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Article

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Do ETFs Undermine Takeover Success? Evidence from German Takeover Offer Outcomes

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Abstract Passive exchange-traded funds (ETFs) mechanically replicate the indices they track and therefore lack discretion in responding to takeover offers. Unlike other shareholders, they cannot weigh the benefits and risks of the offer; their ability to tender shares depends entirely on index providers' decisions during the offer period. Using a large sample of German takeover offers, this study documents that passive ETF ownership has a two-sided effect on offer success. First, when no index adjustments occur, ETFs are unable to tender their holdings, producing a significantly negative baseline effect on offer outcomes. A one-percentage-point increase in pre-offer passive ETF ownership reduces the fraction of shares acquired by 5.93 percentage points in the full sample and by 8.03 points for control-taking offers with a bidder toehold below 30%. Second, when index providers adjust the target's index weight during the acceptance period—either through ordinary or extraordinary revisions to the stock's weight or through its entire removal from the index—ETFs are forced to divest. These downward adjustments positively affect offer success, especially when combined with a positive target management recommendation: For indices maintained by Deutsche Börse AG, downward revisions significantly mitigate the negative baseline effect in the subsample of control-taking offers and fully offset it in the full sample.

Keywords M&A · Success Determinants · Ownership Structure · Index Fund · ETF

JEL classification G11, G18, G23, G32, G34

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“The interests of fund managers and shareholders are often not aligned. The managers may be passive, but the consequences are anything but.”

John C. Bogle, *The Clash of the Cultures: Investment vs. Speculation*.

1 Introduction

When a bidder initiates a public takeover offer, shareholders of the target firm are expected to evaluate the bid terms and decide whether to tender their shares. Passive investors, most notably passive exchange-traded funds (ETFs), lack discretion in this process. By design, they replicate the composition of a reference index and adjust their holdings mechanically in response to index-weight changes. Consequently, their behavior is decoupled from any fundamental assessment of the offer. This study documents that the increasing presence of passive ETFs among target shareholders has substantial implications for takeover outcomes and, more broadly, for the functioning of the German market for corporate control.

ETFs are financial vehicles that aim to replicate the performance of specific stock market indices; they are listed and traded intraday on major exchanges. Over the past decade, they have become a key investment for institutional investors. Global ETF assets under management (AuM) grew from USD 2.4 trillion in 2013 to USD 11.5 trillion in 2023.¹ In Germany, ETFs held approximately 24% of DAX constituents in 2022, with providers such as Vanguard and BlackRock holding 5.8% and 4.8%, respectively.² While existing academic literature predominantly examines the role of ETFs in corporate governance via the “voice” channel—proxy voting and engagement (e.g., Appel et al. 2016; Bebchuk & Hirst, 2019a)—this study focuses on its impact on the takeover process and the “exit” channel. Research on the role of ETF ownership in the market for corporate control is scarce. Analyzing the impact of exogenous changes in ownership structure on corporate governance, Schmidt and Fahlenbrach (2017) find that increases in passive fund ownership decrease bidder announcement returns. Specific studies on the role of passive ETFs as target shareholders remain absent.

Our study aims to fill this gap. Using a large sample of 491 regular and 193 control-taking takeover offers³ in Germany between 2004 and 2024, we document significant effects of passive ETF ownership on the success of takeover offers:

- **Negative baseline effect:** A one percent increase in pre-offer passive ETF ownership reduces the percentage of shares⁴ gained in the offer by 5.93 percentage points in the full sample (8.032 points for control-taking offers).

¹ ETFs 2028: Shaping the Future, PWC 2024.

² S&P Global and DIRK 2023, Who owns the German DAX?, p. 11, 12.

³ We define control-taking offers along § 29 Section 2 of the German takeover code as offers with a bidder's toehold below 30%.

⁴ Our study measures target ownership stakes as a percentage of the shares not under bidder's control (instead of all outstanding shares). This allows for a straightforward interpretation of regression coefficients. See Section 3.2. for details.

- **Index-adjustment effect:** As investment/divestment of passive ETFs is exclusively dependent on index revisions, takeover outcomes depend critically on changes to the target stock's index weight during the acceptance period. Tracking adjustments by Deutsche Börse AG, we document a significant positive effect of downward adjustments, mitigating the negative baseline effect of ETF ownership. Especially when combined with target management supporting the offer, the index adjustments significantly reduce (subsample control taking offers) or even fully offset (full sample, all offers) the negative baseline effect.

Notably, the negative impact of passive ETF holdings exceeds their ownership stake: a 1% passive ETF share generates a disproportionately large reduction in shares tendered. This suggests indirect effects through investor coordination and strategic behavior by market participants. Hedge funds frequently accumulate positions in targets with high passive ETF ownership, speculating on offer-price increases or higher settlement in judicial appraisals following a subsequent domination agreement and/or a squeeze-out (Dobmeier et al. 2020). Thus, as the presence of passive ETFs may trigger additional trading by other market participants, even smaller ETF stakes in the target's shares may yield a significant impact on the outcome of the offer. A prominent example is the 2017 takeover attempt by Bain Capital and Cinven for STADA Arzneimittel AG. Despite a lowered acceptance threshold from 75% to 67.5%, the conditional offer initially failed (65.5% acceptance), partly due to the 7.6% ETF stake and subsequent hedge fund engagement after the offer announcement.⁵ A renewed offer with an increased premium and a reduced threshold eventually succeeded.

We also investigate changes in ETF holdings during the acceptance period and find substantial divestment: the number of ETFs invested in the target, their aggregate ownership, and their average individual holdings all decline. For Deutsche Börse AG indices, these adjustments are closely linked to downward index-weight revisions.⁶

The German legal environment is well-suited for studying the impact of increasing ETF ownership on the market for corporate control. Gaining complete control of a target typically requires a Domination and Profit and Loss Transfer Agreement (DPLA), which requires a 75% majority vote, while squeeze-outs require 90% or 95% ownership, depending on the legal mechanism (§ 62(5) UmwG or § 327a AktG). Therefore, control-taking offers target specific ownership thresholds, meaning that even small ETF holdings, especially when combined with hedge fund activities, can

⁵ See "Das Drama um Stada: Warum ETF Übernahmen immer schwieriger machen" (Lindner 2017).

⁶ We find approximately 22% of targets in both samples which are constituents of the corresponding indices, to be completely removed from the index during the acceptance period. For example, during KKR's takeover offer for Axel Springer SE, the free float of the target company fell below the threshold of 5%, resulting in the removal from the German MDAX index (Handelsblatt 2019; Deutsche Börse AG Group 2019).

⁷ The conditional offer of Vonovia AG for Deutsche Wohnen AG in June 2021 failed to meet the minimum acceptance threshold because hedge funds accumulated shares during the acceptance period and blocked the transaction. See Deutsche-Wohnen-Kauf geplatzt: Hedgefonds schuld an Fusions-Aus, *Wirtschaft v.* 27.06.2021.

preclude a successful offer.⁷ As a result, the German market for corporate control is particularly exposed to passive ETFs' effects.

We further control for established determinants of offer success, such as premiums, toeholds, and board support. We employ instrumental-variable (IV) regressions to address potential endogeneity in ETF ownership, and our findings remain robust across alternative specifications, including subsamples restricted to ETFs tracking Deutsche Börse indices and logit regressions for binary outcomes. Our results have important implications: increasing passive ETF ownership weakens the disciplinary effectiveness of the market for corporate control. To compensate for this effect, bidders must actively seek index-weight reductions during the offer period. Moreover, this effect may extend to offer deterrence, implying that some bids may not be initiated, meaning our estimates likely understate ETFs' full impact on takeover activity.

This study makes several contributions: First, it provides the first empirical evidence on passive ETFs' effect on takeover outcomes from the target perspective, complementing Schmidt and Fahlenbrach (2017) on the bidder's ownership structure. Second, we contribute to the literature on M&A determinants, particularly the role of shareholder composition and passive ownership (Köke 1999; Kobayashi 2007; O'Sullivan and Wong 1999; Ferreira and Matos 2008; Achleitner et al. 2013). Third, we highlight the institutional features of the German takeover regime and demonstrate how passive investment intersects with control thresholds and investor activism.

The remainder of this paper is organized as follows: Section 2 provides an overview of ETF ownership, corporate governance, and the market corporate control in Germany. Section 3 presents data and variable definitions. Section 4 reports baseline results and extensions. Section 5 addresses endogeneity concerns. Section 6 presents robustness checks. Section 7 concludes the paper.

2 ETF Ownership and the German Market for Corporate Control

2.1 ETF Ownership and Corporate Governance

Research on corporate governance distinguishes two primary channels of shareholder influence: "exit" (selling shares or threatening to do so) and "voice" (engagement and voting) (Shleifer and Vishny 1997; Broccardo et al. 2022). For passive ETFs, the exit channel is widely considered ineffective (Edmans and Holderness 2017; Schmidt and Fahlenbrach 2017; Bebchuk and Hirst 2019a; Heath et al. 2022), because their mandates typically require holding all index constituents. Therefore, they cannot sell shares in response to poor governance without deviating from their benchmark. As BlackRock CEO Larry Fink stated in 2017: "BlackRock cannot express its disapproval by selling a company's securities as long as that company remains in the relevant index."⁸

⁸ Letter from Larry Fink, Annual letter to CEOs (BlackRock 2018).

Academic discussion has thus focused on the “voice” channel. The evidence on ETF ownership and governance is mixed. Appel et al. (2016) observe that passive fund ownership is associated with stronger board independence, fewer takeover defenses, and improved firm performance, whereas other studies report a weakening of shareholder influence. Bebchuk and Hirst (2019a) and Bolton et al. (2020) show that ETFs rarely pursue litigation or oppose management in shareholder votes. Heath et al. (2022) find ETFs more likely than active funds to vote with management on contentious issues. Schmidt and Fahlenbrach (2017) similarly observe that passive (mutual funds and ETF) ownership strengthens managerial power. In contrast, Appel et al. (2019) identify a positive indirect effect: ETF ownership increases activism by active funds, thereby improving governance. Dobmeier et al. (2020) report a comparable indirect impact in German takeovers, showing that ETF passivity stimulates hedge fund engagement in the “endgame” bidding stages of takeovers. This point is particularly relevant for our analysis, as it suggests that ETF ownership may indirectly hinder offer success by attracting hedge fund activity.

The concept of the “market for corporate control” concerns the disciplining effect of takeover threats on underperforming firms. Poorly managed companies may become acquisition targets, allowing bidders to replace incumbent management, and improve performance (Scharfstein 1988; Walsh and Kosnik 1993; Denis and Kruse 2000; Franks et al. 2001). Therefore, an active takeover market can serve as a governance mechanism. The role of ETFs in this market has received limited attention. Extant literature primarily examines effects on bidding firms: Schmidt and Fahlenbrach (2017) show that higher passive ownership reduces bidder announcement returns, suggesting that ETFs do not effectively monitor or intervene in M&A decisions.

2.2 Types of ETF

ETFs can be classified along two key dimensions: management approach and index-tracking strategy.

- **Active vs. Passive Management:** Passive ETFs track a predefined index and do not alter portfolio composition unless the index changes. In contrast, active ETFs can deviate from the index and adjust holdings based on discretionary investment strategies.
- **Tracking Strategy:** ETFs may replicate an index through (1) full replication, holding all constituent securities; or (2) sampling, holding a representative subset to reduce transaction costs, particularly for illiquid stocks, at the cost of increased tracking error (Lettau and Madhavan 2018; Dyer and Guest 2022, Brogaard et al. 2024). Synthetic replication uses derivatives to replicate index performance rather than holding the securities directly.⁹ Table A.1 in the Appendix reports the distribution of fund types in our sample using Refinitiv’s classification. Our analysis focuses on passive ETFs, which lack discretion to accept or reject a takeover offer.

⁹ Saffi and Zheng (2023) compare the performance of the different tracking strategies.

The final dataset comprises 3733 passive ETFs: 1516 fully replicating, 1785 using sampling, 431 partially or fully synthetic, and one classified as “other.”¹⁰

ETFs may influence takeover outcomes through securities lending. To generate additional income, ETFs lend shares, often to short sellers, temporarily transferring ownership rights, including voting and tendering rights (e.g. BlackRock 2020). These loans are callable at any time. Fund providers typically recall lent shares during major corporate events, such as takeover offers, to meet stewardship obligations. Once recalled, the fund regains full ownership rights, rendering lending irrelevant for tendering decisions.

Refinitiv attributes beneficial ownership (including lent shares) to the lending party, consistent with Bundesbank guidelines. Although securities lending cannot be precisely isolated in the data, its impact is likely negligible. Conversations with fund managers confirm that ETFs generally recall lent shares during takeover events. Moreover, securities lending is less common among European ETFs compared to U.S. funds due to lower profitability and greater regulatory complexity.

Finally, the ETF creation and redemption mechanism may influence ETF shareholdings. Authorized Participants (APs) act as intermediaries, exchanging baskets of underlying securities for newly created ETF shares. During creation, these intermediaries purchase the basket of stocks, exchanging it against ETF shares, and selling these to investors. During redemptions, APs return ETF shares to the issuer and receive the underlying securities, which are then sold in the market (Lettau and Madhavan 2018). These transactions influence the liquidity of the target stock and, may thus influence offer outcomes. Accordingly, we include measures for the liquidity of the stock.

2.3 Index Methodology Around Takeover Offers and Their Impact On ETF Tendering

Index methodologies govern how index providers treat special corporate events, including takeover offers. As passive ETFs replicate every change in index composition, their behavior during a takeover is directly shaped by these rules. Our analysis focuses on the regulations of Deutsche Börse AG.

First, general rules govern the inclusion and weighting of a target stock in the index. These rules influence ETF behavior during a takeover offer. Two variables are particularly relevant:

- **Free float:** A minimum free float of 10% is required for index eligibility (Guide to the DAX Equity Indices 2023, Section 4.1.1.1).
- **Market capitalization:** A stock’s index weight is determined by its market capitalization adjusted for free float factor (Section 2.4 and 7.2).

¹⁰ In the terminology used by Refinitiv “Full” relates to ETF that completely replicate the index, “optimized” characterizes funds using sampling strategies and “swap” labels funds using synthetic replication.

We acknowledge that sampling and synthetic replication may include cases, in which the ETF does not physically own the target’s stock. However, we believe that finding support for our hypotheses under this wider definition of passive ETF strengthens our findings.

During a takeover offer, changes in these variables may trigger index adjustments that influence ETF tendering behavior. Deutsche Börse's index methodology distinguishes three types of adjustments:

1. **Regular quarterly index adjustment** (March, June, September, December):
Index weights are updated using the most recent free-float and market capitalization data. If a regular adjustment date falls within the offer acceptance period, the target stock's index weight is updated accordingly.
2. **Extraordinary adjustment.**
If a stock's free float factor changes by more than 10% between two regular adjustment dates, an extraordinary update is triggered (Section 5.1.4). During an ongoing takeover, reported acquirer holdings under the German Takeover Act (WpÜG) are deducted from total shares outstanding when calculating free float (Section 2.3). Only the target's weight is adjusted; all other index constituents remain unchanged.¹¹
3. **Index removal.**
If the target's free float falls below 10%, it is removed entirely from the index (Section 5.1.5). During ongoing takeover, the free float again depends on the reported acceptance rate.¹²

Second, index methodologies also include rules that apply specifically to takeover offers and directly affect ETF behavior. According to Section 5.1.6, Deutsche Börse switches to an index calculation based on tendered shares once the notified acceptance rate exceeds 50%. Because a small price discrepancy typically exists between tendered and untendered shares, ETFs have an incentive to tender their holdings to minimize tracking error relative to the updated benchmark.¹³

2.4 The Impact of German Corporate and Takeover Law

Germany, traditionally classified as a bank-based economy, has long exemplified an "insider-oriented" corporate governance system, characterized by powerful financial institutions (Franks and Mayer 2001; Hopt 2015). Although banks' influence has declined, Germany continues to exhibit high ownership concentration, with families and individuals maintaining significant corporate control (Franks and Mayer 2001; Edwards and Weichenrieder 2004; La Porta et al. 2008). For our analysis, the most relevant institutional feature is the strong position of the management board combined with substantial legal protections for minority shareholders. Together, these characteristics create high barriers for bidders seeking complete control. Under the

¹¹ In the takeover offer for Osram Licht AG, Deutsche Börse AG announced an adjustment of the stock's MDAX weight due to a significant reduction of its free float on October 7, 2019, after that the total ownership stake of ETF dropped from 9.0% to 7.6%. (Source Refinitiv).

¹² During KKR's takeover offer for Axel Springer SE, the free float of the target company fell below the minimum threshold, resulting in removal from the German MDAX index (Handelsblatt 2019; Deutsche Börse AG Group 2019).

¹³ During the offer for Linde AG, Deutsche Börse AG moved the shares to a tendered line as the acceptance rate of the offer crossed the 50% threshold, triggering the removal of Linde stock from the DAX index (Deutsche Börse AG 20.10.2017).

German Stock Corporation Act (AktG), the supervisory board appoints the management board (Vorstand), which operates with considerable independence and cannot be dismissed by a simple shareholder vote. Even majority shareholders cannot issue binding instructions to the board.

To gain effective control, bidders typically pursue a Domination and Profit and Loss Transfer Agreement DPLA with the target firm. A DPLA enables full operational integration but requires approval by at least 75% of shareholders (§ 293 AktG). Consequently, takeover offers in Germany are frequently conditioned on minimum acceptance thresholds that enable such approval. However, even with a DPLA, a bidder cannot unilaterally squeeze out minority shareholders: a formal squeeze-out requires ownership of at least 90% or 95% of the shares, depending on the legal mechanism (§ 62(5) UmwG or § 327a AktG).

These structural barriers make Germany a particularly suitable setting for analyzing ETF ownership and takeover outcomes. Given the “stickiness” of ETF holdings, even relatively small ETF stakes can meaningfully influence offer success. The resulting reduction in freely available shares, often amplified by speculative hedge fund activity following the offer announcement, imposes greater constraints on bidders in Germany than in jurisdictions where corporate control requires only a simple majority.

3 Data Selection and Empirical Design

3.1 Data

Our sample comprises takeover attempts of publicly listed German companies between 2004 and 2024. We begin by extracting all registered takeover attempts from the German Federal Financial Supervisory Authority (BaFin) database, which provides complete information starting from January 1, 2004. This yields 506 takeover attempts involving 383 distinct targets.

We manually collect deal-specific information, including offer dates, compensation, minimum acceptance thresholds, and initial bidder toeholds, from official offer documents published on BaFin’s website. This data are supplemented with management and supervisory board statements, fairness opinions, and offer outcomes (e.g., achievement of minimum acceptance thresholds, launch of revised offers) retrieved from the Bundesanzeiger.

To assess ETF behavior during the acceptance period, we match takeover data with ownership information from the Refinitiv Ownership & Profiles database. This database, widely used in asset management and corporate governance research (Aguilera et al. 2017; Benz et al. 2020), consolidates data from exchanges, regulators, institutions, and financial disclosures. We obtain ownership snapshots for each target at two points: the month-end before offer registration and the month-end following the offer period. Regarding shareholder types, we distinguish between active and passive ETFs, as discussed in Section 2.1.

After excluding firms with missing ownership or financial data, the final sample consists of 491 takeover attempts involving 375 unique targets (see Table A.2 for details).

Table 1 presents takeover offers over time, grouped into four toehold clusters based on the bidder's initial ownership stake:

- <30% (Control-Seeking): Below the 30% threshold defined by § 29 (2) WpÜG as control-taking.
- 30–50%: Above the control threshold but below the majority control.
- 50–75%: With majority control, but below the 75% required for a DPLA.
- >75%: High toehold, potentially already under a DPLA and likely aiming for a squeeze-out.

Panel A shows that the largest group of offers (39.3%) falls into the <30% cluster. Notably, a substantial 44.6% of offers are launched by majority shareholders, including 25.25% in the >75% cluster, indicating frequent “endgame” strategies in which majority owners seek complete control through further share acquisition. As a squeeze-out requires 90% or 95% ownership (§ 62(5) UmwG/§ 327a AktG), launching a public takeover offer often becomes necessary to acquire the required shares to cross this threshold.¹⁴ Given their relevance for the “market for corporate control,” we separately analyze offers from bidders starting with <30% ownership.

Panel B shows that Technology (21.6%) and Consumer Cyclical (18.9%) dominate the sample, consistent with literature identifying these sectors as M&A hotspots (Schoenberg and Reeves 1999; Campa and Moschieri 2009).

3.2 Variables and Descriptive Statistics

Because of Germany's strong minority protection and the legal obstacles to gaining full control (see Section 2.4), defining “takeover success” simply as achieving majority ownership is insufficient. Instead, we measure takeover success as the percentage of shares not already under the bidder's control that are acquired during the offer:

$$\text{Success rate} = \frac{\text{\# of shares tendered during acceptance period}}{\text{\# of shares not under bidder's control at the offer announcement}}$$

This continuous success measure avoids arbitrary thresholds (50%, 75%, 90%) as a criterion for offer success. Second, as it relates to the number of outstanding shares not yet under the bidder's control, it is independent of the bidder's toehold, and lies between 0% and 100%.¹⁵ Finally, it is a continuous variable allowing a standard

¹⁴ For example, Skion GmbH in October 2009 launched a takeover offer to the minority shareholders of Altana AG while already owning 91.7% stake in the target company.

¹⁵ Defining the success rate as the fraction of shares gained relative to all outstanding shares distorts results: an increase of 5% ownership is a different “success” when the offer starts from a bidder toehold of 5% than when starting from a bidder toehold of 90%.

Table 1 Takeover offers**Panel A: Distribution by year of offer submission**

Year of offer submission	Takeover attempts				Total (%)
	Toehold below 30%	Toehold between 30%–50%	Toehold between 50%–75%	Toehold above 75%	
2004	0	0	0	1	1 (0.20)
2005	4	2	6	7	19 (3.87)
2006	11	3	10	11	35 (7.13)
2007	17	7	8	14	46 (9.37)
2008	10	10	8	11	39 (7.94)
2009	6	4	3	5	18 (3.67)
2010	8	4	3	6	21 (4.28)
2011	13	4	5	7	29 (5.91)
2012	14	3	4	6	27 (5.50)
2013	8	5	3	5	21 (4.28)
2014	9	2	6	7	24 (4.89)
2015	6	3	5	2	16 (3.26)
2016	8	6	5	3	22 (4.48)
2017	12	3	2	3	20 (4.07)
2018	5	1	3	4	13 (2.65)
2019	15	4	4	3	26 (5.30)
2020	11	5	5	2	23 (4.68)
2021	14	5	3	9	31 (6.31)
2022	7	1	2	8	18 (3.67)
2023	6	4	3	1	14 (2.85)
2024	9	3	7	9	28 (5.70)
Total	193	79	95	124	491 (100.0)

Panel B: Distribution by target industry

Basic Materials	7	2	7	5	21 (4.28)
Consumer Cyclicals	33	15	22	23	93 (18.94)
Consumer Non-Cyclicals	3	4	1	5	13 (2.65)
Energy	7	1	2	2	12 (2.44)
Financials	26	9	12	21	68 (13.85)
Healthcare	19	11	4	4	38 (7.74)
Industrials	32	11	13	17	73 (14.87)
Real Estate	17	8	6	25	56 (11.41)
Technology	44	15	27	20	106 (21.59)
Utilities	5	3	1	2	11 (2.24)
Total	193	79	95	124	491 (100.0)

Panel A reports the sample annual distribution of takeover offers, differentiated into four clusters based on the bidder's initial toehold. Panel B presents the sample distribution by target industry, classified according to Thomson Reuters industry classification and Cleary Gottlieb and Hamilton (2017), and differentiated by four toehold cluster

regression analysis and providing easily interpretable results.^{16,17} However, it does not necessarily align with the bidder's own perception of success: 30 offers in the full sample and 26 in the control-taking sample show positive success rates but were ultimately withdrawn.¹⁸ We analyze how various factors influence this success rate, grouped into the following main categories: ownership variables, offer characteristics, index variables, and financial data from the target. Summary statistics are presented in Table 2.

Dependent Variable The average success rate is 38.8% across all offers and 52.8% for control-taking offers (toehold <30%).

Ownership Our primary explanatory variable is ETF ownership, split into active and passive, with passive ETF ownership expected to reduce bidder success. Given the long data history and the most recent rise in ETF ownership, average ETF stakes remain small: 0.8% in the full sample (with 0.6% passive) and 1% in control-taking offers (0.8% passive).¹⁹ Only 129 offers in the full sample (81 in the control-taking offers subsample) have any ETF ownership. To distinguish passive ETFs from other passive investors, we construct a variable for non-ETF passive institutional ownership, defined as ownership by passive funds classified as "Index" but not structured as ETFs. These include traditional index mutual funds and other passive institutional investors, such as insurance company portfolios, closed-end funds, investment trust portfolios, and pension fund portfolios. We also calculate a Herfindahl-Hirschman Index to capture ownership concentration. Bidder toeholds average 44% over all offers and 10% in control-taking offers.²⁰ German takeover law triggers ownership disclosure at 3% (§ 21 WpÜG) and a mandatory bid at 30% ownership (§ 35 Section 1 and § 29 Section 2 WpÜG).

Offer-Related Variables Offer premium, measured as the excess of the average target stock price in the three months before the offer, is 19.9% for the full sample

¹⁶ U.S. studies measure takeover success using an indicator variable equal to one when the bidder gains a simple majority, analyzed through probit/logit regressions (Duggal and Millar 1994; Flanagan et al. 1998). See our analysis on this success variables in Section 6.

¹⁷ Combined with pre-offer ownership measured relative to shares not controlled by the bidder, the regression coefficient directly translates ETF ownership into shares gained. For example, a coefficient estimate of -1 means that a 10% ETF reduces the success by exactly 10%.

¹⁸ Because only 103/80 cases (21%, 41.5% resp.) in the full/control-taking samples were conditional offers with a minimum threshold using the probability to cross the threshold as our main success measure was not an option... Under German takeover law, mandatory offers must be unconditional.

¹⁹ Ownership stakes again refer to shares not controlled by the bidder.

²⁰ In our sample, we find two cases where the target issued new shares during the offer acceptance period: During the bid of McKesson for Celesio AG in 2014, prepared for serving outstanding convertible debt by issuing new shares. In the case of the bid of Standard Industries for Braas Monier in 2016, target management issued new shares during the acceptance period to hinder the bidder from gaining the majority of shares. In these cases, we calculated the toehold based on the number of shares at announcement of the bid, while the success rate based on shares at the end of the acceptance period.

Table 2 Summary Statistics**Panel A: Full Sample/All Offers**

Variable	Obs	Mean	Std. Dev.	Q1	Median	Q3
<i>Dependent Variable</i>						
SUCCESS RATE	491	0.388	0.330	0.064	0.316	0.705
<i>Ownership Variable</i>						
ETF	491	0.008	0.025	0	0	0.001
Passive ETF	491	0.006	0.020	0	0	0
Active ETF	491	0.002	0.005	0	0	0
DAX ETF	491	0.002	0.006	0	0	0
Passive DAXETF	491	0.002	0.006	0	0	0
Active DAXETF	491	0	0.000	0	0	0
Passive Ownership	491	0.004	0.0131	0	0	0
HHI	491	0.707	9.158	0.002	0.023	0.092
<i>Offer Related Variables</i>						
Mgt. Recommend	491	0.593	0.492	0	1	1
Irrevocable Undertaking	491	0.088	0.219	0	0	0
Competitive Bid	491	0.026	0.161	0	0	0
Consideration	491	0.943	0.232	1	1	1
Minimum Threshold	491	0.21	0.408	0	0	0
Mandatory offer	491	0.265	0.442	0	0	1
Multiple round	491	0.118	0.323	0	0	0
SI Bidder	491	0.458	0.499	0	0	1
Financial Bidder	491	0.371	0.483	0	0	1
Foreign Bidder	491	0.475	0.500	0	0	1
Toehold	491	0.44	0.326	0.118	0.433	0.75
VWAP premium	491	0.199	0.289	0.001	0.108	0.291
<i>Other Variables</i>						
Index Removal	491	0.132	0.339	0	0	0
Index Listing	491	0.138	0.346	0	0	0
Bid-Ask Spread	480	-0.006	0.014	0	0	0
Crisis	491	0.334	0.472	0	0	1
<i>Financial Variables</i>						
EV (log-scaled)	491	5.043	2.251	3.546	4.898	6.593
Retained Earnings/Total Assets	442	-0.115	1.208	-0.001	0.151	0.314
MarketCAP/Total Liability	434	5.153	27.893	0.493	1.257	2.97
Cash/Total Asset	442	0.167	0.196	0.034	0.095	0.235
Leverage	403	0.257	0.232	0.083	0.209	0.365
Panel B: Toehold below 30%/Control-taking Offers						
Variable	Obs	Mean	Std. Dev.	Q1	Median	Q3
<i>Dependent Variable</i>						
SUCCESS RATE	193	0.528	0.358	0.148	0.655	0.866
ETF	193	0.01	0.018	0	0	0.012

Table 2 (Continued)

Passive ETF	193	0.008	0.015	0	0	0.009
Active ETF	193	0.002	0.004	0	0	0.002
DAX ETF	193	0.002	0.004	0	0	0.002
Passive DAXETF	193	0.002	0.004	0	0	0.002
Active DAXETF	193	0	0.000	0	0	0
Passive Ownership	193	0.004	0.0110	0	0	0.0006
HHI	193	0.084	0.149	0.009	0.026	0.092
<i>Offer Related Variable</i>						
Mgt Recommend	193	0.658	0.476	0	1	1
Irrevocable undertaking	193	0.192	0.288	0	0	0.361
Competitive bid	193	0.052	0.222	0	0	0
Consideration	193	0.876	0.331	1	1	1
Minimum Threshold	193	0.415	0.494	0	0	1
Mandatory offer	193	0.01	0.102	0	0	0
Multiple round	193	0.223	0.417	0	0	0
First round	193	0.777	0.417	1	1	1
SI Bidder	193	0.497	0.501	0	0	1
Financial Bidder	193	0.368	0.483	0	0	1
Foreign Bidder	193	0.534	0.500	0	1	1
Toehold	193	0.1	0.116	0	0.042	0.203
VWAP premium	193	0.243	0.272	0.038	0.171	0.352
<i>Other Variable</i>						
Index removal	193	0.202	0.403	0	0	0
Index Listing	193	0.228	0.421	0	0	0
Bid-Ask Spread	189	-0.009	0.016	-0.017	0	0
Crisis	193	0.363	0.482	0	0	1
<i>Financial Variable</i>						
EV (log-scaled)	193	5.78	2.046	4.243	5.743	7.158
Retained Earnings/Total Assets	178	-0.071	1.051	0.013	0.157	0.314
MktCAP/TotLiability	176	2.699	4.496	0.49	1.314	3.118
Cash/Total Asset	176	0.151	0.154	0.04	0.098	0.237
Leverage	171	0.261	0.242	0.084	0.197	0.354

This table shows summary statistics for dependent, independent, and control variables used in the analysis of determinants of takeover success for publicly listed companies in Germany between 2004 and 2024.

Panel A presents summary statistics for the full sample of all offers, and Panel B shows summary statistics for the sub-sample of bidders with a toehold below 30% and control-taking offers

and 24.3% for the control-taking sample.²¹ German takeover law requires target management to publish a statement on the offer conditions, including a recommendation on whether to accept the offer (§ 27 WpÜG): 59.3% of all and 65.8% of the control-taking offers include a positive recommendation.

²¹ There is a variety of approaches to measure the offer premium: The proposals range from the excess of the offer price over the 42-trading day average stock price (Schwert 1996; Bates and Becher 2017), the 60-

Given prior literature's emphasis on pre-negotiated share transfers (Barclay and Holderness 1991; Wright et al. 2007), we include negotiated stake transfers and irrevocable undertakings. We find that 8.8% of the target's available shares across all offers and 19.2% in control-taking offers are subject to pre-negotiated transactions.²² Offer competition is indicated by a variable denoting the presence of a competing bid, 2.6% of all offers and 5.2% of the control-taking offers. The vast majority of offers are made in cash (94.3% of all offers, 87.6% of control-taking offers). German takeover law allows improvements of offer conditions; we aggregate all bidding rounds into one and include an indicator variable for multiple bidding rounds. We find that 11.8% of all offers and 22.3% of control-taking offers have several rounds.²³ We observe that 26.5% of all offers and 0.5% of control-taking offers are mandatory takeover offers.²⁴ It is found that strategic bidders dominate (45.8% of full sample; 49.7% of control-taking), followed by financial bidders (37.1% and 36.8%, respectively).

Index-related Variables For ETFs tracking Deutsche Börse indices, 13.8% of the targets belong to an index in the full sample and 22.8% in the control-taking sample. In takeover offers, 13.2% of the targets face a downward adjustment of their weight and 20.2% of control-taking offers.

Control Variables We include a crisis dummy capturing the 2008–09 financial crisis, the 2012 European crisis, and the 2020–21 pandemic. These periods account for 30.6% (all offers) and 32.2% (control-taking offers). Target fundamentals include size (log market cap), retained earnings/total assets, market cap/total liabilities, and cash/total assets.

3.3 Methodology

We use multivariate regression analysis to examine the relationship between passive ETFs in the target company's shareholder structure and the shares acquired by

trading day average stock price (Betton and Eckbo 2000), to the excess over the 20-trading day average stock price (Cao et al. 2016). As we examine takeover attempts governed by German takeover legislation, we define offer premium in line with § 5 Section 1 German Securities Acquisition and Takeover Act Offer Ordinance (WpÜGAV), which specifies the average stock price of the target company three months prior to takeover offer announcement as minimum offer price.

²² Shareholders who sign such a contract are required to tender their shares at given conditions. Our toehold definition excludes these irrevocables.

²³ See Table A.3 in the Appendix.

²⁴ As the mandatory offers are triggered by the bidder having crossed the 30% ownership threshold, there is only one such case of a mandatory offer in the subsample of control taking bids with a toehold below 30%: The main shareholder of Dresdner Factoring AG had crossed the 30% threshold on December 24, 2008 with a stake of 30.65%, but missed to announce a mandatory offer acc. to § 35 Section 1 WpÜG. While having meanwhile reduced its stake below the 30% threshold in 2010, the main shareholder was forced by the German BaFin to launch a mandatory offer on December 18, 2012. The bidder was required to include accrued interest for the delay of the offer into the offer price on top of the minimum requirement of the three-month VWAP. In our analysis, we treated the interest component as a positive premium on top of the minimum offer price.

a bidder during a takeover attempt. Because the dependent variable is censored from both sides, we employ a Tobit regression model with the following specification:

$$\begin{aligned} \text{Percentage Shares Gained}_{ijt} = & \beta_0 + \beta_1 \times \text{Stake ETF}_{ijt} + \beta_2 \\ & \times \text{Bidder Ownership Stake}_{ijt} + \beta_3 \times \text{Offer related Variables}_{ijt} + \beta_4 \\ & \times \text{Index related Variables}_{ijt} + \lambda \times \text{Controls}_{ijt} + v_j + \delta_t + \varepsilon_{ijt} \end{aligned}$$

where i denotes target firms, j denotes target industries, v_j and δ_t represent industry and year fixed effects and ε_{ijt} is an error term. *Percentage Shares Gained*_{ijt} is the dependent variable, indicating the percentage of shares secured by the bidder after the takeover offer's acceptance period. *Stake ETF*_{ijt} is the fraction of passive ETF ownership in the target not under the bidder's control. The resulting coefficient β_1 can be easily interpreted as both the ownership stake and the success rate relate to the same number of shares.²⁵ *Bidder Ownership Stakes*_{ijt} reflects the bidder's initial toehold. *Offer-related Variables*_{ij} includes offer premium and management recommendation, *Index-related variables capture* index membership and index adjustments by Deutsche Börse Indices. *Controls*_{ijt} include takeover-related control variables (competing offer, method of payment, multiple bidding rounds, mandatory offer, minimum acceptance rate, and crisis-period bids) and bidder characteristics (financial bidder, strategic bidder, foreign bidder). Standard errors are clustered by offer announcement year to address potential time-series dependence (Ferreira and Matos 2008; Petersen 2009). To ensure that multicollinearity does not distort the results, we perform a Variance Inflation Factor (VIF) analysis.

3.4 Hypothesis Development

The performance of passive ETFs is judged by their ability to track their corresponding index as closely as possible; therefore, fund managers seek to minimize tracking error. If an ETF receives a takeover offer for a stock it holds as part of its benchmark index, it cannot tender those shares without deviating from the index composition. Thus, we hypothesize that, given specific properties of a takeover offer (e.g., the offer premium), passive index funds are less willing to tender their shares than other shareholders unless the index itself changes. Therefore, an increasing share of ETF ownership in the target lowers the potential success rate of an offer, *ceteris paribus*.

H1 An increasing stake of passive ETFs in the target shares has a direct negative impact on the success rate of a takeover offer.

If the index provider adjusts the weight of the target stock during the acceptance period, the fund must mirror-image the change of the index composition and, depending on the sign of the change, adjust its ownership stake in the target. Thus, our second hypothesis on the impact of ETF ownership on takeover success is related to the effects of downward index adjustments:

²⁵ A coefficient estimate of -1 implies the offer success is reduced by exactly the ownership stake of the ETF.

H2 A downward adjustment of the target stock's weight in the index tracked during the acceptance period has a positive impact on the success rate.

H2 reflects that passive ETFs are tied to the index composition and must react mechanically to weight changes in composition.

4 ETF Ownership and Offer Success—multivariate Results

Our primary analysis examines how passive ETF shareholdings affect the success rate of takeover offers. Results of our Tobit regression are presented in Table 3, Panel A for the full sample and Panel B for the sample of controls taking offers.

Specification model (1) includes passive ETF ownership, management recommendation, and offer-related variables. Models (2) to (4) add stepwise index adjustments (only related to Deutsche Börse AG Indices), irrevocables, and an interaction between management recommendation and ETF ownership as variables of interest.

The results strongly support our central hypothesis, H1. In both samples, ETF shareholdings have a negative impact on the success rate of a takeover offer; the coefficients estimated for the full model (4) in both samples are significant at the 99% confidence level. A 1 pp. stake of a passive ETF (referring to shares not owned by the bidder) reduces offer success by 5.93 pp in the full sample and 8.03 pp in the control-taking sample. Notably, the impact of ETF ownership significantly exceeds the ownership stake itself. Thus, an ETF stake in the target company is likely to affect the divestment/investment decisions of other shareholders. Hedge funds acquire stakes in a target company after the offer announcement, speculating on an increase in the offer price or on higher compensation connected to a DPLA or a squeeze-out.²⁶ The significant negative coefficient of the index-listing dummy variable in both samples also supports hypothesis H1.

We find support for H2. While our dummy variable indicating index membership has a negative impact on offer success at the 99% confidence level in both samples, we find in the full sample that the variable indicating a reduction or removal of the target shares from a Deutsche Börse Index has a positive coefficient at the 99% confidence level. For the subsample of control-taking offers, we do not find a significant relationship in the full model. As this result may reflect our limitation of only tracking and including changes to Deutsche Börse AG indices, we refine our analysis in the robustness section and find strong additional support for H2.²⁷

The remaining independent variables behave consistently with earlier studies. A positive management recommendation significantly increases the success rate (99% confidence level in both samples). Interacting the recommendation with pas-

²⁶ Dobmeier et al. (2020) show that even after the offer is announced, hedge funds invest into the target corporation, speculating on higher compensation in a DPLA or squeeze out.

In the Stada takeover, the hedge fund Elliott succeeded in demanding a compensation offer of 74.4€ per share for supporting a domination agreement DPLA, whereas the offer itself was 66.25€. See "Bain, Civen give in to Elliott's demand for higher Stada buyout," Reuters September 4, 2017.

²⁷ Restricting to ETFs tracking Deutsche Börse indices we find ETF divestments and offer success rate are positively related to downward adjustments of the target's weight in the index at 99% confidence level. See Section 6.2.

Table 3 Impact of ETF shareholdings on offer success rate—Tobit regression results**Panel A: Full Sample/All Offers**

Dependent Variable: SUCCESS RATE				
VARIABLES	(1)	(2)	(3)	(4)
Passive ETF	-0.674 (0.830)	-1.042 (0.746)	-5.363*** (1.824)	-5.934*** (1.743)
Passive Ownership	2.018 (1.369)	2.084* (1.244)	1.928* (1.160)	1.985* (1.143)
Index Listing	-0.174*** (0.0428)	-0.198*** (0.0422)	-0.135*** (0.0424)	-0.134*** (0.0421)
Mgt. Recommend	0.220*** (0.0276)	0.208*** (0.0275)	0.153*** (0.0275)	0.154*** (0.0275)
Index removal	—	0.139*** (0.0380)	0.171*** (0.0367)	0.146*** (0.0429)
Irrevocable Undertaking		—	0.435*** (0.0653)	0.432*** (0.0654)
Mgt Recommend#Passive ETF			5.076*** (1.721)	4.885*** (1.677)
Index removal#Passive ETF			—	1.363* (0.819)
LNEV	0.0394*** (0.00783)	0.0346*** (0.00776)	0.0283*** (0.00714)	0.0293*** (0.00714)
Competitive bid	-0.236*** (0.0670)	-0.250*** (0.0608)	-0.208*** (0.0581)	-0.208*** (0.0586)
Consideration	-0.118** (0.0524)	-0.110** (0.0520)	-0.132*** (0.0475)	-0.132*** (0.0471)
Toehold	-0.228*** (0.0470)	-0.219*** (0.0471)	-0.0944* (0.0496)	-0.0950* (0.0496)
Premium	0.114** (0.0484)	0.118** (0.0475)	0.109** (0.0433)	0.108** (0.0435)
HHI	-0.00169*** (0.000517)	-0.00224*** (0.000478)	-0.00245*** (0.000490)	-0.00269*** (0.000468)
Observation	491	491	491	491
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Control FE	YES	YES	YES	YES
Pseudo R2	0.971	1.004	1.175	1.178

Panel B: Toehold below 30%/Control-taking Offers Sample

Dependent Variable: Success Rate				
VARIABLES	(1)	(2)	(3)	(4)
Passive ETF	-3.918** (1.929)	-3.906** (1.707)	-8.005*** (2.242)	-8.035*** (2.220)
Passive Ownership	0.558 (1.839)	0.622 (1.784)	1.510 (1.583)	1.414 (1.472)

Table 3 (Continued)

Index Listing	−0.219*** (0.0515)	−0.227*** (0.0535)	−0.149*** (0.0481)	−0.155*** (0.0481)
Mgt Recommend	0.328*** (0.0528)	0.321*** (0.0519)	0.216*** (0.0515)	0.219*** (0.0518)
Index removal	–	0.0505 (0.0444)	0.0994** (0.0422)	0.0588 (0.0636)
Irrevocable Undertaking		–	0.404*** (0.0585)	0.400*** (0.0591)
Mgt Recommend#Passive ETF			6.088*** (1.887)	5.740*** (1.923)
Index removal#Passive ETF			–	2.311 (2.306)
LNEV	0.0717*** (0.0145)	0.0700*** (0.0156)	0.0528*** (0.0133)	0.0539*** (0.0133)
Competitive bid	−0.173*** (0.0609)	−0.183*** (0.0664)	−0.157*** (0.0582)	−0.161*** (0.0588)
Consideration	−0.187*** (0.0577)	−0.186*** (0.0545)	−0.193*** (0.0518)	−0.188*** (0.0522)
Toehold	−0.496** (0.192)	−0.509*** (0.183)	−0.182 (0.162)	−0.178 (0.163)
Premium	0.119** (0.0559)	0.126** (0.0558)	0.160*** (0.0577)	0.159*** (0.0581)
HHI	−0.413*** (0.119)	−0.408*** (0.115)	−0.315*** (0.107)	−0.319*** (0.107)
Observation	193	193	193	193
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Control FE	YES	YES	YES	YES
Pseudo R2	1.531	1.538	1.794	1.799

This table presents estimates from a multivariate Tobit regression. The dependent variable is the success rate, which indicates a bidder's ability to secure the targeted shares in a takeover attempt. Explanatory variables are specified in Table A.3. Control variables include *minimum acceptance rate*, *mandatory offer*, *strategic bidder*, *bidder is a financial investor*, and *bidder is foreign*. Panel A displays the results for the full sample with all offers, Panel B for the sub-sample of bidders with a toehold below 30% and control-taking offers. Standard errors are clustered by offer announcement year and are reported in parentheses. Statistical significance is represented at the 1% (***), 5% (**), and 10% (*) level

sive ETF shareholdings yields a highly significant positive effect in both samples. Under H2, this finding can be interpreted as an indirect effect: a positive recommendation increases the propensity of other shareholders to tender, thereby increasing the probability of an index adjustment. Notably, this conditional effect completely offsets or significantly reduces the negative baseline effect of passive ETF ownership (−5.93% vs. +4.88% and −8.03% vs. +5.74% resp.). The offer premium has a significantly positive impact in both samples (95%/99% levels). Bidder toehold shows a weakly significant negative impact only in the full sample, suggesting increasing

“stickiness” among shares not under the bidder’s control as the toehold increases.²⁸ We further find that irrevocable undertakings are positively related to offer success (99% confidence level). Target size (LNEV) has a positive effect, whereas the presence of a competing bid has a negative impact in both samples (99% level). Cash consideration significantly reduces offer success. Finally, our results suggest a negative impact of increasing shareholder concentration (HHI), significant at 99% for both samples: higher concentration among shares not yet held by the bidder increases share “stickiness” and reduces offer success (Kobayashi 2007). To assess the impact of target-stock liquidity, we ran our model including the target stock’s bid-ask spread as a control, but it did not find a significant impact to change the results.²⁹

To check for multicollinearity, we perform a VIF analysis based on model (2). As presented in Table A.6, all VIF values remain well below conventional thresholds, indicating the absence of multicollinearity.

5 Endogeneity

One challenge in our analysis is the endogenous nature of a firm’s shareholder structure. Firm characteristics that influence shareholder composition may also influence the likelihood of a successful takeover. This creates potential endogeneity when estimating the effect of ETF ownership on deal success, as ETF ownership may itself be driven by factors such as firm size, liquidity, or governance quality that are also correlated with deal outcomes. This may result in a bidirectional relationship or omitted-variable bias. To address this concern, we employ a two-stage instrumental variable (IV) regression framework, using the average age of ETFs holding the target firm as an instrument for ETF ownership. For this IV to be valid, it must satisfy two conditions: relevance (correlation with ETF ownership) and exogeneity (no correlation with the error term in the second-stage regression explaining deal success). The relevance condition is supported by the fact that older ETFs generally have larger assets under management and greater liquidity, enabling them to maintain or expand positions in target firms. Moreover, older ETFs often follow stable, established investment strategies, increasing the likelihood that they hold shares in mature firms, which frequently become takeover targets. These characteristics make average ETF age a strong predictor of ETF ownership levels.

The exogeneity condition assumes that ETF age is not systematically related to unobserved factors influencing deal success. As ETF age is determined by the fund’s inception date, an external characteristic unrelated to any specific target firm or deal, there is no reason to expect it to directly influence the success of a particular M&A transaction, except through its impact on ETF ownership. Table 4 presents the IV results for both samples (Panel A: all ETFs; Panel B: ETFs tracking Deutsche Börse

²⁸ As by definition the toeholds of the control-taking offers are below 30%, this effect is not significant in this subsample.

²⁹ As the inclusion of this variable reduced the number of observations, we stick to our results in Table 4. The results of the model with bid-ask spread are available upon request.

Table 4 Instrumental variable regression result**Panel A: All ETFs**

–	Full Sample		Below 30%	
	<i>1st Stage</i> (1)	<i>2nd Stage</i> (2)	<i>1st Stage</i> (3)	<i>2nd Stage</i> (4)
Passive ETF	–	–2.963** (1.265)	–	–5.321** (2.226)
Fund Age	0.00033** (0.0001)	–	0.0002** (.0001)	–
Number of Full Replicated ETFs	0.0004** (.0001)		0.0003 (.0002)	
Number of Optimized Rep ETFs	0.0004** (.0002)		0.0003** (.0001)	
LNEV	–0.0002 (.0002)	0.029*** (0.008)	0.00003 (.0004)	0.038** (0.015)
Index removal	0.007* (.0039)	0.129*** (0.044)	0.0024 (.0022)	0.031 (0.049)
Mgt Recommend	0.001 (.001)	0.216*** (0.027)	0.0010 (.0012)	0.364*** (0.054)
Toehold	0.0064** (.0031)	–0.197*** (0.047)	0.0085 (.0054)	–0.497** (0.203)
Premium	0.0009 (.0021)	0.086* (0.047)	–0.0005 (.0021)	0.190*** (0.052)
Herfindahl Index	0.0003* (.0002)	–0.001 (0.001)	0.0022 (.0030)	–0.327*** (0.105)
Delisting	0.0043 (.0047)	–0.060 (0.048)	–0.0021 (.0021)	–0.221** (0.109)
Observations	491	491	193	193
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Control FE	YES	YES	YES	YES
Adjusted R2	0.7437	0.386	0.8139	0.494

Panel B: ETF tracking Deutsche Börse Indices

–	Full Sample		Below 30%	
	<i>1st stage</i> (1)	<i>2nd Stage</i> (2)	<i>1st stage</i> (3)	<i>2nd stage</i> (4)
VARIABLES				
Passive DAX ETF	–	–9.998*** (3.559)	–	–16.189** (7.360)
Fund Age	0.0001** (.00004)	–	0.0001*** (.00003)	–
Number of Full Rep ETFs	0.0029*** (.0007)		0.0014*** (.0002)	
Number of Optimized Rep ETFs	–0.0077** (.0035)		–0.0004 (.0009)	

Table 4 (Continued)

LNEV	-0.0001 (.0001)	0.029*** (0.007)	0.00007 (.0001)	0.037*** (0.014)
Index removal	0.0014 (.001)	0.134*** (0.044)	0.0003 (.00060)	0.042 (0.052)
Mgt Recommend	0.0001 (.003)	0.216*** (0.027)	-0.00001 (.00034)	0.364*** (0.055)
Toehold	0.0018** (.0006)	-0.199*** (0.046)	0.0014 (.00116)	-0.542*** (0.202)
Premium	0.0006 (.001)	0.091* (0.047)	0.00023 (.0006)	0.196*** (0.051)
Herfindahl Index	0.00003 (.0001)	-0.002* (0.001)	-0.0011 (.0007)	-0.359*** (0.103)
Delisting	0.002 (.002)	-0.051 (0.048)	0.0007 (.0005)	-0.214* (0.118)
Observations	491	491	193	193
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Control FE	YES	YES	YES	YES
Adjusted R2	0.5538	0.390	0.8391	0.502

This table reports estimates from two-stage least squares (2SLS) instrumental variable regressions. The dependent variable in the first stage is the index fund stake, and the percentage shares gained by the bidder in the second stage. Panel A reports regression results for all ETFs, and Panel B presents results for the sub-sample of ETFs tracking Deutsche Börse indices only. Both panels display the corresponding figures for the full sample with all offers and the sub-sample of bidders with a toehold below 30% (control-taking offers). Explanatory variables are specified in Table A.3 in the Appendix. Controls include *minimum acceptance rate*, *mandatory offer*, *same industry*, *bidder is a financial investor*, *bidder is foreign*, and *same industry*. Standard errors are clustered by offer announcement year and reported in parentheses. Statistical significance is represented at the 1% (***), 5% (**), and 10% (*) levels

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

AG indices). In the first-stage regressions, we observe a strong positive relationship between average ETF age and ETF ownership for both the full sample and the subsample of control-taking offers. The coefficients are statistically significant at the 95% and 99% levels. The Cragg-Donald F-statistics exceed the critical threshold of 10.01, and adjusted R^2 values range from 55% to 84%, indicating that the instrument is not weak.

The second-stage estimates support our earlier findings from Section 4 on hypothesis 1. The results confirm a negative effect of ETF ownership on takeover success. The coefficient is statistically significant at the 95% level for the full ETF sample and at the 99%/95% levels for the Deutsche Börse index subsample.

To further control for confounding variables, we also conduct impact analyses to examine whether bias in our sample could invalidate the significance of key explanatory variables. Table A.7 in the Appendix reports the impact analysis for the independent variables used in model (2) of the baseline regression analysis in Table 3. The results show that 31.65% of the full sample and 35.63% of the control-

taking sample would need to be biased to invalidate the impact of passive ETF on the success rate.

6 Robustness Checks

6.1 ETF Tendering During the Offer Acceptance Period

In a separate step, we analyze changes in passive ETF ownership during the offer acceptance period. Table 5 documents the evidence, Panel A for all offers and Panel B for control-taking offers.

We observe a significant decline in passive ETF ownership across all ownership variables employed: The number of passive ETFs invested in the target declines by 43% from 28.7 to 16.5 in the full sample and by 38.5% from 29.3 to 18.0 in the control-taking subsample. We also observe a substantial reduction in both aggregate and average individual ETF ownership: total ETF stake falls from 1.5% to 0.729% (1.635 to 0.855 for control taking offers), while average individual ownership declines from 0.05% to 0.023% (0.054 to 0.028 control taking offers). Going beyond the average changes, we calculate the signed change in ETF ownership. Table 6, Panels A and B, present fund-level results:

At the fund level, the majority of passive ETFs reduce their stake in the target during the offer acceptance period: Panel A shows a decline for approximately two-thirds (66%) in the full sample and 60.62% in the control-taking sample. We also observe a significant fraction of passive funds, 19.6% in the full sample and 23.3% in the control-taking offers to increase their stake in the target during the offer acceptance period. In these cases, a positive offer premium regularly caused an increase in the market capitalization of the target, thereby triggering an increase of its weight in the index during a regular index adjustment. At the target level (Panel B), we find that 77.52% of targets in the full sample and 76.54% in the control-taking sample experience a decline in passive ETF ownership stakes.³⁰

6.2 Index Adjustments and Offer Success

Hypothesis H2 states that changes in ETF ownership are directly related to changes in the target's index weight. To corroborate the results in Section 4, we directly track adjustments in indices provided by Deutsche Börse AG and analyze their impact on ETF holdings. Table 7 provides an overview of the changes affecting target stocks.

Panel A shows that 69 passive ETFs tracking Deutsche Börse AG indices in the full sample and 26 in the control-taking sample are affected by the complete index removal of the target stock. In contrast, 148 of 337 funds (full sample) and 86 of 220 funds (control-taking sample) experience extraordinary adjustments. Combining extraordinary adjustments and removals into a downward adjustment indicator ("index removal"), we observe 164 cases in the full sample and 92 in the control-

³⁰ We observe similar figures when analyzing ETF tracking indices from Deutsche Börse only. Results are available from the authors on request.

Table 5 Divestment of Funds and ETF during the offer acceptance period**Panel A: Full Sample**

–	N	Mean	S.D	Min	Median	Max
<i>Number of invested ETFs</i>						
Before the takeover offer acceptance period						
ETF	129	40.899	53.461	6	22	48
Passive ETF	129	28.876	41.326	4	15	32
Active ETF	129	12.023	13.365	3	7	17
After the takeover offer acceptance period						
ETF	129	23.295	36.751	3	10	28
Passive ETF	129	16.473	28.280	1	6	16
Active ETF	129	6.822	9.239	1	4	9
Divested stake						
ETF	129	17.605	28.554	1	7	23
Passive ETF	129	12.403	22.387	0	5	15
Active ETF	129	5.202	7.166	1	2	7
<i>Ownership stake of ETF</i>						
Before the takeover offer acceptance period						
ETF	129	1.909	2.081	0.306	1.144	2.896
Passive ETF	129	1.517	1.787	0.206	0.96	2.257
Active ETF	129	0.392	0.477	0.04	0.173	0.632
After the takeover offer acceptance period						
ETF	129	0.922	1.353	0.101	0.483	1.05
Passive ETF	129	0.729	1.144	0.049	0.311	0.835
Active ETF	129	0.193	0.358	0.004	0.06	0.19
Divested stake						
ETF	129	0.987	1.531	0.048	0.345	1.393
Passive ETF	129	0.788	1.359	0.009	0.168	1.054
Active	129	0.199	0.275	0.002	0.057	0.294
<i>Individual Ownership stake of ETF</i>						
Before the takeover offer acceptance period						
ETF	5288	0.047	0.127	0.001	0.007	0.032
Passive ETF	3733	0.052	0.141	0.001	0.008	0.033
Active ETF	1555	0.033	0.082	0.001	0.005	0.031
After the takeover offer acceptance period						
ETF	5288	0.023	0.085	0	0	0.008
Passive ETF	3733	0.025	0.092	0	0	0.009
Active ETF	1555	0.016	0.062	0	0	0.006
Divested stake						
ETF	5288	0.024	0.091	0	0.001	0.011
Passive ETF	3733	0.027	0.103	0	0.001	0.012
Active ETF	1555	0.017	0.052	0	0.001	0.009

Table 5 (Continued)**Panel B: Below 30%/Control taking**

–	N	Mean	S.D	Min	Median	Max
<i>Number of invested ETFs</i>						
Before the takeover offer acceptance period						
ETF	81	41.728	55.981	6	21	50
Passive ETF	81	29.321	43.332	3	14	30
Active ETF	81	12.407	14.001	3	7	18
After the takeover offer acceptance period						
ETF	81	25.704	39.728	4	12	30
Passive ETF	81	18.037	30.731	2	6	20
Active ETF	81	7.667	9.841	2	5	10
Divested stake						
ETF	81	16.025	29.561	1	6	21
Passive ETF	81	11.284	23.538	0	3	13
Active ETF	81	4.741	7.080	0	2	6
<i>Ownership stake of ETF</i>						
Before the takeover offer acceptance period						
ETF	81	2.07	2.045	0.38	1.547	2.96
Passive ETF	81	1.635	1.776	0.29	1.056	2.276
Active ETF	81	0.435	0.492	0.047	0.22	0.669
After the takeover offer acceptance period						
ETF	81	1.082	1.471	0.212	0.547	1.29
Passive ETF	81	0.855	1.288	0.079	0.443	0.984
Active ETF	81	0.227	0.364	0.017	0.085	0.253
Divested Stake						
ETF	81	0.987	1.531	0.049	0.345	1.456
Passive ETF	81	0.78	1.351	0.006	0.239	1.207
Active	81	0.208	0.281	0.002	0.041	0.331
<i>Individual Ownership stake of ETF</i>						
Before the takeover offer acceptance period						
ETF	3577	0.048	0.131	0.001	0.007	0.032
Passive ETF	2514	0.054	0.145	0.002	0.008	0.033
Active ETF	1063	0.034	0.087	0.001	0.005	0.03
After the takeover offer acceptance period						
ETF	3577	0.025	0.089	0	0.001	0.011
Passive ETF	2514	0.028	0.097	0	0.001	0.012
Active ETF	1063	0.018	0.067	0	0.001	0.008
Divested stake						
ETF	3577	0.023	0.094	0	0.001	0.009
Passive ETF	2514	0.026	0.107	0	0.001	0.009
Active ETF	1063	0.016	0.051	0	0	0.007

This table reports changes in ETF ownership during the acceptance period of takeover attempts of publicly listed companies in Germany. It displays changes in the number of ETFs invested, the change of the total stake of all ETFs, and the change of the average individual stake in the target during the acceptance period. Panel A shows summary statistics for the full sample with all offers, and Panel B shows summary statistics for the sub-sample of bidders with a toehold below 30% and control-taking offers

Table 6 Change of ETF stake in the target during the offer acceptance period**Panel A: Fund level**

–	Full Sample/All Offers			Below 30%/Control-taking Offers		
	Freq	Percent	CUM	Freq	Percent	CUM
<i>ALL ETFS</i>						
No change	762	14.41	14.41	589	16.47	16.47
Reduced	3494	66.07	80.48	2173	60.75	77.22
Increased	1032	19.52	100.00	815	22.78	100.00
Total	5288	100.00	–	3577	100.00	–
<i>Passive ETF</i>						
No change	535	14.33	14.33	404	16.07	16.07
Reduced	2465	66.03	80.36	1524	60.62	76.69
Increased	733	19.64	100.00	586	23.31	100.00
Total	3733	100.00	–	2514	100.00	–
<i>Active ETF</i>						
No change	227	14.60	14.60	185	17.40	17.40
Reduced	1029	66.17	80.77	649	61.05	78.46
Increased	299	19.23	100.00	229	21.54	100.00
Total	1555	100.00	–	1063	100.00	–

Panel B: Target level

–	Full Sample/All Offers			Below 30%/Control-taking Offers		
	Freq	Percent	Cum	Freq	Percent	Cum
<i>ALL ETFS</i>						
No change	6	4.65	4.65	4	4.94	4.94
Reduced	109	84.50	89.15	68	83.95	88.89
Increased	14	10.85	100.00	9	11.11	100.00
Total	129	100.00	–	81	100.00	–
<i>Passive ETF</i>						
No change	14	10.85	10.85	9	11.11	11.11
Reduced	100	77.52	88.37	62	76.54	87.65
Increased	15	11.63	100.00	10	12.35	100.00
Total	129	100.00	–	81	100.00	–
<i>Active ETF</i>						
No change	16	12.40	12.40	12	14.81	14.81
Reduced	99	76.74	89.15	62	76.54	91.36
Increased	14	10.85	100.00	7	8.64	100.00
Total	129	100.00	–	81	100.00	–

This table reports changes in ETF ownership during the acceptance period for takeover attempts of publicly listed companies in Germany. Panel A displays the number of funds with an increase, decrease, or no change in ownership; Panel C displays the corresponding figures for funds tracking Deutsche Börse indices only. Panel B displays the number of targets with an increase, a decrease, and no change of the aggregate ETF ownership stake during the acceptance period for all ETFs; Panel D provides the corresponding figures for the funds tracking Deutsche Börse indices only. All panels show the corresponding figures for the full sample with all offers and sub-sample of bidders with a toehold below 30% and control-taking offers

Table 7 Index adjustments affecting target shares during the offer acceptance period**Panel A: Changes of Deutsche Börse indices—Fund Level**

–	Full Sample/All Offers		Below 30%/Control-taking Offers	
	Freq	Percent	Freq	Percent
Passive ETFs				
Removal	69	21.97	26	12.68
Extraord. Adjustment	148	47.13	86	41.95
Index removal	164	52.23	92	44.88

Panel B: Changes of Deutsche Börse indices—Target Level

–	Full Sample/All Offers		Below 30%/Control-taking Offers	
	Freq	Percent	Freq	Percent
Removal	21	22.11	14	21.88
Extraord. Adjustment	43	45.26	30	46.88
Index removal	49	51.58	33	51.56

This table reports change in the composition of Deutsche Börse indices affecting target stocks during the offer acceptance period. Panel A displays the change on the individual level of passive funds and Panel B the change on the target level. Both panels show the corresponding figures for the full sample with all offers and for the sub-sample of bidders with a toehold below 30% and control-taking offers

taking sample, highlighting the fact that extraordinary downward adjustments are often followed by complete index removal.³¹ Consequently, 52.2% of ETFs in the full sample and 44.9% in the control-taking sample are affected by a downward weight adjustment. At the target level (Panel B): 21 targets (22.1%) in the full sample and 14 targets (21.9%) in the control-taking sample are removed from the index.

To further test hypothesis H2, we perform a univariate analysis linking the percentage change in passive ETF ownership during the acceptance period to changes in index composition. Table 8 provides these results.

We find support for hypothesis H2. At fund level, the percentage decline in passive ETF ownership is significantly higher when the target experiences index removal or an extraordinary adjustment (significant at the 95% or 99% levels in both samples). For the combined downward adjustment indicator, the difference relative to changes in ownership stake without index adjustment is significant at the 99% level for both samples. Panel B provides similar evidence at the target level. For the combined “index removal” variable, the decline in ownership is 42.99% for all offers, compared with 14.8% targets without extraordinary adjustment or removal. In the control-taking subsample, the corresponding figures are 40.61% versus 16.07%, with both differences significant at the 95% level.

Subsequently, we employ OLS regression with the percentage change in ETF holdings as the dependent variable and index-adjustment indicators as independent variables. We employ our analysis on ETFs tracking Deutsche Börse AG indices; Table 9 presents these results.

³¹ During the KKR for Axel Springer SE offer, the free float of the target company fell below the minimum threshold resulting in the removal of the target company from the German MDAX index (Handelsblatt 2019; Deutsche Börse AG Group 2019). In the takeover offer for Osram Licht AG Deutsche Börse AG announced an adjustment of the weight of the stock in the MDAX due to a significant reduction of its free flow on October 7, 2019, after that the total ownership stake of ETF dropped from 9.0% to 7.6%. (Source Refinitiv).

Table 8 Index adjustments and change in ETF ownership stake during the offer acceptance period—Deutsche Börse indices—univariate analysis**Panel A: Fund Level—Deutsche Börse Indices**

–	Full Sample/All Offers			Below 30%/Control-taking Offers		
	Freq	Mean	Dif	Freq	Mean	Dif
<i>Passive ETFs</i>						
Removal						
No	245	0.0654	–0.0902***	179	0.0720	–0.1048**
Yes	69	0.1556	–	26	0.1768	–
Extraord. Adjustment						
No	166	0.0516	–0.0713**	119	0.0458	–0.0941**
Yes	148	0.1229	–	86	0.1399	–
Index Removal						
No	150	0.0384	–0.0895***	113	0.0360	–0.1097***
Yes	164	0.1280	–	92	0.1458	–

Panel B: Target Level—Deutsche Börse Indices

–	Full Sample/All Offers			Below 30%/Control-taking Offers		
	Freq	Mean	Dif	Freq	Mean	Dif
Removal						
No	74	0.2314	–0.2807**	50	0.2772	–0.04582
Yes	21	0.5121	–	14	0.3230	–
Extraord. Adjustment						
No	52	0.1859	–0.2374**	34	0.1871	–0.2136*
Yes	43	0.4234	–	30	0.4008	–
Index Removal						
No	46	0.1480	–0.2819**	31	0.1607	–0.2454**
Yes	49	0.4299	–	33	0.4061	–

This table presents the results of a univariate test on the change in ETF ownership stake during the acceptance period across different types of index adjustments announced by Deutsche Börse AG. *Removal* indicates the cases of full removal of the target stock from the index, *extraordinary adjustment* is the case for an extraordinary adjustment of the target's weight in the index, *regular adjustment* is the case of a regular adjustment during the acceptance period. *Index removal* indicates the combined case of extraordinary adjustment and removal. Change of composition of Deutsche Börse indices related to target stocks announced during the offer acceptance period. Panel A displays the change on the individual fund level, Panel B shows the change on the target level. Both Panels show the corresponding figures for the full sample with all offers, and for the sub-sample of bidders with a toehold below 30% and control-taking offers. Statistical significance is represented at the 1% (***), 5% (**), and 10% (*) levels

We find strong support for hypothesis H2. The combined variable “index removal” is significant at the 99% confidence level in both the full sample and the control-taking sample, indicating a positive impact of downward index adjustments on the divestment of funds tracking these indices. For the narrower downward adjustment variables, we also find significant, albeit weaker evidence: the positive effect of extraordinary adjustments is significant at the 90% level in both samples, while the effect of complete removal is significant only for the full sample at the same level.

Table 9 Impact of index adjustments on ETF divestment—Fund level—Deutsche Börse Indices—Multivariate linear regression results

ETF tracking Deutsche Börse Indices				
VARIABLES	Dependent Variable: divest			
	(1)	(2)	(3)	(4)
	Full Sample/All Offers	Full Sample/All Offers	Below 30%/ Control-taking Offers	Below 30%/ Control-taking Offers
Index removal	–	0.0974*** (0.0176)	–	0.104*** (0.0283)
Removal	0.0847* (0.0428)	–	0.0251 (0.0798)	–
Extraord. Adjustment	0.0524* (0.0254)		0.0655* (0.0358)	
Mgt Recommend	0.0187 (0.0349)	0.0169 (0.0334)	0.0844 (0.0527)	0.0817 (0.0484)
Irrevocable undertaking	0.01000 (0.151)	–0.0434 (0.138)	–0.318* (0.182)	–0.336** (0.140)
Toehold	0.00644 (0.0594)	0.00269 (0.0622)	–0.753* (0.378)	–0.633* (0.354)
Premium	0.0203 (0.0587)	0.0409 (0.0539)	0.0560 (0.0694)	0.0342 (0.0644)
Competitive bid	–0.0747 (0.0493)	–0.0764* (0.0428)	–0.266** (0.124)	–0.240** (0.114)
LNEV	–0.0184** (0.00817)	–0.0170* (0.00912)	–0.0150 (0.0183)	–0.00596 (0.0168)
Consideration	–0.0127 (0.0457)	–0.0106 (0.0419)	–0.0453 (0.0476)	–0.0537 (0.0514)
ETF age	0.0142*** (0.00269)	0.0143*** (0.00265)	0.0154*** (0.00493)	0.0152*** (0.00493)
Physical Replication	0.0605*** (0.0154)	0.0610*** (0.0164)	0.0794*** (0.0119)	0.0797*** (0.0118)
Observations	337	337	220	220
R-squared	0.385	0.387	0.494	0.503
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Control FE	YES	YES	YES	YES

Table 9 (Continued)

ETF tracking Deutsche Börse Indices				
–	Dependent Variable: divest			
VARIABLES	(1)	(2)	(3)	(4)
	Full Sample/All Offers	Full Sample/All Offers	Below 30%/Control-taking Offers	Below 30%/Control-taking Offers
R2 adjusted	0.287	0.292	0.367	0.381

This table reports estimates from OLS regressions. The dependent variable is divestment, measured as the change in ETF target shareholding during the offer's acceptance period. Independent variables of interest are changes in index compositions announced by Deutsche Börse AG during the offer acceptance period. *Removal* indicates the cases of full removal of the target stock from the index, *extraordinary adjustment* is of the case for an extraordinary adjustment of the target's weight in the index, and regular adjustment is of the case of a regular adjustment during the acceptance period. *Index removal* indicates the combined case of extraordinary adjustment and removal. Remaining explanatory variables are specified in Table A.3 in the Appendix. Controls include minimum acceptance rate, mandatory offer, strategic bidder, financial bidder, and foreign bidder. Table 9 shows the results for the case of including only ETF tracking Deutsche Börse indices: Columns (1) and (2) show the results for the full sample with all offers, and columns (3) and (4) show the results for the sub-sample of bidders with a toehold below 30% and control-taking offers. Standard errors are clustered by offer announcement year and are reported in parentheses. Statistical significance is represented at the 1% (***), 5% (**), and 10% (*) levels

6.3 Logit Regression

Due to the particular German legal environment, there are strong arguments for using our continuous measure “percentage of outstanding shares gained” to assess offer success. To allow comparison with studies in other countries, we rerun our analysis using an alternative success measure: We estimate the effect of ETFs ownership stakes on the probability that a bidder attains a controlling stake in a target. Standard practice in empirical research on U.S. and European takeovers defines deal completion as the bidder holding at least 50% of target shares at the end of the acceptance period (Branch and Yang 2003; Betton et al. 2009; Bessler and Schneck 2015). Following this approach, we set the dependent variable, *Takeover outcome*, equal to one when the bidder obtains at least 50% of shares after the offer, and equal to zero in the remaining cases. Additionally, as an alternative threshold, we also use 65%, generally regarded as the minimum needed to secure a 75% vote in favor of a DPLA at the shareholder meeting. Results of our logit-regression analysis are provided in Table 10. Panel A shows the results for all ETFs, and Panel B presents results for ETF tracking Deutsche Börse indices:

The results confirm our main findings. Passive ETF ownership has a significant negative impact on the probability of crossing the 65% ownership threshold from a toehold below 50% in both samples at the 99% confidence level. For the same combination, index membership is significantly negative (at the 90% level), whereas downward index adjustment or removal has a positive effect (significant at the 95% level) in both samples. We also find a positive interaction between index removal and a positive management recommendation, significant at the 99% confidence level in both samples. For the remaining two combinations of bidder toehold and success threshold, we observe only a negative impact of passive ETF ownership (30% toe-

Table 10 Logit regression results—probability of a successful takeover**Panel A: All funds**

–	Dependent Variable: Probability to cross the ownership threshold		
	(1)	(2)	(3)
VARIABLES	Success above 50% Toehold < 30%	Success above 65% Toehold < 30%	Success above 65% Toehold < 50%
Passive ETF	−9.838 (7.095)	−13.69 (8.888)	−13.56*** (4.826)
Index Listing	−0.0709 (0.0882)	−0.0201 (0.0858)	−0.131* (0.0707)
Mgt. Recommend	0.154*** (0.0471)	0.162*** (0.0601)	0.117*** (0.0410)
Irrevocable undertaking	0.623*** (0.109)	0.480*** (0.0925)	0.517*** (0.0877)
Index removal	0.211** (0.106)	0.0716 (0.107)	0.202** (0.103)
Passive ETF#Index removal	−1.380 (2.980)	2.922 (3.790)	2.559 (2.530)
Passive ETF#Mgt Recommend	7.796 (7.089)	11.46 (9.019)	13.44*** (3.829)
Toehold	−0.0357 (0.239)	−0.272 (0.278)	−0.238 (0.167)
Premium	0.351*** (0.120)	0.320** (0.125)	0.278*** (0.108)
HHI	−0.131 (0.136)	−0.0981 (0.133)	−0.00437 (0.155)
Competitive	−0.300*** (0.0654)	−0.292*** (0.0821)	−0.270*** (0.0664)
Industry FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Observations	190	190	272
Pseudo R2	0.6102	0.5540	0.4755

Panel B: Deutsche Börse Indices

–	Dependent Variable: Probability to cross ownership threshold		
	(1)	(2)	(3)
VARIABLES	Success above 50% Toehold < 30%	Success above 65% Toehold < 30%	Success above 65% Toehold < 50%
Passive DAX ETF	−15.54 (12.09)	−31.86** (15.26)	−42.55*** (14.44)
Index Listing	−0.0467 (0.0976)	0.00155 (0.0895)	−0.121* (0.0701)
Mgt Recommend	0.178*** (0.0420)	0.180*** (0.0545)	0.136*** (0.0413)
Irrevocable Undertaking	0.611*** (0.103)	0.476*** (0.0892)	0.518*** (0.0864)

Table 10 (Continued)

Index removal	0.226** (0.0884)	0.0888 (0.0997)	0.220** (0.0953)
Passive DAX ETF#Index removal	-6.213 (8.788)	7.406 (11.60)	4.214 (9.995)
Passive DAX ETF#Mgt Recommend	7.144 (12.62)	20.65 (16.79)	39.00*** (12.06)
Toehold	-0.110 (0.230)	-0.313 (0.256)	-0.227 (0.169)
Premium	0.351*** (0.125)	0.321** (0.125)	0.262** (0.106)
HHI	-0.170 (0.128)	-0.130 (0.134)	-0.0281 (0.159)
Competitive Bid	-0.335*** (0.0702)	-0.299*** (0.0751)	-0.272*** (0.0664)
Control FE	Yes	Yes	Yes
Observations	190	190	272
Pseudo R2	0.6087	0.5509	0.4699

This table reports estimates from multivariate logit regressions. The dependent variable equals one if the bidder's stake in target equity is above a threshold of 50% or 65%, respectively, and zero otherwise. Explanatory variables are specified in Table A.3 in the Appendix. Controls include *competing offer*, *minimum acceptance rate*, *mandatory offer*, *strategic bidder*, *bidder is a financial investor*, *bidder is foreign*, *consideration*, and *lnev*. Standard errors are clustered by offer announcement year and are reported in parentheses. Statistical significance is represented at the 1% (***), 5% (**), and 10% (*) levels

hold and 65% threshold for Deutsche Börse indices, significant at the 95% level) and a positive effect of the downward-adjustment variable (30% toehold and 50% threshold for both samples, significant at 95% level). We attribute this lower explanatory power to the ambiguity of the categorical success measure under the German regulatory environment. The coefficients of the other control variables support the findings of our Tobit regression: management recommendations, irrevocable undertakings, and the premium offered have a significant positive impact on takeover success.

7 Conclusion

This study analyzes the influence of ETF ownership on the success of takeover offers for publicly listed German firms between 2004 and 2024. As ETFs are required to track a specific index, they face significant constraints to tender their shares when a firm in that index becomes the target of a takeover offer, as long as the stock remains in the index. We thus hypothesize that ETF ownership negatively influences takeover success.

Our primary regressions provide strong support for our hypotheses. First, ETF ownership is negatively associated with the percentage of shares gained in the offer, with Tobit regression results indicating significant negative coefficients at the

99% confidence level in both samples. Second, the baseline effect of ETF target shareholdings is mitigated, or even fully offset, when the target's index weight is adjusted downwards during the acceptance period. Regression results confirm this hypothesis; additional analysis of index adjustments and ETF divestment during the acceptance period further corroborate it. In addition to our main results, the remaining independent variables exhibit the expected signs.

While we observe a significant decline in ETF ownership stakes during the acceptance period, we do not find evidence that these reductions are driven by strategic considerations. Instead, by directly analyzing changes in index-compositions for ETFs tracking indices of Deutsche Börse AG, we find strong support for the hypothesis that these divestments are mechanically enforced by index adjustments.

Our estimates show that the impact of ETF ownership on offer success is higher than the fund ownership itself, suggesting that ETF ownership influences the divestment/investment behavior of other investors. Notably, our results suggest a significant relationship between passive ETFs and hedge fund activity in German takeover situations (Dobmeier et al. 2020). While Appel et al. (2019) document that higher ETF ownership facilitates monitoring by activist funds, our findings are in a different direction: the reduced ability of ETFs to tender their shares may prompt hedge funds to intervene, push for higher premiums, or speculate on a higher compensation in a later structural measure (DPLA or squeeze out). This results in higher transaction costs, lower success rates, and in contrast to the findings of Appel et al. (2019) for the US, does not yield an improvement in corporate governance under German corporate law.

The coefficients imply that ETF stake reduces the success rate by 5.93 times (full sample) and 8.03 times (control-taking sample) the ETF ownership stake. It may help to put these figures into perspective in order to assess hedge fund activities in German takeovers: We observe an average bidder toehold of 44%/10% and an average passive ETF ownership stake of 0.6%/0.8% resp. in our full/control taking sample. Combining these figures with our coefficient estimates, the stake of target ownership not accessible to the bidder due to passive ETF ownership is $(1-44\%) \times 0.6\% \times 5.93 = 1.99\%$ for the full sample and $(1-90\%) \times 0.8\% \times 8.03 = 0.64\%$ for the control-taking sample. These figures are consistent with hedge-fund stakes observed in practice.

Overall, our results suggest that rising ETF ownership materially weakens the German market for corporate control. The negative effect of ETF may be even more pronounced than our results suggest. Given the steady increase in ETF ownership and its negative effect on takeover success rates, potential bidders may be less likely to launch a takeover offer when targets are index constituents with significant ETF ownership.³²

³² This argument implies the market for corporate control to be an important disciplinary device for target management under the German governance system. Drobetz and Momtaz (2020) show that for bidders

8 Appendix A

Table A.1 Tabulation of Management Approach and Index Replication Method

Management Approach	Index Replication Method				
	Full	Optimized	Other	Swap	Total
Active	280	1207	0	68	1555
Passive	1516	1785	1	431	3733
Total	1796	2985	1	499	5288

Table A.2 Sample Selection Criteria

Chair's database		
Last round offers	–	506
Drop cases where Refinitiv records toehold as zero and HHL database gives a value for that	11	–
Drop if premium is missing	4	15
Final Sample Size	–	491

Table A.3 Descriptives conditional and multiple round offers**Panel A: Full Sample/All Offers**

–	<i>N</i>	Mean	Median
<i>Minimum acceptance rate</i>			
Offers are conditional on a minimum acceptance rate	103	0.5869	0.55
<i>First round of settled offers</i>	80	0.6084	0.6
Thereof completed	54	0.5956	0.55
Thereof cancelled	21	0.6291	0.7
Thereof renegotiated	0	0	0
Offers with a revision of the minimum acceptance rate during the acceptance period	–		
New Offers with revised minimum acceptance rate			
<i>Second round of settled offers</i>	20	0.5341	0.5005
Thereof completed	10	0.5405	0.5050
Thereof cancelled	8	0.5127	0.500
Thereof renegotiated	0	0	0
<i>Third round of settled offers</i>	3	0.3666	0.3
Thereof completed	2	0.45	0.45
Cancelled	1	0.2	0.2
Thereof renegotiated	0	0	0

Panel B: Toehold below 30%/Control-taking Offers

–	<i>N</i>	Mean	Median
<i>Minimum acceptance rate</i>			
Offers are conditional on a minimum acceptance rate	80	0.5778	0.55
<i>First round of settled offers</i>	58	0.6007	0.555
Thereof completed	38	0.6034	0.55
Thereof cancelled	17	0.5801	0.6
Thereof renegotiated	0	0	0
Offers with a revision of the minimum acceptance rate during the acceptance period	–		
New Offers with revised minimum acceptance rate			
<i>Second round of settled offers</i>	19	0.5412	0.501
Thereof completed	9	0.5561	0.51
Thereof cancelled	8	0.5127	0.500
Thereof renegotiated	0	0	0
<i>Third round of settled offers</i>	3	0.3666	0.3
Thereof completed	2	0.45	0.45
Cancelled	1	0.2	0.2
Thereof renegotiated	0	0	0

Panel C: Full Sample/All Offers

–	<i>N</i>	Mean	Median
All offers (both conditional and unconditional)	491	0.1231	0
<i>First round of settled offers</i>	433	0.1124	0
Thereof completed	290	0.1109	0
Thereof cancelled	103	0.1282	0
Thereof renegotiated	3	0	0

Table A.3 (Continued)

Offers with a revision of the minimum acceptance rate during the acceptance period	–		
New Offers with revised minimum acceptance rate			
<i>Second round of settled offers</i>	51	0.2094	0
Thereof completed	29	0.1863	0
Thereof cancelled	19	0.2158	0
Thereof renegotiated	1	0	0
<i>Third round of settled offers</i>	7	0.1571	0
Thereof completed	3	0.3	0.3
Cancelled	2	0.2	0.2
Thereof renegotiated	0	0	0
Panel D: Toehold below 30%/Control-taking Offers			
–	<i>N</i>	Mean	Median
All offers (both conditional and unconditional)	193	0.2395	0
<i>First round of settled offers</i>	150	0.2322	0
Thereof completed	79	0.2902	0
Thereof cancelled	50	0.1972	0
Thereof renegotiated	0	0	0
Offers with a revision of the minimum acceptance rate during the acceptance period	–		
New Offers with revised minimum acceptance rate			
<i>Second round of settled offers</i>	37	0.2779	0.250
Thereof completed	17	0.2944	0.36
Thereof cancelled	17	0.2412	0
Thereof renegotiated	1	0	0
<i>Third round of settled offers</i>	6	0.1833	0.1
Thereof completed	3	0.3	0.3
Cancelled	2	0.1	0.1
Thereof renegotiated	0	0	0

Panels A and B provide an overview of offers that were conditional on a minimum acceptance rate by target shareholders. Across the entire sample (491 last-round offers), 98 last-round offers were conditional on a minimum acceptance rate. Panel A displays the results for the full sample with all offers, and Panel B for the sub-sample of bidders with a toehold below 30% and control-taking offers.

Panels C and D give an overview of offers with several bidding rounds. Panel C displays the results for the full sample with all offers, Panel D displays the sub-sample of bidders with a toehold below 30% and control-taking offers.

Table A.4 Definition of Variables**Dependent variable***Variable*

Percentage shares gained	Own construction, takeover offer document published on BaFin Website	Proportion of shares acquired during the acceptance period divided by the proportion of shares not under the bidder's control at the offer
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Independent variables*Target ownership structure variables*

Removal	Refinitiv Ownership and Profile	1 if Deutsche Börse announces the removal of the target from DAX, TECDAX, SDAX, or MDAX and zero during the acceptance period, otherwise
Extraordinary adjustment	Deutsche Borse	1 if Deutsche Börse announces an unscheduled adjustment connected to the target during the acceptance period, zero otherwise
Index removal	Own calculation	1 if removal = 1 or extra ordinary adjustment = 1, 0 otherwise
Stake Passive ETF	Refinitiv Ownership and Profile	Proportion of total shares held by Passive ETF divided by proportion of shares not under the bidder's control by the time of the offer
Passive Ownership	Refinitiv Ownership and Profile	Proportion of total shares held by funds with an investment style of "Index" but that are <i>not</i> ETFs, divided by proportion of shares not under the bidder's control by the time of the offer
Herfindahl-Hirschman ownership index	Refinitiv Ownership and Profile	Ownership concentration, measured as the accumulated sum of individual shareholders' number of shares divided by the square number of shares not under the bidder's control by the time of the offer (see Table A.1 in the Appendix for further details on the calculation methodology)
Toehold	Refinitiv Ownership and Profile, takeover offer document published on the BaFin website	Proportion of total shares the bidder owns in the target company's shares prior to the offer
Irrevocable	Offer document	Proportion of total shares secured through irrevocable undertakings and pre-negotiated share transfers, divided by the proportion of shares not under the bidder's control at the time of the offer

Takeover variables

Offer premium	Takeover offer document published on BaFin Website	Percentage takeover premium on three-month weighted average target share price, according to § 5 WpÜGAV
Management recommendation	Statement of the Board of Directors, Bundesanzeiger	Indicator variable set equal to one if target management provides a positive recommendation on the takeover offer (i.e., recommends accepting the offer), zero otherwise
Competing offer	Takeover offer document published on BaFin Website	Indicator variable set equal to one if a competing bid exists, zero otherwise
Method of payment	Takeover offer document published on the BaFin website	Indicator variable set to 1 if the offer consideration is made in cash, 0 otherwise

Table A.4 (Continued)

Multiple round	Takeover offer document published on BaFin Website	Indicator variable set equal to one if the bidder has made changes to the original bid, thus extending the acceptance period of the offer
Mandatory offer	Takeover offer document published on BaFin website	Indicator variable set equal to one if the bidder had to make a mandatory offer, zero otherwise
Minimum acceptance rate	Takeover offer document published on the BaFin website	The indicator variable is set equal to one if the takeover attempt is conditional on a minimum rate of shareholders accepting the takeover offer
Financial bidder	Refinitiv Ownership and Profile	Indicator variable set equal to one if bidder is a financial investor (incl. private equity) according to Refinitiv classification and zero otherwise
Strategic bidder	Cleary Gottlieb Steen & Hamilton LLP, Refinitiv Ownership and Profile	Indicator variable set to 1 if the target and the bidder operate in the same industry, according to Cleary Gottlieb Steen & Hamilton LLP's industry classification
Foreign bidder	Refinitiv Ownership and Profile	Indicator variable set equal to one if the bidder is foreign and operates from a non-German-speaking country and zero if the bidder is from a German-speaking country (Germany, Austria, Switzerland)
Crisis	Takeover offer document published on BaFin Website	Indicator variable set equal to one if a takeover offer was made in the Financial Crisis years (2008, 2009) or European Crisis year (2012) or Covid era (2019, 2021)
Size	Takeover offer document published on BaFin website	Natural logarithm of enterprise value (in EUR mn), calculated as total shares outstanding multiplied with offered share price by the time of the offer

$$\text{Relative ownership concentration} = \frac{\sum (\text{Ownership stake}_i)^2}{(1 - \text{Stake under bidder's control at the offer})^2}$$

$$\text{with Ownership stake}_i = \frac{\# \text{ shares owned by shareholder}_i}{\# \text{ total shares outstanding}}$$

$$\text{and Stake under bidder's control at the offer} = \frac{\# \text{ shares under bidder's control at the offer}}{\# \text{ total shares outstanding}}$$

Fig. A.1 Calculation of relative ownership concentration

Table A.5 Divestment of Funds and ETF—Deutsche Börse Indices**Panel A: Full Sample/All Offers**

–	<i>N</i>	Mean	S.D	Q1	Median	Q3
<i>Number of invested ETFs</i>						
Before the takeover offer acceptance period						
ETF	95	3.537	4.148	1	2	5
Passive ETF	95	3.295	3.596	1	2	5
Active ETF	95	0.242	0.795	0	0	0
After the takeover offer acceptance period						
ETF	95	2.211	2.440	1	1	3
Passive ETF	95	2.137	2.368	1	1	3
Active ETF	95	0.074	0.300	0	0	0
Divested fund						
ETF	95	1.326	3.154	0	0	1
Passive ETF	95	1.158	2.707	0	0	1
Active ETF	95	0.168	0.613	0	0	0
<i>Ownership stake of ETF</i>						
Before the takeover offer acceptance period						
ETF	95	0.61	0.529	0.204	0.427	1.037
Passive ETF	95	0.593	0.514	0.192	0.426	0.964
Active ETF	95	0.017	0.063	0	0	0
After the takeover offer acceptance period						
ETF	95	0.317	0.391	0.028	0.19	0.458
Passive ETF	95	0.311	0.382	0.022	0.19	0.458
Active ETF	95	0.005	0.039	0	0	0
Divest						
ETF	95	0.293	0.474	0	0.118	0.421
Passive ETF	95	0.282	0.467	0	0.094	0.401
Active	95	0.012	0.055	0	0	0
<i>Individual Ownership stake of ETF</i>						
Before the takeover offer acceptance period						
ETF	337	0.172	0.243	0.025	0.068	0.21
Passive ETF	314	0.179	0.249	0.028	0.07	0.216
Active ETF	23	0.071	0.109	0.007	0.02	0.098
After the takeover offer acceptance period						
ETF	337	0.089	0.179	0	0.016	0.078
Passive ETF	314	0.094	0.183	0	0.02	0.088
Active ETF	23	0.022	0.079	0	0	0.003
Divested stake						
ETF	337	0.083	0.194	0	0.013	0.075
Passive ETF	314	0.085	0.199	0	0.013	0.077
Active ETF	23	0.048	0.102	0.003	0.011	0.069

Table A.5 (Continued)**Panel B. Toehold below 30%/Control-taking Offers**

–	N	Mean	S.D	Min	Median	Max
<i>Number of invested ETFs</i>						
Before the takeover offer acceptance period						
ETF	64	3.422	4.305	1	2	5
Passive ETF	64	3.188	3.720	1	1	4.5
Active ETF	64	0.234	0.831	0	0	0
After the takeover offer acceptance period						
ETF	64	2.297	2.518	1	1	3
Passive ETF	64	2.234	2.480	1	1	3
Active ETF	64	0.063	0.244	0	0	0
Divested fund						
ETF	64	1.125	2.941	0	0	1
Passive ETF	64	0.953	2.407	0	0	1
Active ETF	64	0.172	0.656	0	0	0
<i>Ownership stake of ETF</i>						
Before the takeover offer acceptance period						
ETF	64	0.63	0.538	0.211	0.392	1.07
Passive ETF	64	0.61	0.517	0.211	0.36	1.051
Active ETF	64	0.02	0.072	0	0	0
After the takeover offer acceptance period						
ETF	64	0.342	0.415	0.033	0.192	0.473
Passive ETF	64	0.336	0.403	0.033	0.192	0.473
Active ETF	64	0.006	0.046	0	0	0
Divest						
ETF	64	0.287	0.479	0	0.132	0.372
Passive ETF	64	0.273	0.469	0	0.107	0.29
Active	64	0.014	0.064	0	0	0
<i>Individual Ownership stake of ETF</i>						
Before the takeover offer acceptance period						
ETF	220	0.183	0.257	0.025	0.07	0.216
Passive ETF	205	0.19	0.263	0.029	0.07	0.218
Active ETF	15	0.086	0.130	0.01	0.02	0.121
After takeover offer acceptance period						
ETF	220	0.1	0.192	0	0.021	0.091
Passive ETF	205	0.105	0.197	0	0.028	0.095
Active ETF	15	0.026	0.094	0	0	0.003
Divested stake						
ETF	220	0.084	0.203	0	0.008	0.07
Passive ETF	205	0.085	0.208	0	0.008	0.068
Active ETF	15	0.059	0.123	0.006	0.011	0.081

This table reports changes in ETF ownership during the acceptance period for takeover attempts of publicly listed companies in Germany, focusing on ETFs tracking Deutsche Börse AG indices. It displays changes in the total stake of all ETF and the change of the average individual stake in the target during the acceptance period. Panel A shows summary statistics for the full sample of all offers, and Panel B shows summary statistics for the sub-sample of bidders with a toehold below 30% and control-taking offers

Table A.6 Test of Multicollinearity

Variable	Full Sample		Below 30%/Control-taking Offers	
	VIF	1/VIF	VIF	1/VIF
Passive ETF	1.460	0.683	1.830	0.545
Index Listing	1.770	0.565	1.930	0.519
Irrevocable undertaking	1.320	0.757	1.440	0.694
Index removal	1.440	0.693	1.330	0.750
Mgt. Recommend	1.230	0.813	1.580	0.632
Toehold	1.690	0.591	1.630	0.615
Premium	1.150	0.870	1.300	0.767
HHI	1.100	0.908	1.170	0.854
Competitive Bid	1.060	0.944	1.080	0.929
LNEV	2.050	0.488	2.630	0.381
Consideration	1.160	0.865	1.250	0.800
Minimum Threshold	1.480	0.676	1.650	0.605
Mandatory Offer	1.450	0.692	1.070	0.936
SI Bidder	2.160	0.463	2.600	0.385
Foreign Bidder	2.000	0.501	2.570	0.389
Financial Bidder	1.100	0.906	1.240	0.805
Mean VIF	1.480	–	1.640	–

Table A.7 Impact analysis of confounding variables*Panel A: Analysis of hedge fund stake*

Variable	Bias to invalidate the inference of a variable		Impact threshold for omitted variable to invalidate inference	
–	Percent	Case number	Correlation outcome variable	Correlation predictor of interest
Stake Passive ETF	31.65%	152	–0.150	0.150

Panel B: Below 30%

Variable	Bias to invalidate the inference of a variable		Impact threshold for omitted variable to invalidate inference	
–	Percent	Case number	Correlation outcome variable	Correlation predictor of interest
Stake Passive ETF	35.63%	67	0.199	0.199

This table reports sensitivity analyses on the impact of a potentially confounding variable. It assesses the statistical inference for the regression coefficient on the ETF impact on success rate. The table reports the impact analysis for the key independent variable used in model (2) of the baseline regression analysis shown in Table 3

Table A.8 Correlation Analysis

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) SUCCESS	1.000	–								
(2) Passive ETF	0.152*** (0.001)	1.000	–							
(3) Index Listing	0.140*** (0.002)	0.438*** (0.000)	1.000	–						
(4) DAX Passive ETF	0.139*** (0.002)	0.900*** (0.000)	0.548*** (0.000)	1.000	–					
(5) Mgt. Recommend	0.424*** (0.000)	0.147*** (0.001)	0.104** (0.021)	0.136*** (0.003)	1.000	–				
(6) irrevocable undertaking	0.431*** (0.000)	–0.059 (0.190)	–0.073* (0.106)	–0.072 (0.111)	0.182*** (0.000)	1.000	–			
(7) Index Removal	0.302*** (0.000)	0.391*** (0.000)	0.418*** (0.000)	0.386*** (0.000)	0.202*** (0.000)	–0.013 (0.779)	1.000	–		
(8) Threshold	–0.362*** (0.000)	–0.075* (0.098)	–0.234*** (0.000)	–0.088* (0.051)	–0.069 (0.129)	–0.374*** (0.000)	–0.205*** (0.000)	1.000	–	
(9) premium	0.250*** (0.000)	0.025 (0.575)	0.105*** (0.020)	0.044 (0.334)	0.243*** (0.000)	0.091** (0.043)	0.069 (0.126)	–0.113** (0.012)	1.000	–
(10) HHI	–0.049 (0.283)	0.208*** (0.000)	–0.007 (0.885)	0.087* (0.054)	0.044 (0.326)	–0.033 (0.470)	0.133*** (0.003)	0.093** (0.039)	–0.035 (0.436)	1.000

Pairwise correlations—Full Sample/All Offers Size

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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Availability of data and material The data underlying the findings of this study is available upon request from the corresponding author, Bernhard Schwetzler.

Code availability Custom STATA code generated and used during the study is available upon request from the corresponding author, Bernhard Schwetzler.

Declarations

Consent for publication The authors confirm to have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including timing of publication, with respect to intellectual property.

Conflict of interest K. Brefo Osei and B. Schwetzler declare that they have no competing interests.

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References

- Achleitner, A.-K., A. Betzer, M. Goergen, and B. Hinterramskogler. 2013. Private equity acquisitions of continental European firms: the impact of ownership and control on the likelihood of being taken private. *European Financial Management* 19(1):72–107.
- Aguilera, R.V., K.A. Desender, M.L.P. Lamy, and J.H. Lee. 2017. The governance impact of a changing investor landscape. *Journal of International Business Studies* 48(2):195–221.
- Antoniou, C., F. Li, X. Liu, A. Subrahmanyam, and Ch Sun. 2023. Exchange traded funds and real investment. *Review of Financial Studies* 36(3):1043–1093.
- Appel, I.R., T.A. Gormley, and D.B. Keim. 2016. Passive investors, not passive owners. *Journal of Financial Economics* 121(1):111–141.
- Appel, I.R., T.A. Gormley, and D.B. Keim. 2019. Standing on the shoulders of giants: the effect of passive investors on activism. *Review of Financial Studies* 32(7):2720–2774.

there is no comparable effect and anti-takeover provisions may even have a positive effect on deal performance.

- Barclay, M.J., and C.G. Holderness. 1991. Negotiated block trades and corporate control. *The Journal of Finance* 46(3):861–878.
- Bates, T., and D.A. Becher. 2017. Bid resistance by takeover targets: managerial bargaining or bad faith? *Journal of Financial and Quantitative Analysis* 52(3):837–866.
- Bebchuk, L., and S. Hirst. 2019a. Index funds and the future of corporate governance: theory, evidence, and policy. *Columbia Law Review* 119(8):2029–2146.
- Bebchuk, L., and S. Hirst. 2019b. The specter of the giant three. *Boston University Law Review* 99:721–741.
- Benz, L., A. Jacob, S. Paulus, and M. Wilkens. 2020. Herds on green meadows: the decarbonization of institutional portfolios. *Journal of Asset Management* 21(1):13–31.
- Bessler, W., and C. Schneck. 2015. Excess premium offers and bidder success in European takeovers. *Eurasian Economic Review* 5(1):23–62.
- Bessler, W., W. Drobetz, and J. Holler. 2015a. The returns to hedge fund activism in Germany. *European Financial Management* 21(1):106–147.
- Bessler, W., C. Schneck, and J. Zimmermann. 2015b. Bidder contests in international mergers and acquisitions: the impact of toeholds, preemptive bidding, and termination fees. *International Review of Financial Analysis* 42:4–23.
- Betton, S., and E.B. Eckbo. 2000. Toeholds, bid jumps, and expected payoffs in takeovers. *The Review of Financial Studies* 13(4):841–882.
- Betton, S., E.B. Eckbo, and K. Thorburn. 2009. Merger negotiations and the toehold puzzle. *Journal of Financial Economics* 91(2):158–178.
- BlackRock, Inc. 2018. *Larry Fink's annual letter to CEOs—2018*. New York City: BlackRock.
- BlackRock, Inc. 2020. Securities lending viewed through the sustainability lens. <https://www.blackrock.com/corporate/literature/publication/securities-lending-viewed-through-the-sustainability-lens.pdf>.
- Bolton, P., T. Li, E. Ravina, and H. Rosenthal. 2020. Investor ideology. *Journal of Financial Economics* 137(2):320–352.
- Branch, B., and T. Yang. 2003. Predicting successful takeovers and risk arbitrage. *Quarterly Journal of Business & Economics* 42(1):3–17.
- Broccardo, E., O. Hart, and L. Zingales. 2022. Exit versus voice. *Journal of Political Economy* 130(12): 3101–3145.
- Brogaard, J., D. Heath, and D. Huang. 2024. *ETF sampling and index arbitrage*. Working Paper.
- Campa, J.M., and C. Moschieri. 2009. The European M&A industry: trends, patterns and shortcomings. *Academy of Management Perspectives* 23(4):71–87.
- Cao, C., B.A. Goldie, B. Liang, and L. Petrask. 2016. What is the nature of hedge fund manager skills? Evidence from the risk-arbitrage strategy. *Journal of Financial and Quantitative Analysis* 51(3):929–957.
- Cleary Gottlieb, Steen, and L.L.P. Hamilton. 2017. *Public bids and squeeze-outs, A statistical survey (2002–2016)*. Frankfurt, Cologne: Cleary Gottlieb Steen & Hamilton LLP.
- Cragg, J.C., and S. Donald. 1993. Testing identifiability and specification in instrumental variable models. *Economic Theory* 9(2):222–240.
- Denis, D.J., and T.A. Kruse. 2000. Managerial discipline and corporate restructuring following performance declines. *Journal of Financial Economics* 55(3):391–424.
- Deutsche Börse. 2020. *20 Years ETF Trading on Xetra*. Frankfurt am Main: Deutsche Börse.
- Deutsche Börse AG Group. 2019. Unscheduled Adjustment in MDAX. <https://deutsche-boerse.com/dbg-en/media/press-releases/Unscheduled-adjustment-in-MDAX-1611870>.
- Dobmeier, L., R. Lavrova, and B. Schwetzler. 2020. *Determinants of hedge fund investment in corporate endgames*. Working Paper.
- Drobetz, W., and P. Momtaz. 2020. Antitakeover provisions and firm value: new evidence from M&A markets. *Journal of Corporate Finance* 62:101594.
- Duggal, R., and J.A. Millar. 1994. Institutional investors, antitakeover defenses and success of hostile takeover bids. *The Quarterly Review of Economics and Finance* 34(4):387–402.
- Dyer, T., and N.M. Guest. 2022. *A tale of two index funds: full replication vs. representative sampling*. Working Paper.
- Edmans, A., and C.G. Holderness. 2017. Blockholders: a survey of theory and evidence. In *The handbook of the economics of corporate governance*, Vol. 1, ed. B. Hermalin, M. Weisbach, 541–636. North Holland.
- Edwards, J., and A. Weichenrieder. 2004. Ownership concentration and share valuation. *German Economic Review* 5(4):143–171.

- ETFGI. 2020. ETFGI reports assets in the global ETFs and ETPs industry which Will turn 30 years old in march started the new decade with a record 6.35 trillion US dollars. <https://etfgi.com/news/press-releases/2020/01/etfgi-reports-assets-global-etfs-and-etps-industry-which-will-turn-30>.
- Ferreira, M.A., and P. Matos. 2008. The colors of investors' money: the role of institutional investors around the world. *Journal of Financial Economics* 88(3):499–533.
- Flanagan, D.J., J.P. D'Mello, and K. O'Shaughnessy. 1998. Completing the deal: determinants of successful tender offers. *The Journal of Applied Business Research* 14(3):21–32.
- Franks, J., and C. Mayer. 2001. Ownership and control of German corporations. *The Review of Financial Studies* 14(4):943–977.
- Franks, J., C. Mayer, and L. Renneboog. 2001. Who disciplines management in poorly performing companies? *Journal of Financial Intermediation* 10(3-4):209–248.
- Glosten, L., S. Nallareddy, and Y. Zou. 2021. ETF activity and informational efficiency of underlying securities. *Management Science* 67(1):22–47.
- Handelsblatt. 2019. Axel Springer verlässt MDax – Cancom rückt auf. <https://www.handelsblatt.com/finanzen/maerkte/marktberichte/medienkonzern-axel-springer-verlaesst-mdax-cancom-rueckt-auf/24945098.html>.
- Heath, D., D. Macciocchi, R. Michaely, and M.C. Ringgenberg. 2022. Do index funds monitor? *The Review of Financial Studies* (35):91–131.
- Höfler, P., Ch Schlag, and M. Schmeling. 2025. *Passive investing and market quality*. Working Paper. Frankfurt: Goethe University.
- Hopt, K.J. 2015. Corporate governance in Europe: a critical review of the European commission's initiative on corporate law and corporate governance. *New York University Journal of Law & Business* 12(1):139–158.
- Kobayashi, M. 2007. Ownership structure, shareholder intervention, and success in takeovers. *Japan and the World Economy* 19(4):425–440.
- Köke, F.J. 1999. *New evidence on ownership structures in Germany*. Working Paper.
- La Porta, R., F. Lopez-de-Silanes, and A. Shleifer. 2008. The economic consequences of legal origins. *Journal of Economic Literature* 46(2):285–332.
- Lettau, M., and A. Madhavan. 2018. Exchange-traded funds 101 for economists. *Journal of Economic Perspectives* 32(1):135–154.
- Lindner, H.G. 2017. Das Drama um Stada: Warum ETFs Übernahmen immer schwieriger machen. <https://www.finanzzournalisten.de/das-drama-um-stada-warum-etfs/>.
- O'Sullivan, N., and P. Wong. 1999. Board composition, ownership structure and hostile takeovers: some UK evidence. *Accounting and Business Research* 29(2):139–155.
- Petersen, M.A. 2009. Estimating standard errors in finance panel data sets: comparing approaches. *Review of Financial Studies* 22(1):435–480.
- Saffi, P., and X. Zheng. 2023. *Does the replication method matter? Comparing tracking performance during market turmoil*. Working Paper. Judge Business School, Cambridge University.
- Scharfstein, D. 1988. The disciplinary role of takeovers. *Review of Economic Studies* 55(2):185–199.
- Schmidt, C., and R. Fahlenbrach. 2017. Do exogenous changes in passive Institutional ownership affect corporate governance and firm value? *Journal of Financial Economics* 124(2):285–306.
- Schoenberg, R., and R. Reeves. 1999. What determines acquisition activity within an industry? *European Management Journal* 17(1):93–98.
- Schwert, G.W. 1996. Markup pricing in mergers and acquisitions. *Journal of Financial Economics* 41(2):153–192.
- Shleifer, A., and R.W. Vishny. 1997. A survey of corporate governance. *The Journal of Finance* 52(2):737–783.
- Walsh, J.P., and R.D. Kosnik. 1993. Corporate raiders and their disciplinary role in the market for corporate control. *Academy of Management Journal* 36(4):671–700.
- Wright, M., C. Weir, and A. Burrows. 2007. Irrevocable commitments and going private. *European Financial Management* 13(4):757–775.