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Sondernewsletter

BAI-Wissenschaftspreis 2025

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Leitartikel

Sehr geehrte Damen und Herren,

die Vergabe des diesjährigen BAI-Wissenschaftspreises fand am 18. November 2025 in Bad Homburg bei unserem Mitgliedsunternehmen FERI statt. Die Laudationen wurden wieder von dem Gremiumsmitglied Prof. Dr. Dirk Schiereck von der TU Darmstadt gehalten, die Übergabe der Preise erfolgte durch das BAI Vorstandsmitglied Prof. Dr. Rolf Tilmes.

Der Bundesverband Alternative Investments e.V. entschloss sich bereits vor über einem Jahrzehnt wissenschaftliche Arbeiten im Bereich der Alternativen Investments zu fördern und einen jährlichen Preis für hervorragende Arbeiten in diversen Kategorien zu vergeben. 2010 war die Geburtsstunde des etablierten BAI Wissenschaftspreises! Seit der Einführung erreichten den Verband inzwischen 229 Bewerbungen aus dem Bereich der Alternativen Investments.

Für den BAI war schon damals absehbar, dass das Thema Alternative Investments und deren Bedeutung für institutionelle Investoren, Asset Manager und auch Dienstleister weiter zunehmen wird.

Seit Einführung des Preises entscheidet ausschließlich ein vom Verband völlig unabhängiges mehrköpfiges Gremium über die Gewinnerarbeiten. Die Autorinnen & Autoren erhalten als Auszeichnung und Anerkennung einen BAI-Award sowie ein Preisgeld, insgesamt diesmal iHv. EUR 10.000.

Die Branche hat sich seit damals permanent stark weiterentwickelt, es sind neue Assetklassen hinzugekommen und die Alternativen Investments gehören bei den meisten institutionellen Investoren mit weiterhin steigendem Anteil heutzutage im Portfolio dazu.

Dies wird auch wieder in dem aktuellen BAI Investor Survey 2025 sehr deutlich und nach unserer festen Überzeugung in Zukunft so bleiben.

Wir merken ebenso seit vielen Jahren mit Freude, dass auf der wissenschaftlichen Seite sich immer mehr Studenten, Doktoranden und andere Wissenschaftler dem Gebiet der Alternativen Investments durch intensive Forschungsarbeit widmen. Für uns also weiterhin Ansporn dies zu fördern und zu belohnen!

Roland Brooks
Senior Referent
BAI e.V.

Nun zu den diesjährigen Gewinnern und deren Arbeiten wozu Sie in diesem Sondernewsletter die Zusammenfassungen finden.

In der Kategorie **Bachelorarbeiten** überzeugte die Arbeit „Handelsstrategien mit Kryptowährungen" von Julian Wolf. In seiner Arbeit untersucht er, ob sich Preisunterschiede zwischen Kryptowährungspaaren für risikofreie trianguläre Arbitrage nutzen lassen. Die Studie zeigt jedoch, dass reale Handelsbeschränkungen wie Gebühren, Slippage und begrenzte Liquidität nahezu alle theoretischen Chancen eliminieren und damit auf eine hohe Effizienz zentralisierter Kryptomärkte hinweisen.

In der Kategorie **Masterarbeiten** gewann die Arbeit „Private Equity's Carbon Shadow: A Difference-in-Difference Analysis of Emission Changes in Acquired Firms" von Moritz Alexander Hauschild. In seiner Arbeit untersucht der Autor erstmals umfassend, wie Private-Equity-Buyouts die CO_2-Emissionen von Industrieanlagen tatsächlich verändern. Die quantitative Studie zeigt auf, dass PE-Übernahmen kurzfristig zu höheren Emissionen führen können, langfristig jedoch Potenziale für Effizienzsteigerungen und Modernisierungen eröffnen.

Leitartikel

In der Kategorie **Dissertationen** wurde die Arbeit von Dr. Micha Bender zum Thema: „The impact of regulation on securities trading" ausgewählt. Die Arbeit untersucht, wie unterschiedliche Regulierungsmaßnahmen den Wertpapierhandel, die Marktqualität und das Verhalten von Marktteilnehmern beeinflussen. Durch die Analyse von fünf zentralen Themenbereichen liefert die Dissertation Erkenntnisse, die zum besseren Verständnis regulatorischer Effekte und zur fundierten Gestaltung zukünftiger Finanzmarktregulierung beitragen.

In der Kategorie **sonstige wissenschaftliche Arbeiten** überzeugte die Arbeit „Unobserved Performance of Hedge Funds" von dem Autorenteam Prof. Dr. Florian Weigert, Prof. Dr. Stefan Ruenzi und Prof. Vikas Agarwal, Ph.D. In der Arbeit geht es um die „unbeobachtete Performance" von Hedgefonds – also um jene Teile ihrer Rendite, die sich nicht aus den veröffentlichten Portfoliobeständen erklären lassen. Die Studie zeigt, dass diese unbeobachtete Performance ein starker Indikator für die zukünftige Fondsperformance ist und damit bislang verborgene Managementfähigkeiten sichtbar macht, die von Investor:innen oft erst mit Verzögerung erkannt werden.

Der BAI dankt allen Preisträgern und Gremiumsmitgliedern, ohne deren Mithilfe die Realisierung dieses Preises nicht möglich wäre.

Wir möchten an dieser Stelle darauf hinweisen, dass Arbeiten für den BAI-Wissenschaftspreis 2026 noch bis zum 28. Februar 2026 beim BAI eingereicht werden können.

Mehr Informationen finden Sie unter hier:
https://www.bvai.de/ueber-uns/wissenschaft

Wir wünschen Ihnen eine erkenntnisreiche Lektüre!

Roland Brooks
Koordinator des BAI-Wissenschaftspreises

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Das Gremium

Der Wissenschaftspreis wird vom BAI gesponsert und verliehen. Über die Gewinner entscheidet jedoch allein und unabhängig ein Gremium, welches sich aus sechs anerkannten Experten aus Wissenschaft und Praxis zusammensetzt.

Die Mitglieder des Gremiums sind:

Prof. Dr. Demir Bektić

Prof. Dr. Demir Bektić ist Managing Director und Head of Multi Asset Solutions im Portfolio Management der Commerzbank. Parallel zu seinem Studium der Wirtschaftsinformatik an der Universität Mannheim sammelte er bereits erste praktische Erfahrung an den Kapitalmärkten. Im Rahmen seiner Promotion über faktorbasierte Investmentstrategien an der TU Darmstadt war er zudem Gastwissenschaftler an der University of Chicago Booth School of Business. Nach weiteren Stationen im Portfoliomanagement & Trading bei Lupus alpha sowie als Portfolio Manager bei einem Single Family Office war er Executive Director und Head of Quant Fixed Income bei Deka Investment. Im Anschluss war er Director Absolute Return bei ansa capital management sowie Head of Portfolio Management beim Multi Family Office FINVIA. Er ist außerplanmäßiger Professor für Finance an der International University of Monaco. Zudem war er Gastprofessor an der University of Miami und Lehrbeauftragter an der TU Darmstadt. Er präsentiert sein Research regelmäßig auf internationalen Fachkonferenzen und bekam für eine Publikation zum Thema Factor Investing den Bernstein Fabozzi / Jacobs Levy Outstanding Article Award des Journal of Portfolio Management verliehen.

Dr. Philippe Jost

is a Managing Director and Head of Risk & Solutions. He is a member of our Responsible Investment Committee, of the Global Valuation Committee and he chairs the Risk Committee. With over 15 years of experience in the financial industry, Philippe specialized in portfolio and risk management for private assets. He has authored and co-authored several research papers in this field. Prior to joining Capital Dynamics, Philippe was a quantitative researcher at Fundo, where he developed dynamic risk management solutions for pension funds. Earlier in his career, he was a researcher at the Swiss Federal Institute of Technology, where he wrote his thesis on sparse approximation. Philippe holds a Master's degree in Communication Systems and a PhD in Signal Processing from the Swiss Federal Institute of Technology.

Prof. Dr. Mark Mietzner

ist Rektor der HTWK Leipzig. Nach seinem Studium an der Johann Wolfgang Goethe-Universität Frankfurt promovierte der Ökonom im Jahr 2008 im Bereich Finanzen mit Auszeichnung an der European Business School in Oestrich-Winkel. Im Anschluss wechselte er als wissenschaftlicher Mitarbeiter an das Fachgebiet für Unternehmensfinanzierung der TU Darmstadt, an der er sich 2017 habilitierte und die venia legendi für Betriebswirtschaftslehre verliehen bekam. Bis zu seinem Wechsel an die HTWK Leipzig war Mark Mietzner als Dekan und kaufmännischer Leiter für die Weiterbildungsprogramme der Zeppelin Universität in Friedrichshafen tätig. Dort hatte er die Professur für Bank- und Finanzwirtschaft inne und veröffentlichte zahlreiche Aufsätze in international führenden Fachzeitschriften. Im Rahmen seiner Forschung befasst er sich u.a. mit Fragestellungen aus den Bereichen Corporate Finance & Accounting, Corporate Governance sowie der empirischen Kapitalmarktforschung.

Gremium

Professor Dr. Dirk Schiereck

ist seit August 2008 Leiter des Fachgebiets Unternehmensfinanzierung an der Technischen Universität Darmstadt. Seine aktuellen Forschungsschwerpunkte an dieser führenden technischen Hochschule liegen im Bereich der (kapitalmarktorientierten) Unternehmensfinanzierung, dem Asset Management und der Digitalisierung der Finanzindustrie. Mit seinen akademischen Erfahrungen im Bereich der Kapitalanlagen wurde er Aufsichtsratsmitglied der BayernInvest und der creditshelf AG sowie Mitglied im Wissenschaftlichen Beirat des Deutschen Investor Relations Verbands, des Deutsche Kreditmarkt Standard e.V. und des Bundesverbands für Strukturierte Wertpapiere (BSW). Die Wirtschaftswoche zählt ihn aktuell zu den 30 forschungsstärksten Betriebswirtschaftlern im deutschsprachigen Raum. Bevor er an seine heutige Wirkungsstätte kam, promovierte (1995) und habilitierte (2000) er an der Universität Mannheim, baute als Inhaber des Lehrstuhls für Kapitalmärkte und Corporate Governance an der Universität Witten/ Herdecke (2000-2002) dort das Institute for Mergers & Acquisitions auf und war Professor für Bank- und Finanzmanagement an der European Business School in Oestrich-Winkel (2002-2008).

Prof. Dr. Denis Schweizer

Professor Dr. Denis Schweizer studied business administration at Johann Wolfgang Goethe-University in Frankfurt/Main and earned his doctorate in 2008 at the European Business School (EBS) in Oestrich-Winkel with a thesis on alternative investments. During his doctoral studies, he worked at the PFI Private Finance Institute/EBS Finance Academy, designing executive education programs and conducting training sessions. He also earned the Financial Risk Manager (FRM) and Certified Financial Planner (CFP) designations. In 2008, he was appointed Assistant Professor of Alternative Investments at WHU – Otto Beisheim School of Management and served as a visiting scholar at New York University in 2011. He joined Concordia University's John Molson School of Business in 2014 as an Associate Professor, becoming Full Professor in 2020. He also serves as a Research Fellow at Zeppelin University in Germany. Dr. Schweizer is the Director of the Desjardins Centre for Innovation in Business Finance and Scientific Director of the Climate Business Institute. He previously directed the Van Berkom Small-Cap Investment Management Program (2016–2019), where the $1M fund outperformed its benchmark by ~40% during the 2017–2018 period. From 2015 to 2021, he held the Manulife Professorship in Financial Planning.

Dr. Jan Tille

Seit Juli 2025 ist Dr. Jan Tille als Portfoliomanager Aktienfonds bei der Evangelischen Zusatzversorgungskasse AöR (EZVK) tätig. Zuvor leitete er ab April 2018 das Research Team der Absolut Research GmbH und befasste sich intensiv mit der Analyse liquider alternativer Anlagestrategien und Multi-Asset-Konzepten. Daneben ist er als Honorardozent im Bereich Finanzen und Kapitalmärkte an der ISM tätig sowie Practioner Fellow am Hamburg Financial Research Center. Zuvor absolvierte er sein Studium der Betriebswirtschaftslehre an der Universität Hamburg, wo er auch als externer Doktorand am Lehrstuhl für Unternehmensfinanzierung und Portfoliomanagement promovierte.

Jurymitglieder, die in ihrer beruflichen Praxis bzw. wissenschaftlichen Tätigkeit in Bezug auf eine eingereichte wissenschaftliche Arbeit in Kontakt mit dem Autor standen, waren von der Bewertung dieser Arbeit ausgeschlossen.

by Julian Wolf

Julian Wolf

Introduction

Cryptocurrencies have experienced a remarkable surge in popularity in recent years. Market revenues increased from USD 1.7 billion in 2017 to an expected USD 51.5 billion in 2024 (Statista, o. D.-b), and by now roughly one in six investors holds cryptocurrency assets (Splendid Research, 2024). Academic interest has grown in parallel: between 2018 and 2021, the number of published studies on crypto trading strategies more than doubled (Fang et al., 2022).

One potential trading strategy that has attracted attention is triangular arbitrage, a form of spatial arbitrage that exploits price inconsistencies between three trading pairs within the same exchange. Unlike cross-exchange arbitrage, this approach avoids additional transfer fees and time delays. While triangular arbitrage was historically applied mainly in foreign exchange markets, growing efficiency in FX markets has made profitable execution increasingly challenging. Prior studies (e.g., Fenn et al. (2009); Ito et al. (2020)) show that FX markets are so efficient that profitable triangular arbitrage has nearly disappeared since the mid-2000s.

In contrast, the efficiency of cryptocurrency markets remains debated. Some studies suggest rising efficiency and diminishing anomalies, whereas others continue to find evidence of mispricing, behavioral biases, or regime-dependent efficiency levels. This raises two central questions: Can a retail trader sustainably profit from triangular arbitrage in cryptocurrency markets? What does this imply for market efficiency?

The goal of this study therefore is to analyze the profitability of triangular arbitrage specifically from the perspective of a retail trader, acknowledging realistic limitations such as transaction fees, order-book depth, latency, and slippage.

Triangular Arbitrage

Triangular arbitrage occurs when the quoted exchange rates between three currency pairs become temporarily inconsistent, allowing a trader to cycle through the currencies and end up with more of the initial asset. Formally, the strategy evaluates the *rate product*

$$Y(t) = \prod_{i=1}^{3} r_i(t), \tag{2.1}$$

where each $r_i(t)$ represents the relevant bid or ask exchange rate at time t. An arbitrage opportunity exists whenever

$$Y(t) > 1, \tag{2.2}$$

indicating that converting an initial amount through all three legs of the cycle yields a larger end value. In this study, the following cycle is examined:

$$USDT \rightarrow BTC \rightarrow LTC \rightarrow USDT.$$

The computation uses ask prices for the first two trades and the bid price for the final conversion, ensuring that the correct trading direction is reflected. Although the mathematical structure is straightforward, exploiting such opportunities in practice requires that the implied profitability exceeds transaction fees, slippage, and the liquidity constraints present in the order book.

Data and methodology

To evaluate both the existence and the practical exploitability of triangular arbitrage in cryptocurrency markets, this study constructs a high-frequency dataset based on real-time order book information from the Binance exchange. The data were collected over a one-week period, from June 3 to June 9, 2024, using Binance's WebSocket interface, which provides continuous updates of best bid and best ask prices as well as the corresponding available quantities for each trading pair. For the triangular cycle USDT–BTC–LTC–USDT, every update in any of the three legs triggers a new calculation of the triangular rate relationship, resulting in a dataset of more than 30 million observations.

Because potential arbitrage profits in high-frequency settings are highly sensitive to latency, the physical location of the server plays a crucial role. Initial tests using a European server indicated round-trip times of approximately 80 ms, whereas relocating the trading script to a Tokyo-based server reduced latency to roughly 4 ms. Since Binance's matching engine is assumed to operate in East Asia, the analysis relies on this low-latency environment to approximate realistic trading conditions.

To ensure that identified arbitrage opportunities are feasible in practice, the methodology incorporates order book depth by determining the maximum quantity that could realistically be executed across the three

trading legs. This prevents overstating potential profits and reflects the actual liquidity available at quoted prices. The empirical framework then gradually introduces real-world trading frictions, including transaction fees, limited liquidity at the top of the order book, and slippage caused by rapid price movements. This stepwise approach makes it possible to distinguish between purely theoretical arbitrage opportunities and those that remain profitable once practical constraints are taken into account, ultimately providing a comprehensive assessment of arbitrage exploitability and market efficiency.

Main findings

The analysis identifies a total of 4,879 triangular arbitrage opportunities during the one-week observation period. Although such a number suggests frequent short-term inefficiencies within cryptocurrency markets, a closer look at return magnitudes, duration, liquidity, and trading costs reveals that only a very small subset of these opportunities is exploitable in practice.

Figure 1 illustrates the time series of all exchange rate products that exceed the profitability threshold Y > 1 (*before applying transaction costs*). Most deviations above 1 occur only briefly and with very small amplitudes, indicating that although price inconsistencies arise, they tend to correct quickly. The majority of observations cluster just above the threshold, while larger deviations are extremely rare.

Figure 1 – Time series for the exchange rate product for Y > 1
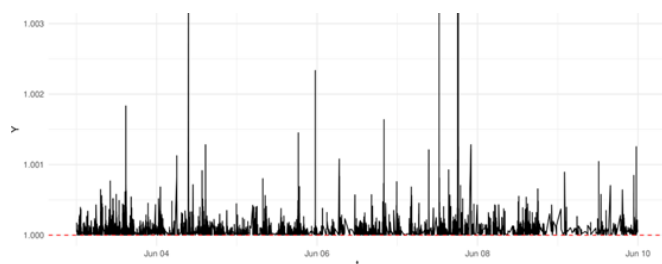
To further characterize these opportunities, Table 1 summarizes their distribution by return buckets, duration, and tradable value. Approximately 89% of all opportunities yield raw returns between 0% and 0.025%, and only three instances exceed 0.5%. Similarly, around two-thirds of all opportunities last less than one second, with many appearing and disappearing within milliseconds. While some arbitrage windows persist for several seconds, these tend to offer lower returns and are typically accompanied by limited order book depth.

Table 1 – Distribution of arbitrage opportunities by return, duration, and tradable value

Category	Count	Share
Return (%)		
0.000–0.025	4,337	88.9%
0.025–0.050	371	7.6%
0.050–0.100	111	2.3%
0.100–0.500	57	1.2%
>0.500	3	0.1%
Duration (seconds)		
0.000–0.500	2,825	57.9%
0.500–1.000	322	6.6%
1.000–2.000	440	9.0%
2.000–5.000	525	10.8%
>5.000	767	15.7%
Tradable value (USD)		
0–1,000	1,636	33.5%
1,000–3,000	1,980	40.6%
3,000–5,000	831	17.0%
>5,000	432	8.9%

After transaction costs are introduced, the number of profitable arbitrage opportunities drops sharply. For a regular Binance user, only 18 of the 4,879 identified opportunities remain profitable after accounting for the exchanges taker fees. Even for traders, who face the lowest available fee tier, just 150 opportunities yield a positive net return. Moreover, order book depth significantly limits the quantities that can be traded: for retail traders, the average executable value is approximately $4,071, resulting in total net profits of only $12–$18 for the entire week.

Conclusion

The analysis shows that even though triangular arbitrage opportunities occur frequently in cryptocurrency markets, almost none can be profitably exploited once real-world trading frictions are taken into account. Transaction fees, limited order book depth, slippage, and latency reduce virtually all identified opportunities to zero or negligible returns, especially for retail traders. These findings indicate that centralized cryptocurrency exchanges, such as Binance, operate with a surprisingly high degree of practical efficiency. The study therefore highlights that apparent price discrepancies alone are not sufficient to conclude true market inefficiencies.

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Splendid Research, 2024. Studie Kryptowaehrung 2024 | Splendid Research. Studie, Splendid Research GmbH.

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Private Equity's Carbon Shadow: A Difference-in-Difference Analysis of Emission Changes in Acquired Firms

from Moritz Alexander Hauschild

Moritz Alexander Hauschild

Introduction

Private equity (PE) has evolved into a central force shaping strategic and operational decisions across a wide range of industries. As PE funds expand their presence in emissions-intensive sectors such as power generation, chemicals, and manufacturing, questions arise about how their ownership affects the environmental performance of portfolio companies. In an era of heightened scrutiny from regulators, institutional investors, and the public, understanding how PE buyouts influence greenhouse gas emissions has become an increasingly important empirical and policy-relevant task. Yet, despite this relevance, systematic evidence remains scarce. Private companies face fewer disclosure requirements than public corporations, leaving significant gaps in available emissions data.

The introduction of the U.S. Environmental Protection Agency's Greenhouse Gas Reporting Program (GHGRP) has changed the data landscape in the United States. The GHGRP provides detailed annual CO_2 emissions for large industrial facilities, enabling researchers to track emissions at the physical sites where they occur. These facility-level records, combined with proprietary ownership and transaction data, create a new opportunity to study the environmental consequences of PE ownership through reliable, standardized, and regulatory reporting.

The thesis leverages this opportunity by linking GHGRP facilities to private equity transactions to examine whether emissions rise or fall following buyouts. Beyond studying total emissions, it evaluates revenue-scaled and electricity-scaled intensity metrics to identify efficiency trends and investigates capital expenditures as a potential mechanism for long-term changes. By adopting a causal framework rather than relying on descriptive correlations, the study contributes to a more accurate understanding of private equity's role in shaping emissions trajectories and offers insights into the timing and nature of environmental adjustments under PE ownership.

Data Basis

The empirical analysis relies on a merged dataset that integrates facility-level emissions, ownership histories, and financial characteristics. GHGRP data form the foundation, offering annual CO_2 emissions for large U.S. facilities across multiple high-emission sectors (US EPA, 2024). Since reporting is mandatory for facilities exceeding regulatory thresholds, the data provide consistent and reliable measures of direct operational emissions, free from the biases often present in voluntary ESG disclosures.

To connect emissions to private equity ownership, detailed transaction data from Pitchbook are incorporated (Pitchbook, n.d.). These data include buyout dates, ownership structures, sponsor identities, and firm-level attributes. Creating the link between GHGRP facilities and Pitchbook portfolio companies required extensive matching using facility names, corporate parents, subsidiary structures, and location information. Once matched, it becomes possible to observe the exact year in which a facility's parent company was acquired by a private equity fund.

Financial variables from LSEG Workspace complement the dataset by supplying annual figures for revenues, capital expenditures, and other firm-level metrics necessary for constructing intensity ratios and evaluating investment behavior (LSEG, n.d.). Since facility-level financial statements are unavailable, company-level financials are assigned to facilities once the ownership match is established. This integrated dataset spans the years 2010 to 2022, allowing for long pre- and post-buyout observation windows. It includes observations from a broad cross-section of facilities in industries with substantial emissions footprints - particularly in the oil and gas sector (*see Figure 1*). Additionally, the set incorporates a separate subsample of electricity-generating units to assess emissions intensity relative to power output.

Overall, the dataset merges regulatory rigor with financial and transactional detail, enabling an analysis that assesses environmental outcomes at the granular level while maintaining a consistent connection to the ownership events that may influence them.

Figure 1: Industry Distribution in the Sample

Facility Type	Control Group	Treatment Group	Total
Chemicals	14	14	28
Chemicals, Industrial Gas Suppliers	14	14	28
Metals	28	14	42
Natural Gas and Natural Gas Liquids Suppliers	196	42	238
Petroleum and Natural Gas Systems	2114	1050	3164
Power Plants	2296	1288	3584
Pulp and Paper	154	28	182
Pulp and Paper, Waste	28	14	42
Waste	140	182	182
Other	350	84	434
N	5334	2590	7924

Methodology

To identify the causal effects of private equity ownership on emissions, the study employs a staggered Difference-in-Difference (DiD) framework based on Callaway and Sant'Anna (2021) to calculate the group-time Average Treatment Effect on the Treated or ATT(g,t). This methodology addresses the challenge that buyouts occur at different times for different firms. Traditional DiD models can produce biased estimates in such settings because they inadvertently compare units that were treated at different times. The staggered approach mitigates this issue by constructing treatment and control groups within each cohort of facilities that are acquired in the same year.

A facility is considered treated from the year its parent company undergoes a private equity buyout. All subsequent emissions observations count as post-treatment. Facilities that are never acquired act as controls. The staggered design allows for the estimation of dynamic treatment effects across event time and supports tests for pre-treatment parallel trends, which constitute a key identifying assumption of DiD models. To further enhance causal credibility, facility fixed effects control for time-invariant characteristics and year fixed effects account for macroeconomic and regulatory shocks.

The analysis focuses on four outcomes. Absolute CO_2 emissions assess the total environmental impact of a facility (*Reg I: ln(CO2 Emissions)*). Emissions intensity relative to revenues serves as an economic efficiency measure (*Reg II: CO2 Emissions/Revenue*), while emissions intensity relative to electricity output offers a physical measure for power-generating sites (*Reg III: ln(CO2 Emissions/Electricity)*). Capital expenditures capture long-term investments that may influence emissions by upgrading equipment or improving operational efficiency (*Reg IV: Capital Expenditures*). Event-study estimates enable visual and statistical evaluation of how these outcomes evolve before and after the buyout (*see Figure 2*). Several robustness checks ensure that the results are not driven by outliers, missing data, or industry composition.

This methodological setup offers a credible approach to disentangling the causal effects of PE buyouts from contemporaneous trends, providing insight into how ownership changes affect emissions at the level of the facility.

Results

The central finding is that private equity acquisitions lead to a substantial increase in absolute CO_2 emissions. On average, emissions rise by approximately forty-one percent over the five years following a buyout. The upward trend emerges in the first year after acquisition and strengthens over time, indicating that the early phase of PE ownership is associated with operational adjustments that increase emissions. This pattern is remarkably consistent across multiple model specifications and robustness exercises, suggesting that the observed increase is not an artifact of data construction or industry composition but a genuine consequence of ownership change.

In contrast, the study detects no statistically significant improvements in emissions intensity in the short or medium term. When emissions are scaled by revenues or electricity output, the intensity measures remain largely unchanged during the first years following a buyout. This absence of improvement implies that rising emissions are not matched by proportional increases in efficiency, reinforcing the view that operational expansion or increased utilization plays a central role in driving emissions upward (Lerner, 2011). Toward the later years of the holding period, intensity coefficients begin to show modest downward tendencies, although their statistical significance remains limited.

A clearer trend emerges in the analysis of capital expenditures. Capital expenditure (CapEx) levels rise noticeably beginning around the fourth year of PE ownership. This pattern suggests that private equity investors tend to focus on operational adjustments and output enhancement in the early years and delay large modernization or efficiency-related investments until later in the holding cycle. Because these investments often require substantial capital, they are timed after initial strategic assessments and operational reorganizations. The fact that the slight improvements in emissions intensity coincide with increased CapEx supports the interpretation that efficiency gains stem from later-stage investment activity rather than immediate post-acquisition changes. Across industries, the general pattern remains similar. Emissions rise following buyouts, though the magnitude and intensity trends differ. Power generation facilities show somewhat clearer long-term intensity improvements, reflecting the capital-intensive nature of generation efficiency. Chemicals and manufacturing show particularly strong increases in absolute emissions and weaker long-term efficiency trends. Despite these differences, the overall conclusion is consistent across sectors: PE buyouts tend to increase emissions substantially and only occasionally produce delayed efficiency improvements.

Figure 2: Average Treatment Effect on the Treated (ATT) of a PE-Buyout
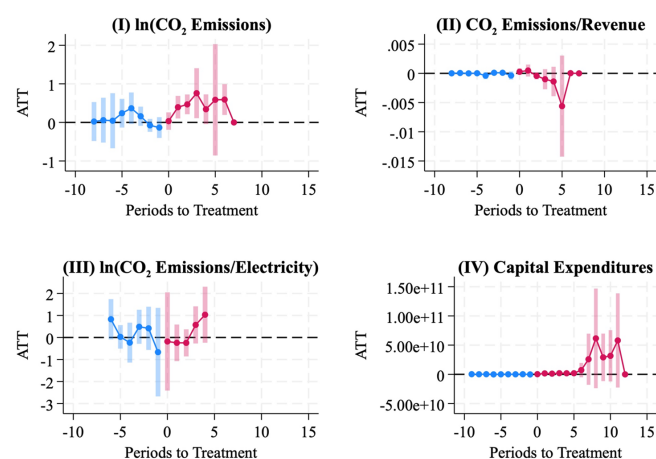
Interpretation and Implications

The findings portray a complex relationship between PE ownership and environmental performance. The immediate rise in emissions suggests that private equity firms prioritize operational scaling and efficiency of production processes in a financial sense rather than improvements in environmental efficiency. Increasing utilization, consolidating production activities, or expanding throughput appear to be common strategies that elevate emissions in the short run (Cohn et al., 2022). These operational changes contribute to financial performance but impose environmental costs that become visible through higher emissions levels.

The later emergence of capital-intensive investments indicates that PE firms eventually engage in modernization efforts. These investments may be driven by economic incentives, regulatory requirements, or preparations for exit. Their timing suggests that PE investors evaluate the economic viability of large environmental or technological upgrades before committing substantial capital to them. Efficiency improvements resulting from these investments therefore appear only toward the end of the holding period and are not guaranteed to reverse the earlier rise in emissions.

For policymakers and investors, the results have important implications. They highlight the need to examine environmental performance across the entire PE ownership cycle rather than focusing solely on final outcomes. Early-stage emissions increases may conflict with short-term climate goals even if long-term improvements occur. Investors integrating ESG considerations into their decision-making processes should be aware that PE-driven operational improvements may come with environmental trade-offs. Monitoring emissions patterns and investment behavior over time becomes crucial for assessing whether PE ownership supports or hinders decarbonization in emissions-intensive sectors.

Outlook

The study raises important questions for future research. Differences among private equity firms, varying investment strategies, the influence of sustainability mandates, and the potential for emissions performance post-exit all represent promising avenues for further investigation. As data availability improves, particularly regarding indirect emissions, researchers will be able to explore a more comprehensive picture of private equity's environmental impact. Understanding these dynamics will be crucial as policymakers and investors seek to align financial markets with global decarbonization goals.

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from Dr. Micha Bender

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Introduction and Motivation

Financial market regulation has become a central pillar of modern economic systems, shaping the functioning of securities trading and safeguarding the stability of global markets. Over the past decades, regulatory interventions such as MiFID, MiFID II, and RegNMS have profoundly transformed the structure, transparency, and competitive dynamics of trading venues. Yet, despite their importance, research on the effects of financial regulation continues to face notable challenges. Regulatory impact assessments often rely on structured and easily quantifiable data, while many of today's policy measures increasingly generate unstructured information—leaving an important gap in the academic understanding of regulatory outcomes. Moreover, regulators' attempts to promote market integrity, reshape trading incentives, or alter investor behavior frequently interact with technological change, raising questions about their broader implications for market quality and price formation.

The goal of the dissertation is to advance the understanding of how regulatory actions influence securities trading, market structure, and market quality. Across five studies, the dissertation examines the effects of key regulatory measures—ranging from policy interventions generating unstructured disclosures to the soft-commission ban, fragmentation dynamics, index rule changes, and the rising importance of closing auctions. Together, these studies contribute to a more nuanced understanding of regulatory mechanisms, their intended and unintended consequences, and their role in shaping modern financial market ecosystems.

Regulation, Unstructured Data, and the Foundations of Regulatory Impact Assessment

The first study investigates how the impact of regulatory actions can be measured when these actions lead to or rely on unstructured data. While Regulatory Impact Analysis (RIA) is widely used to evaluate the effects of policy interventions, existing frameworks predominantly emphasize structured data environments. As regulatory reporting, disclosure obligations, and textual transparency requirements continue to grow, traditional tools fall short in capturing the effects of rules that generate large volumes of unstructured information.

Responding to this gap, the study develops a novel framework that integrates natural language processing and text analytics for the systematic assessment of regulatory outcomes. Using MiFID II's requirements for best-execution disclosures as an empirical application, the analysis demonstrates how techniques for benchmarking and automated text processing can evaluate whether regulations achieve their intended goals. The findings reveal that MiFID II's intervention—designed to enhance comprehensibility and informativeness—did not successfully improve best-execution policies, underscoring the need for more sophisticated regulatory design when targeting disclosure quality.

This essay contributes to the emerging field of RegTech by providing one of the first methodological frameworks that enables regulators and researchers to evaluate the consequences of rules generating unstructured data. It further highlights how automated assessment techniques enhance evidence-based policymaking in complex and data-rich regulatory environments.

The Economics of Soft Commissions: Market Effects and the Impact of MiFID II

Soft commissions represent one of the most debated mechanisms in securities trading due to the conflicts of interest they may introduce between brokers, investment managers, and end-investors. The second study of this dissertation reviews and synthesizes the existing literature on soft commissions and analyzes the implications of MiFID II's requirement to unbundle research and execution services. Historically, bundling emerged as a way to compete under fixed-fee schedules, yet concerns regarding transparency, excessive trading, and investor harm have long motivated regulatory scrutiny.

The study provides a comprehensive categorization of soft-commission research and uncovers a consistent pattern: soft commissions tend to produce negative outcomes for end-investors by distorting incentives and obscuring true trading costs. The analysis further emphasizes the need to understand MiFID II's broader effects on fund performance, transaction costs, and investor welfare—issues that remain insufficiently explored despite the regulation's far-reaching consequences.

By offering the first systematic review of soft-commission practices and their regulatory implications, this essay establishes a foundation for future empirical research and supports global debates on the optimal design of research-funding mechanisms.

Fragmentation in Securities Trading: Drivers and Effects on Market Quality

The third study analyzes the rise of securities-trading fragmentation—a development spurred by both regulatory intervention and technological innovation. While prior empirical research generally shows that fragmentation enhances liquidity for large and liquid stocks, significantly less is known about its implications for smaller or less actively traded securities.

Using a rich market-wide dataset, the study identifies stock-specific drivers of fragmentation and examines how fragmentation affects market quality across different segments of the market. The findings reveal that fragmentation improves liquidity metrics—such as bid-ask spreads, market depth, and order-book balance—not only for large-cap stocks but also for many smaller stocks. However, the analysis also uncovers firm-size and trading-activity thresholds that shape when fragmentation becomes beneficial. These insights highlight that regulatory discussions must account for heterogeneous effects across market segments, particularly in the context of the Capital Markets Union and ongoing reviews of MiFID II.

This study expands the literature by demonstrating that fragmentation's benefits extend beyond blue-chip stocks while identifying important boundary conditions relevant for regulators, market operators, and SME issuers.

Index Rule Changes, Market Expectations, and the Dynamics of Price Discovery

Index providers play an increasingly influential role in global markets as passive investment strategies grow in scale. The fourth study explores how changes in index rules—rather than mere index constituent changes—impact stock prices, trading activity, and market quality. While extensive literature documents the effects of index inclusions and deletions, far less is known about how amendments to the underlying rules shape market expectations and investor behavior.

The study shows that announcements of stricter or more transparent index rules generate positive abnormal returns and increased trading activity for affected constituents. This reaction reflects improved perceptions of index integrity, attracting capital inflows and altering market dynamics. At the same time, the analysis highlights heterogeneous effects across stock groups: incumbents face reduced liquidity, while prospective joiners experience favorable trading conditions.

This study is among the first to document the market effects of index rule modifications, contributing to a deeper understanding of how index governance shapes asset-pricing and liquidity outcomes.

Closing Auctions, Liquidity Concentration, and the Changing Landscape of Price Discovery

The fifth study examines one of the most significant structural shifts in modern equity markets: the dramatic rise in closing-auction volumes. While earlier studies focused on the introduction of closing auctions—when volumes were comparatively small—today's auctions account for 20% to 40% of daily trading volume in Europe, driven by MiFID II, index-tracking strategies, avoidance of high-frequency trading, and liquidity-migration effects.

The study uncovers that high-volume closing auctions systematically distort closing prices, generating persistent overnight reversals. Moreover, high auction shares reduce intraday liquidity even outside the auction window, though they are associated with lower volatility. These findings revise earlier views that closing auctions have uniformly positive effects and underscore that their impact depends on their relative weight in overall trading activity. This study contributes new evidence on how liquidity concentration at the close reshapes trading costs, execution quality, and the informational environment of equity markets.

Conclusion

The findings of the dissertation demonstrate that financial regulation exerts complex and heterogeneous effects on market behavior, trading mechanisms, and price formation. By addressing key research gaps—including the evaluation of unstructured data, the consequences of soft-commission practices, the drivers of fragmentation, the role of index rule changes, and the rising dominance of closing auctions—this dissertation advances the understanding of regulatory impacts on modern securities markets.

Collectively, the studies highlight the importance of evidence-based regulation, the need for nuanced assessments across different market segments, and the necessity of integrating technological considerations into future regulatory design. They also provide actionable insights for regulators, market operators, index providers, exchanges, institutional investors, and policymakers navigating an increasingly complex financial ecosystem.

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by Prof. Dr. Florian Weigert, Prof. Dr. Stefan Rünzi & Prof. Dr. Vikas Agarwal

Introduction and Background

Hedge funds have become a major force in financial markets, yet identifying truly skilled hedge fund managers remains challenging. Unlike mutual funds, hedge funds operate with less transparency and lighter regulation, making it hard for investors to distinguish skill from luck. Traditional approaches either analyze reported returns (which can be driven by various risk exposures) or rely on quarterly stock holdings – each approach giving an incomplete picture.

In our paper Agarwal, Ruenzi, and Weigert (2024), we introduce a novel performance metric called Unobserved Performance (UP) to better capture hedge fund manager skill. The idea is to combine what we learn from both returns and holdings: essentially, UP measures the risk-adjusted return a fund earns beyond what its disclosed equity holdings would predict. By comparing a hedge fund firm's actual gross returns to the returns of its reported stock portfolio, UP isolates the value added (or subtracted) by everything the fund does that we cannot directly observe – such as short positions, derivatives, intra-quarter trades, and any other hidden actions. A positive UP means these actions are paying off, whereas a negative UP implies the fund's private actions are actually hurting performance.

The "Unobserved Performance" Measure

Formally, UP is defined as the difference between a hedge fund firm's reported gross return and the hypothetical return of its disclosed long equity holdings, after adjusting for various risk factors. In practice, we essentially calculate the return an investor would get by simply holding the stocks that a hedge fund reports in its quarterly filings (13F filings in the U.S.), and then compare this to the fund's actual return. Any superior performance beyond the stock portfolio's return is "unobserved" by looking at holdings alone – and is hence called Unobserved Performance. Our analysis covers an extensive dataset of equity-focused hedge fund firms from 1997 to 2017, using a nine-factor model to adjust for market risks (equity, bond, currency, etc.) so that UP represents pure alpha from hidden sources.

Crucially, UP can only be measured at the hedge fund firm level (aggregating if a firm runs multiple funds), because individual hedge funds are typically not reporting holdings, but hedge fund firms beyond certain size limits have to disclose their holdings on the hedge fund firm level.

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Key Findings from the Study

Our main result is that UP is highly effective in predicting future hedge fund performance. Hedge fund firms with higher UP in the past continue to outperform those with lower UP going forward. Below are the key takeaways from our paper:

- Strong Performance Predictability: Funds with high UP subsequently earn significantly higher risk-adjusted returns than those with low UP. The spread in future performance between the top-ranked and bottom-ranked UP firms is about 6.36% per year (annualized alpha). This difference is economically and statistically significant. In fact, UP is a better predictor of future hedge fund success than traditional measures like a fund's past returns or the past performance of its disclosed holdings as well as other performance predictors suggested in the literature like the strategy distinctiveness index or a hedge fund's R2.

- Funds that have high UP measure tend to engage in more active and complex trading strategies. For instance, high-UP funds trade more frequently within each quarter, use derivatives (such as options), engage in short selling, and are more likely to file confidential holdings with the SEC. These activities can generate extra returns beyond the static long-equity portfolio. These findings suggest that skilled managers are able to outperform through informed trading, security selection on the short side, and other trading activities that aren't captured by quarterly stock holdings alone.

- **Persistence and Limited Investor Attention:** The performance gap identified by UP is persistent – it tends to last for several years. A strategy of buying high-UP funds and shorting low-UP funds continues to deliver abnormal returns for up to 2–3 years into the future. This gives rise to the question, why these alphas persist and investors do not quickly direct so much money into those funds that they will find it impossible to continue their outperformance in equilibrium. We document that this long-lasting effect can be largely explained by limited investor attention: many investors overlook or only slowly recognize the importance of the UP signal. Essentially, hedge fund investors often chase funds with good past returns, but they may not be dissecting whether those returns simply came from market bets or from genuine manager skill. UP provides that insight, but if most investors ignore the holdings-based analysis, the few who pay attention can benefit longer. Only after the superior performance materializes for some time more investors start to direct flows to the respective funds, at which point the advantage diminishes. In fact, our findings show that for funds where holdings information is more closely followed by investors (as measured by the download frequency of the respective filings), the predictive power of UP fades faster – confirming that when more people pay attention, it becomes harder to capitalize on UP.
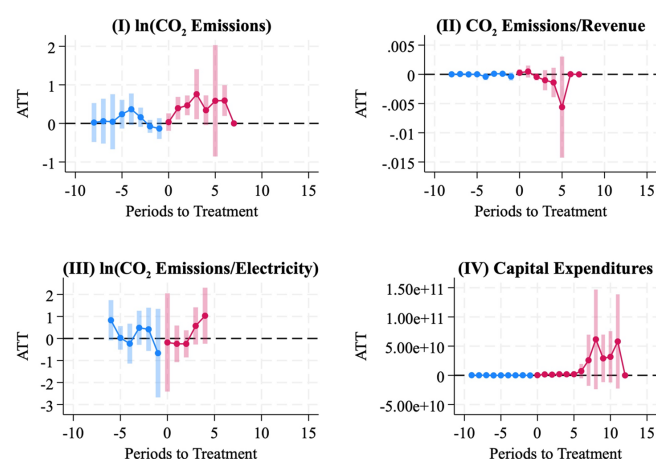
firms with top-quintile UP and hypothetically could have sold short those in the bottom-quintile of UP would have enjoyed substantial gains. By the end of 2017, $1 invested in this UP-based strategy would have grown to about $3.10, much more than the $1.47 or $1.22 from comparable strategies based on past gross returns or past equity-holdings performance, respectively. This highlights that UP not only works in theory but would have yielded more than double the wealth of conventional manager selection approaches over two decades. Even if one were restricted to just investing in the high-UP funds (without shorting the low-UP ones), we still document that one could have earned returns clearly above the hedge fund average.

Digging deeper, we also examine how hedge funds' activities change once they attract investor money. We find that large inflows can erode a fund's unobserved performance advantage. When a high-UP fund grows in size due to new investments, it often cannot scale its profitable trading strategies proportionally. For example, heavy inflows tend to increase trading costs and reduce the fund's agility in strategies like rapid trading, shorting, or options use. This leads to diseconomies of scale – the very techniques that generated high UP become harder to execute with more capital. Consequently, the predictive power of UP for future performance weakens sooner for funds that get big fast. This finding aligns with the classic theory of Berk and Green (2004) that investor flows eventually compete away abnormal performance, but here the process is gradual.

Implications for Investors

Our findings are relevant for institutional investors by showing that UP is a promising tool to identify hedge fund managers who truly add value. A high UP suggests that a manager is doing something right behind the scenes – be it skillful market timing, effective use of leverage/shorts, or superior information – which is translating into positive alphas. Incorporating a metric like UP into the manager selection process would have given investors a clear advantage in picking funds that are likely to outperform in the future.

Also, quickly reacting to UP can pay off, as funds with high UP will eventually see their outperformance recognized by the market. The fact that UP's predictive power endures even after accounting for real-world frictions (like lock-up periods and the inability to short hedge funds directly) is encouraging. It suggests that an UP-based investment strategy could be implementable in practice.

At the same time, investors should be mindful of the capacity constraints highlighted by our study. If you are allocating capital to

- **Long-Term Economic Gains:** The figure shows that an investor who in 1997 dedicated capital to a portfolio of hedge fund

a high-UP fund, be aware that significant inflows (possibly including your own capital and that of other investors) could dilute that fund's edge. In other words, today's star fund might struggle to repeat its success if it becomes too large too fast – not because the manager lost skill, but because the strategies that drove their past performance don't scale indefinitely. This calls for ongoing monitoring: a fund that was high-UP may see its UP decline after asset growth, so the metric should be tracked over time, not just used once.

In summary, Unobserved Performance offers a new tool to evaluate hedge funds. It captures the hidden side of performance that conventional metrics miss, and in doing so, it reliably points investors toward managers with superior skill. For institutional investors in particular – who often have access to detailed fund data and longer investment horizons – UP could become an essential part of the toolkit. By paying attention to a fund's "unobserved" performance (and not just its visible returns), investors can make more informed allocation decisions and potentially boost their portfolio's alpha.

Sources:

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