Do Activist Hedge Funds Target Female CEOs? The Role of CEO Gender in Hedge Fund Activism. *Journal of Financial Economics, Forthcoming*. <https://doi.org/10.2139/ssrn.3013878>
- Franck, E. P. (2014). Financial Fair Play in European Club Football - What is it All About? *SSRN Electronic Journal*. Advance online publication. <https://doi.org/10.2139/ssrn.2284615>
- Franco, G. de, Hope, O.-K., Vyas, D., & Zhou, Y. (2015). Analyst report readability. *Contemporary Accounting Research*, 32(1), 76–104. <https://doi.org/10.1111/1911-3846.12062>
- Frankel, R., & Li, X. (2004). Characteristics of a firm's information environment and the information asymmetry between insiders and outsiders. *Journal of Accounting and Economics*, 37(2), 229–259. <https://doi.org/10.1016/J.JACCECO.2003.09.004>
- French, K. R. (1980). Stock returns and the weekend effect. *Journal of Financial Economics*, 8(1), 55–69. [https://doi.org/10.1016/0304-405X\(80\)90021-5](https://doi.org/10.1016/0304-405X(80)90021-5)

- Friederich, S., Gregory, A., Matatko, J., & Tonks, I. (2002). Short-run Returns around the Trades of Corporate Insiders on the London Stock Exchange. *European Financial Management*, 8(1), 7–30. <https://doi.org/10.1111/1468-036X.00174>
- Fühner, J., Schmidt, S. L., & Schreyer, D. (2021). Are diversified football clubs better prepared for a crisis? First empirical evidence from the stock market. *European Sport Management Quarterly*, 1–24. <https://doi.org/10.1080/16184742.2020.1862273>
- Gangopadhyay, P., Yook, K., & Sarwar, G. (2009). Profitability of Insider Trades in Extremely Volatile Markets: Evidence from the Stock Market Crash and Recovery of 2000–2003. *Quarterly Journal of Finance and Accounting*, 48, 45–62.
- Gantchev, N. (2013). The costs of shareholder activism: Evidence from a sequential decision model. *Journal of Financial Economics*, 107(3), 610–631. <https://doi.org/10.1016/j.jfineco.2012.09.007>
- Ge, W., & Liu, M. (2015). Corporate social responsibility and the cost of corporate bonds. *Journal of Accounting and Public Policy*, 34(6), 597–624. <https://doi.org/10.1016/j.jaccpubpol.2015.05.008>
- Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 66, 101889. <https://doi.org/10.1016/j.jcorpfin.2021.101889>
- Gillan, S. L., & Starks, L. T. (2007). The Evolution of Shareholder Activism in the United States. *Journal of Applied Corporate Finance*, 19(1), 55–73. <https://doi.org/10.1111/j.1745-6622.2007.00125.x>
- Gimet, C., & Montchaud, S. (2016). What Drives European Football Clubs' Stock Returns and Volatility? *International Journal of the Economics of Business*, 23(3), 351–390. <https://doi.org/10.1080/13571516.2016.1204686>
- Glossner, S., Matos, P., Ramelli, S., & Wagner, A. F. (2020). *Where Do Institutional Investors Seek Shelter when Disaster Strikes? Evidence from COVID-19* (European Corporate Governance Institute - Finance Working Paper No. 688/2020). <https://doi.org/10.2139/ssrn.3655271>
- Goette, L., Han, H. J., & Leung, B. T. K. (2020). *Information Overload and Confirmation Bias*. Cambridge Working Papers in Economics (No. 2019). Faculty of Economics, University of Cambridge. <https://ideas.repec.org/p/cam/camdae/2019.html>
- Goranova, M., & Ryan, L. V. (2014). Shareholder Activism. *Journal of Management*, 40(5), 1230–1268. <https://doi.org/10.1177/0149206313515519>
- Goss, A., & Roberts, G. S. (2011). The impact of corporate social responsibility on the cost of bank loans. *Journal of Banking & Finance*, 35(7), 1794–1810. <https://doi.org/10.1016/j.jbankfin.2010.12.002>
- Gourinchas, P. O., Kalemli-Ozcan, S., Penciakova, V., & Sander, N. (2020). *COVID-19 and SME Failures*. International Monetary Fund.
- Greenwood, R., & Schor, M. (2009). Investor activism and takeovers. *Journal of Financial Economics*, 92(3), 362–375. <https://doi.org/10.1016/j.jfineco.2008.05.005>

- Gregory, A., Jeanes, E., Tharyan, R., & Tonks, I. (2013). Does the Stock Market Gender Stereotype Corporate Boards? Evidence from the Market's Reaction to Directors' Trades. *British Journal of Management*, 24(2), 174–190. <https://doi.org/10.1111/j.1467-8551.2011.00795.x>
- Guay, W., Samuels, D., & Taylor, D. (2016). Guiding through the Fog: Financial statement complexity and voluntary disclosure. *Journal of Accounting and Economics*, 62(2-3), 234–269. <https://doi.org/10.1016/j.jacceco.2016.09.001>
- Gupta, V., Han, S., Mortal, S., Silveri, S., & Turban, D. B. (2018). Do Women CEOs Face Greater Threat of Shareholder Activism Compared to Male CEOs? A Role Congruity Perspective. *Journal of Applied Psychology*, 103(2), 228–236. <https://doi.org/10.2139/ssrn.3027096>
- Haeberle, K. S. (2019). Information Asymmetry and the Protection of Ordinary Investors. *UC Davis Law Review*, 145(53). https://heinonline.org/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/davlr53&ion=6
- Hall, B. J., & Liebman, J. (1998). Are CEOs Really Paid Like Bureaucrats? *The Quarterly Journal of Economics*, 113(3), 653–691. <https://doi.org/10.3386/w6213>
- Hall, B. J., & Murphy, K. (2002). Stock Options for Undiversified Executives. *Journal of Accounting and Economics*, 33(1), 3–42. <https://doi.org/10.3386/w8052>
- Hammerschmidt, J., Durst, S., Kraus, S., & Puumalainen, K. (2021). Professional football clubs and empirical evidence from the COVID-19 crisis: Time for sport entrepreneurship? *Technological Forecasting and Social Change*, 165, 120572. <https://doi.org/10.1016/j.techfore.2021.120572>
- Hancock, A. (2020, February 24). Airline stocks plunge as coronavirus hits Italy: Fears that European travel will slow sharply hits hoteliers and tourism businesses. *Financial Times*. <https://www.ft.com/content/f396e8e2-56f8-11ea-a528-dd0f971febbc>
- Hassan, T., Hollander, S., van Lent, L., & Tahoun, T. (2020). Firm-Level Exposure to Epidemic Diseases: Covid-19, SARS, and H1N1. *Institute for New Economic Thinking Working Paper Series*, 1–46. <https://doi.org/10.36687/inetwp119>
- Hayward, M. L. A., & Hambrick, D. C. (1997). Explaining the Premiums Paid for Large Acquisitions: Evidence of CEO Hubris. *Administrative Science Quarterly*, 42(1), 103. <https://doi.org/10.2307/2393810>
- Heaton, J. B. (2002). Managerial Optimism and Corporate Finance. *Financial Management*, Summer. <https://doi.org/10.2139/ssrn.71411>
- Herbst-Bayliss, S. (2019, July 30). Karmic reckoning? Investors in activist hedge funds agitate for change. *Reuters*. <https://www.reuters.com/article/us-usa-hedgefunds-investors-focus/karmic-reckoning-investors-in-activist-hedge-funds-agitate-for-change-idUSKCN1UP17T>
- Hilary, G., & Hsu, C. (2011). Endogenous overconfidence in managerial forecasts. *Journal of Accounting and Economics*, 51(3), 300–313. <https://doi.org/10.1016/j.jacceco.2011.01.002>
- Hillier, D., Korczak, A., & Korczak, P. (2015). The impact of personal attributes on corporate insider trading. *Journal of Corporate Finance*, 30, 150–167. <https://doi.org/10.1016/j.jcorpfin.2014.12.003>

- Hirshleifer, D. (2015). Behavioral finance. *Annual Review of Financial Economics*, 7(1), 133–159. <https://doi.org/10.1146/annurev-financial-092214-043752>
- Hirshleifer, D., Low, A., & Teoh, S. H. (2012). Are Overconfident CEOs Better Innovators? *The Journal of Finance*, 67(4), 1457–1498. <https://doi.org/10.1111/j.1540-6261.2012.01753.x>
- Hirshleifer, D., & Shumway, T. (2003). Good Day Sunshine: Stock Returns and the Weather. *The Journal of Finance*, 58(3), 1009–1032. <https://doi.org/10.1111/1540-6261.00556>
- Hong, H., Lim, T., & Stein, J. C. (2000). Bad News Travels Slowly: Size, Analyst Coverage, and the Profitability of Momentum Strategies. *The Journal of Finance*, 55(1), 265–295. <https://doi.org/10.1111/0022-1082.00206>
- Hribar, P., Melessa, S. J., Small, R. C., & Wilde, J. H. (2017). Does managerial sentiment affect accrual estimates? Evidence from the banking industry. *Journal of Accounting and Economics*, 63(1), 26–50. <https://doi.org/10.1016/j.jacceco.2016.10.001>
- Hsieh, T.-S., Wang, Z., & Demirkan, S. (2018). Overconfidence and Tax Avoidance: The Role of CEO and CFO Interaction. *Journal of Accounting and Public Policy*, 37(3), 241–253. <https://doi.org/10.2139/ssrn.2843355>
- Hu, N., Liu, L., & Zhu, L. (2018). Credit default swap spreads and annual report readability. *Review of Quantitative Finance and Accounting*, 50(2), 591–621. <https://doi.org/10.1007/s11156-017-0639-8>
- Huang, K.-W., & Li, Z. (2011). A multilabel text classification algorithm for labeling risk factors in SEC form 10-K. *ACM Transactions on Management Information Systems*, 2(3), 1–19. <https://doi.org/10.1145/2019618.2019624>
- Hull, J., Predescu, M., & White, A. (2004). The relationship between credit default swap spreads, bond yields, and credit rating announcements. *Journal of Banking & Finance*, 28(11), 2789–2811. <https://doi.org/10.1016/j.jbankfin.2004.06.010>
- Humphery-Jenner, M., Lisic, L. L., Nanda, V., & Silveri, S. D. (2016). Executive overconfidence and compensation structure. *Journal of Financial Economics*, 119(3), 533–558. <https://doi.org/10.1016/j.jfineco.2016.01.022>
- Huth, C. (2019). Who invests in financial instruments of sport clubs? An empirical analysis of actual and potential individual investors of professional European football clubs. *European Sport Management Quarterly*, 1–20. <https://doi.org/10.1080/16184742.2019.1684539>
- Hutto, C. J., & Gilbert, E. (2014). Vader: A parsimonious rule-based model for sentiment analysis of social media text. *Proceedings of the International AAAI Conference on Web and Social Media*, 8(1).
- Hutton, A. P., Miller, G. S., & Skinner, D. J. (2003). The role of supplementary statements with management earnings forecasts. *Journal of Accounting Research*, 41(5), 867–890. <https://doi.org/10.1046/j.1475-679X.2003.00126.x>
- International Data Corporation. (2020, May 8). *IDC's Global DataSphere Forecast Shows Continued Steady Growth in the Creation and Consumption of Data*. International Data Corporation. <https://www.idc.com/getdoc.jsp?containerId=prUS46286020>
- International Monetary Fund. (2020, July 24). *Policy Responses to COVID19*. <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19>

- J.P. Morgan. (2021, September 22). *Undiscovered Managers Behavioral Value Fund-L*.
<https://am.jpmorgan.com/us/en/asset-management/adv/products/undiscovered-managers-behavioral-value-fund-l-904504842>
- Jaffe, J. F. (1974). Special Information and Insider Trading. *The Journal of Business*, 47(3), 410.
<https://doi.org/10.1086/295655>
- Jensen, M. C. (1986). Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. *The American Economic Review*, 76(2), 323–329. <http://www.jstor.org/stable/1818789>
- Jensen, M. C., & Meckling, W. H. (1976). *Theory of the firm: Managerial behavior, agency costs and ownership structure*. North-Holland.
- Johnson, S. (2021, April 26). European sustainable index fund flows surpass all others for first time. *Financial Times*. <https://www.ft.com/content/ff1766b9-2504-426b-aedc-4c13412478cf>
- Judge, W. Q., Gaur, A., & Muller-Kahle, M. I. (2010). Antecedents of Shareholder Activism in Target Firms: Evidence from a Multi-Country Study. *Corporate Governance: An International Review*, 18(4), 258–273. <https://doi.org/10.1111/j.1467-8683.2010.00797.x>
- Kim, C., Wang, K., & Zhang, L. (2019). Readability of 10-K reports and stock price crash risk. *Contemporary Accounting Research*, 36(2), 1184–1216. <https://doi.org/10.1111/1911-3846.12452>
- Kim, O., & Verrecchia, R. E. (1994). Market liquidity and volume around earnings announcements. *Journal of Accounting and Economics*, 17(1-2), 41–67.
[https://doi.org/10.1016/0165-4101\(94\)90004-3](https://doi.org/10.1016/0165-4101(94)90004-3)
- Klein, A., & Zur, E. (2009). Entrepreneurial Shareholder Activism: Hedge Funds and Other Private Investors. *The Journal of Finance*, 64(1), 187–229.
<https://doi.org/10.2139/ssrn.913362>
- Klein, A., & Zur, E. (2011). The Impact of Hedge Fund Activism on the Target Firm's Existing Bondholders. *The Review of Financial Studies*, 24(5), 1735–1771.
<https://doi.org/10.1093/rfs/hhr016>
- Kolari, J. W., & Pynnönen, S. (2010). Event Study Testing with Cross-sectional Correlation of Abnormal Returns. *The Review of Financial Studies*, 23(11), 3996–4025.
<https://doi.org/10.1093/rfs/hhq072>
- Korkeamäki, T., Liljeblom, E., & Pasternack, D. (2017). CEO power and matching leverage preferences. *Journal of Corporate Finance*, 45, 19–30.
<https://doi.org/10.1016/j.jcorpfin.2017.04.007>
- KPMG. (2020a). *Football Benchmark - Season one after the Covid outbreak*. KPMG.
https://footballbenchmark.com/library/season_one_after_the_covid_outbreak
- KPMG. (2020b). *The time has come: The KPMG survey of sustainability reporting 2020*. KPMG.
<https://assets.kpmg/content/dam/kpmg/xx/pdf/2020/11/the-time-has-come.pdf>
- Kraaijeveld, O., & Smedt, J. de (2020). The predictive power of public Twitter sentiment for forecasting cryptocurrency prices. *Journal of International Financial Markets, Institutions and Money*, 65, 101188. <https://doi.org/10.1016/j.intfin.2020.101188>

- Kramer, L. A., & Liao, C. M. (2016). The spillover effects of management overconfidence on analyst forecasts. *Journal of Behavioral and Experimental Finance*, 12, 79–92. <https://doi.org/10.1016/j.jbef.2016.10.004>
- Lakonishok, J., & Lee, I. (2001). Are Insider Trades Informative? *The Review of Financial Studies*, 14(1), 79–111. <https://doi.org/10.1093/rfs/14.1.79>
- Lang, M [Mark], & Lundholm, R. (1993). Cross-Sectional Determinants of Analyst Ratings of Corporate Disclosures. *Journal of Accounting Research*, 31(2), 246. <https://doi.org/10.2307/2491273>
- Lazard. (January 2019). *2018 Review of Shareholder Activism*. Lazard's Shareholder Advisory Group. <https://www.lazard.com/media/450805/lazards-2018-review-of-shareholder-activism.pdf>
- Lehavy, R., Li, F [Feng], & Merkley, K. (2011). The effect of annual report readability on analyst following and the properties of their earnings forecasts. *The Accounting Review*, 86(3), 1087–1115. <https://doi.org/10.2308/accr.00000043>
- Leland, H. E. (1992). Insider Trading: Should It Be Prohibited? *Journal of Political Economy*, 100(4), 859–887. <https://doi.org/10.1086/261843> (*Journal of Political Economy*, 100(4), 859–887).
- Leung, S., Parker, L., & Curtis, J. (2015). Impression management through minimal narrative disclosure in annual reports. *The British Accounting Review*, 47(3), 275–289. <https://doi.org/10.1016/j.bar.2015.04.002>
- Li, F [Feifei], & Polychronopoulos, A. (2020). *What a difference an ESG ratings provider makes!* Research Affiliates. <https://www.researchaffiliates.com/content/dam/ra/documents/770-what-a-difference-an-esg-ratings-provider-makes.pdf>
- Li, F [Feng] (2008). Annual report readability, current earnings, and earnings persistence. *Journal of Accounting and Economics*, 45(2-3), 221–247. <https://doi.org/10.1016/j.jacceco.2008.02.003>
- Li, Y [Yi] (2017). Voluntary disclosure and investment in environmental technology. *Journal of Economic Behavior & Organization*, 133, 331–341. <https://doi.org/10.1016/j.jebo.2016.11.002>
- Li, Y [Yiwei], Gong, M., Zhang, X.-Y., & Koh, L. (2018). The impact of environmental, social, and governance disclosure on firm value: The role of CEO power. *The British Accounting Review*, 50(1), 60–75. <https://doi.org/10.1016/j.bar.2017.09.007>
- Lin, J.-C., & Howe, J. S. (1990). Insider Trading in the OTC Market. *Journal of Finance*, 45(4), 1273–1284. <https://EconPapers.repec.org/RePEc:bla:jfinan:v:45:y:1990:i:4:p:1273-84>
- Lin, M.-C., Ho, P.-H., & Chih, H.-L. (2019). Effects of managerial overconfidence on analyst recommendations. *Review of Quantitative Finance and Accounting*, 53(1), 73–99. <https://doi.org/10.1007/s11156-018-0743-4>
- Liu, H., Liu, W., Yoganathan, V., & Osburg, V.-S. (2021). COVID-19 information overload and generation Z's social media discontinuance intention during the pandemic lockdown. *Technological Forecasting and Social Change*, 166, 120600. <https://doi.org/10.1016/j.techfore.2021.120600>

- Lo, K., Ramos, F., & Rogo, R. (2017). Earnings management and annual report readability. *Journal of Accounting and Economics*, 63(1), 1–25. <https://doi.org/10.1016/j.jacceco.2016.09.002>
- Loughran, T., & McDonald, B. (2011). When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks. *The Journal of Finance*, 66(1), 35–65. <https://doi.org/10.1111/j.1540-6261.2010.01625.x>
- Loughran, T., & McDonald, B. (2014). Measuring readability in financial disclosures. *The Journal of Finance*, 69(4), 1643–1671. <https://doi.org/10.1111/jofi.12162>
- Loughran, T., & McDonald, B. (2016). Textual analysis in accounting and finance: A survey. *Journal of Accounting Research*, 54(4), 1187–1230. <https://doi.org/10.1111/1475-679X.12123>
- Loughran, T., McDonald, B., & Yun, H. (2009). A Wolf in Sheep's Clothing: The Use of Ethics-Related Terms in 10-K Reports. *Journal of Business Ethics*, 89(S1), 39–49. <https://doi.org/10.1007/s10551-008-9910-1>
- Lowenstein, R. (2021, September 6). 'The Antisocial Network' Review: Let Them Eat Shorts. *The Wall Street Journal*. <https://www.wsj.com/articles/the-antisocial-network-review-let-them-eat-shorts-11630964754>
- Lys, T., & Sohn, S. (1990). The association between revisions of financial analysts' earnings forecasts and security-price changes. *Journal of Accounting and Economics*, 13(4), 341–363. [https://doi.org/10.1016/0165-4101\(90\)90009-S](https://doi.org/10.1016/0165-4101(90)90009-S)
- MacKinlay, A. C. (1997). Event studies in economics and finance. *Journal of Economic Literature*, 35(1), 13–39. <https://EconPapers.repec.org/RePEc:aea:jeclit:v:35:y:1997:i:1:p:13-39>
- Mallin, C., Farag, H., & Ow-Yong, K. (2014). Corporate social responsibility and financial performance in Islamic banks. *Journal of Economic Behavior & Organization*, 103, S21–S38. <https://doi.org/10.1016/j.jebo.2014.03.001>
- Malmendier, U. (2018). *Behavioral Corporate Finance* (NBER Working Paper Series No. 25162). Cambridge, MA. <https://doi.org/10.3386/w25162>
- Malmendier, U., Pezone, V., & Zheng, H. (2020). *Managerial duties and managerial biases* (CEPR Discussion Paper No. DP14929). <https://ssrn.com/abstract=3638033>
- Malmendier, U., & Tate, G. (2005). Overconfidence and Corporate Investment. *Journal of Finance*, 60(6), 2661–2700. <https://doi.org/10.1111/j.1540-6261.2005.00813.x>
- Malmendier, U., & Tate, G. (2008). Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics*, 89(1), 20–43. <https://doi.org/10.1016/j.jfineco.2007.07.002>
- Malmendier, U., & Tate, G. (2015). Behavioral CEOs: The Role of Managerial Overconfidence. *Journal of Economic Perspectives*, 29(4), 37–60. <https://doi.org/10.1257/jep.29.4.37>
- Malmendier, U., Tate, G., & Yan, J. (2011). Overconfidence and early-life experiences: The effect of managerial traits on corporate financial policies. *Journal of Finance*, 66(5), 1687–1733. <https://doi.org/10.1111/j.1540-6261.2011.01685.x>

- Marca (2020, February 23). Four Serie A matches postponed due to coronavirus outbreak. *Marca*. <https://www.marca.com/en/football/international-football/2020/02/23/5e5271cae2704e5a808b45b5.html>
- Mc Laughlin, G. H. (1969). SMOG grading - a new readability formula. *Journal of Reading*, 12(8), 639–646. <http://www.jstor.org/stable/40011226>
- McCabe, C. (2020, March 26). *Who's Betting on a Rebound in Stocks? Corporate Insiders*. <https://www.wsj.com/articles/whos-betting-on-a-rebound-in-stocks-corporate-insiders-11585220400>
- McWilliams, A., & Siegel, D. (1997). Event Studies in Management Research: Theoretical and Empirical Issues. *Academy of Management Journal*, 40(3), 626–657. <https://doi.org/10.2307/257056>
- Melloni, G. (2015). Intellectual capital disclosure in integrated reporting: an impression management analysis. *Journal of Intellectual Capital*, 16(3), 661–680. <https://doi.org/10.1108/JIC-11-2014-0121>
- Mentz, M., & Schiereck, D. (2008). Cross-border mergers and the cross-border effect: the case of the automotive supply industry. *Review of Managerial Science*, 2(3), 199–218. <https://doi.org/10.1007/s11846-008-0022-1>
- Merkel-Davies, D. M., & Brennan, N. (2007). Discretionary disclosure strategies in corporate narratives : Incremental information or impression management? *Journal of Accounting Literature*, 26, 116-196.
- Miller, B. P. (2010). The effects of reporting complexity on small and large investor trading. *The Accounting Review*, 85(6), 2107–2143. <https://doi.org/10.2308/accr.00000001>
- Mohammed, M., Sha'aban, A., Jatau, A. I., Yunusa, I., Isa, A. M., Wada, A. S., Obamiro, K., Zainal, H., & Ibrahim, B. (2021). Assessment of COVID-19 Information Overload Among the General Public. *Journal of Racial and Ethnic Health Disparities*. Advance online publication. <https://doi.org/10.1007/s40615-020-00942-0>
- Möller, R., & Reichmann, D. (2021). ECB language and stock returns – A textual analysis of ECB press conferences. *The Quarterly Review of Economics and Finance*, 80, 590–604. <https://doi.org/10.1016/j.qref.2021.04.003>
- Monga, V., & Chasan, E. (2015, June 2). The 109,894-Word Annual Report. *The Wall Street Journal*. <https://www.wsj.com/articles/the-109-894-word-annual-report-1433203762>
- Morningstar, Inc. (2021, April 21). *ESG risk comes into focus*. <https://www.morningstar.com/features/esg-risk>
- Mutua, D. C. (2020, April 14). ESG is increasingly important in credit ratings, Moody's says. *Bloomberg*. <https://www.bloomberg.com/news/articles/2020-04-14/esg-is-increasingly-important-in-credit-ratings-moody-s-says>
- Naumer, H.-J., & Yurtoglu, B. (2020). It is not only what you say, but how you say it: ESG, corporate news, and the impact on CDS spreads. *Global Finance Journal*, 100571. <https://doi.org/10.1016/j.gfj.2020.100571>
- The New York Times (2020, March 10). Wall Street Plunges in Worst Drop Since 2008. *The New York Times*. <https://www.nytimes.com/2020/03/09/business/stock-market-today.html>

- Nofer, M., & Hinz, O. (2015). Using Twitter to Predict the Stock Market. *Business & Information Systems Engineering*, 57(4), 229–242. <https://doi.org/10.1007/s12599-015-0390-4>
- Offermann, P., Blom, S., Schönherr, M., & Bub, U. (2010). Artifact Types in Information Systems Design Science – A Literature Review. In *Global Perspectives on Design Science Research: 5th International Conference, DESRIST 2010, St. Gallen, Switzerland, June 4-5, 2010. Proceedings*. (pp. 77–92). https://doi.org/10.1007/978-3-642-13335-0_6
- Oikonomou, I., Brooks, C., & Pavelin, S. (2014). The effects of corporate social performance on the cost of corporate debt and credit ratings. *Financial Review*, 49(1), 49–75. <https://doi.org/10.1111/fire.12025>
- Otani, A. (2021, February 5). Teens Are Gambling Their Savings on GameStop Stock. Their Parents Are Worried. *The Wall Street Journal*.
- Payne, J. W., Bettman, J. R., & Luce, M. F. (1996). When Time Is Money: Decision Behavior under Opportunity-Cost Time Pressure. *Organizational Behavior and Human Decision Processes*, 66(2), 131–152. <https://doi.org/10.1006/obhd.1996.0044>
- Phillips, M., & Lorenz, T. (2021, January 27). GameStop Stock Soars as Reddit Investors Take On Wall St. *The New York Times*. <https://www.nytimes.com/2021/01/27/business/gamestop-wall-street-bets.html>
- Ramelli, S., & Wagner, A. F. (2020). Feverish Stock Price Reactions to the Novel Coronavirus. *Review of Corporate Finance Studies*, Forthcoming. <https://doi.org/10.2139/ssrn.3550274>
- Ravina, E., & Sapienza, P. (2010). What Do Independent Directors Know? Evidence from Their Trading. *The Review of Financial Studies*, 23(3), 962–1003. <https://doi.org/10.1093/rfs/hhp027>
- Reber, B., Gold, A., & Gold, S. (2021). ESG Disclosure and Idiosyncratic Risk in Initial Public Offerings. *Journal of Business Ethics*, 1–20. <https://doi.org/10.1007/s10551-021-04847-8>
- Renneboog, L., Ter Horst, J., & Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of Banking & Finance*, 32(9), 1723–1742. <https://doi.org/10.1016/j.jbankfin.2007.12.039>
- Reuters (Wed, 2021, June 30). Juventus to propose rights issue of up to 400 mln euro to mitigate COVID-19 impact. *Nasdaq*. <https://www.nasdaq.com/articles/juventus-to-propose-rights-issue-of-up-to-400-mln-euro-to-mitigate-covid-19-impact-2021-06>
- Ricci, O. (2015). The impact of monetary policy announcements on the stock price of large European banks during the financial crisis. *Journal of Banking & Finance*, 52, 245–255. <https://doi.org/10.1016/j.jbankfin.2014.07.001>
- Roll, R. (1986). The Hubris Hypothesis of Corporate Takeovers. *The Journal of Business*, 59(2), 197. <https://doi.org/10.1086/296325>
- Rösch, C. G., & Kaserer, C. (2013). Market liquidity in the financial crisis: The role of liquidity commonality and flight-to-quality. *Journal of Banking & Finance*, 37(7), 2284–2302. <https://doi.org/10.1016/j.jbankfin.2014.06.010>
- Rost, K., & Osterloh, M. (2010). Opening the Black Box of Upper Echelons: Drivers of Poor Information Processing During the Financial Crisis. *Corporate Governance: An International Review*, 18(3), 212–233. <https://doi.org/10.1111/j.1467-8683.2010.00796.x>

- Ruggeri, C., & Beine, F. (2019). *CFO Insights: Investor relations: What CFOs need to know before an IPO*. Deloitte Touche Tohmatsu Limited.
https://www2.deloitte.com/content/dam/Deloitte/de/Documents/finance-transformation/CFO_Insights_investor-relations.pdf
- S&P Global. (2021). *S&P Global makes over 9,000 ESG scores publicly available to help increase transparency of corporate sustainability performance*. <https://press.spglobal.com/2021-02-16-S-P-Global-makes-over-9-000-ESG-Scores-publicly-available-to-help-increase-transparency-of-corporate-sustainability-performance>
- Samuelson, S. S. (1988). The prevention of insider trading: A proposal for revising section 16 of the securities exchange act of 1934. *Harvard Journal on Legislation*, 25, 511–531.
https://heinonline.org/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/hjl25§ion=15
- Sarkis, J., Koo, C., & Watson, R. T. (2013). Green information systems & technologies – this generation and beyond: Introduction to the special issue. *Information Systems Frontiers*, 15(5), 695–704. <https://doi.org/10.1007/s10796-013-9454-5>
- Schaffer, R. (2011). Piece of the Rock (or The Rockets): The Viability of Widespread Public Offerings of Professional Sports Franchises. In S. R. Rosner & K. L. Shropshire (Eds.), *The business of sports* (2nd ed., pp. 31–41). Jones & Bartlett Learning.
- Schoenfeld, J. (2020). The Invisible Risk: Pandemics and the Financial Markets. *SSRN Electronic Journal*. Advance online publication. <https://doi.org/10.2139/ssrn.3567249>
- Scholes, M., & Williams, J. (1977). Estimating betas from nonsynchronous data. *Journal of Financial Economics*, 5(3), 309–327. [https://doi.org/10.1016/0304-405X\(77\)90041-1](https://doi.org/10.1016/0304-405X(77)90041-1)
- Schroder, H. M., Driver, M. J., & Streufert, S. (1967). *Human Information Processing: Individuals and Groups Functioning in Complex Social Situations*. Holt, Rinehart and Winston.
<https://books.google.de/books?id=cIF9AAAAMAAJ>
- Schumaker, R. P., & Chen, H. (2009). Textual analysis of stock market prediction using breaking financial news. *ACM Transactions on Information Systems*, 27(2), 1–19.
<https://doi.org/10.1145/1462198.1462204>
- Exchange Act of 1934 - Schedule 13D, 1934. <https://www.sec.gov/fast-answers/answerssched13htm.html>
- Seyhun, H. (1986). Insiders' profits, costs of trading, and market efficiency. *Journal of Financial Economics*, 16(2), 189–212. [https://doi.org/10.1016/0304-405X\(86\)90060-7](https://doi.org/10.1016/0304-405X(86)90060-7)
- Snedecor, G. W., & Cochran, W. G. (1989). *Statistical methods* (8. ed.). Blackwell Publ.
- Somayaji, C., & Hirtenstein, A. (2020, February 24). Travel Stocks Hammered as Coronavirus Spreads Globally. *The Wall Street Journal*. <https://www.wsj.com/articles/european-airline-stocks-tumble-as-coronavirus-spreads-in-italy-11582552223>
- Souha, S. B., Anis, J., & McMillan, D. (2016). Corporate governance and firm characteristics as explanatory factors of shareholder activism: Validation through the French context. *Cogent Economics & Finance*, 4(1), 154. <https://doi.org/10.1080/23322039.2016.1150407>
- Speier, C., Valacich, J. S., & Vessey, I. (1999). The Influence of Task Interruption on Individual Decision Making: An Information Overload Perspective. *Decision Sciences*, 30(2), 337–360.
<https://doi.org/10.1111/j.1540-5915.1999.tb01613.x>

- Standard & Poor's. (2019). *S&P Composite 1500*. Available at: <https://us.spindices.com/indices/equity/sp-composite-1500>
- Teitelbaum, R. (2017, June 12). When Activists Enter the Kitchen, the CFOs Feel the Heat. *The Wall Street Journal*. <https://www.wsj.com/articles/when-activists-enter-the-kitchen-the-cfos-feel-the-heat-1497259802>
- Tetlock, P. C. (2007). Giving content to investor sentiment: The role of media in the stock market. *The Journal of Finance*, 62(3), 1139–1168. <https://doi.org/10.1111/j.1540-6261.2007.01232.x>
- Thomson Reuters. (2012). *US Insider Filing Feed Specification*. Thomson Reuters.
- Tiscini, R., & Strologo, A. D. (2016). What Drives the Value of Football Clubs: An Approach Based on Private and Socio-Emotional Benefits. *Corporate Ownership & Control*, 14(1), 673–683. <https://doi.org/10.22495/cocv14i1c4art14>
- Toms, J. S. (2002). Firm resources, quality signals and the determinants of corporate environmental reputation: Some UK evidence. *The British Accounting Review*, 34(3), 257–282. <https://doi.org/10.1006/bare.2002.0211>
- Treanor, J. (2015, May 18). Carl Icahn: Apple shares 'dramatically undervalued' and should trade at \$240. *The Guardian*.
- Trentmann, N., & Maurer, M. (2021, February 25). GameStop CFO Was Forced Out as Activist Investor Pushes New Strategy. *The Wall Street Journal*. <https://www.wsj.com/articles/gamestop-cfo-was-forced-out-as-activist-investor-pushes-new-strategy-11614214793>
- Tversky, A., & Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases. *Science (New York, N.Y.)*, 185(4157), 1124–1131. <https://doi.org/10.1126/science.185.4157.1124>
- UEFA. (2020). *The European Club Footballing Landscape: Club Licensing Benchmarking Report Financial Year 2018*. Nyon. UEFA. https://www.uefa.com/MultimediaFiles/Download/OfficialDocument/uefaorg/Clublicensing/02/64/06/95/2640695_DOWNLOAD.pdf
- Vardi, N. (2013, April 18). Former Israeli Intelligence Operatives Now Working For Hedge Funds. *Forbes*. <https://www.forbes.com/sites/nathanvardi/2013/04/18/former-israeli-intelligence-operatives-now-working-for-hedge-funds/?sh=1d03511435c3>
- Verheyden, T., Eccles, R., & Feiner, A. (2016). ESG for all? The impact of ESG screening on return, risk, and diversification. *Journal of Applied Corporate Finance*, 28(2), 47–55. <https://doi.org/10.1111/jacf.12174>
- Wang, Z., Hsieh, T.-S., & Sarkis, J. (2018). CSR performance and the readability of CSR reports: Too good to be true? *Corporate Social Responsibility and Environmental Management*, 25(1), 66–79. <https://doi.org/10.1002/csr.1440>
- Weber, M., & Camerer, C. F. (1998). The disposition effect in securities trading: an experimental analysis. *Journal of Economic Behavior & Organization*, 33(2), 167–184. [https://doi.org/10.1016/S0167-2681\(97\)00089-9](https://doi.org/10.1016/S0167-2681(97)00089-9)
- WHO. (2020). *Coronavirus Disease (COVID-19) Situation Reports*. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>

The World Bank. (2020). *GDP (constant 2010 US\$) - European Union*. The World Bank.
<https://data.worldbank.org/indicator/NY.GDP.MKTP.KD?locations=EU>

Zhang, D., Hu, M., & Ji, Q. (2020). Financial markets under the global pandemic of COVID-19.
Finance Research Letters, 36, 101528. <https://doi.org/10.1016/j.frl.2020.101528>

DECLARATION OF HONOR

I declare on my word of honor that the dissertation submitted herewith is my own work, with the exception of the help clearly indicated in the dissertation. I have included a list of all references used in the dissertation. All quotes, whether word for word or in my own words, are labeled as such. This dissertation has not been published elsewhere or submitted to any other institution for review.

Ich erkläre hiermit ehrenwörtlich, dass ich die vorliegende Arbeit, abgesehen von den in der Arbeit ausdrücklich genannten Hilfen, selbstständig angefertigt habe. Die Dissertation ist von mir mit einem Verzeichnis aller benutzten Quellen versehen. Sämtliche aus fremden Quellen direkt und indirekt übernommene Zitate sind als solche kenntlich gemacht. Diese Dissertation wurde zuvor nicht veröffentlicht und keiner anderen Institution zur Prüfung vorgelegt.

Ort, Datum

Unterschrift