Passive Ownership and Short Selling

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Abstract

We exploit quasi-exogenous variation in passive ownership around the Russell 1000/2000 cutoff to explore the causal effects of passive ownership on the securities lending market. We find that passive ownership causes an increase in lendable supply and short interest, while lending fees remain largely unchanged. The utilization ratio—i.e., the ratio of short interest over lendable supply—goes up, implying that shorting demand increases more than lendable supply. We argue that this additional demand results from an increase in the quality of lendable supply as passive funds are less likely to recall stock loans. This higher supply quality attracts informed short sellers, who improve the information efficiency around negative news releases and correct overpricing.

JEL classification: G11, G12, G14, G15

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The past two decades have seen a tremendous growth in passive investment. In August 2019, passive investment funds overtook active funds in terms of assets under management for the first time.[1] A growing body of research tries to understand the consequences of this seismic shift in asset management (e.g., Wurgler 2010; Ramaswamy 2011; Da and Shive 2016; for a survey, see Ben-David et al. 2017). We contribute to this literature by studying the impact of passive ownership on the securities lending market. In a way, we feel like research has jumped ahead by studying the consequences of passive ownership on diverse issues such as corporate governance, payout policy, firm value, mergers and acquisitions, corporate investment, price efficiency, activist investing etc.,[2] without fully mapping out the more direct and immediate consequences of passive ownership. We argue that one such direct consequence concerns the equity lending markets, in which passive funds are known to actively participate as security lenders (Blocher and Whaley 2016). Specifically, we conjecture that, through their role as suppliers of shares, passive lenders facilitate short selling, which can help explain—and potentially even drive—some of the aforementioned effects ascribed to passive ownership.

Short sellers need to borrow the security in the equity lending market if they want to keep a position open overnight. This makes equity lending key for enabling short selling, which itself is vital for the price and informational efficiency of the underlying shares in the stock market (Saffi and Sigurdson 2011; Beber and Pagano 2013; Boehmer and Wu 2013). Because passive funds are known to actively participate as security lenders (Blocher and Whaley 2016), we hypothesize that a sudden increase in passive ownership should first and foremost be associated with an increase in the lendable supply of securities. If this were the only effect, we would expect a decrease in the equilibrium lending fee and a resulting increase in short interest (i.e., the fraction of shares that are shorted over the number of outstanding shares) as displayed in Figure 1 Panel A. Our results, however, paint a more nuanced picture. In particular, we find evidence of a simultaneous and pronounced shift in lending supply *and* short selling demand. Importantly, the utilization ratio (i.e., the ratio of short interest over lendable supply) and the lending fee if anything increase, as displayed in Figure 1 Panel B.

[1] Confer Bloomberg article by John Gittelsohn: "End of Era: Passive Equity Funds Surpass Active in Epic Shift," published September 11, 2019.

[2] See for example Crane et al. (2014), Mullins (2014), Boone and White (2015), Appel et al. (2016, 2019), Schmidt and Fahlenbrach (2017), Israeli et al. (2017), Antoniou et al. (2018), Ben-David et al. (2018), Glosten et al. (2021), Heath et al. (2022).

Why does passive ownership cause additional short selling demand? The literature so far emphasizes three potential explanations: the *index inclusion effect* (Shleifer 1986; Chang et al. 2015), *poor governance* (Heath et al. 2022), and *ETF arbitrage*. According to the first two arguments, stocks added to an index widely followed by passive investors see a run-up in prices and/or a deterioration in governance quality, which leads to lower future returns and thereby attracts short sellers (Pavlova and Sikorskaya 2023; Sikorskaya 2023). According to the third argument, additional short selling occurs as part of an ETF arbitrage strategy when ETFs trade below the value of their baskets. We find that these explanations fall short of explaining all the increase in short selling demand. Indeed, we document a similarly large increase in short selling demand for stocks with a low inclusion returns (i.e., when future returns should not be lower) or on days when ETFs are overvalued (i.e., when ETF arbitrage would require shorting the ETF instead of the underlying stocks).

We therefore focus on a fourth channel as to why passive ownership causes more short selling: short sellers prefer borrowing shares from passive lenders, because they are long-term and stable shareholders and thus less likely to recall equity loans. Indeed, as pointed out by Reed (2013), p. 254: "Often the most stable sources of stock loans are portfolios with little turnover, such as index funds." Such a stable source of lendable supply may be particularly valuable to *informed* short sellers, who may be worried about information leakage and opportunistic loan recalls when borrowing from active owners (Honkanen 2024). We provide several pieces of evidence—summarized below—consistent with this conjecture. Our paper's key contribution is therefore to establish that passive owners increase both the quantity and *quality* of the supply of lendable shares, and that this supply by passive investors is particularly attractive to informed short sellers.

Identifying the causal effects of passive ownership is challenging. Given ample confounding factors, the interpretation of simple correlations between ownership and short selling variables are fraught with peril. To name one example, larger stocks are more likely to be tracked by passive investors, and are also known to be less short sale constrained. Controlling for firm size is no solution as the relation between firm size, passive ownership, and short sale constraints may well be non-linear. Other confounding factors are likely to be unobserved. For instance, it is plausible that investors' recognition of a stock drives both short selling and the extent with which it is held by passive index funds.

To circumvent these endogeneity concerns, we employ a well-established identification strategy surrounding Russell 1000/2000 reconstitution events (Chang et al. 2015; Appel et al. 2016). Every year in June, Russell decides which stocks from the Russell 1000 (2000) move down (up) to the Russell 2000 (1000) based on their end-of-May market capitalization. Both indexes are tracked by large passive funds with substantial assets under management (Chang et al. 2015). Importantly, the assets of passive funds tracking the Russell 2000 represent a larger percentage of the total market capitalization of that index, and hence stocks that are demoted to the Russell 2000 experience a surge in passive ownership. Following Appel et al. (2016, 2019, 2020), we therefore use Russell 2000 index membership as an instrumental variable for passive ownership. The identification assumption is that after controlling for market capitalization, stocks above and below the Russell 1000/2000 are similar except for their quasi-exogenous difference in passive ownership. Crucially, Appel et al. (2019) further show (and we confirm) that active ownership is not affected by the index assignment.

We implement this identification design by carefully taking into account the latest recommendations from the literature (Ben-David et al. 2019; Appel et al. 2020; Glossner 2020; Wei and Young 2020). We pay particular attention to sampling and to using the best available end-of-May market capitalization controls.[3] Following these recommendations, the Russell 1000/2000 setting allows us to isolate the causal effect of passive ownership without a confounding effect on total institutional ownership (Appel et al. 2020; Glossner 2020; Wei and Young 2020). Our results obtain in the cross-section (i.e., by comparing firms around the Russell 1000 membership threshold), as well as when we focus on firms that change index membership—further strengthening the confidence in our findings.

Our results can be summarized as follows. In the first stage, we find that Russell 2000 membership increases passive ownership by 1.2-1.5 percentage points, which represents an increase of 11-14% relative to the mean of passive ownership in our sample. This number is in line with prior studies (Appel et al. 2016, 2019). In the second stage, we document a large increase in lendable supply. Indeed, the magnitude of our coefficient estimate implies that passive ownership and lendable supply go up one-for-one, essentially

[3] Glossner (2020) and Wei and Young (2020) emphasize that, in order to prevent selection bias, sampling should be based on end-of-May market capitalization, which Russell uses to assign index membership. We construct our end-of-May market capitalization variable following Ben-David et al. (2019). They find that their variable strongly predicts actual index membership (and thus of the unobserved end-of-May market cap variable used by Russell). See below for further details.

suggesting that new passive owners offer all their shares for lending. If we allow for the possibility that standard mutual ownership databases (which we use) underestimate the true extent of passive ownership (Chinco and Sammon 2023; Huang et al. 2024), the true economic effect may be somewhat lower, but it remains sizable. Concomitant to this rise in lendable supply, we find a sizable increase in short interest; i.e., the fraction of outstanding shares that are on loan. Moreover, we find that the lending fee and the utilization ratio—i.e., the ratio of shares lent to the lendable supply—if anything go up. This shows that both the supply and the demand for short selling shift up in response to increased passive ownership.

We hypothesize that this increase in short selling demand arises from a preference to borrow from passive stockowners, which occurs for two reasons. First, passive owners are long-term shareholders with little discretion to adjust their stock positions, reducing the risk of a premature loan recall. Second, informed short sellers may be worried that active owners free-ride on their information when they see a rise in borrowing demand (Honkanen 2024; Greppmair et al. 2023).

We find several pieces of evidence consistent with this explanation. First, we propose and study three different empirical proxies for loan supply quality—average loan tenure, delivery failures, and lending supply drops. Intuitively, a more stable (i.e., higher quality) supply should be associated with a longer average loan tenure, fewer delivery failures (as a measure of recall risk), and fewer sharp drops in lending supply. Using panel regressions, we find that passive ownership is indeed much more strongly related to these quality proxies compared to active ownership. Using our IV specification, we confirm that the relation between passive ownership and lending supply quality is causal. Second, we exploit novel regulatory data (collected from SEC form N-PORT) to provide direct evidence that stock loans given by passive lenders are more likely to be continued from one quarter to the next, and that—presumably for this reason—short sellers prefer borrowing from passive funds. Third, linking back to our earlier analysis, we show that the passive ownership-induced increase in short selling demand for Russell 2000 stocks is more pronounced for stocks with *ex-ante* high utilization ratios, high lending fees, and low lending supply quality.

Finally, we document that passive ownership attracts *informed* short sellers. Indeed, we find that short interest becomes a better predictor for future returns after the exogenous increase in passive ownership. Taken together with the fact that short interest increases, this suggests that the composition of short sellers

has shifted to relatively more informed ones. We further find that, for Russell 2000 stocks, short sellers are more active before negative news disclosed on earnings announcement dates and 8-K filing events, and we show that this accelerates the incorporation of *negative news* into prices (relative to other news, implying that this finding comes on top of any unconditional effect of passive ownership on price informativeness; see, e.g., Coles et al. 2022; Antoniou et al. 2023; Sammon 2023). Moreover, we document that, for Russell 2000 stocks, overpricing as measured by the Stambaugh et al. (2015) mispricing measure is corrected more quickly (i.e., returns of overpriced stocks over the next 10 or 20 days are more negative). Overall, our findings suggest that informed short sellers prefer borrowing from passive owners because they provide higher quality lendable supply.

We contribute to the growing literature on passive ownership by showing that passive ownership promotes short selling not only because of an increase in supply, but also by enticing additional short selling demand. This has the potential to inform the underlying channels behind diverse findings documented in the literature. For example, consider corporate governance. Appel et al. (2016) and Mullins (2014) document that firms with passive owners improve governance by, among other things, appointing more independent directors and removing takeover defenses. In contrast, Heath et al. (2022) show that passive funds are less likely to vote against management on contentious governance issues. Our findings offer an explanation that can help reconcile this seemingly conflicting evidence: by facilitating short selling, passive owners indirectly increase the pressure on management to adopt better governance practices (Massa et al. 2015; Fang et al. 2016). Thus, passive owners may well be worse monitors (consistent with Heath et al. 2022) and yet their presence can lead to better governance outcomes (consistent with Appel et al. 2016). The indirect effect of passive ownership via short selling may also play a role in explaining other findings that have commonly been attributed to passive owners directly, such as the effects on firm value (Schmidt and Fahlenbrach 2017), payout policy (Crane et al. 2014), mergers and acquisitions (Antoniou et al. 2018), corporate investment (Fich et al. 2015), activist investing (Appel et al. 2019), price and information efficiency (Boone and White 2015, Israeli et al. 2017, Glosten et al. 2021), and volatility (Ben-David et al. 2018).[4] Moreover, our results suggest there is a complementarity between ownership structure and the

[4] Morck and Yeung (2011) write about identification based on IVs: "Each time an instrumental variable is shown to work in one study, that result automatically generates a latent variable problem in every other study that has used, or will use, the same instrumental variable, or another correlated with it, in a similar context." We feel that this comment aptly applies to the Russell

equity lending market and are thus important for correctly evaluating the effectiveness of regulatory policy. Indeed, policies that aim to promote or curb passive ownership will have different effects depending on conditions in the equity lending market.

Our second contribution is to the literature on equity lending (e.g. Geczy et al. 2002; Cohen et al. 2007; Kolasinski et al. 2013; Kaplan et al. 2013; Thornock 2013; Aggarwal et al. 2015; Engelberg et al. 2018; Sikorskaya 2023). Here, the papers closest to ours are Porras Prado et al. (2016) and Palia and Sokolinski (2024). The former paper finds that lending supply is correlated with less concentrated and higher long-term institutional ownership, and with passive ownership. The latter paper shows that passive investing is correlated with both higher lending supply and lending demand and argues that short sellers may prefer borrowing from passive investors. Our contribution is in *cleanly identifying* the effect of passive ownership on equity lending markets, providing an in-depth discussion of the different channels, and exploring new data (loan recalls and investor-level lending decisions) to establish a causal link between passive ownership and lending supply quality. Moreover, we show that the higher quality of lendable supply attracts informed short sellers, which spurs informed trading and affects asset prices by improving the price informativeness around *negative* news events and by accelerating the correction of overpricing.

Our paper proceeds as follows. Section 1 outlines our hypotheses. Section 2 presents the data and Section 3 the empirical methodology. Section 4 documents the main results for lendable supply, short interest, lending fees, and the utilization ratio. Section 5 shows that passive owners increase the quality of lendable supply. Section 6 studies the effects on the informational efficiency of the stock market. Section 7 offers robustness checks and Section 8 concludes.

1. Hypotheses

In this section, we explain the empirical hypotheses for the effects of passive ownership on the equilibrium in the securities lending market.

1000/2000 setting. Our study can be read as an attempt to provide a plausible narrative that "connects the dots" between passive ownership and firm outcomes/governance etc.

Passive funds (and especially ETFs) are active participants in the securities lending market (Blocher and Whaley 2016). Lending policies of U.S. mutual funds are generally set at the fund family level and dictate whether funds may participate in the lending market and how much they are allowed to lend if they do participate. While SEC rules constrain how much of a portfolio can be lent out at a given point in time, this constraint is rarely binding. Moreover, there is no additional regulatory constraint at the individual position level. Thus, while passive funds do not lend *all* of their portfolio holdings, they can lend all of their holding in a particular stock with high borrowing demand. Our first prediction is therefore that passive ownership will lead to an increase in lendable supply; i.e., the fraction of outstanding shares that is available for lending to short sellers. Moreover, if the shift in supply were the only effect (i.e., if there was no simultaneous shift in demand), one would expect a decrease in the equilibrium lending fee and an increase in short interest; i.e., the fraction of shares that are actually shorted. This situation is depicted in Figure 1 Panel A. Finally, as the equilibrium demand would increase by less than the total upshift in supply, the utilization ratio—i.e., shares shorted divided by lendable shares—should not increase.

As discussed in the introduction, existing literature suggests three reasons why an increase in passive ownership might lead to an upshift in shorting demand: first, the additional inelastic demand by passive investors pushes up stock prices, thereby attracting short sellers[5]; second, passive owners are known to be worse monitors (Heath et al. 2022), which could again attract short sellers; and finally, many passive owners are ETFs, whose secondary-market trading creates room for arbitrage between the ETF price and the price of the underlying stock basket.

While the results documented below are consistent with a simultaneous increase in short selling supply and demand (as depicted in Figure 1 Panel B), we explain in Section 4.4 why these explanations cannot explain all the documented increase in shorting demand. We therefore entertain a fourth channel why passive ownership can cause an increase in short-selling demand. This channel starts from the observation that equity loans are by design bilateral, renegotiable, and short-term agreements, thereby exposing short sellers to *recall risk* (Reed 2013; Engelberg et al. 2018). We posit that, since passive owners are long-term

[5] The literature is divided on whether the price effect from a surge in buying demand by passive investors should be transient (Greenwood 2005) or permanent (Kashyap et al. 2021; Pavlova and Sikorskaya 2023). Either way, short sellers may be attracted as they expect future returns to be either temporarily or permanently lower.

shareholders with little portfolio turnover, they provide a more stable lendable supply that is particularly attractive for long-horizon (e.g., informed) short sellers. In addition, passive lenders are less likely to opportunistically recall shares or free-ride on the information provided by the short seller. Active lenders, in contrast, appear to be reducing their stock position after a short seller borrows some shares (Honkanen 2024; Greppmair et al. 2023).

To study this channel, we investigate the effect of passive ownership on several proxies of loan supply quality: loan maturity, sudden drops in lendable supply, and the probability of delivery failures (as a proxy for short selling risk). If passive owners are, as hypothesized, more stable equity lenders, we expect loan maturity to increase and the occurrences of delivery failures and lending supply drops to decrease with passive ownership. Moreover, in the disaggregated fund-level lending data, we expect a higher likelihood for equity loans to be continued when the lender is a passive fund, as well as for short sellers being more likely to borrow from passive owners in the first place.

Finally, we study whether passive ownership affects the informativeness of short sales. We are motivated by the idea that short sellers wanting to trade on long-lived negative information benefit especially from a more stable supply provided by passive lenders. If passive ownership indeed attracts more informed short selling, we expect (a) the correlation between short interest and future stock returns (Asquith et al. 2005) to increase, (b) an increase in short selling and thus more information incorporation into prices prior to negative news releases, and (c) a faster correction of overpricing.

2. Data

2.1 Passive and Active Fund Holdings Data and Russell 1000/2000 Index Membership

We follow Appel et al. (2016) in how we construct the percentage of stocks held by active and passive funds. We use the s12 mutual fund holdings data from Thompson Reuters, which contains quarterly holdings of all U.S.-domiciled (open-ended) mutual funds and ETFs as reported to the SEC, and match it to CRSP mutual fund data using the MFLINKS table available on WRDS. We define a fund as passively managed if the CRSP Mutual Fund Database classifies the fund as an index fund or if its name in CRSP

contains a string that suggests that it is an index fund.[6] All other funds that we can match to CRSP are classified as active funds; funds that are not matched to CRSP are left unclassified. Then we compute the percentage of each stock's shares outstanding (obtained from CRSP securities data) that is owned by active, passive, and unclassified funds at the end of each quarter.

We obtain monthly data on the constituents of the Russell 1000 and Russell 2000 indexes from Mergent. In addition to index assignments and weights, the data includes Russell's float-adjusted market capitalization, which Russell uses to determine the weights in the index. We merge Russell data to our other datasets using 8-digit CUSIPs.

2.2 Market Capitalization Data and Equity Lending Data

For our identification strategy, it is important to control for a stock's market capitalization, as this is the key variable that determines whether the stock is assigned to the Russell 1000 or Russell 2000 (see details below). Because we do not have access to the exact market capitalization variable used by Russell, we follow the approach proposed by Ben-David et al. (2019) to obtain a close substitute market capitalization measure from CRSP and Compustat data (see Internet Appendix A.1 for details). We construct this measure using the SAS-code provided in their paper. For robustness, we verify that our results obtain if we simply use market capitalizations computed from CRSP (see Section 7.2).

We obtain equity lending data from IHS Markit for the period July 2006 to December 2018. IHS Markit collects its equity lending data from custodians, in-house lending arms, and prime brokers that lend and borrow securities and is the leading provider of such data. In addition, we have access to the underlying raw data that includes all individual equity lending transactions in the dataset. We aggregate these data on the stock-day level and compute the following variables: *Lendable supply* is defined as the number of shares available to lend (this includes the shares that are actually lent out) divided by shares outstanding (from CRSP). *Short interest (equity loans)* is defined as shares currently on loan divided by shares outstanding.[7]

[6] We use the same set of strings to identify index funds as Appel et al. (2016): Index, Idx, Indx, Ind_ (where _ indicates a space), Russell, S & P, S and P, S&P, SandP, SP, DOW, Dow, DJ, MSCI, Bloomberg, KBW, NASDAQ, NYSE, STOXX, FTSE, Wilshire, Morningstar, 100, 400, 500, 600, 900, 1000, 1500, 2000, and 5000. The comparison is case sensitive.

[7] We call this variable *Short interest* because short selling is the main reason for borrowing equities. As there can be other reasons to borrow equities (e.g., tax arbitrage (Thornock 2013) or vote lending before annual meetings (Aggarwal et al. 2015), we also use short interest data from Compustat in a robustness check. These data are provided by NASDAQ, NYSE, and American Stock

Lending fee is defined as the value-weighted average fee that equity lenders receive from prime brokers. As discussed in Muravyev, Pearson, and Pollet (2022), short sellers such as hedge funds usually borrow shares through their prime brokers, who in turn borrow them from ultimate owners like mutual or pension funds. Short sellers have to pay a fee that may include a mark-up and may thus be higher than the fee paid by the prime broker to the ultimate lender, which is measured by our *Lending fee* variable. However, as these mark-ups are sticky, changes in *Lending fee* should correlate strongly with changes in fees faced by short sellers. *Utilization* is the fraction of shares available to lend that is actually lent out.[8] Finally, we compute monthly averages of these variables and merge the data via 8-digit CUSIPs to our other datasets.

2.3 Lending Supply Quality Proxies

Here we briefly describe the data sources behind the lending supply quality proxies that we study in our paper; see Section 5.1 below for more detail. Our first proxy is *Loan tenure*, defined as the average number of days that equity loans have been open that month. While there are some term loans, most equity loans are rolled over and can thus be recalled every day. A long tenure therefore implies that the loan was not recalled. Our second proxy is based on the idea that large and sudden declines in lendable supply increase the risk that short sellers will be forced to close their positions. We thus define *Lendable supply drops* as the fraction of days within a stock-month on which lendable supply declines by more than 5%. Both *Loan tenure* and *Lendable supply drops* are directly computed from the IHS Markit data.

Our third lending supply quality proxy captures recall risk more directly by looking at failures to deliver (FTD), recorded by the National Securities Clearing Corporation's settlement system and provided on the Securities and Exchange Commission (SEC)'s website.[9] Failures to deliver are closely related to shorting because short sellers (by definition) do not own the stocks they are selling. When they cannot (or strategically do not; see Boni (2006)) borrow the promised stock before the sell transaction settles, a failure to deliver occurs. Thus, FTD are a manifestation of short selling risk. Consistent with this view, we show

Exchange and are available bi-monthly on the 15th and the last business days of the month. We average these variables to compute *Short interest (Compustat)* at the monthly level.

[8] Markit receives data from both lenders and borrowers but can only get "shares available to lend" from equity lenders. Thus, when computing utilization, we only include shares on loan where IHS Markit received the information from the lender.

[9] SEC failures to deliver data: https://www.sec.gov/data/foiadocsfailsdatahtm.

in Internet Appendix A.6 that (1) FTD strongly correlate with short interest (Panel A), and that (2) FTD scaled by short interest correlate negatively with one-month ahead short interest, suggesting that short sellers are reluctant to short stocks with a high fraction of equity loans resulting in delivery failures. We therefore define *Delivery Failures* as the number of shares that fail to deliver divided by open short positions as measured using the equity lending data. We compute this variable for each trading day and then average it over the month. The FTD data is available starting in February 2004. Prior to September 16, 2008, the FTD data is restricted to outstanding balances of 10,000 shares or more. We merge the FTD data with our other datasets using 8-digit CUSIPs.

2.4 Earnings Announcements, 8-K Filings, and Overpricing Measure

To gauge the impact of short selling on information efficiency, we study two major firm-specific news releases: quarterly earnings announcements and 8-K filings. The former are prescheduled, the latter are ad-hoc disclosures of material changes in financial conditions or operations (see Ben-Rephael et al. (2022) for more detail). By studying both types of news events, we shed light on the sources of short sellers' information advantage: do they collect more information before pre-scheduled announcements and/or do they react quickly to rumors or private tips prior to unscheduled announcements? Earnings announcement dates come from I/B/E/S, 8-K event dates are obtained from SEC Analytics Suite by WRDS.[10]

We examine whether short sellers trade more actively in anticipation of negative news releases and whether their activity spurs the capitalization of information in stock prices using two measures based on the return response to the news: Weller (2018)'s *price jump ratio* and, following Sammon (2023), the absolute announcement alpha scaled by the stock's prior standard deviation, $|Alpha|/SD$. For both measures, a lower value indicates that more information is capitalized prior to being publicly announced and hence a higher information efficiency. Details on the construction of these measures are provided in Section 6.3.

Finally, we assess the impact of passive ownership-induced short selling on another dimension of price efficiency: the correction of stock overpricing. For this test, we rely on the mispricing measure constructed

[10] If 8-K event days or earnings announcement days are on the weekend or holidays, we use the next trading day as the event/announcement date. The same is true of earnings announcements released after 4pm.

by Stambaugh et al. (2015), which measures overvaluation by combining rankings based on 11 prominent anomaly strategies.[11] We download this variable directly from WRDS.

2.5 Disaggregated Lending Data by Passive and Active Owners

To provide direct evidence on the lending behavior of active or passive owners, we leverage novel data hand-collected from N-PORT filings at the SEC. The N-PORT filings contain all portfolio holdings of all U.S. mutual funds and identify securities that are on loan to short sellers or other market participants. Using these filings from the universe of U.S. mutual funds, we restrict the sample to common stock (investment category = "EC") and investments within the United States (investment country = "US"). We then match the stock holdings of mutual funds to CRSP, from where we obtain the number of shares outstanding. This sample contains 5,251,920 fund-stock observations over the period from the third quarter of 2019 to the last quarter of 2022. 6.83% of securities positions are at least partially on loan by mutual funds, in line with the average short interest in our overall stock sample. We define a dummy variable *D(On loan)* that equals one if (at least a part of) the position is currently on loan and zero otherwise.

2.6 Summary Statistics

Table 1 presents summary statistics for our main sample focusing on ±500 stocks around the Russell 1000/2000 cutoff (summary statistics for the sample of ±250 stocks around the cut-off look very similar). *Passive ownership* is about 11% of shares outstanding, while *Active ownership* is about 21%. With 4% owned by unclassified funds, we get a total fund ownership of about 36 percent. *Lendable supply* is 27% of shares outstanding. *Short interest* is on average 6% to 7% of shares outstanding, irrespective of the underlying data source. *Utilization* is 11% on average and *Lending fee* is about 30 basis points. However, *Lending fee* has a large standard deviation of about 125 basis points, suggesting that some stocks are hard to borrow, leading to very high fees. On average, equity loans are open for slightly more than two months (about 70 calendar days) and half of equity loans have a tenure of more than one month. *Delivery failures* are rare at 0.5% of shorted stocks but also have a high standard deviation, suggesting that for some stocks delivery failures are more common. The median *Price jump ratio* based on alpha is 56% in our sample of

[11] For more details, see: https://finance.wharton.upenn.edu/~stambaug/Mispricing_Measure_Documentation.pdf

earnings announcements (similar to the value reported in Weller (2018)), and 35% in our sample of 8-K events.

Our sample period spans the period from July 2006 to December 2018 and is dictated by the availability of the equity lending data. Finally, we note that all continuous variables are winsorized at the 1st and 99th percentiles in order to mitigate the effect of outliers.

3. Methodology

Identifying the causal effects of passive ownership on equity lending and short selling is challenging. For example, omitted variables such as unobservable firm characteristics may drive both passive ownership and short selling. In addition, there could be reverse causality; for example, high shorting demand may increase the fee that lenders can charge and thereby make the stock more attractive to passive investors. To address these issues, we use Russell 1000 and Russell 2000 index membership as a source of exogenous variation in passive ownership. Appel et al. (2020) explain that, when implemented carefully, index membership provides a powerful instrument for passive ownership and, as such, this approach has been widely used (e.g., Chang et al. 2015; Appel et al. 2016, 2019; and Ben-David et al. 2018). We briefly describe and motivate this identification strategy below and refer the reader to Appel et al. (2020), Glossner (2020), and Wei and Young (2020) for more detail.

The Russel 1000 index comprises the 1000 U.S. stocks with the largest market capitalization and the Russell 2000 index comprises the next largest 2000 stocks. While both indexes are tracked by a large number of index funds and ETFs, these funds' assets under management make up a larger fraction of the total market capitalization for the Russell 2000, implying that passive funds own a larger fraction of that index. Thus, when a stock's market capitalization falls enough so that it moves from the Russell 1000 to the Russell 2000 index, its passive ownership increases significantly. This can be clearly seen in Figure 2 Panel A, which shows average passive ownership for the largest (smallest) firms in the Russell 2000 (1000). In contrast, and as shown in Panel B, active ownership shows no discernable change around the market capitalization cutoff that determines index membership.

The fact that Russell assigns index membership based on market capitalization (which we control for) allows us to use Russell 2000 index membership as an instrumental variable for passive ownership. Specifically, every year at the end of June, Russell reconstitutes the indexes to account for changes in firms' market capitalizations. The variable that determines index membership is the *total* (not float-adjusted) market capitalization at the end of May. The weight within the index is then determined using the *float-adjusted* market capitalization at the end of June (i.e, weights are based on market capitalizations excluding closely held shares). Until 2007, Russel simply ranked stocks by their end-of May (total) market capitalization and assigned the top 1000 stocks to the Russell 1000 index. From 2007 onwards, Russell has implemented a banding policy in order to reduce the number of stocks that switch indexes each year. We implement the instrumental variable strategy developed in Appel at al. (2019), which allows for identification despite the banding policy.

Specifically, we run monthly instrumental variable regressions with the following first-stage regression:

$$Passive\ Ownership_{i,t} = \alpha_t + \beta_1 * D\left(Russell\ 2000_{i,t}\right) + \sum_{n=1}^{3} \gamma_n * \left(Ln\left(Mktcap_{i,last\ May}\right)\right)^n$$
$$+\beta_2 * D\left(banded_{i,last\ May}\right) + \beta_3 * D\left(Russell_{i,last\ May}\right)$$
$$+\beta_4 * D\left(banded_{i,last\ May}\right) * D\left(Russell\ 2000_{i,last\ May}\right) + \beta_5 * Ln\left(Float_{i,last\ June}\right) + \varepsilon_{i,t}$$

where α_t are time fixed effects, *D(Russell 2000)* is a dummy variable equal to one if the company is in the Russell 2000 index and equal to zero if it is in the Russell 1000 index, $Mktcap_{i,last\ May}$ is the estimate of market capitalization at the end of last May following Ben-David et al. (2019), $D\left(banded_{i,last\ May}\right)$ is a dummy variable equal to one if the company was close enough to the threshold to be banded, $D\left(Russell\ 2000_{i,last\ May}\right)$ is a dummy variable equal to one if the stock was in the Russell 2000 index as of last May (and thus over the course of the prior year), and $Float_{i,last\ June}$ is the float-adjusted market capitalization at the end of last June based on which Russell assigns index weights for the following year. Following Appel et al. (2016, 2019), we also control for the second and third order polynomial of the end-of-May market capitalization. Since we control for all variables that determine Russell membership (market capitalization, banding controls, and prior index membership), the use of *D(Russell 2000)* as an instrument provides plausibly exogenous variation in passive ownership (see Appel et al. 2020; Glossner 2020).

To determine whether a firm is banded, we compute the total market capitalization of the Russell 3000 index and sort all firms in that index by market capitalization.[12] We then compute the cumulated market capitalization percentiles for each firm (for example, if a firm has a 75th percentile, it means that firms smaller than it make up 75% of the total market capitalization of the Russell 3000 index). A firm is banded if its cumulated percentile is less than 2.5 percentage points different from the cumulated percentile of the 1000th stock. This approach follows the instructions by Russell and we show in Internet Appendix A.3 that it is highly predictive of actually realized index changes.

Identification will be tighter for stocks close to the cutoff between the Russell 1000 and Russell 2000 index. However, there is a trade-off as a smaller bandwidth implies fewer stocks and thus less statistical power to reject the null. We therefore show results for two samples: a larger sample of 500 stocks around the cut-off as used in Appel et al. (2019) and a smaller sample of only 250 stocks around the cut-off. Following Glossner (2020) and Wei and Young (2020), we use the market capitalization at the end of May (constructed following Ben-David et al. 2019) to form these samples. However, we show in Table 13 that our results are robust to sampling based on Russell's float-adjusted market capitalization (as used by Appel et al. (2019)) or market capitalization from CRSP.

4. Lendable Supply and Short Selling

4.1 Graphical Analysis

Before implementing cross-sectional IV specification as described above, we present here graphical evidence based on a simple event study analysis for stocks that switch indexes. For this event study analysis, we exploit the fact that our equity lending variables are available at the daily frequency.

In Figure 3, we plot average *Lendable supply* and *Short interest* in the 100 trading days around the date of a Russell 1000/2000 index reconstitution event. The left (right) panels display the effects for stocks that move from the Russell 1000 (2000) to the 2000 (1000) index. Panel A shows a sharp increase in lendable

[12] Russell actually uses the Russell 3000E index, which includes a few additional small stocks relative to the Russell 3000. Unfortunately, our data does not contain the Russell 3000E members. However, given the fact that the additional stocks are very small, using the Russell 3000 index instead of the Russell 3000E index does not make much of a difference. Indeed, we verify in Internet Appendix A.3 that our approach accurately identifies banded stocks.

supply of about 2.5 percentage points after a stock moves down to the Russell 2000 index and a corresponding 2.5 percentage point decrease in lendable supply for stocks moving up to the Russell 1000 index. Such a swift change is unlikely to be driven by an underlying trend and thus strongly suggests a causal effect of index reconstitution events. Panel B displays similar results for short selling activity. Stocks moving down (up) to the Russell 2000 (1000) indices experience on average a roughly 1.5 percentage point increase (decrease) in short interest. Our results thus indicate that both lendable supply and short selling demand increase with passive ownership around index reconstitution events. These effects are not temporary; indeed, we find that these increases persist in the cross section even after excluding the months surrounding index reconstitution events from our analysis (see Section 7.2).

4.2 Lendable Supply

We now proceed to our instrumental variable regression in order to study the causal effect of passive fund ownership on lendable supply. We begin with the first stage results shown in Table 2. In Columns 1 and 2, we regress passive ownership on the Russell 2000 index inclusion dummy for the narrow band of 250 stocks (on either side of the cutoff) and the wider band of 500 stocks, respectively. As explained above, all regressions control for a third-degree polynomial of the logarithm of total market capitalization at the end of last May computed using the methodology of Ben-David et al. (2019) as well as the logarithm of float-adjusted market capitalization at the end of last June as provided by Russell. In addition, we include a dummy variable indicating whether the stock was close enough to the cutoff to be banded, a dummy for whether the stock was included in the Russell 2000 index in the previous year, as well as the interaction of these two dummy variables. We include month fixed effects (in a robustness test, we confirm that our results continue to hold when we further include stock fixed effects; see Section 7.2). Standard errors are double-clustered by stock and month.

The first stage results show that a stock's inclusion in the Russell 2000 index increases passive fund ownership by about 1.1-1.5 percentage points. The Kleibergen-Paap (2006) F-statistic comfortably exceeds the Stock-Yogo (2005) critical value of 10, confirming the instrument is not weak. In contrast, we show in Columns 3 and 4 of Table 2 that Russell 2000 membership does *not* lead to an increase in active ownership. This confirms prior literature arguing that Russell 2000 membership can serve as an instrument for passive

ownership, while not affecting active ownership (e.g., Appel et al. 2016, 2019). Recent evidence suggests that conventional holdings-based passive ownership measures (which we use in our paper) underestimate the true extent of passive ownership by up to 50% (e.g., by not capturing (1) closet-indexers, (2) internally managed index portfolios, and (3) foreign passive investors; see Chinco and Sammon 2023; Huang et al. 2024). If true, the first stage effect of Russell 2000 membership on passive ownership may be closer to 2-3 percentage points.

In Table 3, we show the second stage results, in which we instrument passive fund ownership by the Russell 2000 index dummy. In Columns 1 and 2 of Panel A, we find that a 1 percentage point change in passive fund ownership increases lendable supply by 1.2 to 1.3 percentage points. The magnitude of the effect is large and suggests that essentially all of the shares newly held by passive investors are made available for lending.[13] If we consider the possibility that we underestimate the true effect of Russell membership on passive ownership, the second stage effect on lendable supply may consequently be overestimated. For instance, based on the back-of-the-envelope calculation in Chinco and Sammon (2023), what we identify as the effect of a one percentage point increase in passive ownership would actually be the effect of a two percentage points increase in passive ownership. Hence, passive owners would make available about two thirds of their newly owned shares available for lending—a plausible magnitude given passive funds' lending practices.

4.3 Short Selling

Next, we study the effect of passive ownership on short selling activity. In Columns 3 and 4 of Table 3 Panel A, we report the second stage coefficients from the IV regression for *Short interest*, defined as the fraction of outstanding shares that are lent out. We include the same control variables as above. Depending on whether we look at the narrow (250 stocks) or wide bandwidth (500 stocks), *Short interest (equity loans)* increases 0.7 to 0.9 percentage points for every percentage point increase in passive fund ownership (Panel A, Columns 3 and 4). This effect is about 60-75% of the increase in lendable supply (see above). It thus appears that a large fraction of lendable shares newly made available by passive owners are borrowed by

[13] In unreported tests, we find that the coefficients are not statistically different from one; i.e., the coefficient one would obtain if passive owners of Russell 2000 stocks were to supply all their additional shares.

short sellers, despite the fact that the average stock in our sample has a large excess supply of lendable shares (as indicated by an average *Utilization* ratio of about 11%, see Table 1). Hence, short sellers seem to show a strong preference for borrowing shares from Russell 2000 index funds as opposed to borrowing shares supplied by other owners.

The preference for lendable shares supplied by passive owners is further confirmed in Panel B, Columns 1 and 2, in which we directly examine *Utilization* (i.e., the ratio of shares on loan over lendable supply) as the dependent variable. We find a statistically marginally significant increase in utilization of about 1.5 percentage points in the narrow sample and a statistically significant increase of about 1 percentage point in the wider sample. Panel B, Columns 3 and 4 focus on lending fees. In both the narrow and the wide sample, we find that lending fees increase by small and statistically insignificant 4-6 basis points. Given our earlier result of a large increase in lending supply, one might actually have expected a decrease in lending fees. We find this not to be the case.

In aggregate, we find strong evidence of a large increase in *Short interest*, which is further evidenced by an increase in *Utilization*. The *Lending Fee* is largely unchanged and, if anything, slightly increases. Interestingly, the increase in shorting is larger than what would be expected if passive ownership were to only lead to an increase in the quantity of lendable supply. Indeed, such a pure supply increase should lead to a decrease in *Utilization* and *Lending Fee*. The increase in *Utilization* thus suggests that being added to the Russell 2000 leads to a simultaneous increase in shorting demand.

4.4 Index Inclusion Effect, poor Governance, and ETF Arbitrage

Here we briefly discuss three possible explanations for the increase in shorting demand—the index inclusion effect, poor governance, and ETF arbitrage—and argue why we believe they are not the full story. In the next section, we develop our main explanation—passive owners provide higher lending supply quality.

Index inclusion effect: index additions trigger buying pressure by passive investors and thus cause a run-up in prices for the added stock (e.g., Shleifer 1986; Chang et al. 2015). This may attract short sellers who anticipate lower returns for added stocks going forward (Sikorskaya 2023). Importantly, the index inclusion

effect will be different for different stocks depending on their weights in the new and the old index, their simultaneous membership in other indexes, and the amount of assets under management tracking those indexes (Kashap et al. 2021; Pavlova and Sikorskaya 2023). In Figure 4, we therefore split stocks that are switching between the Russell 1000 and Russell 2000 indexes by their return in the month of June; i.e., the month in which the index change is announced and the index inclusion effect is observed (Chang et al. 2015). If the increased short selling demand were to come from short sellers betting on low returns following the index addition, the increase in short selling demand should be concentrated in stocks with high index inclusion returns. Figure 4 shows this not to be the case. Indeed, the increase in short selling demand for stocks with negative inclusion returns is almost as large as the one for stocks with positive inclusion returns. Moreover, as we report in the robustness section, the increase in short interest is not restricted to the months surrounding the index reconstitution.

Poor governance: Heath et al. (2022) find that passive owners are less diligent monitors, thereby causing a reduction in governance quality. Short sellers may be attracted if this lower governance quality leads to future underperformance. We first note that, if the stock market is reasonably efficient, the lower governance quality should be priced in when the index reconstitution is announced. Yet, as just argued, the increase in short selling is *not* concentrated in stocks with poor announcement returns and/or during the reconstitution period. Moreover, we show in Internet Appendix A.5 that the effect of passive ownership on short interest is robust to controlling for board independence and pay-performance sensitivity—the two governance measures that Heath et al. (2022) find to be affected. If the increase in short interest had been explained by poor governance, one would have expected these controls to drive out the effect of passive ownership.

ETF arbitrage: another possibility is that the increased shorting demand is driven by ETF arbitrage. Authorized participants can directly convert stocks into ETF shares with the ETF sponsor and thus do not require short selling to arbitrage price differences between the ETF and the index basket portfolio. Other investors, however, may establish short positions to engage in ETF arbitrage. Hence, additional short selling demand could come from increased ETF arbitrage activity following the increase in ETF ownership caused by Russell 2000 index additions. One important caveat of this potential explanation is that ETF arbitrage

opportunities are usually short-lived.[14] Thus, ETF arbitrageurs can often close their short positions during the trading day, which means that they do not need to borrow the underlying stocks in the equity lending market. We nevertheless check whether at least part of the additional lending demand can be explained by ETF arbitrage. Importantly, such additional lending demand should only occur if the ETF is *undervalued* relative to the underlying securities (at the end of the trading day). Hence, if ETF arbitrage were responsible for the increase in shorting demand, we would expect a larger increase in *Short interest* for a given stock on days when the ETFs holding that stock are undervalued. In Internet Appendix A.4, we thus conduct a daily analysis in which we regress *Short interest* on an interaction between the Russell 2000 dummy and *D(ETF undervalued)*, a dummy variable equal to 1 if the ETFs holding the stock are on average undervalued. We find that the interaction coefficient between *D(Russell 2000)* and *D(ETF undervalued)* is not significant and economically small, while the coefficient of the Russell 2000 dummy remains significantly positive, showing that short selling is also increased on days when ETF arbitrageurs do not want to short-sell the stock (i.e., when ETFs are overvalued).

5. Passive Ownership and Lending Supply Quality

In this section, we turn to our preferred explanation for the increase in short selling demand: passive owners provide lendable supply of higher quality. Specifically, we hypothesize that short sellers prefer to borrow from passive owners as they are stable, long-term lenders of securities and thus less likely to recall their shares. In addition, informed short sellers may be less worried about information leakage with passive lenders (Honkanen 2024; Greppmair et al. 2023). Thus, when the supply of lendable shares provided by new passive owners increases, utilization goes up as the demand for these shares is particularly strong.[15]

5.1 Lending Supply Quality by Active and Passive Owners

Short sellers face *recall risk*; i.e., the risk that the lender recalls the shares before the short seller wants to close its position (Reed 2013). While loan recalls are not directly observable, we employ three empirical

[14] For example, Marshall et al. (2013) find that mispricings in ETFs tracking the S&P 500 index have a median (mean) lifespan of only 2.27min (86.46min). This suggests that most ETF mispricings correct themselves within the same trading day.

[15] As pointed out by Dow et al. (2021), such a demand increase by informed short sellers can be self-reinforcing by shortening arbitrage duration and improving arbitrageurs' ability to close existing positions profitably, thereby attracting more short selling.

proxies that naturally correlate with their occurrence—*loan tenure*, *lending supply drops*, and *delivery failures*.

Intuitively, when recalls occur, short sellers that want to keep their positions open must find new lenders. If they can, this shows up in the data as a reduction in the average *loan tenure*, as old loans get replaced by new ones. If they cannot and if they fail to return their shares to the lender on time, a *delivery failure* can be triggered.[16] Finally, we also look at *lending supply drops*, defined as the fraction of days on which a stock's lendable supply drops by more than 5%, as a source for loan recalls. This measure has the advantage that it solely captures an action on the part of potential lenders; i.e., their choice to reduce the number of shares available to lend.

In Table 1 Panel B, we report correlations between our different loan quality proxies. We see that loan tenure is negatively correlated with delivery failures and lending supply drops, consistent with the idea that low average loan tenure, a high level of delivery failures and a large fraction of lending supply drops are indicative of a poor lending supply quality. At the same time, the fact that correlation coefficients are between 0.1 and 0.2 in absolute terms suggests that there is incremental information in each of these measures. Below, we therefore report separate results for these measures, as well as combining them into a *loan supply risk* index.[17] By construction, this index correlates negatively with tenure and positively with delivery failures and lending supply drops. Hence, the higher this index, the lower is the lending supply quality.

[16] For example, a delivery failure will be triggered if the lender sells and recalls the loaned shares, but does not receive them on time and thus fails to deliver. Fails to deliver are costly to the brokers who intermediate the short sell transactions (see https://www.sec.gov/investor/pubs/regsho.htm). Brokers therefore typically close out fails to deliver by buying back the stock. These close-outs pose a risk for the short seller as they can lead to unmitigated losses (e.g., during a short squeeze). Consistent with this view, we show in Internet Appendix A.7 that the amount of delivery failures predict net-of-fee returns to shorting *after controlling* for short interest. As argued by Muravyev et al. (2022), this is an important hurdle to pass to be credible as a proxy for short selling risk. Indeed, the result implies that short sellers are aware of the risk associated with delivery failures and require larger returns from their short positions in stocks exposed to this risk.

[17] We construct this lending supply risk index as follows. We first standardize all lending supply quality metrics to have a mean of zero and a standard deviation of 1. We then take an equal-weighted average of standardized delivery failures, the standardized fraction of loans with below 30-day loan tenure, and standardized lending supply drops. Higher values of this index therefore correspond to a *lower* lending supply quality.

In Table 4, we run panel regressions to compare the quality of lendable supply provided by passive vs. active owners.[18] Specifically, we regress our proxies for lending supply quality on passive and active fund ownership (at the most recent quarter-end) while controlling for firm size, past returns, liquidity (as measured by the effective spread), market-to-book, and industry (based on 2-digit SIC codes) and month fixed effects. Standard errors are double-clustered by stock and month. Panel A focuses on loan tenure as our first proxy of loan supply quality. Columns 1 and 2 show results for the average loan tenure (measured as the natural logarithm of the monthly average of the number of days that equity loans have been open), Columns 3 and 4 show results for the fraction of loans with a tenure greater than 30 days. We consistently find a strong positive correlation between the fraction of passive ownership and loan tenure. Importantly, we find an economically much smaller (albeit still significantly positive) coefficient for the fraction of active ownership (even columns). For example, based on the coefficient estimates from Column 2, a one-percentage point increase active ownership is associated with an increase in average loan tenure of 0.4%, while a one-percentage point increase passive ownership increases average loan tenure by 2.8%—7 times as much. Table 4 Panel B shows results for the average fraction of delivery failures in Columns 1 and 2, and for *Lending supply drops* in Columns 3 and 4, while Panel C focuses on the lending supply risk index. We consistently find a strong negative correlation between these proxies and passive ownership, while the correlation with active ownership is notably weaker.

5.2 Causal Effect of Passive Ownership on Lendable Supply Quality

The panel regressions from the previous subsection only reveal correlations. Here, we return to our IV-strategy around the Russell 2000 cutoff to confirm that the effect of passive ownership on lendable supply quality is causal. Table 5 shows the results. As before, we look at loan tenure in Panel A, delivery failures and lending supply drops in Panel B, and our loan supply risk index in Panel C. In Panel A, we find that an increase of passive ownership by one percentage point increases loan tenure by 5-6% (Columns 1 and 2) and the share of long-tenure loans (longer than 30 days) by about 2.5-3.3 percentage points (Columns 3 and 4). In Panel B, we find that a one-percentage point increase in passive ownership significantly decreases the delivery failures and lending supply drops by about 25-33% (relative to their respective means). In Panel

[18] Our identification strategy based on Russell index reconstitutions only provides quasi-exogenous variation in passive ownership. Hence, we cannot use it to compare the effects of active and passive ownership, explaining why we resort to panel regressions here.

C, we obtain similar results for the lending supply risk index. All these findings are strongly statistically significant and thus suggest that short sellers maintain short positions for longer, face fewer delivery failures and lending supply drops, and overall a lower lending supply risk when they can borrow from passive owners.

5.3 Stock Loan Persistence and Preference for Passive Lenders: Direct Evidence

In this subsection, we exploit hand-collected data on mutual funds' equity lending decisions observed from N-PORT filings (see Section 2.5 for more detail) to provide direct evidence that (1) stock loans given by passive lenders have a longer tenure, and that (2) short sellers prefer borrowing from passive lenders.

To test whether loans by passive lenders are less likely to be recalled, we restrict our sample to fund-stock positions currently on loan and run the following linear probability model:

$$D\left(On\ loan_{i,f,t+1}\right) = \alpha_{i,t} + \beta_1 * D\left(Passive\ fund_f\right) + \beta_2 * Position\ size_{i,f,t} + \varepsilon_{i,f,t}$$

where $D\left(On\ loan_{i,f,t+1}\right)$ is a dummy that takes the value one if the position of fund *f* in stock *I* continues to be on loan in quarter *t+1* and zero otherwise, $D\left(Passive\ fund_f\right)$ is a dummy that takes the value one if fund *f* is a passive fund, $Position\ size_{i,f,t}$ is the number of shares in stock *I* owned by fund *f* scaled by number of shares outstanding, and $\alpha_{i,t}$ are stock-quarter fixed effects. The coefficient of interest, β_1, captures whether the probability that a stock is still on loan next quarter is different if the loan comes from a passive lender. *Position size* controls for the fact that, for larger positions, the probability that at least part of the position is still on loan next quarter is naturally higher. Note that, due the inclusion of stock-quarter fixed effects, we are essentially testing whether a loan given by a passive lender is more or less likely to be continued than a loan by an active lender in the *same stock and quarter* (thereby controlling for loan demand as in Khwaja and Mian 2005).

Table 6 Panel A shows the results. Across specifications (i.e., without fixed effects, just stock fixed effects, just quarter fixed effects, or with stock-quarter fixed effects), we find a significantly positive β_1-coefficient. In the most conservative specification (with stock-quarter fixed effects), the coefficient estimate is 0.023, suggesting that the probability of a stock loan being continued is 2.3 percentage points higher with a passive lender. This represents a 5% increase relative to the unconditional probability of a stock loan continuing of

47% (unreported). Since our specification with stock-quarter fixed effects controls for short selling demand, the result is driven by lending supply. In other words, our result means that the lending supply provided by passive owners is more stable than the one provided by active owners.

If short sellers appreciate a stable lending supply, we expect them to prefer borrowing from passive owners. We test this prediction in Table 6 Panel B. Specifically, we now regress $D(On\ loan_{i,f,t})$, i.e., the dummy for whether stock *I* held by fund *f* is currently on loan, on the passive fund dummy in the full sample of stock positions by funds that report at least one stock position to be partially or fully on loan. Again, we find a significantly positive coefficient for the *D(passive owner)* dummy, even in the specification with stock-quarter fixed effects. Hence, we find that, out of all potential lenders holding the same stock in the same quarter, short sellers are more likely to borrow from passive owners, consistent with them preferring passive owners' more stable loan supply.[19]

5.4 Interaction by Ex-ante Utilization, Fee, and Loan Supply Quality

In this subsection, we return to the Russell 1000/2000 setting to test a direct implication of our hypothesis that passive owners' higher lendable supply quality attracts additional short selling. Specifically, according to our story, we expect the passive ownership-induced increase in short-selling demand to be strongest in stocks where the ex-ante lending supply was more constrained and/or of lower quality. In contrast, for stocks with an ex-ante higher level and a higher quality of lendable supply, we expect to see a smaller demand increase. We therefore check whether the increase in short selling demand (but not the increase in lendable supply) is particularly strong for stocks with a high prior utilization ratio, lending fee, or lending supply risk index—i.e., stocks for which high-quality lendable supply was more likely to be scarce.

We test this idea in Table 7 by running the reduced form regression of lendable supply and short interest on the Russell 2000 dummy interacted with a variable capturing whether, at the end of the previous May (when index membership is decided), a stock's utilization ratio was above median (Panel A), a stock's lending fee was above median (Panel B), or whether it had a high lending supply risk index (Panel C),

[19] Since a stock that is lent out must be supplied in the first place, this result also suggests that passive funds are more likely to supply their shares for lending.

where the latter signals that a stock had an ex-ante low quality of lendable supply.[20] As indicated by the positive significant interaction coefficient for short interest for each panel, the increased short selling demand is indeed concentrated in stocks with high prior utilization ratios, lending fees, or lending supply risk, suggesting that short sellers are particularly eager to borrow from the new passive owners of these stocks.

6. Informativeness of Short Sales

Our results indicate that passive ownership, by increasing the quantity and quality of lendable supply, attracts short selling. In this section, we test whether this additional short selling activity is informed.

6.1 Short Interest and Return Predictability

We start by investigating whether passive ownership affects the correlation between short interest and future stock returns. Past research has documented that high short interest predicts low returns (e.g., Asquith et al., 2005) and has thus concluded that short sellers, on average, are informed. If passive ownership just reduced short selling costs, we would expect less profitable trades to become viable and average (gross) profitability of short positions to be lower. In contrast, if especially *informed* short sellers prefer to borrow from passive owners because of lower risk of information leakage (Honkanen, 2024), an increase in passive ownership can change the *composition* of short sellers. As informed short sells (rather than uninformed, such as hedging-related shorts) make up a larger fraction of all short sells, we expect short interest to be more predictive of future returns.

We test this prediction in Table 8. Specifically, we run a reduced form regression of future stock returns on short interest interacted with the Russell 2000 dummy together with the usual market cap and banding controls.[21] For both average daily returns over the next 10 and 20 trading days, we find that short interest

[20] In all these tests, we include the interaction variables separately and also interact them with all other controls. In Table 7, we do not show these coefficients for brevity, while showing the complete regression output in Internet Appendix A.10.

[21] For brevity, we do not show the coefficients on short interest itself and on short interest interacted with all controls, while showing the full regression output in Internet Appendix A.10. In any case, because short interest is interacted with all controls, the coefficient on short interest itself cannot be easily interpreted (as it reflects the effect of short interest on the returns for a hypothetical company with all control variables, including market capitalization, equal to zero). When we run a regression of future returns on short interest together with stock and month fixed effects, we confirm the negative return predictability of short interest for our sample (see Internet Appendix A.8).

is a stronger predictor for negative returns for stocks in the Russell 2000. In terms of economic significance, a one-standard deviation higher short interest for Russell 2000 stocks predicts a 0.03% lower average daily return over the next 20 trading days compared to Russell 1000 stocks, which corresponds to 0.6% cumulative or about 8% annualized. Hence, the additional short selling activity for Russell 2000 stocks appears to come from informed short sellers, consistent with our hypothesis.

6.2 Short Selling prior to Negative News Releases

If passive owners attract informed short selling, we expect short selling activity to be more pronounced prior to negative information releases. We test this idea in the context of quarterly earnings announcements and 8-K filing events.[22] The former are recurring and pre-scheduled, while the latter are ad-hoc disclosures "on a rapid and current basis" of material changes in financial conditions or operations (Section 409 of the 2002 Sarbanes-Oxley Act). Our analysis thus sheds light on the sources of short sellers' information advantage: do they intensify their information acquisition efforts prior to pre-scheduled announcements or are they also quick to react to rumors or inside information before unanticipated news releases.

For both types of events, we measure short interest in the 30 or 60 days prior to the news release date and regress this measure in reduced form on the Russell 2000 membership dummy interacted with a dummy for whether the news is negative,[23] as well as our usual set of controls (which we also interact with the negative news dummy).[24] The interaction coefficient therefore captures whether there is more *informed* short selling (i.e., short selling in anticipation of negative news returns) for stocks that have higher passive ownership due to their Russell 2000 membership.

For earnings announcements, we define *D(Negative earnings surprise)*, a dummy variable equal to one when the standardized unexpected earnings (SUE) or the cumulative 3-factor alpha/raw return over the

[22] In order to have enough negative news events, we focus on the wider bandwidth of 500 stocks for this analysis.

[23] For the 8-K filings, we rely on the event date (instead of the filing date which can be a few days later) since Ben-Rephael et al. (2022) document that price discovery (and Bloomberg coverage) usually occurs on the event date.

[24] For brevity, we do not show the negative news dummy and its interactions with other controls, while reporting the full regression output in Internet Appendix A.10. In any case, because the negative news dummy is interacted with all controls, its coefficient cannot be easily interpreted (as it reflects the effect of negative news on short selling for a hypothetical company with all control variables, including market capitalization, equal to zero). In Internet Appendix A.9, we document a significantly positive coefficient when we regress short interest on the negative news dummy without controls, implying that, on average, there is more short selling prior to negative announcements.

announcement window from t-1 to t+2 falls in the bottom tercile and zero otherwise.[25] Table 9 Panel A shows the results. For instance, in the specification in which the negative earnings dummy is based on SUE, we find that short interest is roughly 2.3 percentage points higher prior to negative earnings announcements for stocks in the Russell 2000 index, representing an increase of 40% relative to the average short interest in our sample (compare Table 1).[26]

For the 8-K events, we define *D(Negative 8-K event)*, a dummy variable equal to one when the cumulative 3-factor alpha/raw return over the announcement window from t-1 to t+4 falls in the bottom tercile and zero otherwise (we use a slightly longer event window to account for the slower reaction to 8-K events, see Ben-Rephael et al. 2022). The results for 8-K events, reported in Table 9 Panel B, are similar to those for earnings announcements and always statistically significant at the 5% level. Overall, these results show that higher passive ownership of Russell 2000 stocks attracts more informed short selling prior to negative news events.

6.3 Information Efficiency

Next, we test whether the passive ownership-induced short selling prior to negative news improves the information efficiency of stock prices. We regress, in reduced form, measures of price informativeness on the Russell 2000 index membership dummy, a dummy for a negative news reaction, and the interaction of the two (as well as our usual set of controls, also interacted with a negative news reaction dummy). We are specifically interested in the interaction coefficient, which captures the *incremental* effect of Russell 2000 membership (and its associated higher passive ownership) on price informativeness *for negative news compared to other news*. Indeed, while the literature has studied other channels for how passive ownership may affect price informativeness,[27] none of these alternative channels involve short selling or predict an incremental effect of price informativeness for negative news only.

[25] SUE is computed as the difference between the actual earnings per share (EPS) and the EPS four quarters ago, divided by the standard deviation of that difference over the previous eight quarters. This measure has the advantage that it is independent of stock returns (which are potentially endogenous to short selling) and of analyst forecasts (which could themselves be affected by changes in passive ownership, see Sammon 2023).

[26] We find a lower magnitude in the specifications in which the negative earnings dummy is based on returns or alphas. This could be because short selling prior to the earnings announcement itself affects the announcement return and therefore induces measurement noise into our negative news dummy. We thank the anonymous referee for pointing out this possibility.

[27] This literature comes to mixed conclusions. On the one hand, Israeli et al. (2017) and Sammon (2023) find evidence that passive ownership hurts price informativeness overall and attribute this to reduced information acquisition and monitoring by passive owners. On the other hand, Glosten et al. (2021) and Antoniou et al. (2023) show that ETF (i.e., passive) ownership strengthens

We use two measures of price informativeness, both built on the intuition that prices often reflect news before it is made public due to informed trading (Ball and Brown 1968). Our first measure is the *price jump ratio* introduced by Weller (2018), which captures the fraction of the return associated with a large earnings surprise (or 8-K event) that is priced-in on the announcement date (and its immediate aftermath) compared to the total period from before to after the announcement. This measure is well-grounded in theory and widely used in the literature.[28] Following Weller (2018), we define the price jump ratio as

$$Price\ jump\ ratio = \frac{Alpha_{t-1,t+k}}{Alpha_{t-21,t+k}},$$

where $Alpha_{t-n,t+k}$ is the cumulative 3-factor Fama-French (1993) alpha from n days before to k days after the earnings announcement (or 8-K event) date.[29] As in Weller (2018), we set $k = 2$ for earnings announcements, while using $k = 4$ for 8-K events (since Ben-Rephael et al. (2022) show that the price reaction is a bit slower for these events).

One drawback of the price jump ratio is that it does not account for differences in volatility across stocks.[30] Inspired by Sammon (2023), we therefore also use a second price informativeness measure, $|Alpha|/SD$, which captures the absolute announcement alpha scaled by the stock's prior volatility. Specifically, we compute this measure as the absolute value of $Alpha_{t-1,t+k}$ (with $k = 2$ and $k = 4$ for earnings announcements and 8-Ks, respectively) scaled by the return volatility measured over the previous month.

To ensure that we focus on information events that are sufficiently large to attract short selling, we follow Weller (2018) and impose an event filter that only includes earnings announcements (or 8-K events) if the absolute value of the total event-time return is sufficiently large:

information efficiency, consistent with theoretical predictions in Buss and Sundaresan (2023). Coles et al. (2022) find that index investing leads to lower information production but does not reduce price informativeness.

[28] Intuitively, the price jump ratio captures the *share* of information incorporated into prices before an immanent public news event, consistent with models of informed trading that predict a smooth convergence of prices to the post-announcement value (e.g., Kyle 1985; Back 1992). Other papers using the price jump ratio measure include, for example, Chen et al. (2020), Sani et al. (2023), or Sammon (2023), while its underlying idea to scale the announcement return by the total announcement-related return goes back to Meulbroek (1992).

[29] We describe the details of constructing 3-factor Fama-French (1993) alphas in Internet Appendix A.2.

[30] For instance, consider two stocks having the same event-day alpha and no pre-event drift, while having very different return volatilities. These two stocks would have the same price jump ratio, even though the event-day alpha is arguably more abnormal for the stock with a lower return volatility.

$$\left|Alpha_{t-21,t+k}\right| > \sqrt{X} * \hat{\sigma}_{past\ month}\ ,$$

where $X = 12$, $X = 24$ (as in Weller 2018), or $X = 36$, and $\hat{\sigma}_{past\ month}$ is the standard deviation of daily alphas over the previous month.[31] Finally, in line with the definition of our dependent variables, we set the negative news reaction dummy to one when the total market reaction over *t-21* to *t+k* window around the earnings announcement or 8-K event (i.e., the denominator of the *price jump ratio*) is in the bottom tercile and zero otherwise.

Table 10 shows the results of regressing our price informativeness measures on the interaction of the Russell 2000 membership dummy and the dummy for a negative news reaction. Given that we document more informed short selling prior to negative news events, we expect more information to be incorporated before as opposed to on the actual event date. We therefore expect both the *price jump ratio* and $|Alpha|/SD$ to go down for *negative* news events for stocks in the Russell 2000—i.e., we expect the interaction coefficient to be negative. As can be seen in Panel A, which shows the results for earnings announcements, the interaction coefficient between the Russell 2000 dummy and the negative earnings reaction dummy is indeed negative and statistically significant for both the price jump ratio (Columns 1-3) and $|Alpha|/SD$ (Columns 4-6) and regardless of the threshold for the event filter. For instance, based on the coefficient estimate in Column 2, we find that, compared to nearby Russell 1000 stocks, Russell 2000 membership decreases the price jump ratio for negative earnings announcements by 7.8 percentage points, which represents a 14% decrease relative to its unconditional mean. Thus, the effect is economically meaningful.

Similarly, for 8-K events (Table 10 Panel B), we find a significantly negative interaction coefficient between the Russell 2000 dummy and the negative 8-K reaction dummy in all cases except for Column 4 (the most lenient event filter for the $|Alpha|/SD$ measure). Our results imply that, relative to Russell 1000 stocks, the passive ownership-induced increase in short selling for Russell 2000 stocks increases the price informativeness around large negative news releases compared to similarly large positive news releases, thereby supporting the idea that the lendable supply by passive owners attracts informed short selling.

[31] The event filter has the additional advantage that it avoids the problem that, for small information events (i.e., when the total return from before to after the news is close to zero), the price jump ratio is mostly driven by noise.

6.4 Correction of Overpricing

Finally, we examine if passive ownership also enables short sellers to quicker correct overpricing in the stock market. For this purpose, we rely on the measure of overpricing developed in Stambaugh et al. (2015). This measure ranks stocks by mispricing at the end of each month according to 11 well-known pricing anomalies and is defined such that higher values indicate more overpricing (and therefore predict lower future returns). We create the variable *D(Overpriced stock)*, which is equal to one if a stock is in the top tercile in a month according to this overpricing measure and zero otherwise.

To examine whether the overpricing is corrected more quickly for stocks in the Russell 2000, we regress average returns over the next 20 trading days on the interaction between *D(Russell 2000)* and *D(Overpriced stock)*, as well as our usual set of control variables (which we also interact with *D(Overpriced stock)*). Table 11, Columns 1 and 2 show the results. The interaction of *D(Russell 2000)* and *D(Overpriced stock)* is statistically significantly negative, suggesting that overpricing in Russell 2000 stocks is more forcefully corrected over the next 20 trading days compared to similar overpriced stocks in the Russell 1000. The economic magnitude is also meaningful at 0.06% per day over the next 20 trading days, corresponding to 1.2% cumulative. In Columns 3 to 6, we further see that this return correction is pronounced in the first 10 trading days, while being insignificantly negative over trading days 11 to 20. These findings suggest that, in addition to improving the information efficiency around negative news events, increased passive ownership allows short sellers to more quickly correct overpricing in stocks. This is again consistent with the idea that the higher-quality lendable supply by passive owners is particularly attractive to informed short sellers.

7. Robustness Checks

7.1 Robustness Check using Coles et al. (2022) Methodology

Coles et al. (2022) propose an alternative identification strategy based on the Russell 1000/2000 setting. They argue that, instead of using Russell 2000 index membership as an instrumental variable together with banding controls (Appel at al. 2019), one can run difference-in-difference tests for stocks close to their respective banding thresholds. This essentially allows for two tests. First, for stocks in the Russell 1000

that, at the end of May (when Russell decides index membership), are close (withing +/- 250 ranks) to the lower end of the band, one can compare the stocks that move down to the Russell 2000 and thus have an increase in passive ownership with stocks that remain in the Russell 1000. Second, for stocks in the Russell 2000 that are close to the upper end of the band, one compares the stocks that move up to the Russell 1000 and thus have a decrease in passive ownership with stocks that remain in the Russell 2000.

As a robustness check, we carefully implement their approach for our main variables of interest. Following Coles et al. (2022), we use a 12 months window before and after index reconstitution for each reconstitution cohort. Again following Coles et al. (2022), we use cohort-stock and year fixed effects. The former are crucial in that they subsume the (unobserved) ex-ante market capitalization used by Russell to determine index membership. As before, standard errors are two-way clustered by stock and month. Table 12 shows the results. We find that stocks that move down to the Russell 2000 (up to the Russell 1000) exhibit an increase (decrease) in passive ownership and a concurrent increase (decrease) in lendable supply and short interest. For stocks that move down to the Russell 2000, our results point to an improved quality of supply (e.g., utilization and the fraction of long-tenured loans go up and the lending supply risk index goes down), while the reverse is true for stocks that move up to the Russell 1000 (e.g., tenure goes down, delivery failures and lending supply risk go up). Overall, our results are consistent with those obtained above: passive ownership increases the quantity and quality of lendable supply, thereby fostering short selling activity.

7.2 Other Robustness Checks

In this section, we return to our baseline identification strategy (following Appel et al. 2019) and perform various robustness checks. For brevity, we focus on the second stage IV regressions at the monthly frequency with a 500 firm bandwidth. We present the results in Table 13. All control variables are included in the estimation but are not reported for better readability.

In Panels A and B, we focus on the variables used for sample selection. In our main specification, we follow the recommendations by Glossner (2020) and Wei and Young (2020) and form our samples based on the end-of-May total market capitalization estimated from Compustat/CRSP data following Ben-David et al.

(2019). Alternatively, Appel et al. (2020) propose to use for sample construction the float-adjusted market capitalization measure provided by Russell. They argue that this approach, while potentially introducing a bias, should improve power as it accentuates the discontinuity in passive ownership around the membership cutoff (as the float-adjusted market cap determines the index weight). Confirming this intuition, we indeed obtain slightly stronger results when we implement this sampling approach in Table 13 Panel A. In Panel B, we form samples based on the simple CRSP market capitalization instead of using the market capitalization measure constructed as in Ben-David et al. (2019). In this case, we also base our control variables on CRSP market capitalization. Our results are again robust to this alternative sampling choice.

In Panel C, we tackle the concern that our results could partly be driven by abnormal shorting activity surrounding the months of actual index changes. Indeed, some investors may speculate on which firms change index and/or there may be abnormal trading activity after an index change becomes effective (and passive investors are forced to rebalance). To mitigate this concern, we re-run our main analyses after excluding stock-month observations surrounding actual index changes. Specifically, we exclude the months of May, June, and July whenever a stock changes index. As shown in Panel C, our results remain largely unchanged. In a similar vein, stocks are likely to change indexes after unusually positive or negative returns. Past returns have been shown to be related to future returns (see Jegadeesh and Titman (2011) for a review) and short sellers may, therefore, be trading on information contained in past returns. To address this concern, we control for past returns in Panel D. Our results remain very similar.

In our main analyses, we show results for samples using a 250 and 500 firm bandwidth around the cut-off. In Panel E, we show that our results remain significant if we use an even smaller bandwidth of 150 stocks. Furthermore, in our main specification, we identify our results from the cross-section (because we only include month fixed effects). In Panel F of Table 13, we show as a robustness check that our results remain statistically significant if we add firm fixed effects. Adding firm fixed effects to the specification implies that the identification now comes only from firms that have changed the index.

Finally, in Panel G, we use a different measure of short selling activity. In our main specification, we measure shorting as the fraction of shares that are on loan according to the IHS Markit data. In Panel G, we instead use a measure of short selling based on short interest data provided by the stock exchanges (as

reported in Compustat). The result confirms our earlier finding and is very similar in magnitude: short selling increases by about 0.8 to 1.2 percent for every percentage point increase in passive ownership.

8. Conclusion

This paper studies the causal effects of passive ownership on equity lending and short selling by exploiting Russell 1000/2000 index reconstitution events. We find that passive ownership leads to an increase in both the lendable supply *and* the demand for short selling. This demand increase is not fully explained by the index inclusion effect, poor governance, or ETF arbitrage. Instead, it is partly driven by a higher *quality* of lendable supply, as indicated by an increase in loan tenure and decreases in lending supply drops and delivery failures. Finally, we show that the additional short selling activity from Russell 2000 membership is informed: both the return predictability of short interest and the stock price informativeness around negative news events improve, and overpricing is corrected more quickly.

An important takeaway of our study is that not all lending supply is created equal. Passive owners not only supply a larger fraction of their portfolios for equity lending, but—thanks to them being stable and long-term shareholders—they also lower operational risks to short sellers (e.g., by being less likely to recall loaned shares). Together, these two factors increase the propensity to short and contribute to market quality by accelerating the incorporation of negative information into prices.

Our results are important for understanding the channels through which passive ownership may affect diverse topics such as corporate governance, investment, innovation, mergers, and/or payout policy. Indeed, the short selling literature usually identifies short sellers as an informed group of investors with the power to influence corporate actions (e.g., through activist campaigns).[32] Hence, despite being passive—and possibly less engaged—shareholders, passive owners matter *indirectly* for corporate policy by facilitating short selling. Future research on the impact of passive investors on financial markets and corporate activity should take this effect into account. Moreover, policymakers ought to be aware of the complementarity between ownership structure and the equity lending market.

[32] See, for example, Boehmer et al. (2008), Christophe et al. (2010), and Appel and Fos (2020).

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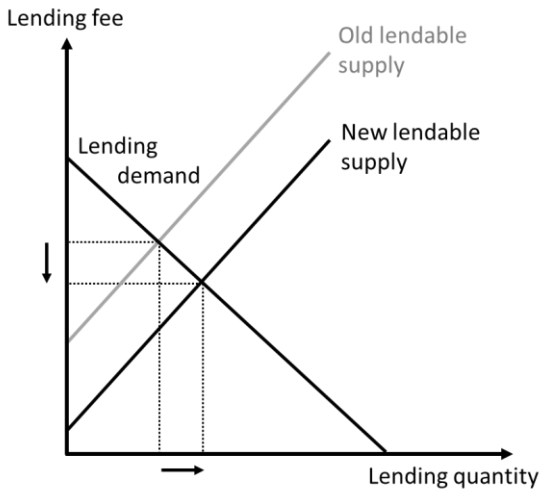
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Figure 1: Illustration of Demand and Supply Shifts in the Securities Lending Market

Panel A shows the equilibrium implications that are expected when an increase in passive ownership leads only to a shift in lendable supply. As the supply curve for lendable shares shifts down, the new equilibrium in the securities lending market features a lower lending fee and an increase in lending quantity (i.e., short interest). Panel B shows the equilibrium implications that are expected when the increase in passive ownership leads to a simultaneous demand and supply shift in the securities lending market. As the supply curve for lendable shares shifts down and the demand curve shifts up, the new equilibrium in the securities lending market features an increase lending quantity, but the lending fee remains unchanged.
Alt text: Figure 1, Panel A, shows a downward sloping demand curve, and an upward sloping supply curve that shifts outwards, resulting in an increase in the equilibrium lending quantity and a decrease in the equilibrium lending fee. Figure 1, Panel B, shows a downward sloping demand curve that shifts outwards, and an upward sloping supply curve that shifts outwards. The effect of both curves shifting is an increase in the equilibrium lending quantity, while the equilibrium lending fee remains constant.

Panel A: Only supply shift



Panel B: Simultaneous supply and demand shift

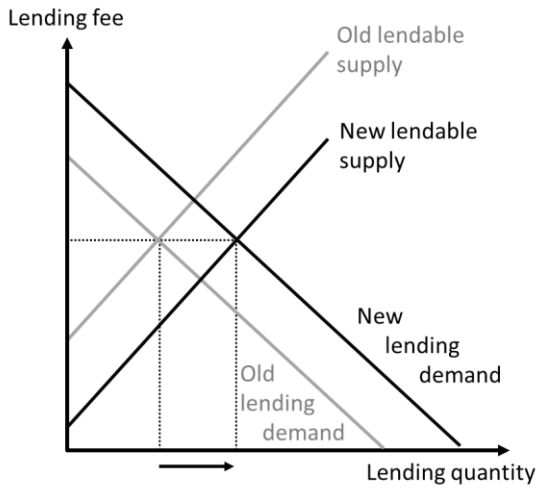
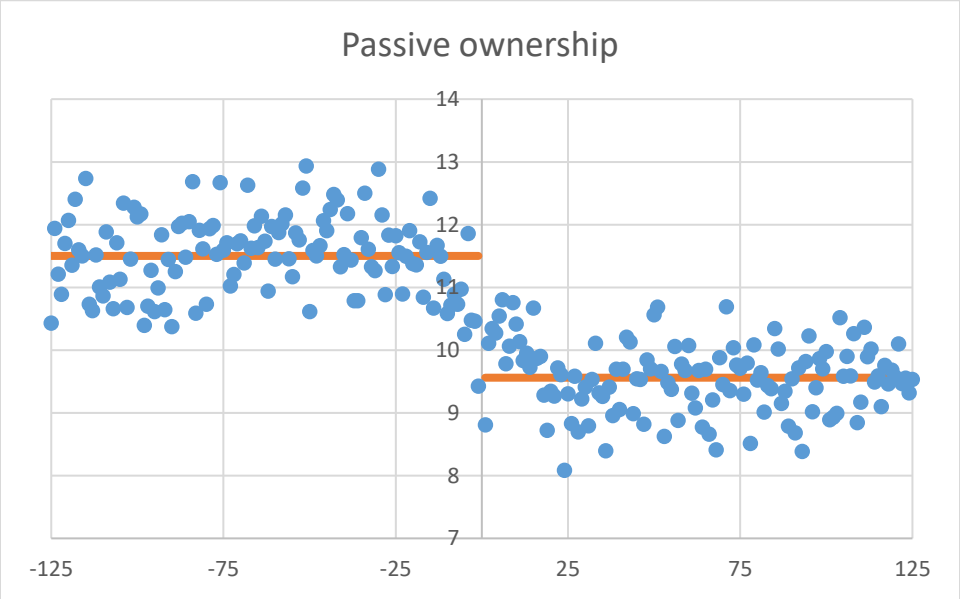


Figure 2: Passive and active ownership around the Russell 1000/2000 cutoff

This figure shows average passive (Panel A) and active (Panel B) ownership levels for the 625 largest firms in the Russell 2000 (to the left of the vertical line) and the 625 smallest firms in the Russell 1000 (to the right of the vertical line). For better visibility, firms are ranked by groups of five. Hence, each dot represents the average passive (or active) ownership level for a group of five firms (e.g., the rank -1 corresponds to the five largest firms in the Russell 2000, the rank +1 corresponds to the five smallest firms in the Russell 1000, etc.). The horizontal lines indicate the average ownership level across all ranks for firms in the Russell 2000 (to the left of the horizontal line) and in the Russell 1000 (to the right of the horizontal line).

Alt text: Figure 2, Panel A, displays a discontinuity in the passive fund ownership share between firms ranked by size, where firms to the left of the cutoff are the largest firms in the Russell 2000 index, and firms to the right of the cutoff are the smallest firms in the Russell 1000 index. Passive fund ownership is higher for firms in the Russell 2000 index. Figure 2, Panel B, displays the active fund ownership share between firms ranked by size, where firms to the left of the cutoff are the largest firms in the Russell 2000 index, and firms to the right of the cutoff are the smallest firms in the Russell 1000 index. Active fund ownership is the same in firms around the index cutoff.

Panel A: Passive ownership



Panel B: Active ownership

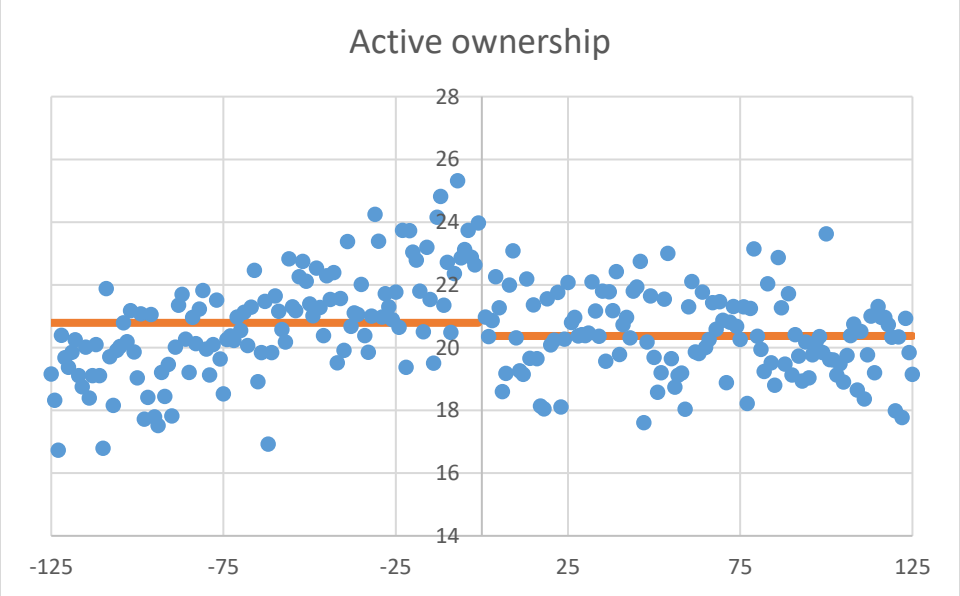
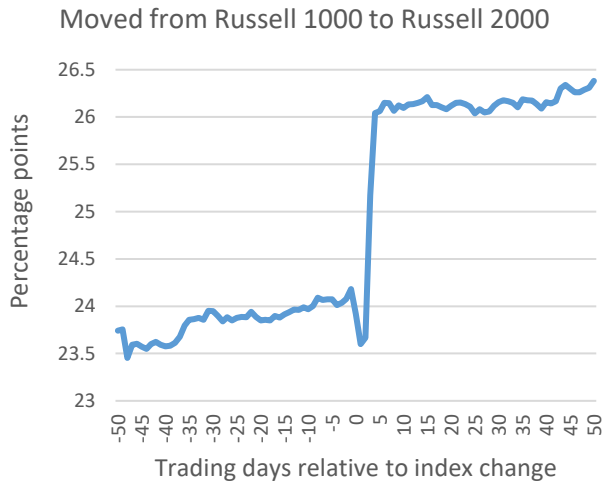


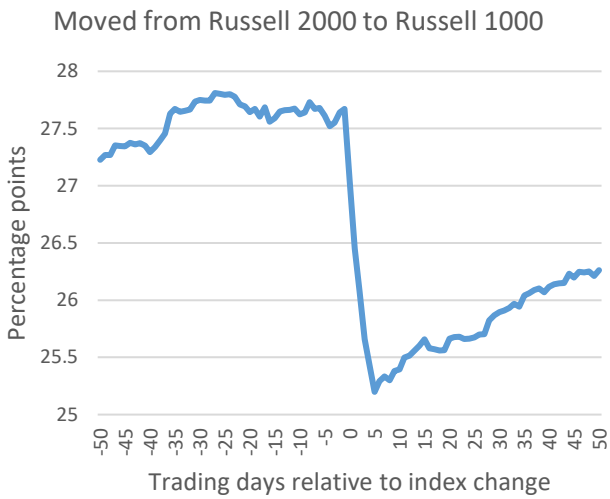
Figure 3: Changes after index switches

This figure shows changes to lendable supply and short selling after a stock switches between the Russell 1000 and Russell 2000 index. On the left, we show the average lendable supply and short interest for stocks that moved (down) from the Russell 1000 to the Russell 2000. On the right, we show the same for stocks that moved (up) from the Russell 2000 to the Russell 1000. In both cases, we display 50 trading days before and after the index change.

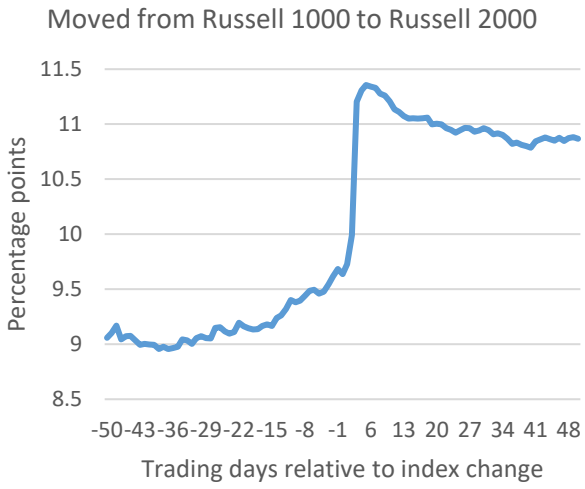
Alt text: Figure 3, Panel A, displays lendable supply around the Russell index reconstitution events. The left panel shows that lendable supply jumps up on the reconstitution date for stocks moving from the Russell 1000 to the Russell 2000 index. The right panel shows that lendable supply drops on the reconstitution date for stocks moving from the Russell 2000 to the Russell 1000 index. Figure 3, Panel B, displays short interest around the Russell index reconstitution events. The left panel shows that short interest jumps up on the reconstitution date for stocks moving from the Russell 1000 to the Russell 2000 index. The right panel shows that short interest drops on the reconstitution date for stocks moving from the Russell 2000 to the Russell 1000 index.

Panel A: Lendable supply





Panel B: Short interest (equity loans)



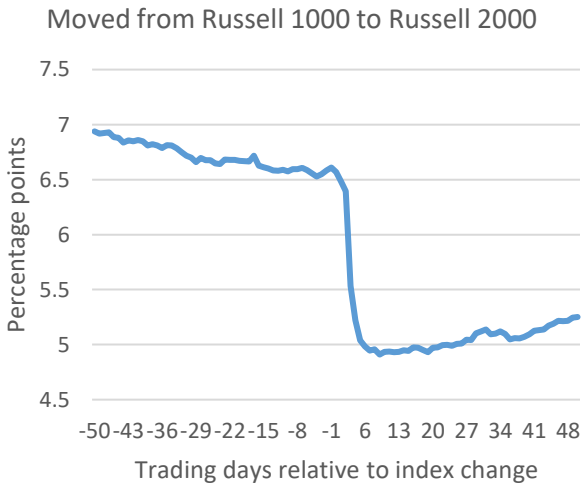
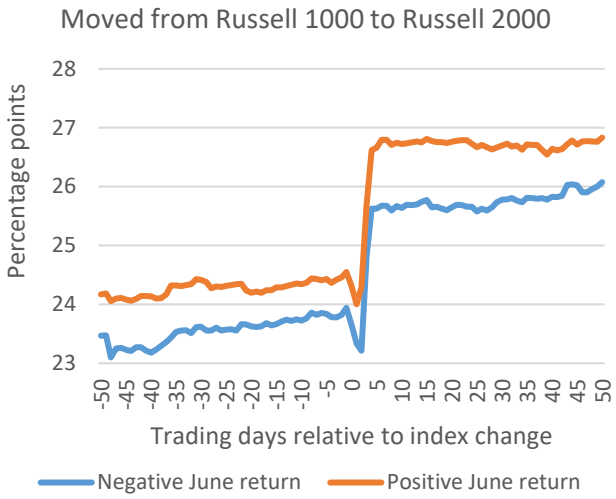


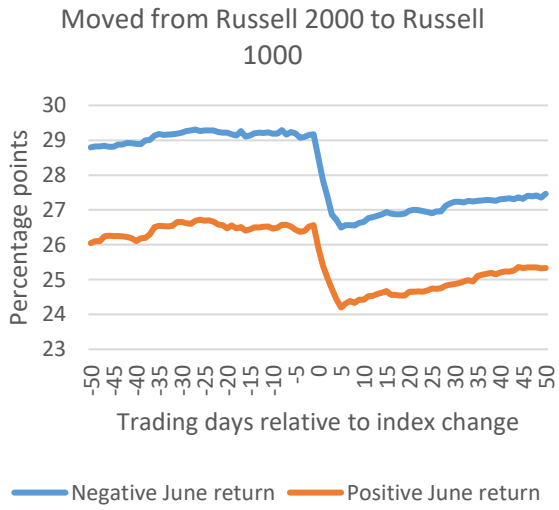
Figure 4: Changes after index switches – split by inclusion return

This figure shows changes to lendable supply and short selling after a stock switches between the Russell 1000 and Russell 2000 index, separately for stocks with positive (orange line) or negative (blue line) June returns (when the index inclusion effect is observed, see Chang et al. (2015)). On the left, we show the average lendable supply and short interest for stocks that moved (down) from the Russell 1000 to the Russell 2000. On the right, we show the same for stocks that moved (up) from the Russell 2000 to the Russell 1000. In both cases, we display 50 trading days before and after the index change.

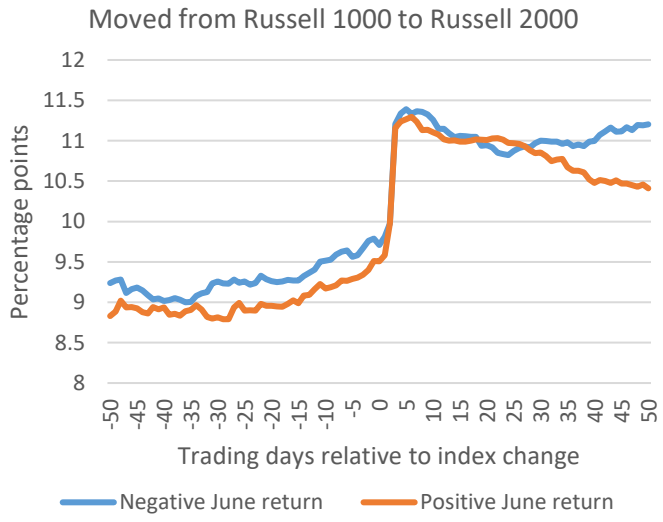
Alt text: Figure 4, Panel A, displays lendable supply around the Russell index reconstitution events, comparing stocks with positive returns in June to stocks with negative returns in June. The left panel shows that lendable supply jumps up on the reconstitution date for stocks moving from the Russell 1000 to the Russell 2000 index by a roughly equal amount for stocks with both positive and negative June returns. The right panel shows that lendable supply drops on the reconstitution date for stocks moving from the Russell 2000 to the Russell 1000 index by a roughly equal amount for stocks with both positive and negative June returns. Figure 4, Panel B, displays short interest around the Russell index reconstitution events, comparing stocks with positive returns in June to stocks with negative returns in June. The left panel shows that short interest jumps up on the reconstitution date for stocks moving from the Russell 1000 to the Russell 2000 index by a roughly equal amount for stocks with both positive and negative June returns. The right panel shows that short interest drops on the reconstitution date for stocks moving from the Russell 2000 to the Russell 1000 index by a roughly equal amount for stocks with both positive and negative June returns.

Panel A: Lendable supply





Panel B: Short interest (equity loans)



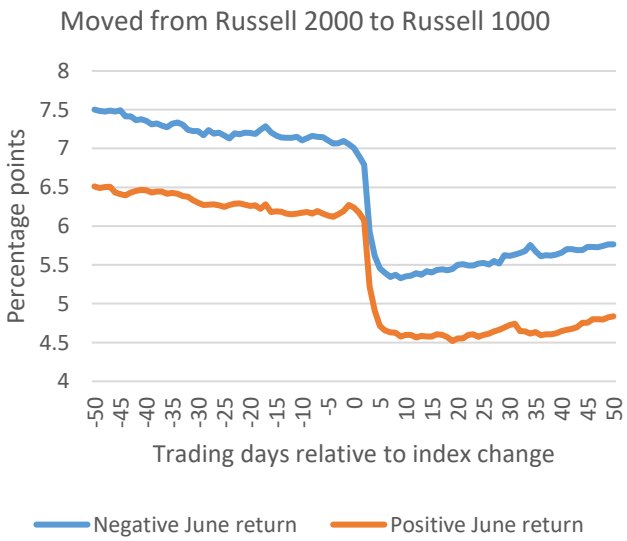


Table 1: Summary statistics and correlations

This table displays monthly summary statistics and correlations. In Panel A, we display the summary statistics for the sample of +/- 500 companies around the cut-off (summary statistics for the sample of +/- 250 companies around the cut-off look very similar). *Passive*, *Active*, and *Fund ownership* is the percent of shares outstanding held by passive, active, and all (including unclassified) funds, respectively. *Lendable supply* is the fraction of shares that are available to be lent out by equity lenders. *Short interest (equity loans)* is the average fraction of outstanding shares that are lent out. *Short interest (Compustat)* is the fraction of outstanding shares that are shorted based on bi-weekly short interest data. *Utilization* is the fraction of lendable supply that is lent out. *Lending fee* is the value-weighted average fee that equity borrowers pay to borrow the stock. *Average tenure* is the average number of days that an equity loan has been open. *Fraction of loans with tenure above 30 days* is the fraction of outstanding equity loan volume with a tenure above 30 days. *Delivery failure* is the number of shares that were not delivered divided by number of shares that were shorted. *Lendable supply drops* is the fraction of days that lendable supply declined more than 5%. *Lending supply risk index* is the equal-weighted average of delivery failures, the fraction of loans with below 30-day loan tenure, and *Lendable supply drops*, after standardizing each variable to have a mean of zero and a standard deviation of one. Higher values of this index therefore correspond to a *lower* lending supply quality. *Price jump ratio(earnings ann.)* is defined as $\frac{Alpha_{t-1,t+2}}{Alpha_{t-21,t+2}}$ and $|Alpha|/SD$ *(earnings ann.)* is the absolute value of $Alpha_{t-1,t+2}$ divided by the standard deviation of daily alpha for the stock measured over t-50 to t-22 , where *t* denotes the quarterly earnings announcement date. Similarly, *Price jump ratio(8-K)* is defined as $\frac{Alpha_{t-1,t+4}}{Alpha_{t-21,t+4}}$ and $|Alpha|/SD$ *(earnings ann.)* is the absolute value of $Alpha_{t-1,t+4}$ divided by the standard deviation of daily alpha for the stock measured over t-50 to t-22 , where *t* denotes the 8-K event date. In Panel B, we display correlations between different lending supply quality measures. Details on variable constructions can be found in Appendix A.

Panel A: Summary Statistics

Variable	Mean	10th Percentile	Median	90th Percentile	Standard Deviation
Passive ownership (%)	10.5	3.54	9.89	18.4	5.66
Active ownership (%)	20.8	6.72	20.8	34.4	10.3
Fund ownership (%)	35.7	16.3	37.5	51.7	13.6
Lendable supply (%)	27.0	14.3	27.7	38.3	9.17
Short interest (equity loans) (%)	5.81	0.55	3.70	14.4	5.97
Short interest (Compustat) (%)	6.68	1.44	4.91	14.5	5.74
Utilization (%)	11.0	0.72	6.57	27.9	12.4
Lending fee (bp)	29.3	1.59	8.90	24.5	124.8
Average tenure (days)	67.9	28.6	60.8	115.4	37.1
Fraction of loans with tenure above 30 days (%)	50.4	21.5	53.2	74.1	19.6
Delivery failure (%)	0.50	0.020	0.12	1.01	1.38
Lendable supply drops (%)	1.41	0.00	0.00	6.25	3.44
Lending supply risk index	-0.028	-0.54	-0.12	0.55	0.51
Price jump ratio (earnings ann.) (%)	56.1	0.12	56.1	111.7	46.6
Price jump ratio (8-K) (%)	39.6	-11.2	35.3	97.7	45.6
$\|Alpha\|/SD$ (earnings ann.) (%)	5.09	0.77	4.26	10.5	4.03
$\|Alpha\|/SD$ (8-K) (%)	3.83	0.43	2.63	8.84	3.82

Panel B: Correlations

Variable	Average tenure (days)	Fraction of loans with tenure above 30 days (%)	Delivery failure (%)	Lendable supply drops (%)	Lending supply risk index
Average tenure (days)	1.00				
Fraction of loans with tenure above 30 days (%)	0.54	1.00			
Delivery failure (%)	-0.13	-0.26	1.00		
Lendable supply drops (%)	-0.18	-0.28	0.15	1.00	
Lending supply risk index	-0.27	-0.50	0.22	0.63	1.00

Table 2: Russell 2000 membership as an instrument for passive ownership

This table examines how passive and active ownership depends on membership in the Russell 2000 index. In Columns 1 and 2, we regress passive ownership on an indicator whether a firm is member of the Russell 2000 index (this is the first stage of the instrumental variable specification in Tables 3, 5, and 12). In Columns 3 and 4, we show results for a falsification test, in which we regress active ownership on the Russell 2000 indicator. In all regressions, we control for a third polynomial of log-market cap measured at the end of (previous) May, the logarithm of float-adjusted market cap as of the end of June, and the following banding controls: D(banded), an indicator for having an end-of-May market cap sufficiently close to the cutoff such that the firm will not switch indexes, D($Russel\ 2000_{last\ May}$), an indicator whether the firm was in the Russell 2000 index at the end of last May (and thus over the course of the previous year), and their interaction. The sample consists of either the top 250 or 500 stocks in the Russell 2000 index and the bottom 250 or 500 stocks in the Russell 1000 index. The regressions are run on monthly data from 2006 to 2018. We include month fixed effects. Details on variable constructions can be found in Appendix A. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

	First stage		Falsification test	
Dependent variable:	Passive ownership (%)		Active ownership (%)	
	(1)	(2)	(3)	(4)
D(Russell 2000)	1.092***	1.484***	0.020	-0.267
	(4.27)	(6.33)	(0.03)	(-0.46)
Float-adjusted market cap	5.953***	5.881***	8.730***	8.269***
	(20.85)	(24.23)	(14.70)	(18.16)
D(banded)	-0.117	-0.028	0.563	1.163***
	(-0.53)	(-0.15)	(1.04)	(2.66)
D($Russel\ 2000_{last\ May}$)	-0.104	0.104	2.945***	2.964***
	(-0.34)	(0.57)	(4.13)	(6.91)
D($Russel\ 2000_{last\ May}$)* D(banded)	0.543	0.043	-1.188	-0.930
	(1.57)	(0.17)	(-1.45)	(-1.50)
Observations	65,044	129,687	65,044	129,687
Adjusted R^2	0.513	0.511	0.134	0.129
Kleibergen-Paap F-Statistic	18.3	40.1	0.00	0.2
Month fixed effects	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3
Number of firms around threshold	250	500	250	500

Table 3: Passive ownership increases lendable supply and short selling

This table displays the second stage results of an instrumental variable regression where passive ownership is instrumented by membership of the Russell 2000 index. In Panel A, we focus on the effect of passive ownership on lendable supply and short selling. Specifically, in Columns 1 and 2, the dependent variable is *Lendable supply* (%), the percent of shares outstanding made available to be lent out by equity lenders. In Columns 3 and 4, the dependent variable is *Short interest* (%), the percent of shares outstanding that are lent out in the equity lending market (the main reason to borrow equities is to conduct short selling). In Panel B, we focus on the effect of passive ownership on utilization and lending fee. Specifically, in Columns 1 and 2, the dependent variable is *Utilization*, which measures the fraction of lendable supply that is lent out. In Columns 3 and 4, the dependent variables is the *Lending fee* measured in basis points per year. In all regressions, we control for a third polynomial of log-market cap measured at the end of (previous) May, the logarithm of float-adjusted market cap as of the end of June, and the following banding controls: D(banded), an indicator for having an end-of-May market cap sufficiently close to the cutoff such that the firm will not switch indexes, D($Russel\ 2000_{last\ May}$), an indicator whether the firm was in the Russell 2000 index at the end of last May (and thus over the course of the previous year), and their interaction. The sample consists of either the top 250 or 500 stocks in the Russell 2000 index and the bottom 250 or 500 stocks in the Russell 1000 index. The regressions are run on monthly data from 2006 to 2018. We include month fixed effects. Details on variable constructions can be found in Appendix A. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Effect on lendable supply and short selling

	Second stage			
Dependent variable:	Lendable supply (%)		Short interest (equity loans) (%)	
	(1)	(2)	(3)	(4)
Passive ownership (%)	1.236***	1.265***	0.916**	0.728***
	(2.95)	(4.47)	(2.43)	(3.15)
Float-adjusted market cap	7.168***	6.610***	-4.086*	-2.807**
	(2.90)	(3.98)	(-1.85)	(-2.12)
D(banded)	1.004**	1.011***	0.223	0.136
	(2.51)	(3.14)	(0.64)	(0.50)
D($Russel\ 2000_{last\ May}$)	1.171**	1.092***	0.641	-0.388
	(2.44)	(3.74)	(1.39)	(-1.32)
D($Russel\ 2000_{last\ May}$)* D(banded)	-0.648	-0.637	-1.164*	0.202
	(-0.93)	(-1.42)	(-1.75)	(0.54)
Observations	65,044	129,687	65,041	129,682
Month fixed effects	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3
Number of firms around threshold	250	500	250	500

Panel B: Effect on utilization and lending fee

	Second stage			
Dependent variable:	Utilization (%)		Lending fee (bp)	
	(1)	(2)	(3)	(4)
Passive ownership (%)	1.471*	0.980**	4.168	6.258
	(1.81)	(1.98)	(0.60)	(1.30)
Float-adjusted market cap	-13.375***	-10.171***	-82.177**	-91.133***
	(-2.80)	(-3.52)	(-1.99)	(-3.20)
D(banded)	0.288	0.301	-2.344	-5.788
	(0.44)	(0.58)	(-0.46)	(-1.20)
D($Russel\ 2000_{last\ May}$)	0.067	-1.253**	-6.288	-24.609***
	(0.08)	(-2.36)	(-0.93)	(-3.94)
D($Russel\ 2000_{last\ May}$)* D(banded)	-1.873	0.266	-1.433	13.360*
	(-1.37)	(0.36)	(-0.13)	(1.77)
Observations	65,041	129,682	65,041	129,682
Month fixed effects	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3
Number of firms around threshold	250	500	250	500

Table 4: Supply quality and active vs. passive ownership

This table displays panel regression results with the fraction of passive ownership and active ownership as the key independent variables and measures of lending supply quality as dependent variables. Panel A looks at loan tenure, Panel B at delivery failures and lendable supply drops, and Panel C at the lending supply risk index. Specifically, in Panel A, Columns 1 and 2, the dependent variable is the *average tenure* of equity loans in that stock, measured in the natural logarithm of days, while in Columns 3 and 4, the dependent variable is the fraction of equity loans with a tenure above 30 days, measured in percent. In Panel B, Columns 1 and 2, the dependent variable is *Delivery failure*, which is the number of shares that were not delivered divided by number of shares that were shorted, while in Columns 3 and 4, the dependent variable is *Lendable supply drops*, which is the fraction of days that lendable supply declines more than 5%. In Panel C, the dependent variable is *Lending supply risk*, which is an index based on loan tenure, delivery failures, and lendable supply drops, where a higher index signals lower lending supply quality. In all regressions, we control for log-market cap at the end of the previous month (from CRSP), stock returns over the past 3- and 12-months, the average effective spread in the previous month, and the market-to-book ratio at the end of the previous month. For brevity, we don't show coefficients for these controls here, but they are available in Internet Appendix A.10. The regressions are run on monthly data for all stocks with a price equal to or larger than $5 in CRSP from 2006 to 2018. We include 2-digit SIC and month fixed effects. Details on variable constructions can be found in Appendix A. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Loan tenure

Dependent variable:	Average tenure (log)		Fraction of loans with tenure above 30 days (%)	
	(1)	(2)	(3)	(4)
Passive ownership (%)	0.030***	0.028***	0.898***	0.796***
	(21.45)	(19.43)	(23.34)	(20.20)
Active ownership (%)		0.004***		0.141***
		(6.45)		(8.47)
Observations	466,643	466,643	465,830	465,830
Adjusted R^2	0.120	0.122	0.110	0.113
Controls	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes

Panel B: Delivery failures and lendable supply drops

Dependent variable:	Delivery failure (%)		Lendable supply drops (%)	
	(1)	(2)	(3)	(4)
Passive ownership (%)	-0.490***	-0.358***	-0.209***	-0.194***
	(-9.48)	(-7.71)	(-20.15)	(-20.11)
Active ownership (%)		-0.183***		-0.021***
		(-5.21)		(-5.76)
Observations	429,693	429,693	467,542	467,542
Adjusted R^2	0.056	0.056	0.108	0.109
Controls	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes

Panel C: Lending supply risk index

Dependent variable:	Lending supply risk	
	(1)	(2)
Passive ownership (%)	-0.013***	-0.012***
	(-26.44)	(-24.27)
Active ownership (%)		-0.002***
		(-8.58)
Observations	468,685	468,685
Adjusted R^2	0.109	0.111
Controls	Yes	Yes
Industry fixed effects	Yes	Yes
Month fixed effects	Yes	Yes

Table 5: Causal effect of passive ownership on supply quality

This table displays the second stage results of an instrumental variable regression where passive ownership is instrumented by membership of the Russell 2000 index. Panel A looks at loan tenure, Panel B at delivery failures and lendable supply drops, and Panel C at the lending supply risk index. Specifically, in Panel A, Columns 1 and 2, the dependent variable is the *Average tenure* of equity loans in that stock, measured in the natural logarithm of days, while in Columns 3 and 4, the dependent variable is the fraction of equity loans with a tenure above 30 days, measured in percent. In Panel B, Columns 1 and 2, the dependent variable is *Delivery failure*, which is the number of shares that were not delivered divided by number of shares that were shorted, while in Columns 3 and 4, the dependent variable is *Lendable supply drops*, which is the fraction of days that lendable supply declines more than 5%. In Panel C, the dependent variable is *Lending supply risk*, which is an index based on loan tenure, delivery failures, and lendable supply drops, where a higher index signals lower lending supply quality. In all regressions, we control for a third polynomial of log-market cap measured at the end of (previous) May, the logarithm of float-adjusted market cap as of the end of June, and the following banding controls: D(banded), an indicator for having an end-of-May market cap sufficiently close to the cutoff such that the firm will not switch indexes, D($Russel\ 2000_{last\ May}$), an indicator whether the firm was in the Russell 2000 index at the end of last May (and thus over the course of the previous year), and their interaction. The sample consists of either the top 250 or 500 stocks in the Russell 2000 index and the bottom 250 or 500 stocks in the Russell 1000 index. The regressions are run on monthly data from 2006 to 2018. We include month fixed effects. Details on variable constructions can be found in Appendix A. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Loan tenure

	Second stage			
Dependent variable:	Average tenure (log)		Fraction of loans with tenure above 30 days (%)	
	(1)	(2)	(3)	(4)
Passive ownership (%)	0.059**	0.055***	3.292***	2.464***
	(2.11)	(2.82)	(3.20)	(3.83)
Float-adjusted market cap	-0.288*	-0.235**	-19.149***	-13.584***
	(-1.76)	(-2.07)	(-3.16)	(-3.64)
D(banded)	0.019	0.037	0.620	1.356*
	(0.65)	(1.58)	(0.57)	(1.73)
D($Russel\ 2000_{last\ May}$)	0.033	0.099***	1.607	2.702***
	(1.00)	(4.49)	(1.23)	(3.73)
D($Russel\ 2000_{last\ May}$)* D(banded)	0.031	-0.033	-1.034	-1.130
	(0.62)	(-1.02)	(-0.57)	(-1.07)
Observations	65,041	129,682	65,041	129,682
Month fixed effects	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3
Number of firms around threshold	250	500	250	500

Panel B: Delivery failures and lendable supply drops

	Second stage			
Dependent variable:	Delivery failure (%)		Lendable supply drops (%)	
	(1)	(2)	(3)	(4)
Passive ownership (%)	-0.163**	-0.127***	-0.468***	-0.340***
	(-2.23)	(-3.10)	(-2.79)	(-3.62)
Float-adjusted market cap	0.685	0.434*	2.141**	1.275**
	(1.54)	(1.83)	(2.17)	(2.34)
D(banded)	-0.065	-0.096**	-0.139	-0.198**
	(-1.11)	(-2.23)	(-1.12)	(-2.29)
D($Russel\ 2000_{last\ May}$)	-0.076	-0.120***	0.260	0.117
	(-1.05)	(-2.67)	(1.49)	(1.05)
D($Russel\ 2000_{last\ May}$)* D(banded)	0.148	0.134**	0.213	0.205
	(1.28)	(2.21)	(0.86)	(1.62)
Observations	61,469	122,612	65,044	129,687
Month fixed effects	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3
Number of firms around threshold	250	500	250	500

Panel C: Lending supply risk index

	Second stage	
Dependent variable:	Lending supply risk	
	(1)	(2)
Passive ownership (%)	-0.104***	-0.073***
	(-3.61)	(-4.61)
Float-adjusted market cap	0.532***	0.334***
	(3.15)	(3.69)
D(banded)	-0.026	-0.041**
	(-0.92)	(-2.26)
D($Russel\ 2000_{last\ May}$)	-0.009	-0.047**
	(-0.25)	(-2.47)
D($Russel\ 2000_{last\ May}$)* D(banded)	0.051	0.051**
	(1.06)	(2.04)
Observations	65,044	129,687
Month fixed effects	Yes	Yes
Polynomial order of market cap	3	3
Number of firms around threshold	250	500

Table 6: Passive lenders and loan persistence – direct evidence

This table exploits novel data collected from SEC N-PORT filings at the fund-stock-quarter level from the third quarter of 2019 to the end of 2022 to provide direct evidence (a) that stocks lent out by passive lenders are more likely to remain on loan over the next quarter, and (b) that stock positions by passive owners are more likely to be lent out. In Panel A, we focus on all stocks currently on loan in a given fund's portfolio (i.e., $D(on\ loan)_t = 1$). We then regress $D(on\ loan)_{t+1}$, a dummy that takes the value one if the stock continues to be on loan next quarter, on *D(passive fund)*, which is a dummy variable equal to one if the fund's N-CEN filing indicates it is an index fund, while controlling for *position size*, the fraction of shares held by the fund over all shares outstanding, and different fixed effects (as indicated at the bottom of the table). In Panel B, we focus on all stocks in a given fund's portfolio (i.e., *position size* > 0) and regress $D(on\ loan)_t$, a dummy that takes the value one if the stock is currently on loan, on *D(passive fund)* while controlling for *position size* and different fixed effects. Details on variable constructions can be found in Appendix A. All standard errors are clustered by stock. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Loan persistence (for stocks currently on loan)

Dependent variable:	$D(on\ loan)_{t+1}$			
	(1)	(2)	(3)	(4)
D(passive fund)	0.0511***	0.0475***	0.0243***	0.0232***
	(18.12)	(16.11)	(10.62)	(9.74)
Position size	0.00462***	0.00477***	0.00740***	0.00746***
	(11.58)	(11.91)	(35.49)	(34.87)
Observations	358,511	358,511	358,511	358,511
Quarter fixed effects	No	Yes	Yes	No
Stock fixed effects	No	No	Yes	No
Stock-Quarter fixed effect	No	No	No	Yes

Panel B: Preference for passive lenders (for stocks currently held)

Dependent variable:	$D(on\ loan)_t$			
	(1)	(2)	(3)	(4)
D(passive fund)	0.0330***	0.0332***	0.0152***	0.0147***
	(29.23)	(29.39)	(25.45)	(25.01)
Position size	0.000115**	0.000115**	0.000102**	0.000111**
	(2.66)	(2.67)	(2.62)	(2.64)
Observations	5,180,027	5,180,027	5,180,027	5,180,027
Quarter fixed effects	No	Yes	Yes	No
Stock fixed effects	No	No	Yes	No
Stock-Quarter fixed effect	No	No	No	Yes

Table 7: Interaction by ex-ante utilization, lending fee, and lending supply risk

This table examines if the ex-ante level of short sale constraints and lendable supply quality affects the impact of being in the Russell 2000 (our instrument for passive ownership) on lendable supply and short selling. We display monthly regressions of lendable supply and short interest on an interaction between *D(Russell 2000)* and $D(Utilization_{last\ May})$ in Panel A, $D(Lending\ fee_{last\ May})$ in Panel B, or $Lending\ supply\ risk_{last\ May}$ in Panel C. $D(Utilization_{last\ May})$ is a dummy variable equal to one if *Utilization* at the end of last May was above the median. $D(Lending\ fee_{last\ May})$ is a dummy variable equal to one if *Lending fee* at the end of last May was above the median. $Lending\ supply\ risk_{last\ May}$ is last May's value of our lending supply risk index, which is based on loan tenure, delivery failures, and lendable supply drops, where a higher index signals lower lending supply quality. In all regressions, we control for a third polynomial of log-market cap measured at the end of (previous) May, the logarithm of float-adjusted market cap as of the end of June, and the following banding controls: D(banded), an indicator for having an end-of-May market cap sufficiently close to the cutoff such that the firm will not switch indexes, D($Russel\ 2000_{last\ May}$), an indicator whether the firm was in the Russell 2000 index at the end of last May (and thus over the course of the previous year), and their interaction. In addition, we interact all of these variables with the ex-ante utilization, fee, or lending supply risk, respectively. For brevity, we do not show here the coefficients on the controls and interactions, while displaying the full regression output in Internet Appendix A.10. The sample consists of either the top 250 or 500 stocks in the Russell 2000 index and the bottom 250 or 500 stocks in the Russell 1000 index. The regressions are run on daily data from 2006 to 2018. We include month fixed effects. Details on variable constructions can be found in Appendix A. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Interaction by ex-ante utilization

	Reduced Form Regression			
Dependent variable:	Lendable supply (%)		Short interest (equity loans) (%)	
	(1)	(2)	(3)	(4)
D(Russell 2000) * $D(Utilization_{last\ May})$	0.537	-0.106	1.617***	1.154***
	(0.61)	(-0.16)	(2.99)	(2.62)
D(Russell 2000)	1.275	2.663***	0.626*	0.748**
	(1.65)	(4.30)	(1.80)	(2.50)
Observations	65,105	130,031	65,105	130,031
Adjusted R^2	0.464	0.437	0.320	0.335
Month fixed effects	Yes	Yes	Yes	Yes
Banding and market cap controls	Yes	Yes	Yes	Yes
Banding and market cap controls interacted with D($Utilization_{\text{last May}}$)	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3
Number of firms around threshold	250	500	250	500

Panel B: Interaction by ex-ante lending fee

	Reduced Form Regression			
Dependent variable:	Lendable supply (%)		Short interest (equity loans) (%)	
	(1)	(2)	(3)	(4)
D(Russell 2000) * $D(Lending\ fee_{last\ May})$	0.454	0.250	1.570**	2.706***
	(0.51)	(0.38)	(2.04)	(4.70)
D(Russell 2000)	1.366**	2.422***	1.090**	0.553
	(2.35)	(4.70)	(2.45)	(1.61)
Observations	65,111	130,037	65,111	130,037
Adjusted R^2	0.480	0.452	0.212	0.223
Month fixed effects	Yes	Yes	Yes	Yes
Banding and market cap controls	Yes	Yes	Yes	Yes
Banding and market cap controls interacted with D($Lending\ fee_{\text{last May}}$)	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3
Number of firms around threshold	250	500	250	500

Panel C: Interaction by ex-ante lending supply risk index

	Reduced Form Regression			
Dependent variable:	Lendable supply (%)		Short interest (equity loans) (%)	
	(1)	(2)	(3)	(4)
D(Russell 2000) * $Lending\ supply\ risk_{last\ May}$	-0.405	-0.249	2.002**	1.713**
	(-0.50)	(-0.35)	(2.52)	(2.18)
D(Russell 2000)	1.542***	2.338***	1.650***	1.513***
	(2.91)	(4.76)	(3.91)	(4.29)
Observations	60,894	121,729	60,894	121,729
Adjusted R^2	0.451	0.424	0.116	0.131
Month fixed effects	Yes	Yes	Yes	Yes
Banding and market cap controls	Yes	Yes	Yes	Yes
Banding and market cap controls interacted with $Lending\ supply\ risk_{last\ May}$	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3
Number of firms around threshold	250	500	250	500

Table 8: Russell 2000 membership and short selling profitability

This table examines if short selling is more profitable in stocks of the Russell 2000 index (our instrument for passive ownership). We display daily regressions of future average daily returns over the next 10 or 20 trading days, on an interaction between *D(Russell 2000)* and *Short interest*. In all regressions, we control for a third polynomial of log-market cap measured at the end of (previous) May, the logarithm of float-adjusted market cap as of the end of June, and the following banding controls: D(banded), an indicator for having an end-of-May market cap sufficiently close to the cutoff such that the firm will not switch indexes, D($Russel\ 2000_{last\ May}$), an indicator whether the firm was in the Russell 2000 index at the end of last May (and thus over the course of the previous year), and their interaction. In addition, we interact all of these variables with *Short interest*, which we also include itself. For brevity, we do not show here the coefficients on the controls and interactions, while displaying the full regression output in Internet Appendix A.10. The sample consists of either the top 250 or 500 stocks in the Russell 2000 index and the bottom 250 or 500 stocks in the Russell 1000 index. The regressions are run on daily data from 2006 to 2018. We include month fixed effects. Details on variable constructions can be found in Appendix A. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

	Reduced Form Regression			
Dependent variable:	$Avg.Return_{t+1,t+10}$ (%)		$Avg.Return_{t+1,t+20}$ (%)	
	(1)	(2)	(3)	(4)
D(Russell 2000) * Short interest (equity loans)	-0.004**	-0.005**	-0.004**	-0.005***
	(-1.98)	(-2.44)	(-2.10)	(-2.70)
D(Russell 2000)	-0.004	-0.008	-0.006	-0.008
	(-0.26)	(-0.75)	(-0.44)	(-0.81)
Observations	1,491,410	2,980,123	1,491,410	2,980,123
Adjusted R^2	0.326	0.324	0.331	0.330
Month fixed effects	Yes	Yes	Yes	Yes
Banding and market cap controls	Yes	Yes	Yes	Yes
Banding and market cap controls interacted with Short interest (equity loans)	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3
Number of firms around threshold	250	500	250	500

Table 9: Russell 2000 membership and short selling before negative news releases

This table examines if there is more short selling before negative news releases if a stock is in the Russell 2000 (our instrument for passive ownership). In Panel A, we display the results of earnings announcement-level regressions, where the dependent variable is *Short interest* in the 30 or 60 days leading up to the earnings announcement and the explanatory variable of interest is the interaction between *D(Russell 2000)* and *D(Negative earnings surprise)*. *D(Neg. earnings surprise)* is a dummy variable equal to one when the standardized unexpected earnings (SUE) or cumulative announcement alpha (or return) from t-1 to t+2 is in the bottom tercile and zero otherwise. In Regressions 1 and 4, we base *D(Negative earnings surprise)* on SUE, which are defined as the difference between the actual earnings per share (EPS) and the EPS four quarters ago, divided by the standard deviation of that difference over the previous eight quarters. In Regressions 2 and 5, we base *D(Negative earnings surprise)* on alphas and in Regressions 3 and 6 on returns. In Panel B, we display the results for 8-K events, where the dependent variable is *Short interest* in the 30 or 60 days leading up to the event date and the explanatory variable of interest is the interaction between *D(Russell 2000)* and *D(Neg. 8-K event)*. *D(Neg. 8-K event)* is a dummy variable equal to one when the cumulative announcement alpha (or return) from t-1 to t+2 is in the bottom tercile and zero otherwise. In Regressions 1 and 3, we base *D(Neg. 8-K event)* on alphas and in Regressions 2 and 4 on returns. *D(Russell 2000)* is an indicator variable equal to one if the stock is in the Russell 2000 index. In all regressions, we control for a third polynomial of log-market cap measured at the end of (previous) May, the logarithm of float-adjusted market cap as of the end of June, and the following banding controls: *D(banded)*, an indicator for having an end-of-May market cap sufficiently close to the cutoff such that the firm will not switch indexes, $D(Russel\ 2000_{last\ May})$, an indicator whether the firm was in the Russell 2000 index at the end of last May (and thus over the course of the previous year), and their interaction. In addition, in both panels, we include all these variables interacted with the negative news dummy. For brevity, we do not show here the coefficients on the controls and interactions, while displaying the full regression output in Internet Appendix A.10. The sample consists of all quarterly earnings announcements or 8-K filing events from 2006 to 2018 for the top 500 stocks in the Russell 2000 index and the bottom 500 stocks in the Russell 1000 index. We include month fixed effects. Details on variable constructions can be found in Appendix A. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Earnings announcement

	Reduced Form Regression					
Dependent variable:	$Short\ interest_{t-30,t-1}$			$Short\ interest_{t-60,t-1}$		
	Based on SUE	Based on Alphas	Based on Returns	Based on SUE	Based on Alphas	Based on Returns
	(1)	(2)	(3)	(4)	(5)	(6)
D(Russell 2000)* D(Neg. earnings surprise)	2.290***	0.668***	0.630**	2.251***	0.669***	0.610**
	(5.30)	(2.72)	(2.27)	(5.24)	(2.81)	(2.25)
D(Russell 2000)	0.473	0.654**	0.652**	0.368	0.528*	0.534*
	(1.39)	(2.29)	(2.23)	(1.09)	(1.86)	(1.84)
Observations	42,823	45,472	45,475	42,823	45,472	45,475
Adjusted R^2	0.138	0.127	0.127	0.139	0.128	0.128
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Banding and market cap controls	Yes	Yes	Yes	Yes	Yes	Yes
Banding and market cap controls interacted with D(Negative earnings surprise)	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3	3	3
Number of firms around threshold	500	500	500	500	500	500

Panel B: 8-K filings

	Reduced Form Regression			
Dependent variable:	$Short\ interest_{t-30,t-1}$		$Short\ interest_{t-60,t-1}$	
	Based on Alphas	Based on Returns	Based on Alphas	Based on Returns
	(1)	(2)	(3)	(4)
D(Russell 2000)* D(Neg. 8-K event)	0.669***	0.569***	0.658***	0.546**
	(3.31)	(2.69)	(3.25)	(2.57)
D(Russell 2000)	0.898**	0.926**	0.816**	0.850**
	(2.47)	(2.54)	(2.26)	(2.36)
Observations	133,435	133,459	133,435	133,459
Adjusted R^2	0.125	0.125	0.128	0.128
Month fixed effects	Yes	Yes	Yes	Yes
Banding and market cap controls	Yes	Yes	Yes	Yes
Banding and market cap controls interacted with D(Neg. 8-K event)	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3
Number of firms around threshold	500	500	500	500

Table 10: Russell 2000 membership and information efficiency around negative news releases

This table examines whether information efficiency is higher for negative news releases if a stock is in the Russell 2000 (our instrument for passive ownership). In Panel A, we display the results of earnings announcement-level regressions. In Columns 1-3, the dependent variable is the price jump ratio defined as in Weller (2018) as $\frac{Alpha_{t-1,t+2}}{Alpha_{t-21,t+2}}$, where Alpha is the 3-factor Fama French (1993) alpha in days around the earnings announcement. In Columns 4-6, the dependent variable is $|Alpha|/SD$, which is the absolute value of $Alpha_{t-1,t+2}$ divided by the standard deviation of daily alpha for the stock measured over t-50 to t-22 and is inspired by Sammon (2023). *D(Neg. earnings reaction)* is a dummy variable equal to one when the cumulative announcement alpha from t-21 to t+2 is in the bottom tercile and zero otherwise (this variable is included as a control in the regression but not reported). *D(Russell 2000)* is an indicator variable equal to one if the stock is in the Russell 2000 index. Following Weller (2018), we filter for events with absolute cumulative announcement alpha from t-21 to t+2 being large enough relative to the standard deviation of the daily alpha from t-50 to t-22. Specifically, we require it to be $\sqrt{12}$ times larger in regression 1 and 4, $\sqrt{24}$ times larger in regressions 2 and 5, and $\sqrt{36}$ times larger in regressions 3 and 6. In Panel B, we display the results of 8-K event-level regressions. The set-up is analogous to the earnings announcement-level regressions with the exception that we let the reaction window go up to t+4 to account for the slower reaction to 8-K events (Ben-Rephael et al. (2022)). In all regressions, we control for a third polynomial of log-market cap measured at the end of (previous) May, the logarithm of float-adjusted market cap as of the end of June, and the following banding controls: *D(banded)*, an indicator for having an end-of-May market cap sufficiently close to the cutoff such that the firm will not switch indexes, *D(*$Russel\ 2000_{last\ May}$*)*, an indicator whether the firm was in the Russell 2000 index at the end of last May (and thus over the course of the previous year), and their interaction. In addition, in both panels, we include all these variables interacted with the respective negative news dummy (*D(Negative earnings reaction)* or *D(Neg. 8-K reaction)*), which we also include itself. For brevity, we do not show here the coefficients on the controls and interactions, while displaying the full regression output in Internet Appendix A.10. The sample consists of all quarterly earnings announcements or 8-K filing events from 2006 to 2018 for the top 500 stocks in the Russell 2000 index and the bottom 500 stocks in the Russell 1000 index. We include month fixed effects. Details on variable constructions can be found in Appendix A. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Earnings announcement

	Reduced Form Regression					
Dependent Variable	Price jump ratio (%)			$\|Alpha\|/SD$		
Filter	$\|Alpha_{t-21,t+2}\| > \sqrt{12} * SD$	$\|Alpha_{t-21,t+2}\| > \sqrt{24} * SD$	$\|Alpha_{t-21,t+2}\| > \sqrt{36} * SD$	$\|Alpha_{t-21,t+2}\| > \sqrt{12} * SD$	$\|Alpha_{t-21,t+2}\| > \sqrt{24} * SD$	$\|Alpha_{t-21,t+2}\| > \sqrt{36} * SD$
	(1)	(2)	(3)	(4)	(5)	(6)
D(Russell 2000)* D(Neg. earnings reaction)	-7.316**	-7.777**	-8.664**	-0.441**	-0.592**	-0.747**
	(-2.19)	(-2.20)	(-2.20)	(-2.36)	(-2.52)	(-2.54)
D(Russell 2000)	2.121	2.081	0.982	0.057	0.153	0.203
	(0.79)	(0.73)	(0.34)	(0.32)	(0.71)	(0.83)
Observations	24,879	18,020	13,938	24,585	17,835	13,818
Adjusted R^2	0.016	0.025	0.029	0.031	0.034	0.038
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Banding and market cap controls	Yes	Yes	Yes	Yes	Yes	Yes
Banding and market cap controls interacted with D(Neg. earnings reaction)	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3	3	3
Number of firms around threshold	500	500	500	500	500	500

Panel B: 8-K filings

	Reduced Form Regression					
Dependent Variable	Price jump ratio (%)			$\lvert Alpha \rvert / SD$		
Filter	$\lvert Alpha_{t-21,t+4} \rvert > \sqrt{12} * SD$	$\lvert Alpha_{t-21,t+4} \rvert > \sqrt{24} * SD$	$\lvert Alpha_{t-21,t+4} \rvert > \sqrt{36} * SD$	$\lvert Alpha_{t-21,t+4} \rvert > \sqrt{12} * SD$	$\lvert Alpha_{t-21,t+4} \rvert > \sqrt{24} * SD$	$\lvert Alpha_{t-21,t+4} \rvert > \sqrt{36} * SD$
	(1)	(2)	(3)	(4)	(5)	(6)
D(Russell 2000)* D(Neg. 8-K reaction)	-3.649**	-7.125***	-7.357***	-0.167	-0.317**	-0.477**
	(-2.06)	(-3.44)	(-3.12)	(-1.58)	(-2.12)	(-2.53)
D(Russell 2000)	3.268**	5.316***	4.642***	0.177**	0.278**	0.353**
	(2.27)	(3.50)	(2.76)	(1.99)	(2.51)	(2.60)
Observations	63,114	44,268	33,275	63,112	44,266	33,274
Adjusted R^2	0.018	0.024	0.030	0.035	0.037	0.040
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Banding and market cap controls	Yes	Yes	Yes	Yes	Yes	Yes
Banding and market cap controls interacted with D(Neg. 8-K reaction)	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3	3	3
Number of firms around threshold	500	500	500	500	500	500

Table 11: Russell 2000 membership and correction of overvaluation

This table examines if overvaluation in stock prices is more quickly corrected in stocks included in the Russell 2000 index (our instrument for passive ownership). We display monthly regressions of future average daily returns over the next 20 trading days (Columns 1-2), the next 10 trading days (Columns 3-4), or trading days 11 to 20 (Columns 5-6) on an interaction between *D(Russell 2000)* and *D(Overpriced stock)*. *D(Overpriced stock)* is equal to one if a stock is in the top tercile in a month by the overpricing measure of Stambaugh et al. (2015). In all regressions, we control for a third polynomial of log-market cap measured at the end of (previous) May, the logarithm of float-adjusted market cap as of the end of June, and the following banding controls: D(banded), an indicator for having an end-of-May market cap sufficiently close to the cutoff such that the firm will not switch indexes, D($Russel\ 2000_{last\ May}$), an indicator whether the firm was in the Russell 2000 index at the end of last May (and thus over the course of the previous year), and their interaction. In addition, we interact all of these variables with *D(Overpriced stock)*, which we also include itself. For brevity, we do not show here the coefficients on the controls and interactions, while displaying the full regression output in Internet Appendix A.10. The sample consists of either the top 250 or 500 stocks in the Russell 2000 index and the bottom 250 or 500 stocks in the Russell 1000 index. The regressions are run on monthly data from 2006 to 2018. We include month fixed effects. Details on variable constructions can be found in Appendix A. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

	Reduced Form Regression					
Dependent variable:	$Avg.Return_{t+1,t+20}$ (%)		$Avg.Return_{t+1,t+10}$ (%)		$Avg.Return_{t+11,t+20}$ (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
D(Russell 2000)* D(Overpriced stock)	-0.058**	-0.059**	-0.076**	-0.088**	-0.043	-0.031
	(-2.54)	(-2.21)	(-2.44)	(-2.23)	(-1.60)	(-1.03)
D(Russell 2000)	0.010	0.006	-0.001	-0.002	0.021	0.015
	(0.53)	(0.37)	(-0.05)	(-0.10)	(0.87)	(0.63)
Observations	49,867	100,359	49,867	100,359	49,749	100,137
Adjusted R^2	0.365	0.363	0.354	0.351	0.303	0.298
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Banding and market cap controls	Yes	Yes	Yes	Yes	Yes	Yes
Banding and market cap controls interacted with D(Overpriced stock)	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3	3	3
Number of firms around threshold	250	500	250	500	250	500

Table 12: Robustness check using Coles et al. (2022) methodology

This table displays a robustness check to our main results where we employ the methodology of Coles et al. (2022). The sample consists of monthly observations for 12 months pre- and post- index reconstitution, for stocks that were potential switchers within a +/-250 rank window of the two Russell bands, each year from 2007 to 2018. In Panel A, we include stocks around the lower end of the band and the explanatory variable of interest is a dummy variable equal to one if the stock was moved to the Russell 2000 index. In Panel B, we include stocks around upper end of the band and the explanatory variable of interest is a dummy variable equal to one if the stock was moved to the Russell 1000 index. In all regressions we include cohort-stock and year fixed effects. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Moves to Russell 2000

Dependent variable	Passive ownership (%)	Lendable supply (%)	Short interest (equity loans) (%)	Utilization (%)	Average tenure (log)	Fraction of loans with tenure above 30 days (%)	Delivery failure (%)	Lendable supply drops (%)	Lending supply risk
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
D(Stock moved to Russell 2000)	1.083***	1.256***	1.596***	1.094*	0.009	2.717**	-0.051	-0.142	-0.047**
	(6.07)	(4.15)	(4.62)	(1.69)	(0.25)	(2.50)	(-1.10)	(-0.99)	(-1.98)
Observations	24,157	27,103	27,103	27,106	27,106	27,103	26,492	27,102	27,103
Adjusted R^2	0.934	0.906	0.779	0.779	0.560	0.365	0.379	0.158	0.363
Cohort-stock fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms around threshold	250	250	250	250	250	250	250	250	250

Panel B: Moves to Russell 1000

Dependent variable	Passive ownership (%)	Lendable supply (%)	Short interest (equity loans) (%)	Utilization (%)	Average tenure (log)	Fraction of loans with tenure above 30 days (%)	Delivery failure (%)	Lendable supply drops (%)	Lending supply risk
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
D(Stock moved to Russell 1000)	-1.224***	-1.836***	-1.340***	-0.549	-0.101***	-4.010***	0.088**	0.018	0.063**
	(-9.40)	(-7.44)	(-5.40)	(-1.24)	(-3.65)	(-4.41)	(2.32)	(0.09)	(2.54)
Observations	23,097	26,530	26,530	26,535	26,535	26,530	25,956	26,528	26,530
Adjusted R^2	0.950	0.920	0.786	0.792	0.522	0.363	0.235	0.122	0.271
Cohort-stock fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms around threshold	250	250	250	250	250	250	250	250	250

Table 13: Robustness checks

This table displays robustness checks to our main results. We show the second stage of our instrumental variable regression where passive ownership is instrumented by membership of the Russell 2000 index. In Panel A, we form our sample based on the ranking of float-adjusted market capitalization provided by Russell rather than on our CRSP/Compustat market capitalization. In Panel B, we form our sample based on market capitalization using only information from CRSP only. Similarly, all market cap control variables (and banding controls) are based only on CRSP market capitalization. In Panel C, we exclude firms in the 3 months (May to July) around the time they switch between the Russell 1000 and 2000 index. In Panel D, we include control variables for the stock return over the past 1, 3 and 6 months. In Panel E, we rerun our main specification on a smaller sample with a bandwidth of just 150 companies in each direction around the threshold. In Panel F, we add firm fixed effects to our baseline regression. Finally, in Panel G, we show a robustness check for our short selling results in which we proxy for short selling using short interest data rather than equity lending data. All regressions are run on monthly data from 2006 to 2018. Details on variable constructions can be found in Appendix A. All standard errors are two-way clustered by stock and month. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Sampling based on float-adjusted market capitalization

	Second stage						
Dependent variable	Lendable supply (%)	Short interest (equity loans) (%)	Utilization (%)	Average tenure (log)	Delivery failure (%)	Lendable supply drops (%)	Lending supply risk
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Passive ownership (%)	1.128***	0.921***	1.175***	0.082***	-0.142***	-0.324***	-0.075***
	(4.92)	(4.33)	(2.87)	(4.89)	(-4.01)	(-4.10)	(-5.71)
Observations	129,333	129,328	129,328	129,328	122,193	129,332	129,333
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banding controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3	3	3	3
Number of firms around threshold	500	500	500	500	500	500	500

Panel B: Sampling and control variables only based on CRSP market cap

	Second stage						
Dependent variable	Lendable supply (%)	Short interest (equity loans) (%)	Utilization (%)	Average tenure (log)	Delivery failure (%)	Lendable supply drops (%)	Lending supply risk
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Passive ownership (%)	1.210***	0.542***	0.746**	0.043***	-0.115***	-0.249***	-0.058***
	(7.16)	(3.55)	(2.37)	(3.43)	(-4.18)	(-4.25)	(-5.75)
Observations	129,826	129,821	129,821	129,821	122,735	129,826	129,826
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banding controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3	3	3	3
Number of firms around threshold	500	500	500	500	500	500	500

Panel C: Excluding firms in the 3 months around the time they switch indexes

	Second stage						
Dependent variable	Lendable supply (%)	Short interest (equity loans) (%)	Utilization (%)	Average tenure (log)	Delivery failure (%)	Lendable supply drops (%)	Lending supply risk
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Passive ownership (%)	1.243***	0.695***	0.912*	0.064***	-0.128***	-0.263***	-0.076***
	(4.41)	(3.05)	(1.89)	(3.26)	(-3.16)	(-3.33)	(-4.83)
Observations	127,385	127,380	127,380	127,380	120,408	127,385	127,385
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banding controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3	3	3	3
Number of firms around threshold	500	500	500	500	500	500	500

Panel D: Adding controls for past returns

	Second stage						
Dependent variable	Lendable supply (%)	Short interest (equity loans) (%)	Utilization (%)	Average tenure (log)	Delivery failure (%)	Lendable supply drops (%)	Lending supply risk
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Passive ownership (%)	1.277***	0.650***	0.826*	0.053***	-0.128***	-0.354***	-0.075***
	(4.51)	(2.95)	(1.75)	(2.75)	(-3.13)	(-3.68)	(-4.66)
$Return_{t-1}$	-0.238	1.625***	2.843***	-0.046*	-0.076	0.116	0.024
	(-0.56)	(3.77)	(3.46)	(-1.85)	(-1.11)	(0.49)	(0.61)
$Return_{t-3,t-1}$	-1.081	-0.944	-3.288	0.208***	-0.017	0.255	-0.162*
	(-0.94)	(-0.83)	(-1.39)	(3.32)	(-0.11)	(0.55)	(-1.83)
$Return_{t-6,t-1}$	3.810**	-18.091***	-34.216***	-0.452***	-0.079	-3.348***	-0.288*
	(2.23)	(-7.74)	(-7.58)	(-4.47)	(-0.27)	(-5.03)	(-1.97)
Observations	129,687	129,682	129,682	129,682	122,612	129,687	129,687
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banding controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3	3	3	3
Number of firms around threshold	500	500	500	500	500	500	500

Panel E: Smaller sample (bandwidth of 150 firms around threshold)

	Second stage						
Dependent variable	Lendable supply (%)	Short interest (equity loans) (%)	Utilization (%)	Average tenure (log)	Delivery failure (%)	Lendable supply drops (%)	Lending supply risk
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Passive ownership (%)	0.965**	1.095**	3.058**	0.056*	-0.128	-0.515**	-0.092***
	(2.04)	(2.35)	(2.43)	(1.83)	(-1.31)	(-2.32)	(-3.16)
Observations	38,914	38,911	38,911	38,911	36,824	38,914	38,914
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banding controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3	3	3	3
Number of firms around threshold	500	500	500	500	500	500	500

Panel F: Adding Firm Fixed Effects

	Second stage						
Dependent variable	Lendable supply (%)	Short interest (equity loans) (%)	Utilization (%)	Average tenure (log)	Delivery failure (%)	Lendable supply drops (%)	Lending supply risk
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Passive ownership (%)	1.074***	0.820***	0.845	0.033	-0.171***	-0.412***	-0.075***
	(3.96)	(3.17)	(1.53)	(1.51)	(-3.29)	(-3.12)	(-3.69)
Observations	129,687	129,682	129,682	129,682	122,612	129,687	129,687
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banding controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial order of market cap	3	3	3	3	3	3	3
Number of firms around threshold	500	500	500	500	500	500	500

Panel G: Short interest based on Compustat data

	Second stage	
Dependent variable	Short interest (Compustat) (%)	
	(1)	(2)
Passive ownership (%)	1.183***	0.804***
	(8.24)	(8.50)
Observations	55,436	109,900
Month fixed effects	Yes	Yes
Banding controls	Yes	Yes
Polynomial order of market cap	3	3
Number of firms around threshold	250	500

Appendix A: Variable definitions

This table displays the variable definitions for all variables used in the regressions. All continuous variables are winsorized at the 1% level on both sides.

Variable Name	Definition
D(Russell 2000)	Dummy variable equal to one if the stock is in the Russell 2000 index in the specific month and equal to zero if the stock is in the Russell 1000 index (missing if the stock is in neither index).
Passive ownership (%)	Percentage of shares outstanding held by passive investors. To determine the fraction of passive ownership, we follow Appel, Gormley, Keim (2016). Specifically, we obtain fund names by merging the Thomson Reuters data with CRSP mutual fund data using the MFLINKS table available on WRDS. We then flag a fund as passively managed if its marked as an index fund in the CRSP Mutual Fund database or if the fund name includes one of the following strings that identify it as an index fund: Index, Idx, Indx, Ind_ (where _ indicates a space), Russell, S & P, S and P, S&P, SandP, SP, DOW, Dow, DJ, MSCI, Bloomberg, KBW, NASDAQ, NYSE, STOXX, FTSE, Wilshire, Morningstar, 100, 400, 500, 600, 900, 1000, 1500, 2000, and 5000. (The comparison is case sensitive).
Active ownership (%)	Percentage of shares outstanding held by active investors. Active investors are investors in the Thompson Reuters s-12 data not identified as passive.
Float-adjusted market cap	The natural logarithm of the float-adjusted market cap as of the end of last June as provided by Russell.
D(banded)	Dummy variable equal to one if a stock has an end-of-May market cap sufficiently close to the cut-off such that the firm will not switch indexes. To determine whether a firm is banded, we compute the total market capitalization of the Russell 3000 index and sort all firms in that index by market capitalization. We then compute the market capitalization percentiles for each firm (for example, if a firm has a 75 percentile, it means that firms larger than it make up 75% of the market capitalization of the Russell 3000 index). A firm is banded if its percentile is less than 2.5 percentage points different from the percentile of the 1000th stock. This approach follows the instructions by Russell and as we show in Internet Appendix A.3, it is fairly predictive of actually realized index changes. Our data includes 2006, where Russell was not yet implementing banding. To be consistent, we nonetheless include the same banding controls in 2006. This should only lower the power of the test and not lead to any bias.
D(Russell $2000_{last\ May}$)	Dummy variable equal to one if the stock was in the Russell 2000 index in the previous May (and thus over the course of the previous year).
End-of-May market cap	Market capitalization at the end of May computed from both Compustat and CRSP data using the methodology of Ben-David, Franzoni, and Moussawi (2019). See Internet Appendix A.1 for more details.
Lendable supply (%)	Monthly average of number of shares available to be lent in markit (sometimes referred to as "inventory") divided by shares outstanding from CRSP. Shares that are actually lent out are included in this measure.
Short interest (equity loans) (%)	Monthly average of number of shares lent out provided by markit (sometimes referred to as "demand") divided by shares outstanding from CRSP.
Utilization (%)	Monthly average of shares lent out divided by shares available to lent out as provided by markit. To avoid double counting, shares lent out only includes the case where markit received the data from the equity lender (rather than the borrower).
Lending fee (bp)	Monthly average of the daily value-weighted average fee for borrowing the specific security (provided by markit).
Average tenure (log)	The natural logarithm of the monthly average of the number of days that equity loans in this stock have been open.
Fraction of loans with tenure above 30 days (%)	Monthly average of the fraction of equity loan volume that has a tenure above 30 days.
Delivery failure (%)	Number of shares that were not delivered divided by number of shares that were lent out as reported in markit. Fails to deliver (FTD) balances are obtained from the SEC website (https://www.sec.gov/data/foiadocsfailsdatahtm), and are available daily from February 2004 onwards for stocks with an outstanding balance of FTDs of 10,000 shares or more. From September 16, 2008 the balance is available for all stocks with one or more shares that have failed to deliver.
Lendable supply drops (%)	Fraction of days within the month on which the lendable supply drops by more than 5 percent.
Lending supply risk	An index created as an average of three variables all standardized to have mean zero and standard deviation of one: (1) the fraction of equity loan volume that has tenure of 30 days or less, (2) the number of shares that failed to deliver divided by shares outstanding, (3) the fraction of days within the month on which lendable supply dropped by more than 5 percent.
Average effective spread	The average effective spread is the monthly average of *EffectiveSpread_Percent_DW* obtained from Millisecond Intraday Indicators by WRDS. *EffectiveSpread_Percent_DW* gives the daily average of the dollar-weighted effective spread in percent, as defined in Holden et al. (2023).
Market-to-book ratio	Market capitalization (CRSP) divided by book value obtained from Compustat. If available and positive, we use CEQ (common equity) for book value. If it is not available, we compute book value as total assets (AT) minus total liabilities (LT). We set market-to-book ratio missing if book value is negative.
2-digit SIC fixed effects	Fixed effects for 2-digit Standard Industry Classification (SIC) Code obtained from the CRSP monthly file.
D(on loan)	Dummy variable equal to one if the stock position in a given fund's portfolio is at least partly on loan.
D(passive fund)	A dummy variable equal to one if the CRSP Mutual Fund Database classifies the fund as an index fund or if its name in CRSP contains a string that suggests that it is an index fund.

Position size	Fraction of shares outstanding held by a given fund.
D(Neg. earnings surprise)	A dummy variable equal to one when the standardized unexpected earnings (SUE), or the cumulative alpha, or the cumulated return from t-1 to t+2 around the earnings announcement is in the bottom tercile and zero otherwise.
D(Neg. 8-K event)	A dummy variable equal to one when the cumulative alpha or the cumulated return from t-1 to t+4 around the 8-K event date is in the bottom tercile and zero otherwise.
Price jump ratio (earnings ann.)	$\frac{Alpha_{t-1,t+2}}{Alpha_{t-21,t+2}}$, where Alpha is the 3-factor Fama French (1993) alpha in (calendar) days around the earnings announcement.
$\lvert Alpha \rvert / SD$ (earnings ann.)	The absolute value of $Alpha_{t-1,t+2}$ divided by the standard deviation of daily alpha for the stock measured over t-50 to t-22 (calendar) days around the earnings announcement.
Price jump ratio (8-K)	$\frac{Alpha_{t-1,t+4}}{Alpha_{t-21,t+4}}$, where Alpha is the 3-factor Fama French (1993) alpha in (calendar) days around the 8-K event date.
$\lvert Alpha \rvert / SD$ (8-K)	The absolute value of $Alpha_{t-1,t+4}$ divided by the standard deviation of daily alpha for the stock measured over t-50 to t-22 (calendar) days around the 8-K event date.
D(Negative earnings reaction)	A dummy variable equal to one when the cumulative alpha (or return) from t-21 to t+2 around the earnings announcement is in the bottom tercile and zero otherwise.
D(Neg. 8-K reaction)	A dummy variable equal to one when the cumulative alpha (or return) from t-21 to t+4 around the 8-K event date is in the bottom tercile and zero otherwise.
D(Overpriced stock)	A dummy variable equal to one if the stock is in the top tercile in a month by the overpricing measure of Stambaugh et al. (2015), which measures the average percentile over 11 pricing anomalies. We download this measure directly from WRDS.
Short interest (Compustat) (%)	Monthly average of number of shares sold short according to short interest data from Compustat divided by shares outstanding from CRSP.
D(ETF undervalued)	For each ETF, we compute the mispricing as the difference between the ETF price (from CRSP security files) and the NAV (from CRSP mutual fund data). For each stock, we then compute the weighted average mispricing of ETFs holding the specific stock, where the weight is the number of shares that the ETF holds. D(ETF undervalued) is equal to 1 if this average mispricing is negative and 0 if it is positive.
Independent directors	Share of independent directors on a firm's board according to Boardex.
Pay-performance sensitivity	Natural logarithm of one plus the percentage change in total executive compensation in a firm divided by the percentage change in the firm's stock price.