Passive Exit

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Abstract

Share lending allows passive investors to generate revenue from a decline in portfolio value. When an active mutual fund exits a portfolio firm, passive index funds belonging to the same fund family raise the cost of borrowing the firm's shares for short selling. To identify supply-side shifts, I exploit changes in the identity of active managers exogenous to within-portfolio variation in the informational sensitivity of share lending costs. The exercise of market power is pronounced in value lending programs targeting hard-to-borrow securities. Share lenders with market power capture most of the surplus arising from the price decline.

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1 Introduction

Hirschman (1970) classically set out the two alternatives facing dissatisfied members of an organization: they can *voice* displeasure or *exit* for greener pastures. Hirschman's model has long explained the tradeoff facing shareholders of a poorly governed firm: agitate for change or take the "Wall Street Walk" by selling shares. Coffee (1991) showed that large institutional investors have little incentive to engage in voice, a trend exacerbated by low-fee "passive"[1] index funds facing tight profit margins (Bebchuk et al., 2017).

While voice is often too costly for passive investors, exit is downright impossible. An index fund is contractually bound to replicate its underlying index, which implies buying and holding the securities of every constituent firm regardless of how poorly it is governed. Whether the unavailability of exit hampers effective corporate governance is hotly contested (Fisch et al., 2019). But precisely because they are unable to sell their shares, index funds are well-positioned to lend those shares to short sellers, who place a negative bet that yields a profit as a stock price declines. By lending shares to be sold first and bought later, passive investing lowers the cost of short selling (Palia and Sokolinski, 2019).

Why might passive index funds, which adopt a buy-and-hold investment strategy, wish to facilitate short selling of securities in their portfolios? These funds are hardly stock pickers, so they gain little from enhanced price accuracy—a chief benefit of short selling (Saffi and Sigurdsson, 2011). But short selling can increase the fundamental value of public companies by deterring fraud and mismanagement across an investor's portfolio. The governance externalities of short selling are particularly important for shareholders who hold diversified portfolios and thus are indifferent to idiosyncratic risk (Gordon, 2020).

[1]Robertson (2019) shows that "passive" indexes are often anything but truly passive, as index committees exercise significant discretion over which firms are included in the index.

In this paper, I use share lending data to study the delegation of exit to short sellers by passive investors. Like ordinary exit, passive exit is *informationally sensitive*: while index funds and ETFs cannot sell shares of underperforming firms directly, they can lend to short sellers borrowing shares of those firms' stock. Duong et al. (2017) find a correlation between stock lending fees and lower future returns before earnings announcements. To be sure, passive investors can share in the surplus from shorting on negative information simply by lending their shares. Increased demand will drive up share lending rates, leading to *de facto* profit sharing between shareholder - lenders and informed short seller - borrowers.

Making shares available for borrowing reflects a kind of institutional delegation of exit from passive investors to short sellers, even if lenders are uninformed. But in this article, I examine whether there might also be a *supply-side* exploitation of information and market power held by "passive" share lenders. When lenders possess negative information about a firm and sufficient market power to price discriminate against borrowers, do they constrict supply and raise lending rates above and beyond the demand-side increase?

I take advantage of an institutional characteristic of mutual funds, namely, that the same fund family sometimes manages *both* active and passive funds. For example, when a portfolio manager drops a firm from an actively managed Vanguard fund, that information is shared with Vanguard's Portfolio Review Department and other Vanguard "access persons" who receive portfolio updates as frequently as every day. While access persons are prohibited from *personally* profiting from nonpublic information about active funds' trading, there is no publicly disclosed policy prohibiting that information from being shared with Vanguard index funds and ETFs lending their shares to short sellers. When Vanguard controls a large volume of shares in the securities lending market for that firm, Vanguard is theoretically able to exploit that informational advantage by raising lending rates.

Of course, it is difficult empirically to determine whether an increase in share lending rates correlated with exit by an active fund is driven by supply-side information exploitation as opposed to increased demand from short sellers. Negative information could reach fund managers, passive lenders and borrowers at once, simultaneously increasing the price of share lending. Duong et al. (2017) try to address this problem by controlling for borrowing demand, but one cannot eliminate simultaneity bias this way (Kennan, 1989).

I overcome this identification challenge by exploiting an exogenous supply-side shift in the elasticity of share lending rates to negative information: a prior change in the identity of the portfolio management team of the active fund. The intuition underlying this sort of longevity effect is that a stable portfolio management team likely has better relationships with the securities lending business than one which has experienced turnover. A stable team could also be more effective at digesting information due to the "tournament" nature of fund management (Qiu, 2003). My identifying assumption is simply that instability in a portfolio management team is a supply-side shock affecting the future ability of a share lender to exploit information about a change in an affiliated active fund's portfolio.

What about reverse causality? A management team might undergo changes for choosing poor stocks, which might also be likely to have higher short selling demand in the future. I address this problem by measuring deviations from portfolio-wide averages on a given reporting date. Omitted variables driving the stability of a management team are likely to be uncorrelated with deviations within a portfolio unrelated to average performance. It would be unusual to remove a manager for choosing great stocks which lead the portfolio as a whole to outperform (the average) while a couple of stocks (the deviations) underperform.

This article contributes to a growing literature on securities lending in corporate governance. Over a decade ago, Hu and Black (2005) showed how share lending decouples cash

flows from governance rights, arguing that hedge funds may borrow shares in order to influence corporate elections. Palia and Sokolinski (2019) finds that the introduction of passive investors enhances price efficiency by increasing the supply of shares available for lending, loosening short-sale constraints. Hu, Mitts, and Sylvester (2020) find that passive funds fail to recall shares for voting prior to contested elections, collecting lending fees instead. By identifying the informational sensitivity of share lending fees charged by passive funds, my study shows why exit (lending) is preferred to voice (voting) — a prediction made by Coffee (1991) nearly thirty years ago in the context of ordinary exit.

My study also highlights the link between passive exit and market power in the share lending market, which is a product of the concentration of share ownership in the hands of large institutional investors. A growing literature examines the anticompetitive effects of common ownership in a variety of markets (e.g., Azar et al. (2018)), but share lending has not been systematically considered. I find that the link between portfolio exit by active managers and higher share lending rates is strongest when affiliated passive index and ETF funds hold a large fraction of a firm's shares. The exercise of market power is concentrated in intrinsic value lending programs targeting hard-to-borrow securities.

I find that passive lenders with market power in the share lending market capture most, but not all, of the surplus accruing to short sellers by engaging in this form of price discrimination: from 62% to as much as 87%, depending on the specification. The risk to short selling is low over this period, explaining why short sellers are willing to open a position even though the share lender has extracted a large fraction of the proceeds.

2 A Corporate Governance Theory of Short Selling

2.1 Short Selling and Feedback Effects

Short selling, establishing an economic position that yields a profit as a stock price declines, has long been a controversial trading practice in the capital markets. Section 10(a)(1) of the Securities Exchange Act of 1934 gives the SEC plenary power to regulate short sales, with no parallel grant of authority for purchases or ordinary sales.[2] For decades, the SEC restricted short selling in a variety of settings. Former Rule 10a-1 once imposed an "uptick"' rule which, roughly speaking, prohibited short sales at prices below the last immediately preceding sale.[3] In 2005, the SEC enacted Regulation SHO, which replaced Rule 10a-1 and most other restrictions on short selling with a requirement that broker-dealers identify shares available for borrowing prior to placing a short sale order.[4]

[2]15 U.S.C. § 78j(a)(1) (2018); see also Regulation SHO, 17 C.F.R. §§ 242.200–.204 (2020). The asymmetric statutory treatment of short sales continued in the Dodd Frank Act of 2010, which added a new Section 9(d) to the 1934 Act empowering the SEC to promulgate rules prohibiting the "*manipulative short sale of any security*." 15 U.S.C. § 78i(d) (2018).

[3]17 C.F.R. § 240.10a-1 (since removed).

[4]17 C.F.R. § 242.203(b)(1) (2020). Regulation SHO sought to deter so-called "naked short selling," placing short sale orders without first locating the underlying securities available for borrowing. Because clearing and settlement in securities markets occur two business days after a transaction, a naked short sale will lead to a so-called "failure to deliver" securities if the broker-dealer is unable to borrow the securities for delivery to the buyer prior to the settlement date. If there is a failure to deliver the securities, the broker-dealer may be forced to purchase the securities on the open market for delivery to the original purchaser (known as "buy-in"). This might seem self-defeating, because the price will have likely increased in the interim, leading to substantial losses for the broker-dealer (or its client). However, because naked short selling is not limited to the supply of securities available for borrow, it can lead to the execution of an unlimited volume of sell orders, which can put tremendous downward pressure on the share price prior to settlement. That downward pressure, in and of itself, may cause other investors to sell their shares, making the broker's subsequent buy-in of shares occur at lower prices than it would have otherwise occurred at. Moreover, once a short seller can successfully depress the price by causing genuine sellers to sell their shares, it is not difficult to continually roll over the short position by continuing to engage in naked short selling, induce others to sell, purchase, and repeat until the price has descended far below the fundamental value of the firm and yielded the short seller substantial profits. Naked Short Selling Antifraud Rule, Exchange Act Release No. 58,774, 94 SEC Docket 1095 (Oct. 14, 2008).

The repealing of these restrictions on short selling arose in tandem with a substantial body of scholarship condemning short sale constraints (Reed, 2013). Theoretically, allowing traders who do not presently hold stock to purchase on positive sentiment but not sell on negative sentiment distorts prices (Hong and Stein, 2003; Miller, 1977). Prices are likely to be too high for too long, inflated by the inability of short sellers to express a negative view.[5] Empirically, the imposition of short-sale constraints reduces liquidity, increases trading costs and makes prices more volatile (Boehmer and Wu, 2013; Bris et al., 2007).

Beyond improving price accuracy, could short selling enhance the fundamental value of a public company by reducing agency costs? A sizeable literature shows that managers incorporate information from stock prices when making corporate decisions (Edmans et al., 2012, 2015). And it is well-established that ordinary exit, *i.e.*, selling shares, disciplines managers to pursue long-run growth (Edmans, 2009; Edmans and Manso, 2011). When stock prices fall, managers learn that investors are dissatisfied. Forcing down the price of underperforming firms applies pressure on entrenched or recalcitrant management.

But shorting can be even more potent way to discipline agency costs. A blockholder's ability to express disapproval through trading is limited to the size of the block—and constrained by the cost of liquidating a large block of shares. Short sellers are not limited to the size of a prior position when voting with their feet. They can freely sell as many shares as they can borrow. To be sure, shorts face liquidity costs when trying to sell (short) a large block of shares,[6] but the lack of mandatory disclosure for short selling allows for the

[5]This theoretical inefficiency arises even if short-sale constraints merely raise the cost of short selling, rather than prohibiting it entirely. Securities prices are still likely to be too high when these constraints make it unprofitable to short shares even though the stock is overvalued.

[6]The more shares that one attempts to sell at once—whether owned by the seller (long sale) or borrowed (short sale)—the more market makers will discount the price they are willing to pay to purchase those shares. This is known as a kind of "liquidity" cost, in that a large seller is forced to take a lower price than they otherwise would have, if they were selling a smaller quantity of shares.

subtle accumulation of a large short position without moving the share price too quickly.[7]

Of course, short selling is not a low-risk proposition.[8] Targeted firms often engineer public relation campaigns designed to undermine the credibility and reputation of short sellers.[9] Moreover, in the long run, stock prices will steadily rise due to the equity risk premium, which rewards investors for taking on undiversifiable risk (Damodaran, 2020). This imposes a cost on short selling above and beyond the intrinsic interest rate paid to borrow shares. These costs notwithstanding, when short sellers anticipate that the benefits of shorting exceed its (nontrivial) costs, they are often capable of putting more downward pressure on a share price than an ordinary blockholder. For this reason, delegating exit to short sellers can play a role in corporate governance no less important than ordinary exit.[10]

[7]A short seller is likely to face analogous liquidity costs to those incurred by a selling blockholder when repurchasing shares. But shorts often reveal negative information to the public just prior to covering their position, which reduces the price impact of those purchases by inducing others to sell while the short seller is buying. A blockholder can accumulate a position with minimal price impact during the ten-day disclosure window provided by law, 17 C.F.R. § 240.13d-1 (2020), but has no analogous means of selling the position without paying a liquidity cost. This reduces the expected gains to a traditional activist campaign.

[8]Because a short seller has sold at a given price and must repurchase the shares, the higher the share price, the greater their losses.

[9]During its battle with hedge fund activist Bill Ackman, Herbalife prepared a "secret dossier"' where it conducted psychological profiling on Ackman. Scott Wapner, Herbalife Prepared a 'secret dossier' on Bill Ackman As It Geared Up For Fight With Activist, CNBC (Apr. 20, 2018), https://www.cnbc.com/2018/04/20/herbalife-prepared-a-secret-dossier-on-bill-ackman.html. For an overview of the anti-shorting actions taken by firms, see Lamont (2012).

[10]In a comprehensive analysis of activist short selling, Bliss et al. (2019) points out that short campaigns have revealed staggering governance failures and outright fraud. Bliss et al. (2019) distinguish between informational activism, which seeks to correct mispricing, and operational activism, in which a short seller attempts to reduce the value of a firm they are targeting, e.g., by challenging its patents or hacking its computer systems. Similarly, Mitts and Talley (2019) finds that market arbitrageurs learn of material, yet-to-be-disclosed cybersecurity breaches and execute trades in advance of the public disclosure. By contrast, my focus is on ways that short selling can *improve* the value of the firm or a portfolio more generally by disciplining underperforming managers.

2.2 The Governance Externalities of Short Selling

Short selling is value-enhancing for shareholders in two ways: first, for the target firm in the long run; and second, for portfolio firms other than the target by imposing governance externalities. Consider the target firm. When a short position is opened, it might appear that the short seller's interests are diametrically opposed to those of shareholders. By definition, a $1 increase in the share price is a $1 gain to the shareholders and a $1 loss to the short seller. But after the share price decline, management will likely act more prudently to avoid a similar episode in the future. That will be value-enhancing. Indeed, some short sellers have even turned bullish on the companies they once targeted.[11] In the long run, the increase in fundamental value arising from disciplining poor governance will likely dwarf the price decline following the announcement of a short campaign.

More fundamentally, to the extent that short sellers correct mispricing in the capital markets, their interests are aligned with shareholders in the long run. Investors benefit from accurate prices because they may find themselves on either side of a trade, as a buyer or seller (Fox, 1999). Even large institutional investors who have expressed an aversion to short selling have focused on governance implications—like long-run value creation—while conceding that short selling generally improves the efficiency of capital markets and thus is not inherently opposed to shareholder interests.[12]

While short selling is beneficial for target firms in the long run, investors are likely more interested in value creation across a portfolio as a whole. The governance externalities of

[11] *See, e.g.*, Bill Alpert, Overstock.com: Look Who's Bullish Now!, Oct. 10, 2017, https://www.barrons.com/articles/overstock-com-look-whos-bullish-now-1507674170.

[12] *See, e.g.*, Leo Lewis & Billy Nauman, *Short Sellers Under Fire From Investment Boss of World's Largest Pension Fund*, Financial Times, Dec. 12, 2019, https://www.ft.com/content/9b228d14-1c34-11ea-97df-cc63de1d73f4.

passive exit are of first-order importance to shareholders who follow modern portfolio theory by holding a broad-based index (Gordon, 2020). Diversification renders investors indifferent to idiosyncratic risk associated with a single firm. But diversified investors remain averse to systematic risk, like agency costs across a portfolio as a whole.

Passive exit has unique advantages over ordinary exit and voice in imposing governance externalities. Consider a blockholder who sells the shares of a poorly governed firm. As that decision is made on the basis of firm-specific information, there is no reason to think that the blockholder is any less inclined to invest in equities. The blockholder is thus likely to take the cash obtained from selling shares and buy the shares of other firm(s). As a result, managers of other firms might rationally anticipate that the chance that they will be subject to a similar exercise of exit is quite low.[13]

By contrast, passive exit faces no such limitation. The default position of a short seller is cash, *i.e.*, she can open a short position against a firm without having to purchase those shares to begin with. As a result, when one firm is targeted by a short seller, other firms are on notice that they, too, might be the next target. Managers in the same industry might rationally anticipate that a short seller might be eying opportunities in that industry, and thus proactively take steps to improve governance in advance of a potential short attack.

Moreover, passive exit is likely to be less specific to a given firm. The claims underlying

[13]Consider the two ways that the blockholder might reinvest the cash obtained from selling shares into the equity market. One is to acquire a large block of another firm whose shares are undervalued. That new firm's share price will increase as a result, so its managers are not likely to be substantially worse off after a subsequent exit. Alternatively, suppose that the blockholder invests that cash in a broad-based index. By definition, no constituent firm need fear subsequent exit, because the blockholder is no longer holding a block of shares. If the exercise of exit reduces the likelihood of future exit, it is unlikely to impose positive governance externalities on other portfolio firms. Of course, managers of these other firms do not know with certainty what a blockholder will do after selling shares, but they can form rational expectations and conclude that the exit of a blockholder from a single firm is not likely to raise the chance that they will be subject to the "Wall Street Walk" themselves.

short seller campaigns are often similar: accounting fraud, artificially inflated sales, related party transactions, etc. The ease with which these claims are digestible by the market, as compared to the more nuanced theses underlying ordinary activist campaigns, makes it more likely that a broader base of investors will sell their shares in response. The announcement of a short seller campaign against one firm is likely to cause other firms to take care to ensure that they are not vulnerable to similar accusations—which is the very sort of governance externality that investors holding diversified portfolios value most.

2.3 Securities Lending by Passive Investors

Section 17(f)(1) of the Investment Company Act of 1940 provides that "*[e]very registered management company shall place and maintain its securities and similar investments in the custody*" of a bank or other authorized custodian.[14] The SEC subsequently promulgated Rule 17(f)-2(b), which provides, "*Except as provided in paragraph (c) of this section, all such securities and similar investments shall be deposited in the safekeeping of, or in a vault or other depository maintained by, a bank or other company whose functions and physical facilities are supervised by Federal or State authority.*"[15]

Without the carveout for paragraph (c), Rule 17(f)-2(b) would preclude transferring shares held by a registered management company to any third party, including in a lending transaction, because the shares would no longer be "deposited in the safekeeping of, or in a vault or other depository." However, paragraph (c) provides: "*The first sentence of paragraph (b) of this section shall not apply to securities on loan which are collateralized to the extent of their full market value, or to securities hypothecated, pledged, or placed*

[14] 15 U.S.C. 80a-17(f)(1).

[15] 17 CFR § 270.17f-2(b).

in escrow for the account of such investment company in connection with a loan or other transaction authorized by specific resolution of its board of directors."[16]

Rule 17-f(2)(c) thus allows mutual funds to lend shares so long as the shares are collateralized to the extent of their full market value. The intent behind the collateral requirement is to ensure that investors are made whole in the event of default by the borrower.[17] In a series of no-action letters, the SEC identified several additional conditions which must be met in order for a share lending program to comply with the Investment Company Act of 1940. Specifically, in a no-action letter dated November 3, 1971 to State Street Bank and Trust Company, the SEC's Office of Chief Counsel wrote:

> *We have not interpreted the Investment Company Act of 1940 to prohibit a mutual fund from lending its portfolio securities provided that (1) the fund receives 100 percent cash collateral from the borrower; (2) the borrower adds to such collateral whenever the price of the securities rises (i.e., mark to market on a daily basis); (3) the fund may terminate the loan at any time; (4) the fund receives reasonable interest on such a loan, any dividends, interest or other distributions on the loaned securities, and any increase in the market value of such securities; (5) the fund is not required to pay any service, placement or other fees in connection with such a loan; and (6) the fund retains voting rights on the loaned securities.*[18]

These conditions prompted a series of additional no-action letters in the 1970s and 1980s,

[16] 17 CFR § 270.17f-2(c).

[17] To see why collateral is so important for a share lender, consider that a typical reason why a borrower might fail to return securities is that the price has risen (perhaps substantially) since the date of a short sale. This implies that repurchasing the securities on the open market in the event of default would be quite costly to the lender. The provision of collateral limits investors' losses to the difference between the value of the collateral and the market value of the securities, rather than the latter in its entirety. Requiring additional collateral as the share price rises—i.e., "mark-to-market on a daily basis," in the language of the SEC's November 3, 1971 no-action letter to State Street—provides a lender additional confidence that losses will be minimized in the event of a default by the borrower. In practice, agents often indemnify lenders in the event of default by paying lenders the difference between the value of the collateral and the price of the security to facilitate repurchase.

[18] Letter from State Street Bank and Trust Company to SEC, November 3, 1971.

which sought relief for newer practices emerging in the securities lending industry. For example, on April 12, 1972, Salomon Brothers, at the time a large borrower of securities, requested no-action relief from requirement (6), *i.e.*, that the fund retain voting rights, on the view that redelivery of the securities to a third person implies that the third person will be the new record holder of the security, and voting rights must pass with redelivery, as the third person is the new record holder of the securities.[19]

Salomon Brothers proposed a solution which is still in use today: allowing the mutual fund to recall the securities for voting at any time on short notice. In its response, the SEC stated: "*we would not object if voting rights pass with the lending of portfolio securities. However, this does not relieve the directors of a fund of their fiduciary obligation to vote proxies. If the fund management has knowledge that a material event will occur affecting an investment on loan, the directors would be obligated to call such loan in time to vote the proxies.*" That is, when lending shares, mutual funds must retain the ability to recall shares for voting, because otherwise fund directors would be unable to fulfill their fiduciary duties to vote proxies in a manner that furthers investors' interests, as the literature on empty voting has explored in detail (Hu and Black, 2005).

The demand for borrowing securities arises primarily from short sellers. A short seller typically borrows shares from a lender, immediately sells them, and later repurchases and returns the shares back to the lender. If the share price declines from the date of sale to the date of repurchase, the short seller profits by "selling high and buying low." The availability, costs and risks associated with borrowing shares are critical factors in determining the profitability of a short position, as well as the duration that it may be held open.

In general, securities lending transactions can be structured one of two ways, depending

[19]Letter from Salomon Brothers to SEC, April 12, 1972.

on the type of collateral involved. The first is as a cash collateral loan, in which the borrower supplies the lender cash, often 102% of the market value of the securities on loan, adjusted daily with fluctuations in the market value of the securities, which the lender reinvests in money market funds, repos or even riskier assets (Keane, 2013). Historically, this was the first type of securities lending transaction,[20] and remains highly popular today.

In a cash collateral transaction, the lender's compensation consists of the expected return to reinvestment of the cash collateral, less a fraction paid back to borrowers and their agents. The essence of a cash collateral loan is an exchange of securities for cash of equivalent (or greater) value, which can in turn be reinvested in the capital markets in exchange for a return concomitant with the risk of such reinvestments. By providing a lender with cash, a borrower compensates a lender with an additional return on capital.[21]

This additional return is typically split between the lender and borrowers (and their agents), and the portion paid to the latter is known as the "rebate rate." The rebate rate in a cash collateralized loan is thus an inversely measure of the "price"' of lending a security: a lower rebate implies that the lender keeps a greater share of the reinvestment profits. Specifically, the so-called "intrinsic rate"' (i.e., the effective interest rate) received by the lender is the difference between the collateral reinvestment rate and the rebate rate.[22]

The second kind of transaction is a non-cash collateral loan, a structure which was originally proposed to the SEC by Salomon Brothers in a request for no-action relief dated

[20]Letter from State Street Bank and Trust Company to SEC, November 3, 1971.

[21]In the wake of the financial crisis, a large literature considers the systematic risk implications of the reinvestment of cash collateral. Cash reinvestment is a kind of shadow banking activity that involves maturity transformation of the underlying securities into liquid short-term investments.

[22]For a small number of securities which are highly in demand relative to available supply, rebate rates may even be negative, in which case the borrower must pay an additional fee to the lender, yielding the lender a return in excess of the cash collateral reinvestment rate.

November 4, 1974.[23] Under this structure, the borrower supplies the lender collateral in the form of U.S. treasuries and agency securities which are backed by the federal government, again at 102% of the underlying value of the securities and marked-to-market daily. Borrowers pay lenders an agreed-upon daily premium, which is usually expressed as an annual percentage of the market value of the securities on loan.

What determines this premium? It is helpful to distinguish *volume* vs. *value* lending. In volume lending, an institutional investor seeks to lend a large quantity of securities a low premium. An August 2016 publication on securities lending noted that "*[i]n 2015, general collateral loans—some 80% of global loans by volume—generated annualized lending fees of 20 basis points (0.20%) or less.*"[24] While small in magnitude, this return is still attractive to passive index funds facing low portfolio management fee revenues.[25]

By contrast, value lending seeks "*to capture a scarcity premium by lending hard-to-borrow securities, or 'specials.' The scarcity premiums provide the lender with a high return per dollar of securities lent, though with fewer opportunities to lend.*" Vanguard, in particular, emphasizes a value lending strategy. Rather than investing borrowers' cash collateral

[23]Letter from Salomon Brothers to SEC, November 4, 1974 ("*The rates are normally a percentage, expressed on an annual basis, of the daily value of the securities loaned. The aggregate amount of payment depends upon the duration of the loan. Thus, at the outset of the loan both the borrower and the lender know the price of the loan, and the compensation to the lender is not dependent upon its success in profitably investing in the short-term paper market. In addition to the possible advantage under the insolvency laws mentioned previously, the investment company avoids the administrative expense and burden of reinvesting cash collateral when it is compensated by such a loan premium.*").

[24]Vanguard, Securities Lending : Key Considerations, https://personal.vanguard.com/pdf/ISGSL.pdf.

[25]The choice between volume and value lending was traditionally viewed through the lens of collateral reinvestment risk. Lenders and their agents were criticized for taking risky bets with the reinvestment of cash collateral, which could leave investors on the hook for secondary losses in the cash collateral reinvestment market—which is precisely what occurred following the 2008 financial crisis. For this reason, value lending is viewed as a less risky method of delivering returns to investors from securities lending activities, because a borrower's default risk is largely hedged by the underlying collateral.

in risky assets, Vanguard focuses its lending on those few cases when the intrinsic rate paid by short seller borrowers is high.[26] While other large passive investors like BlackRock and State Street have not specifically disclosed the fraction of value vs. volume lending, an industry publication in January 2020 noted a market-wide trend toward value lending.[27]

Value lending reflects a conscious choice on the part of an investment manager to lend in situations where a short seller is willing to pay a high price for the opportunity to borrow a security. Thus, the revenues from value lending are more likely to be driven by situations where there is negative information about the firm. Compare (a) a short seller who believes a company's stock is overvalued by 1% to (b) a short seller who believes the stock is overvalued by 5%. Clearly, both are willing to borrow shares when the intrinsic rate is 20 basis points (0.20%), the typical lending rate paid for volume lending. But only the latter is willing to borrow shares when the intrinsic rate is 2%.

Thus, when an institutional investor like Vanguard embraces a value lending strategy limited to cases where the intrinsic rate is high, they are more likely to be lending when a short seller-borrower is convinced that the stock is heavily overvalued. That is, situations in which a short seller is willing to pay a high intrinsic rate are likely to be situations in which the fund family would exit the stock in affiliated, active portfolio funds. For this reason, value lending programs are highly sensitive to information sharing between active portfolio managers and passive share lenders.

Nonetheless, mutual funds engaging in value lending programs do not acknowledge adjusting share lending rates based on information possessed by their affiliated active funds. Vanguard claims that their securities lending program is designed to "*capture the scarcity*

[26]Vanguard, Securities Lending: Still No Free Lunch (Jul. 2011), https://www.vanguard.co.uk/documents/adv/literature/securities-lending-still-no-free-lunch.pdf.

[27]https://finadium.com/ihs-markits-2019-securities-lending-snapshot-q4-upswing/

premium found in many hard-to-borrow securities and to conservatively reinvest the cash collateral."[28] The rebate rate "*is affected by the scarcity value of the security, a function of* ***market supply and demand***." [29] Specifically, Vanguard claims that "*for readily available securities, such as those in the large-capitalization Standard & Poors 500 Index, the lender may rebate some of the income from the reinvested collateral back to the borrower.*"[30] By contrast, "*hard-to-borrow securities may command little or no rebate, or even a negative rebate.*"[31] For example, "*Highly sought-after names—which may also be hard-to-borrow securities—are often those of companies in troubled industries.*"[32]

Vanguard has also written an asset manager's scale may impact its securities lending pricing, noting that "*large index funds can command a premium in the securities lending market because of their size and their ability to fill large orders, and because passive management approach means they are less likely to call loans back early.*"[33] Vanguard also notes that larger asset managers have a greater ability to "optimize"' their securities lending through "*smarter lending.*" My findings suggest that one channel of "smarter lending" might be information obtained through active fund portfolio management.

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[28]Vanguard, Securities Lending: Still No Free Lunch (Jul. 2011), https://www.vanguard.co.uk/documents/adv/literature/securities-lending-still-no-free-lunch.pdf.

[29]Vanguard, Securities Lending: There's No Free Lunch (Oct. 2010), https://www.vanguard.co.uk/documents/adv/literature/securities-lending.pdf (emphasis added).

[30]Vanguard, Still No Free Lunch (Jul. 2011).

[31]*Id.*

[32]Vanguard, Securities Lending: There's No Free Lunch (Oct. 2010), https://www.vanguard.co.uk/documents/adv/literature/securities-lending.pdf.

[33]Vanguard, Beyond Expense Ratio: A Contemporary Guide to Index Fund Manager Selection, https://institutional.vanguard.com/iam/pdf/INDEXWP.pdf?INCMPGN=IN;IIG;DC;Resources;Research

3 Empirical Analysis: Data and Design

3.1 Data and Summary Statistics

I begin by obtaining mutual fund holdings data in the CRSP Survivor-Bias-Free US Mutual Fund Database from January 2014 to March 2020. For every mutual fund reporting to the SEC, CRSP reports the portfolio composition of the fund on regular intervals (sometimes quarterly but often monthly) obtained from SEC filings and other sources. I identify passive index funds using the flag in the CRSP Mutual Fund Database which indicates that a fund exclusively tracks an index and does not allow a manager to exercise discretion in choosing securities for inclusion in the portfolio. All other funds are considered "active."[34]

For every active fund in the CRSP database, I identify which publicly traded U.S. equity securities were retained from one reporting cycle to another and which were removed, as well as the fraction of fund ownership of the security as of each reporting date. At each of these intervals, CRSP also provides the identity of the fund family, *i.e.*, the company responsible for managing the fund, as well as the name of the *individual(s)* responsible for managing the portfolio. I merge the portfolio holding data with identifying information on the portfolio manager for every reporting period.

I obtain share lending data from FIS Astec Analytics,[35] which reports daily securities lending positions and loan availability for over 45,000 global fixed income and equity securities. The data begin in mid-2013 and extend to 2020, with increasing coverage of more

[34]Robertson (2019) has persuasively argued that even the S&P 500 index is not truly "passive" but rather reflects a form of delegated management. However, my study focuses on the lending of shares by passive funds which follow a buy-and-hold strategy and thus are inherently able to lend more shares than active funds.

[35]The data are licensed and provided by Quandl, which offers an academic subscription at https://www.quandl.com/databases/SLD.

securities over time. For each security and trading date, I observe a series of aggregate statistics that FIS obtains from lending agents as to both share borrowers and lenders.[36]

On the borrower side, FIS obtains the volume of outstanding shares on loan as of a given date, the volume of new shares borrowed that date, and the volume of shares returned that date. In addition, for each of these categories—outstanding, new, returned loans—FIS reports the mean, standard deviation, minimum, and maximum "intrinsic rate" paid by short seller-borrowers on a given date. The intrinsic rate is the effective interest rate paid by a borrower across both cash and non-cash collateral loans—"a blended weighted average of (a) fees on non-cash loans and (b) spreads between rebate rates on cash loans and the prevailing overnight interest rate for the currency."[37] On the lender side, FIS obtains the total volume of shares made available for borrowing by institutional investors in their securities lending programs (referred to as "available" shares), as well as the volume of shares reported by lenders as out on borrow (referred to as "utilized" shares).

I merge the FIS data with the CRSP mutual fund holdings by calculating the average of these statistics for each of the securities in each of the holding periods reported in the CRSP data. While the FIS data begin in mid-2013 and extend to 2020, there is increasing coverage of securities over time, so it is necessary to discard security-holding periods with missing FIS data. This implies that my analysis should be interpreted as conditional on the observed sample of firms which are covered by FIS.

[36]FIS does not release granular details about its coverage of the securities lending market, other than the "major global custodians and banks in the securities lending market." https://www.quandl.com/databases/SLD/documentation. As FIS advertises its intraday data to hedge funds and other investment management professionals, there is no reason to think that the data are systematically missing certain borrowers or lenders. https://www.fisglobal.com/en-sg/capital-markets-solutions/investment-banking-and-brokerage/securities-finance/fis-astec-analytics. Nonetheless, the absence of certain borrowers or lenders is unlikely to bias my empirical analysis, which examines trends within the available universe of borrowers and lenders within the FIS dataset.

[37]https://www.quandl.com/databases/SLD/documentation

To measure a fund family's ability to set prices in the share lending market, for each active fund - reporting date I calculate the extent of "market share" held by passive index funds belonging to the same fund family as the active fund. Because passive funds follow a buy-and-hold strategy which precludes selling the shares of underperforming companies (except for the occasional index reconstitution events), they are able to lend more shares than active funds and, more importantly, are uniquely dependent on share lending fees to "exit" underperforming firms as ordinary "exit" is unavailable.

For example, suppose the Fidelity Magellan Fund reports its holdings as of March 31, 2020. For every security held by the Fidelity Magellan Fund on that date, I sum the number of shares held by *passive* Fidelity index funds and divide this total by the total number of shares of the security held by mutual funds on that date. The larger the share held by Fidelity passive funds, the larger the market power held by Fidelity funds in the share lending market, and the more likely it is that Fidelity can price discriminate against informed short sellers and thereby share in the expected gains to short selling.

3.2 Research Design and Hypothesis

Identifying the effect of a supply-side shift in share lending is a challenging endeavor. Share lending costs are the product of an equilibrium between supply and demand, which means that changes in lending costs may be driven by omitted variables and reverse causality. For example, negative information about a portfolio firm would likely drive active funds to sell their shares, passive funds to increase lending rates, and short sellers to demand more shares for borrowing. Disentangling any one of these from the others is quite challenging because they are simultaneously determined in equilibrium. Prior literature has attempted to control for short seller demand when estimating changes in share lending supply (Duong

et al., 2017), but that approach may yield biased estimates when supply reacts to changes in demand not measurable in the observed data.

My study overcomes these limitations with a two-step identification strategy. First, I employ a difference-in-differences design with 74,462 fixed effects for every combination of an active fund portfolio and reporting date, which examines over-time variation in short selling costs within an active fund's investment portfolio reported on a given date. While differences in the *levels* of short selling demand can be driven by portfolio and firm-level characteristics as of any reporting date, average differences between portfolios (including portfolio firms) are absorbed by these fixed effects. Thus, my study examines *within-portfolio* deviations in share lending costs *over time*, from one reporting date to the next.

Second, I exploit variation in the supply-side informational sensitivity of share lending which is exogenous to idiosyncratic short selling demand for individual stocks: prior changes in the identity of the individual(s) responsible for managing an active fund's portfolio. Intuitively, while portfolio-wide changes in the identity of investment managers may be driven by aggregate portfolio performance, they are unlikely to be correlated with *future* idiosyncratic deviations in short selling demand *within* a portfolio. The mean (median) number of U.S. equity securities managed by a portfolio manager on any given reporting date is 1,836 (2,325) firms. With that many firms in a portfolio, it is highly unlikely that the relative *deviation* of short selling demand is likely to be driven by unobserved trends leading to a *prior* change in the identity of a portfolio manager.

For example, a manager is likely to be removed for choosing poor stocks, and these are also likely to have higher short selling demand. But it would be unusual to remove a manager for choosing great stocks which lead the portfolio as a whole to outperform (the mean) while a couple of stocks (the deviations) underperform. Because the change in

portfolio manager identity precedes the change in short selling demand, reverse causality appears unlikely as well. I provide evidence consistent with these assumptions through a placebo test on prior periods as well as a visual verification of parallel pre-trends. Indeed, to the extent that information concerning a single security is responsible for a larger share of portfolio-wide performance, that stock will have a smaller *deviation* from the mean.

While idiosyncratic deviations in short selling demand are unlikely to affect prior changes in the identity of a portfolio manager, the exploitation of information by share lenders is likely to be affected by these changes. The intuition underlying this sort of longevity effect is that a stable portfolio management team likely has better relationships with the securities lending business than one which has experienced turnover. A stable team could also be more effective at digesting information due to the "tournament" nature of fund management (Qiu, 2003). My identifying assumption is simply that instability in a portfolio management team is a supply-side shock affecting the future ability of a share lender to exploit information about a change in an affiliated active fund's portfolio.

Critically, there is no general prohibition on sharing information between active and passive funds belonging to the same fund family. For example, when a portfolio manager drops a firm from an actively managed Vanguard fund, that information is shared with Vanguard's Portfolio Review Department and other "access persons" who receive portfolio updates as frequently as every day.[38] While access persons are prohibited from *personally*

[38] *See, e.g.*, Vanguard Wellington Fund: Supplement Dated July 1, 2020 to the Statement of Additional Information Dated March 27, 2020 ("The Fund is a party to an investment advisory agreement with Wellington Management whereby the advisor manages the investment and reinvestment of the Fund's assets. In this capacity, the advisor continuously reviews, supervises, and administers the Fund's investment program. The advisor discharges its responsibilities subject to the supervision and oversight of Vanguard's Portfolio Review Department and the officers and trustees of the Fund. . . . The frequency of disclosure between and among Affiliates and Fiduciaries varies and may be as frequent as daily, with no lag. . . . . Disclosure of Vanguard fund complete portfolio holdings or other investment positions by Vanguard, VMC, or a Vanguard fund to Affiliates and Fiduciaries must be authorized by a Vanguard fund officer or a

profiting from nonpublic information about active funds' trading,[39] there is no publicly disclosed policy prohibiting that information from being shared with Vanguard index funds and ETFs lending their shares to short sellers. One would expect that a manager who has been with the fund family for some time is more likely to identify and convey information which allows affiliated passive funds to capture some of the gains accruing to short sellers, *i.e.*, by exercising market power in the share lending market in situations which suggest that the share price will decline. This leads to the following hypothesis:

Hypothesis 1: *When exiting a portfolio firm, "stable" active managers raise the cost of borrowing shares lent by affiliated passive funds with market power in that firm's shares.*

Hypothesis 1 implies that share lending costs for a portfolio firm should increase for "stable" active fund managers relative to "unstable" managers when these two conditions hold:

- The active fund manager has removed the firm from its portfolio.
- The passive funds affiliated with the active fund have market power in the share lending market, *i.e.*, a large proportion of the shares held by mutual funds.

For any active fund, there should be a positive correlation between the removal of a portfolio firm and short selling costs. That correlation is the product of an endogenous equilibrium

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Principal of Vanguard. Currently, Vanguard discloses complete portfolio holdings to the following Affiliates and Fiduciaries as part of ongoing arrangements that serve legitimate business purposes: Vanguard and each investment advisor, custodian, and independent registered public accounting firm identified in each fund's Statement of Additional Information.'

[39] *See id.* ("Vanguard, Vanguard Marketing Corporation (VMC), the funds, and the funds' advisors have adopted codes of ethics designed to prevent employees who may have access to nonpublic information about the trading activities of the funds (access persons) from profiting from that information. The codes of ethics permit access persons to invest in securities for their own accounts, including securities that may be held by a fund, but place substantive and procedural restrictions on the trading activities of access persons.")

relationship, likely arising from negative information, which drives active managers to drop the firm from the portfolio, lenders to raise short selling costs and short sellers to increase demand for borrowing shares. While I verify the existence of this correlation, my focus is on how the exogenous change of a portfolio manager drives differences in this correlation between stable and unstable managers.

Figure 1 illustrates how an endogenous correlation arises between share lending costs and the removal of a firm from an active fund's portfolio, likely due to the arrival of negative information which leads active managers to exit the firm and share lending costs to rise. The strength of this correlation is reflected by the slope of the line in this figure. The *causal* prediction is that this correlation—between active fund exit and the increase of share lending costs by affiliated passive funds—is strengthened by the exogenous arrival of a "stable" manager prior to the emergence of such negative information, relative to a "unstable" manager. Of course, this prediction holds only when affiliated passive funds have sufficient power in the share lending market to raise borrowing costs for short sellers.

To verify that this prediction holds in the data, I estimate average share lending costs over time by calculating predicted values obtained from the estimation of eq. (1) below for two groups: (a) firms which are removed from affiliated active fund's portfolio over reporting date τ to $\tau+1$, and (b) firms which are not removed from the active fund's portfolio. Figure 2 plots the natural log of the average retail lending rate for new loans with fixed effects for every portfolio - reporting date combination over the window $(\tau-1, \tau+1)$. Similarly, Figure 3 examines trends in the other outcomes examined in this study. The figures show that the data are consistent with the hypothesis illustrated in Figure 1, *i.e.*, the removal of a firm from an active fund's portfolio is accompanied by an increase in share lending costs. This is not a causal claim but rather an equilibrium relationship likely driven by the

arrival of negative information about the portfolio firm.

As I observe portfolio changes and short selling costs over time, it is possible to exploit the time dimension and examine the effect of shifts in the identity of an active fund manager on the correlation between changes in share lending costs and the removal of a firm from an active fund's portfolio. This amounts to a difference-in-difference-in-differences design, which compares share lending outcomes between reporting dates τ and $\tau+1$ (difference #1) for firms removed from an active fund's portfolio (difference #2), as between "stable" and "unstable" managers (difference #3), where a "stable" manager is one who is unchanged between reporting dates $\tau - 1$ and τ.

Figure 4 illustrates this design. The key prediction is that the exogenous presence of a "stable" manager will lead to an increase in share lending costs between reporting dates τ and $\tau + 1$, conditional on the firm being removed from the active fund's portfolio as of $\tau + 1$. As before, this only holds when passive funds affiliated with the active fund have market power in the share lending market to raise borrowing costs for short sellers.

I verify this identification assumption two ways. First, I show that pre-trends for each of the outcomes are parallel. Figure 5 plots the natural log of the average retail lending rate for new loans with fixed effects for every portfolio - reporting date combination over the window $(\tau - 2, \tau + 1)$. Similarly, Figure 6 examines trends in the other outcomes examined in this study. As the figures show, pre-trends from $(\tau - 2, \tau - 1)$ to $(\tau - 1, \tau)$ are parallel and only diverge after the replacement of the manager at time τ. Consistent with the findings in Table 3, the post-treatment trends for demand-side outcomes are unchanged for "stable" managers.

Second, Online Appendix Table OA2 replicates the analysis in Table 3 on pre-treatment trends, examining whether future removals of a portfolio firm by "stable" active managers

are preceded by an increase in the cost of borrowing shares lent by affiliated passive funds with market power in that firm's shares. The coefficients are statistically insignificant and economically close to zero in magnitude, consistent with the visual absence of divergent pre-trends as shown in Figure **??**.

As my hypothesis only holds when active funds have market power in the share lending market to raise borrowing costs for short sellers, I limit my primary sample to cases where the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund exceeds 14.6%, the 95% percentile of the sample distribution of the affiliated passive ownership share. However, Online Appendix Table OA3 shows that the results hold when interacting with affiliated passive ownership share on the full sample (which amounts to a four-way difference design).

3.3 Summary Statistics

My primary sample is limited to cases where the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund exceeds 14.6%, the 95% percentile of the sample distribution of this ownership share. This yields 365,636 security-reporting dates. Summary statistics for the primary sample are given in Table 1. Summary statistics for the full dataset of 7,306,001 security-reporting dates are given in Online Appendix Table OA1.

[Table 1]

Definitions for these variables are as follows. For the share lending data, the "difference" variabels are the "post" minus "pre" difference between the average of the lending variable for the security prior to and following the holding period disclosure date. For example, if

an active fund reports its portfolio holdings on January 31, February 28 and March 31, and the current observation is February 28, the post-pre difference is the average of the lending variable for the security from February 28 to March 31 ("post") minus the average of the lending variable for the security between January 31 to February 28 ("pre").

- **Difference in Avg. Retail Rate for All Loans**: the post-pre difference in the volume-weighted average intrinsic rate paid by borrowers for all outstanding loans as of the security-date, in percentage points.

- **Difference in Avg. Retail Rate for New Loans**: the post-pre difference in the volume-weighted average intrinsic rate paid by borrowers for new loans opened on the security-date, in percentage points.

- **Difference in # of Shares Available (Log)**: the post-pre difference in the natural log of the volume of shares made available for borrowing by institutional investors on the security-date.

- **Difference in # of Newly Borrowed Shares (Log)**: the pre-post difference in the volume of shares borrowed among new loans on the security-date. *Borrower-reported.*

- **Difference in Utilization Percentage**: the post-pre difference in the ratio of "# of shares utilized" to "# of shares available," multiplied by 100.

- **Share of Mgmt. Passive Ownership**: the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund as of the reporting date.

- **Manager Unchanged (0/1)**: an indicator equal to 1 if the portfolio manager for the reporting active fund was unchanged from the prior reporting period.

- **Removed in Next Period (0/1)**: an indicator equal to 1 if the security was removed from the fund's portfolio in the next reporting period.

4 Empirical Findings

4.1 Informed Share Lending by Passive Index Funds

I begin by verifying the informational sensitivity of share lending outcomes. Duong et al. (2017) showed an increase in share lending costs prior to informationally sensitive events. Here, I establish that when a firm is removed from an active fund's portfolio, there is an increase in costs to borrow the firm's shares when passive index funds have market power in the share lending market for that firm's stock. I estimate the following regression by ordinary least squares:

$$y^{i,j}_{\tau-1,\tau,\tau+1} = \beta \cdot removed^{i,j}_{\tau+1} + \eta^{i}_{\tau} + \epsilon^{i,j}_{\tau-1,\tau,\tau+1} \tag{1}$$

where $y^{i,j}_{\tau,\tau+1}$ is the difference in the share lending outcomes for firm j in the portfolio of active fund i over the period $(\tau-1,\tau)$ to the period $(\tau,\tau+1)$, where τ is the current reporting date: (1) average retail rate for all loans; (2) average retail rate for new loans; (3) # of shares available (log); (4) # of utilized shares (log); and (5) # of newly borrowed shares (log); $removed^{i,j}_{\tau+1}$ is equal to 1 if firm j is not present in fund i's portfolio on reporting date $\tau+1$; η^{i}_{τ} is a fixed effect for portfolio i on reporting date τ; and $\epsilon^{i,j}_{\tau,\tau+1}$ is a random error term. The specification employs fixed effects for every portfolio - reporting date combination, denoted by η^{i}_{τ}, which absorbs heterogeneity between funds and firms correlated with $y^{i,j}_{\tau-1,\tau,\tau+1}$ that does not vary *within* portfolio - reporting dates.

The coefficient of interest is β, which estimates the difference between cases with $removed^{i,j}_{\tau+1} = 1$ and $removed^{i,j}_{\tau+1} = 0$ in the over-time difference in share lending outcomes over the period $(\tau - 1, \tau)$ to the period $(\tau, \tau + 1)$. To reiterate, this relationship is *not* causal but simply reflects the association between short selling demand and share lending outcomes in cases where affiliated passive index funds have market power in the share lending market, which could easily be driven by arrival of negative information about the underlying firm. Table 2 presents the results of this estimation for the five outcomes.

[Table 2]

Table 2 shows that the removal of a firm from an active funds portfolio is associated with an increase in the the average retail rate for all loans and new loans of 0.5782 and 0.8316 points, respectively, a reduction of 8.32 log points in the supply of shares available for lending, an increase of 1.34 log points in the volume of new shares, and increase of 0.88 percentage points in the utilization ratio. Taken together, these estimates point toward a reduction in supply, an increase in demand, and an increase in the equilibrium cost of share lending when a portfolio firm is removed from an affiliated active firm's portfolio.

4.2 Supply-Side Shift in Share Lending Costs

Hypothesis 1 predicts that when exiting a portfolio firm, "stable" active managers raise the cost of borrowing shares lent by affiliated passive funds with market power in that firm's shares. To test this hypothesis, I estimate the following regression by OLS:

$$y^{i,j}_{\tau-1,\tau,\tau+1} = \beta_1 \cdot removed^{i,j}_{\tau+1} + \beta_2 \cdot \left(removed^{i,j}_{\tau+1} \times stable^{i}_{\tau-1,\tau}\right) + \eta^{i}_{\tau} + \epsilon^{i,j}_{\tau-1,\tau,\tau+1} \quad (2)$$

where $y^{i,j}_{\tau,\tau+1}$ is the difference in the share lending outcome for firm j in the portfolio of active fund i over the period $(\tau-1,\tau)$ to the period $(\tau,\tau+1)$, where τ is the current reporting date: (1) average retail rate for all loans; (2) average retail rate for new loans; (3) # of shares available (log); (4) # of newly borrowed shares (log); and (5) utilization percentage; $removed^{i,j}_{\tau+1}$ is equal to 1 if firm j is not present in fund i's portfolio on reporting date $\tau+1$; $stable^{i}_{\tau-1,\tau}$ is equal to 1 if the portfolio manager for fund i was unchanged from period $\tau-1$ to τ; η^{i}_{τ} is a fixed effect for portfolio i on reporting date τ; and $\epsilon^{i,j}_{\tau,\tau+1}$ is a random error term. As before, the specification employs fixed effects for every portfolio - reporting date combination, denoted by η^{i}_{τ}, which absorbs heterogeneity between funds and firms correlated with $y^{i,j}_{\tau-1,\tau,\tau+1}$ that does not vary *within* portfolio - reporting dates. For this reason, $stable^{i}_{\tau-1,\tau}$ is only identified when interacted with $removed^{i,j}_{\tau+1}$.

The coefficient of interest is β_2, which estimates the difference in the difference between cases with $removed^{i,j}_{\tau+1}=1$ and $removed^{i,j}_{\tau+1}=0$ as between "stable" managers and "unstable" managers in the over-time difference in share lending outcomes over the period $(\tau-1,\tau)$ to the period $(\tau,\tau+1)$, where a "stable" manager is one who is unchanged from reporting date $\tau-1$ to τ. As the prior portfolio-level replacement of a fund manager is exogenous to subsequent changes in within-portfolio short selling demand, β_2 can be interpreted as the causal effect of a supply-side shift in the identity of a portfolio manager on the informational sensitivity of share lending as reflected in the correlation between supply-side or equilibrium outcomes $y^{i,j}_{\tau,\tau+1}$ and $removed^{i,j}_{\tau+1}$. It follows that a change in $stable^{i}_{\tau-1,\tau}$ should have no effect on the correlation between demand-side outcomes $y^{i,j}_{\tau,\tau+1}$ and $removed^{i,j}_{\tau+1}$, except to the extent that they are effected by supply-side shifts. Table 3 presents the results of this estimation for the five outcomes.

[Table 3]

Table 3 shows that the retention of a "stable" manager of an active fund portfolio causes an increase in the average retail rate for all loans and new loans of 0.7965 and 1.0751 percentage points, respectively, and a decrease in the shares available for lending of 4.99 log points. As expected, the coefficient estimate β_2 is statistically insignificant for the demand-side outcome of newly borrowed shares, indicating that a supply-side shift in the identity of a portfolio manager has no effect on short seller demand for borrowing shares. The coefficient on utilization percentage is significant, which reflects the decrease in the denominator (available shares) even though there is no change in the numerator (utilized shares).

While this model is estimated on my primary sample limited to cases where the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund exceeds 14.6%, the 95% percentile of the sample distribution, Online Appendix Table OA3 reports the result of estimating this model on the full sample with an interaction term for the share of ownership of the security by passive index funds belonging to the same fund family. The coefficient on the interaction term is positive and significant, indicating that the causal effect of a supply-side shift in the identity of a portfolio manager increases with the market share held by affiliated passive index funds.

4.3 Value Lending Programs

To understand the mechanisms underlying this effect, I examine volume vs. value share lending programs. Recall that value lending programs are highly sensitive to information sharing between active portfolio managers and passive share lenders. In light of Vanguard's dominance of the index fund market, it may come as no surprise that Vanguard funds comprise 85.6% of the observations in my primary sample, which is limited to portfolio

- reporting dates where the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund exceeds 14.6%, the 95% percentile of the sample distribution. Vanguard is one of the largest passive index fund managers, but also has a large number of active funds — more than 70 as of May 2020.[40] Online Appendix Table OA4 examines the full sample and confirms that the effect I measure is concentrated in Vanguard funds.

However, not every active fund, whether run by Vanguard or not, is equally poised to exploit informationally sensitive value lending. The ability to do so turns on the extent to which the shares held in a portfolio are hard-to-borrow specials, with high *ex ante* lending fees that allow a lender to act like a monopolist, exploiting its market power by raising lending rates and holding constant—or even increasing—the volume of shares available for lending. On the other hand, it is more difficult for lenders to directly exercise market power over the pricing of securities in greater supply. In that case, lenders might seek to reduce available supply if the price increase offsets the loss of lending volume.

To examine whether difference-in-difference coefficient varies for securities which are hard to borrow, I estimate the following triple-difference regression by OLS:

$$\begin{aligned} y^{i,j}_{\tau-1,\tau,\tau+1} = \beta_1 \cdot removed^{i,j}_{\tau+1} + \beta_2 \cdot rate^{j}_{\tau-1,\tau} + \beta_3 \cdot \left(removed^{i,j}_{\tau+1} \times stable^{i}_{\tau-1,\tau}\right) + \\ \beta_4 \cdot \left(removed^{i,j}_{\tau+1} \times rate^{j}_{\tau-1,\tau}\right) + \beta_5 \cdot \left(stable^{i}_{\tau-1,\tau} \times rate^{j}_{\tau-1,\tau}\right) + \\ \beta_6 \cdot \left(removed^{i,j}_{\tau+1} \times rate^{j}_{\tau-1,\tau} \times stable^{i}_{\tau-1,\tau}\right) + \eta^{i}_{\tau} + \epsilon^{i,j}_{\tau-1,\tau,\tau+1} \end{aligned}$$

where $rate^{j}_{\tau-1,\tau}$ is the volume-weighted average retail lending rate for loans of security j over the period $(\tau-1,\tau)$ and the other variables are as defined in eq. (2). The coefficient of

[40] https://investor.vanguard.com/mutual-funds/actively-managed

interest is β_6, which estimates how the effect of replacing a fund manager on the informational sensitivity of share lending varies between hard-to-borrow and other securities. As before, the specification employs fixed effects for every portfolio - reporting date combination, denoted by η^i_τ, which absorbs heterogeneity between funds and firms correlated with $y^{i,j}_{\tau-1,\tau,\tau+1}$ that does not vary *within* portfolio - reporting dates. For this reason, $stable^i_{\tau-1,\tau}$ is only identified when interacted with $removed^{i,j}_{\tau+1}$ or $rate^j_{\tau-1,\tau}$. Table 4 presents the results of this estimation for the five outcomes.

[Table 4]

Table 4 shows that the difference-in-difference coefficient varies for hard-to-borrow securities in a manner consistent with the theoretical prediction. Specifically, the effect of retaining a "stable" manager of an affiliated active fund increases 0.5396 and 0.5507 percentage points for the average retail rate difference outcome for all and new loans, respectively, for every 1 percentage point increase in the pre-period average retail rate. The coefficient on the "shares available"' outcome increases by 0.60 log points, which is consistent with the theoretical prediction that lenders cannot directly exercise market power over the pricing of securities which are more available for lending, and thus are likely to reduce supply in those cases (or, conversely, increase the supply of securities in limited supply while simultaneously raising prices). Finally, while the retention of a stable manager does not have an effect on demand-side utilization unconditionally, it appears that market participants are responding to the increase in quantity for hard-to-borrow securities by simultaneously increasing borrowing demand as well, though this effect is lacking for new loan volume.

4.4 How Much Profit Sharing?

In this Section, I estimate how much of the surplus to short selling is captured by institutional investors exercising market power in the share lending market. I limit my analysis to the primary sample limited to cases where the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund exceeds 14.6%, the 95% percentile of the sample distribution.

For each firm in the "treatment" group — *i.e.*, a firm removed from portfolio of active fund whose affiliated passive funds have market power in share lending market for the security — I calculate the cumulative raw and abnormal return from the report date to 4 weeks after the report ("information value"), as well as the average share lending rate for new loans from the report date to the next report date ("surplus extraction"). I convert each of these to the daily level—the former by dividing the cumulative abnormal return by 20, the number of trading days over which that spans, and the latter by 252, the number of trading days in a year since lending rates are annualized in the data. I further divide the latter by 100 to account for the fact the returns are expressed in decimal values (*e.g.*, a 1% decline in the share price is represented as 0.01) whereas lending rates were reported in percentage points (*e.g.*, a 1% annual rate is represented as 1.00). I estimate the following regression by ordinary least squares:

$$ret_{t,t+20} = \alpha + \beta rate_{\tau,\tau+1} + \epsilon_{t,t+20} \tag{3}$$

where $ret_{t,t+20}$ is the average daily raw (or abnormal) return from the report date to 20 trading days after; $rate_{\tau,\tau+1}$ is the average daily lending rate from the report date to the following report date; and $\epsilon_{t,t+20}$ is a random error term. It might seem odd that the returns

are estimated over one month while the lending rates are estimated from one report date to the next, which is generally three months thereafter. The reason for this disparity is that the information value exploited by short sellers is likely to diminish, not increase, with time, suggesting that most of the short seller profits are realized earlier in the window. However, as a robustness check, I repeat this analysis but examine the return from the report date to 60 trading days after. Both sets of results are given in Table 5.

[Table 5]

Table 5 shows that passive lenders with market power in the share lending market capture between 77% to 87% of the surplus under the main specification which measures returns up to 20 trading days after the report. The results are only slightly diminished in magnitude when measuring returns up to 60 days after the report, as that specification yields coefficients ranging from 62% to 64%. As expected, including days later in the period between reports simply introduces noise. Both specifications show that passive lenders capture most, but not all, of the surplus accruing to short sellers by engaging in the form of price discrimination shown in this article.

Why might short sellers be willing to borrow in cases like these, when they are forced to share such a large fraction of their profits with share lenders? The data indicate that short sellers are still earning a sufficient return to compensate for the risk of the position. The Sharpe ratio for a portfolio which buys the treatment group stocks and sells other stocks is -8.34 over $(t, t+20)$ in trading days, where t is the report date. This indicates that the risk to short selling is relatively low for the treatment group (by comparison, the historical Sharpe ratio for the S&P 500 has been around 1.00). It is thus far less risky for a short seller to short in these cases, explaining why they are still willing to do so even though the share lender has extracted a large fraction of the proceeds.

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5 Figures and Tables

Figure 1: Active Fund Exit and Share Lending Costs by Affiliated Passive Funds

This figure illustrates how an endogenous positive correlation arises between share lending costs and the removal of a firm from an active fund's portfolio, likely due to the arrival of negative information which leads active managers to exit the firm and share lending costs to rise. The strength of this correlation is reflected by the slope of the line in this figure. The *causal* prediction in this study is that this correlation—between active fund exit and the increase of share lending costs by affiliated passive funds—is strengthened by the exogenous presence of a "stable" manager prior to the emergence of such negative information, relative to a "unstable" manager. This prediction only holds when passive funds affiliated with the active fund have sufficient market power in the share lending market to raise borrowing costs for short sellers.

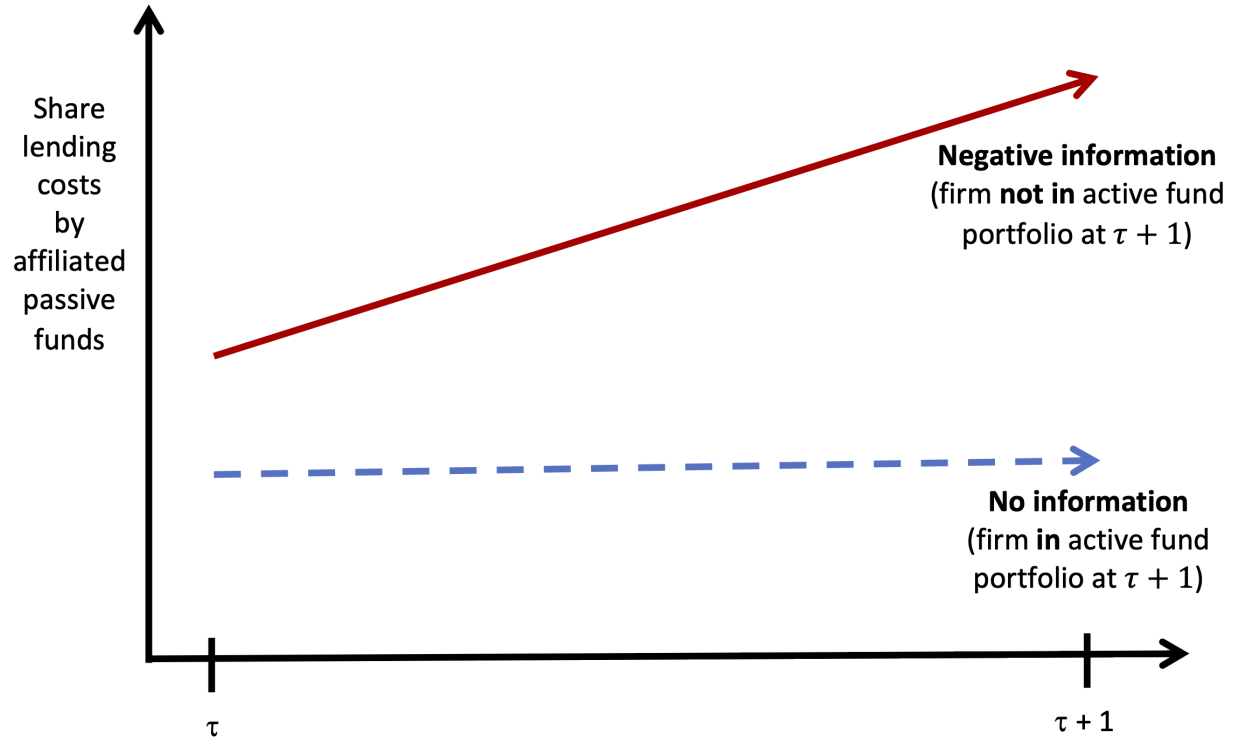

Figure 2: Negative Information Share Lending Costs: Avg. Retail Rate (New Loans)

This figure shows predicted values from the estimation of eq. (1) for two groups: (a) firms which are removed from affiliated active fund's portfolio over reporting date τ to $\tau + 1$, and (b) firms which are not removed from the active fund's portfolio. The y-axis plots the natural log of the average retail lending rate for new loans with fixed effects for every portfolio - reporting date combination over the window $(\tau - 1, \tau + 1)$. The mean of the "no information" group is the value of the linear combination of fixed effects η^i_τ which makes the prediction equal to the mean of the dependent variable. The figure shows that the data are consistent with the hypothesis illustrated in Figure 1, *i.e.*, the removal of a firm from an active fund's portfolio is accompanied by an increase in share lending costs. This is not a causal claim but rather an equilibrium relationship driven by the arrival of negative information about the portfolio firm.

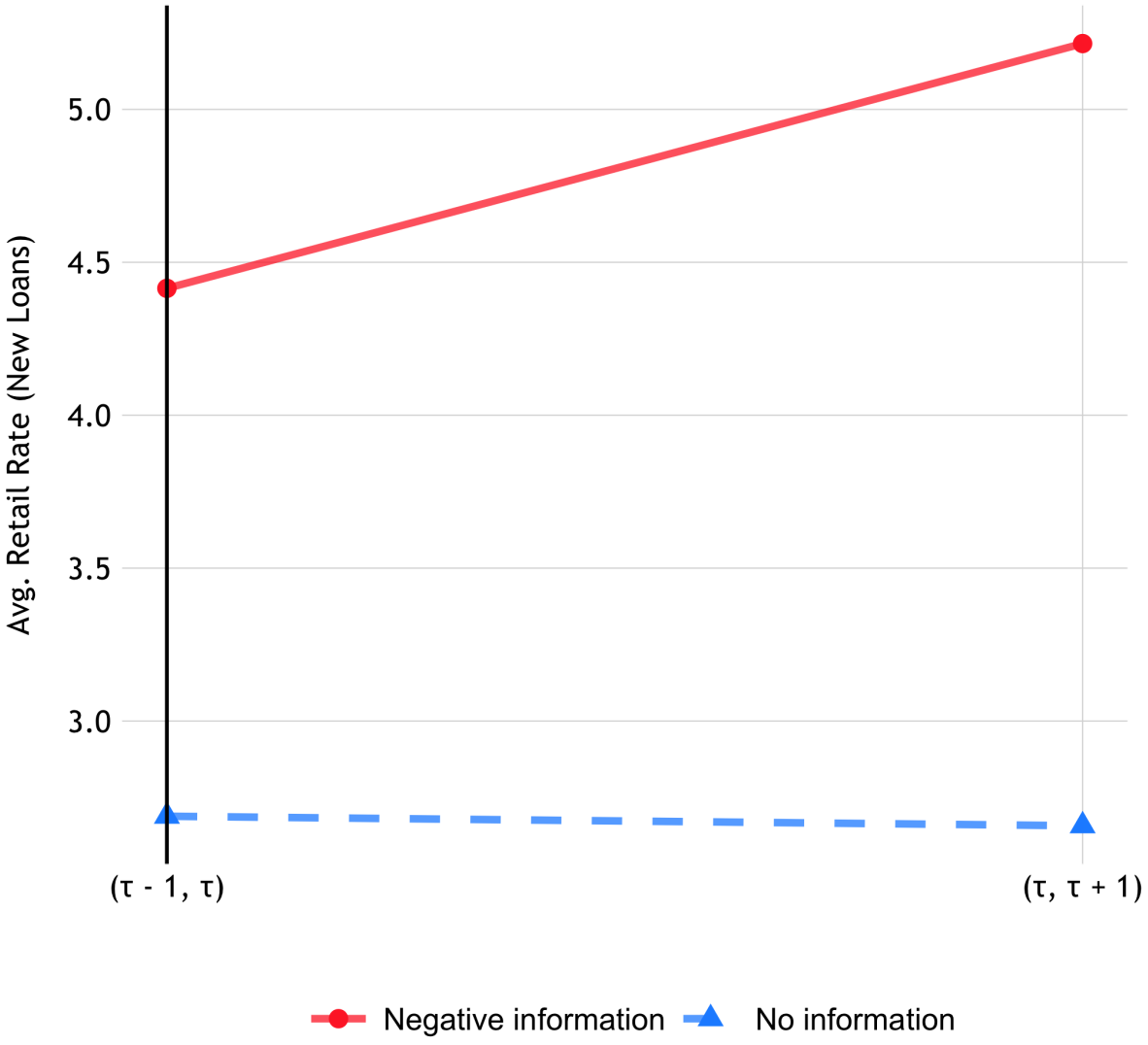

Figure 3: Negative Information Share Lending Costs: Other Outcomes

This figure shows predicted values from the estimation of eq. (1) for two groups: (a) firms which are removed from affiliated active fund's portfolio over reporting date τ to $\tau + 1$, and (b) firms which are not removed from the active fund's portfolio. The y-axis plots the other outcomes examined in this study with fixed effects for every portfolio - reporting date combination over the window $(\tau - 1, \tau + 1)$. The mean of the "no information" group is the value of the linear combination of fixed effects η^i_τ which makes the prediction equal to the mean of the dependent variable. The figure shows that the data are consistent with the hypothesis illustrated in Figure 1, *i.e.*, the removal of a firm from an active fund's portfolio is accompanied by an increase in share lending costs. This is not a causal claim but rather an equilibrium relationship driven by the arrival of negative information about the portfolio firm.

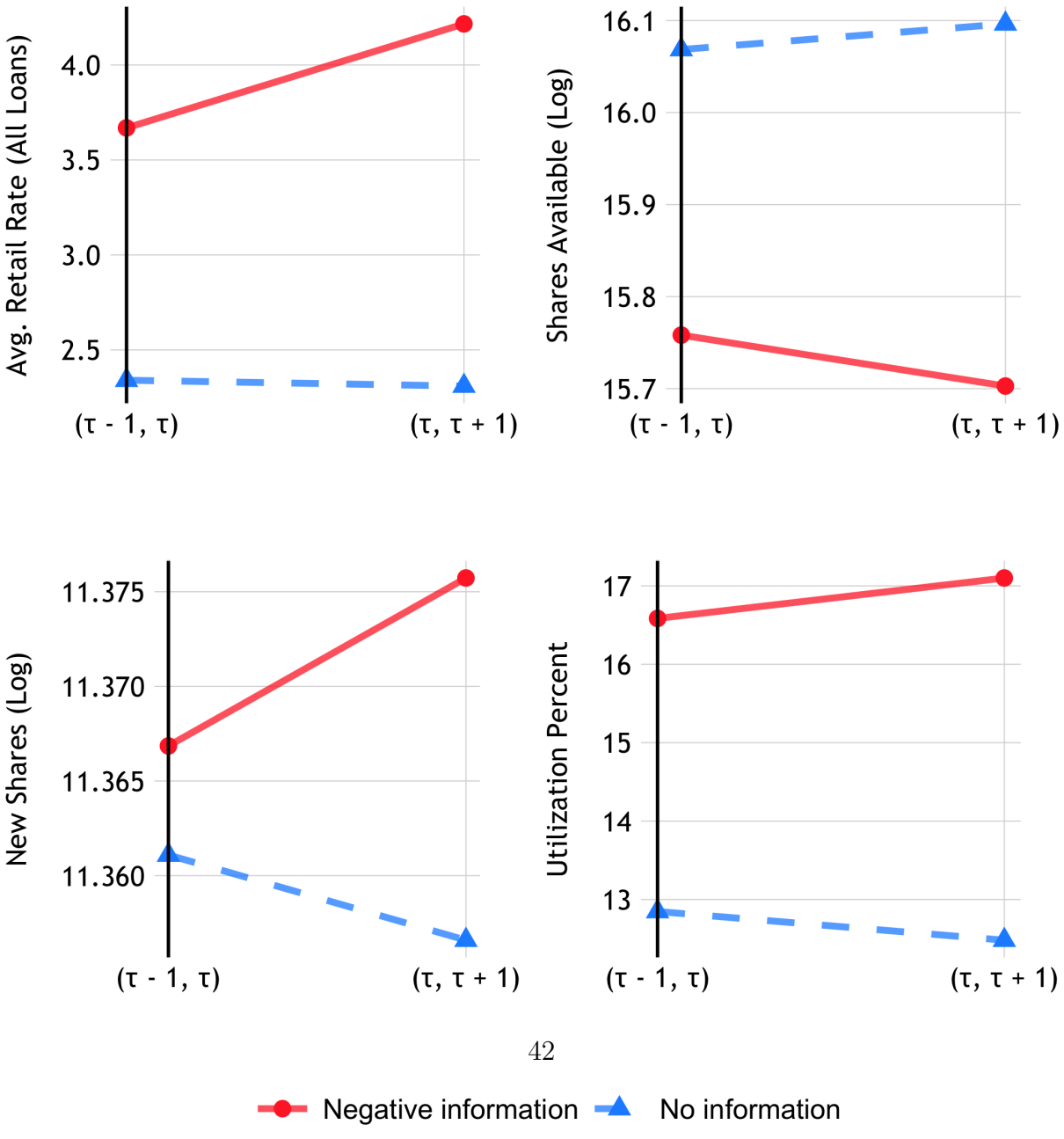

Figure 4: Triple-Difference Design: Active Fund Exit and Affiliated Share Lending Costs

This figure illustrates the difference-in-differences-in-differences design which examines changes in share lending costs for a security in an active fund's portfolio between reporting date τ and $\tau + 1$ (difference #1) between firms which are in an active fund portfolio and those which are not as of $\tau + 1$ (difference #2), as between "stable" managers and "unstable" managers (difference #3), where a "stable" manager is unchanged between reporting dates $\tau - 1$ and τ. The key prediction is that the exogenous presence of a "stable" manager will lead to an increase in share lending costs between reporting dates τ and $\tau + 1$, conditional on the firm being removed from the active fund's portfolio as of $\tau + 1$. This prediction only holds when passive funds affiliated with the active fund have sufficient market power in the share lending market to raise borrowing costs for short sellers.

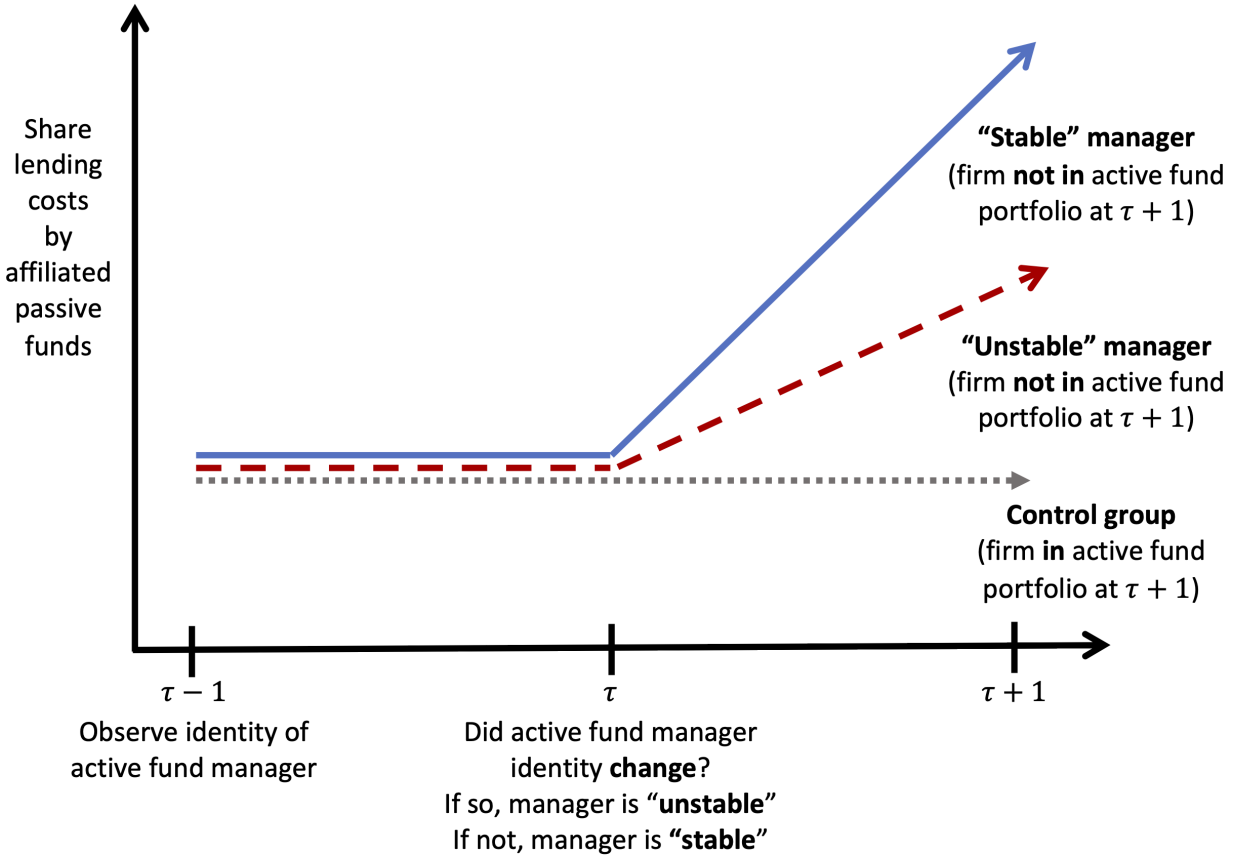

Figure 5: Parallel Trends: Avg. Retail Rate (New Loans)

This figure shows that the data are consistent with the identifying assumption behind the difference-in-differences-in-differences design portrayed in Figure 4, which examines changes in share lending costs for a security in an active fund's portfolio between reporting date τ and $\tau + 1$ (difference #1) between firms which are in an active fund portfolio and those which are not as of $\tau+1$ (difference #2), as between "stable" managers and "unstable" managers (difference #3), where a "stable" manager is one who is unchanged between reporting dates $\tau - 1$ and τ. The y-axis plots the natural log of the average retail lending rate for new loans with fixed effects for every portfolio - reporting date combination. The mean of the control group is the value of the linear combination of fixed effects η^i_τ which makes the prediction equal to the mean of the dependent variable. The figure shows that pre-trends from $(\tau - 2, \tau - 1)$ to $(\tau - 1, \tau)$ are parallel.

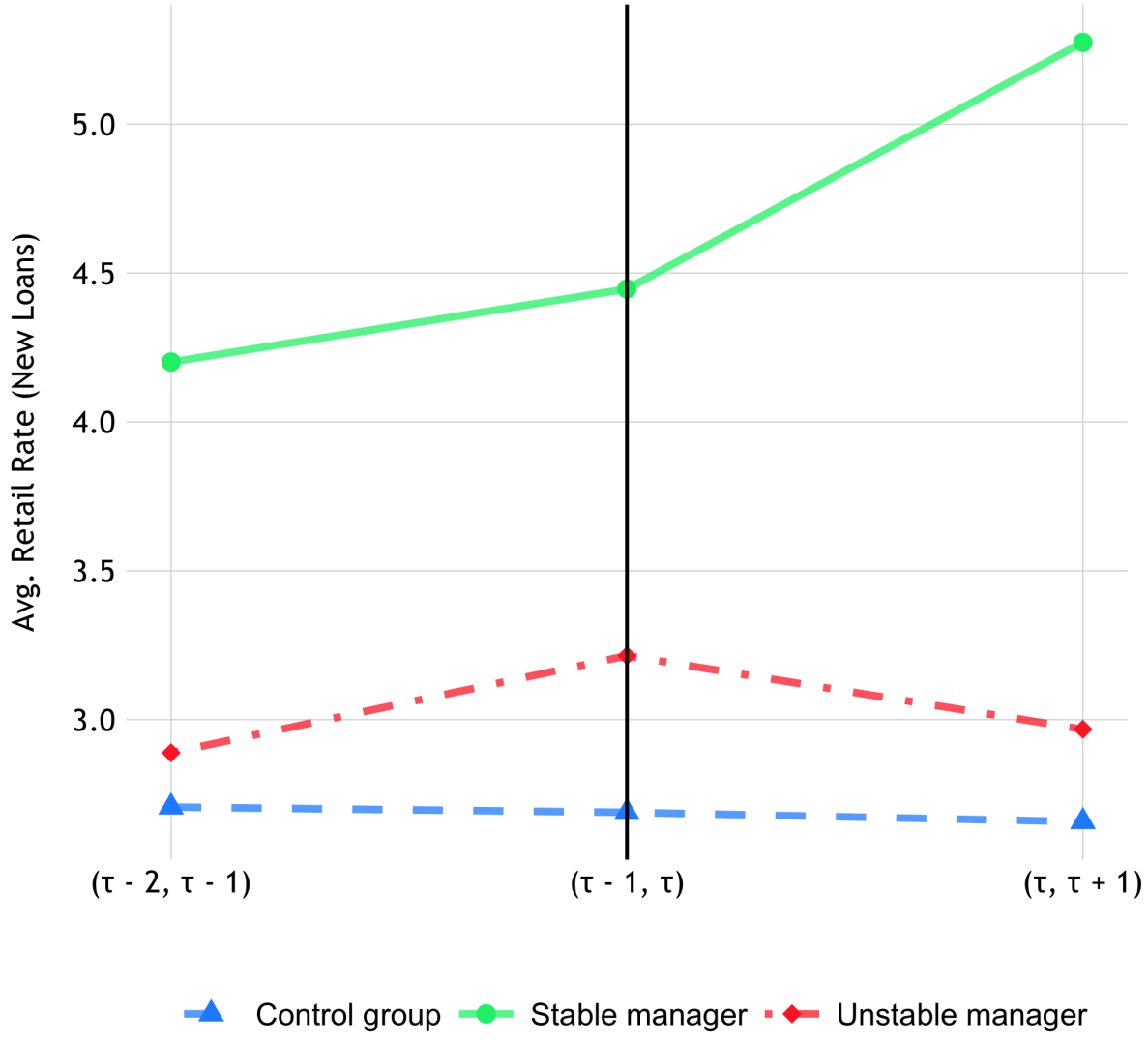

Figure 6: Parallel Trends: Other Outcomes

This figure extends Figure 5 and examines the other outcomes considered in this study. As before, the y-axis plots the average outcome with fixed effects for every portfolio - reporting date combination. The mean of the control group is the value of the linear combination of fixed effects η_τ^i which makes the prediction equal to the mean of the dependent variable. The key identifying assumption is that pre-trends from $(\tau-2,\tau-1)$ to $(\tau-1,\tau)$ are parallel. Consistent with the findings in Table 3, the post-treatment trends for demand-side outcomes are unchanged for "stable" managers.

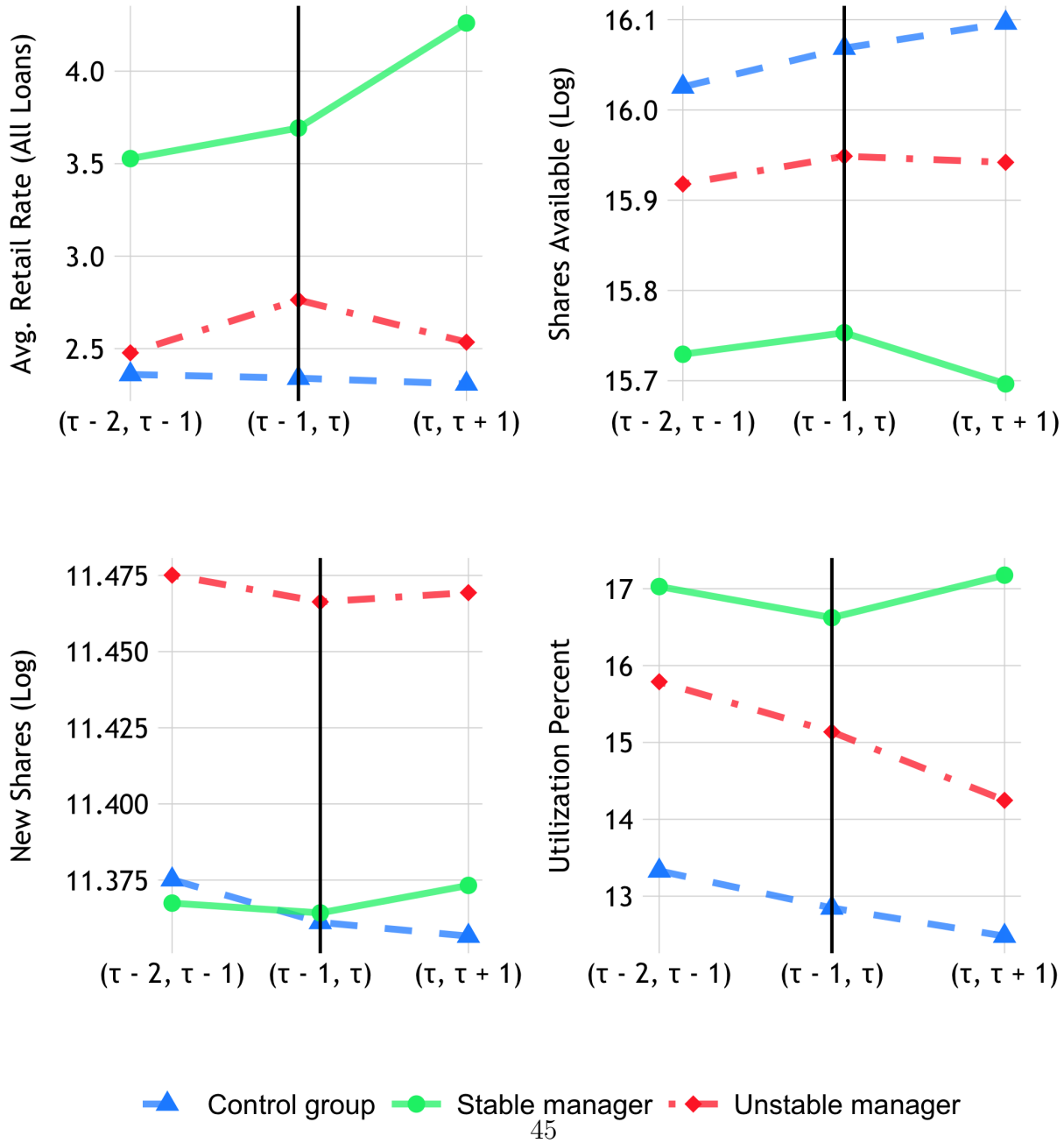

Table 1: Summary Statistics

This table presents summary statistics for the primary dataset, which has 365,636 security-reporting date observations. This dataset is limited to cases where the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund exceeds 14.6%, the 95% percentile of the sample distribution. Definitions for these variables are given in the text. For the share lending data, the "difference" variables are the difference between the average of the lending variable for the security prior to and following the holding period disclosure date. For example, if an active fund reports its portfolio holdings on January 31, February 28 and March 31, and the current observation is February 28, the post-pre difference is the average of the lending variable for the security from February 28 to March 31 ("post") minus the average of the lending variable for the security between January 31 to February 28 ("pre").

Variable	Obs	Mean	Std. Dev.	Min	Max	10%	25%	50%	75%	90%
Difference in Avg. Retail Rate for All Loans	365,636	-.008	5.161	-413.62	319.407	-.168	-.048	-.005	.03	.102
Difference in Avg. Retail Rate for New Loans	365,636	.001	7.645	-381.092	361.889	-.259	-.074	-.008	.048	.162
Difference in # of Shares Available (Log)	365,636	.025	.111	-2.616	4.971	-.045	-.011	.018	.055	.104
Difference in # of New Borrowed Shares (Log)	365,636	-.004	.632	-5.922	5.431	-.729	-.369	-.01	.354	.728
Difference in Utilization Percentage	365,636	-.331	5.279	-88.39	89.964	-4.237	-1.391	-.116	.708	3.139
Share of Mgmt. Passive Ownership	365,636	.29	.13	.146	1	.172	.206	.26	.33	.418
Manager Unchanged (0/1)	365,636	.981	.137	0	1	1	1	1	1	1
Removed in Next Period (0/1)	365,636	.039	.194	0	1	0	0	0	0	0

Table 2: Informational Sensitivity of Share Lending by Affiliated Passive Funds

This table shows that when a firm is removed from an active fund's portfolio, the cost of borrowing its shares rises when affiliated lenders have market power in the share lending market. I estimate the following regression by OLS on my primary sample limited to cases where the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund exceeds 14.6%, the 95% percentile of the sample distribution:

$$y^{i,j}_{\tau-1,\tau,\tau+1} = \beta \cdot removed^{i,j}_{\tau+1} + \eta^{i}_{\tau} + \epsilon^{i,j}_{\tau-1,\tau,\tau+1}$$

where $y^{i,j}_{\tau,\tau+1}$ is a difference in a share lending outcome for firm j in the portfolio of active fund i over the period $(\tau-1,\tau)$ to the period $(\tau,\tau+1)$, where τ is the current reporting date; $removed^{i,j}_{\tau+1}$ is equal to 1 if firm j is not present in fund i's portfolio on reporting date $\tau+1$; η^{i}_{τ} is a fixed effect for portfolio i on reporting date τ; and $\epsilon^{i,j}_{\tau,\tau+1}$ is a random error term. The specification employs fixed effects for every portfolio - reporting date combination, denoted by η^{i}_{τ}, which absorbs heterogeneity between funds and firms correlated with $y^{i,j}_{\tau-1,\tau,\tau+1}$ that does not vary within portfolio - reporting dates. The coefficient of interest is β, which estimates the difference between cases with $removed^{i,j}_{\tau+1} = 1$ and $removed^{i,j}_{\tau+1} = 0$ in the over-time difference in share lending costs over the period $(\tau-1,\tau)$ to the period $(\tau,\tau+1)$. To reiterate, this relationship is *not* causal but simply reflects the association between short selling demand and share lending costs imposed by affiliated passive index funds with market power, which could easily be driven by arrival of negative information about the underlying firm.

	Equilibrium			Supply-Side	Demand-Side
	Avg. Retail Rate (All Loans)	Avg. Retail Rate (New Loans)	Utilization Percentage	Shares Available (Log)	Utilized Shares (Log)
$\mathbf{removed^{i,j}_{\tau+1}}$	**0.5782*** **	**0.8813*** **	**0.8316*** **	**-0.0832*** **	**0.0134** **
	(6.27)	**(6.58)**	**(10.75)**	**(-29.88)**	**(1.97)**
(Intercept)	-0.0307***	-0.0312**	-0.3656***	0.0279***	-0.0045***
	(-3.67)	(-2.50)	(-41.86)	(166.23)	(-4.32)
Observations	365,636	365,636	365,636	365,636	365,636

Robust t statistics in parentheses

The (Intercept) is the value of the linear combination of fixed effects η^{i}_{τ} which makes the prediction calculated at the means of the independent variables equal to the mean of the dependent variable.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Supply-Side Shift in Share Lending Costs

This table tests Hypothesis 1, which predicts that when exiting a portfolio firm, "stable" active managers raise the cost of borrowing shares lent by affiliated passive funds with market power in that firm's shares. I estimate the following regression by OLS on my primary sample limited to cases where the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund exceeds 14.6%, the 95% percentile of the sample distribution:

$$y^{i,j}_{\tau-1,\tau,\tau+1} = \beta_1 \cdot removed^{i,j}_{\tau+1} + \beta_2 \cdot \left(removed^{i,j}_{\tau+1} \times stable^{i}_{\tau-1,\tau} \right) + \eta^{i}_{\tau} + \epsilon^{i,j}_{\tau-1,\tau,\tau+1}$$

where $y^{i,j}_{\tau,\tau+1}$ is the difference in a share lending outcome for firm j in the portfolio of active fund i over the period $(\tau-1,\tau)$ to the period $(\tau,\tau+1)$, where τ is the current reporting date; $removed^{i,j}_{\tau+1}$ is equal to 1 if firm j is not present in fund i's portfolio on reporting date $\tau+1$; $stable^{i}_{\tau-1,\tau}$ is equal to 1 if the portfolio manager for fund i was unchanged from period $\tau-1$ to τ; η^{i}_{τ} is a fixed effect for portfolio i on reporting date τ; and $\epsilon^{i,j}_{\tau,\tau+1}$ is a random error term. The specification employs fixed effects for every portfolio - reporting date combination, denoted by η^{i}_{τ}, which absorbs heterogeneity between funds and firms correlated with $y^{i,j}_{\tau-1,\tau,\tau+1}$ that does not vary *within* portfolio - reporting dates. The coefficient of interest is β_2, which estimates the difference in the difference between cases with $removed^{i,j}_{\tau+1} = 1$ and $removed^{i,j}_{\tau+1} = 0$ as between "stable" managers and "unstable" managers in the over-time difference in share lending outcomes over the period $(\tau-1,\tau)$ to the period $(\tau,\tau+1)$, where a "stable" manager is one who is unchanged from reporting date $\tau-1$ to τ. As the prior portfolio-level replacement of a fund manager is exogenous to subsequent changes in within-portfolio short selling demand, β_2 can be interpreted as the causal effect of a supply-side shift in the identity of a portfolio manager on the informational sensitivity of share lending as reflected in the correlation between supply-side or equilibrium outcomes $y^{i,j}_{\tau,\tau+1}$ and $removed^{i,j}_{\tau+1}$.

	Equilibrium			Supply-Side	Demand-Side
	Avg. Retail Rate (All Loans)	Avg. Retail Rate (New Loans)	Utilization Percentage	Shares Available (Log)	Utilized Shares (Log)
$\mathbf{removed^{i,j}_{\tau+1}}$	**0.7965*** **	**1.0751*** **	**1.4435*** **	**-0.0499*** **	**0.0060**
$\times\mathbf{stable^{i}_{\tau-1,\tau}}$	**(4.38)**	**(4.73)**	**(4.06)**	**(-5.82)**	**(0.17)**
$removed^{i,j}_{\tau+1}$	-0.1976	-0.2156	-0.5248	-0.0346***	0.0075
	(-1.27)	(-1.15)	(-1.52)	(-4.29)	(0.22)
(Intercept)	-0.0309***	-0.0314**	-0.3659***	0.0279***	-0.0045***
	(-3.69)	(-2.52)	(-41.88)	(166.19)	(-4.32)
Observations	365,636	365,636	365,636	365,636	365,636

Robust t statistics in parentheses

The (Intercept) is the value of the linear combination of fixed effects η^{i}_{τ} which makes the prediction calculated at the means of the independent variables equal to the mean of the dependent variable.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Value Lending Heterogeneity

This table examines how the findings in table 3 are driven by value lending programs by examining whether the key coefficient of interest varies with hard-to-borrow securities, as measured by the pre-period average retail rate for each security in the portfolio - reporting date. I estimate the following triple-difference regression by OLS:

$$y^{i,j}_{\tau-1,\tau,\tau+1} = \beta_1 \cdot removed^{i,j}_{\tau+1} + \beta_2 \cdot rate^{j}_{\tau-1,\tau} + \beta_3 \cdot \left(removed^{i,j}_{\tau+1} \times stable^{i}_{\tau-1,\tau}\right) + \beta_4 \cdot \left(removed^{i,j}_{\tau+1} \times rate^{j}_{\tau-1,\tau}\right) + \beta_5 \cdot \left(stable^{i}_{\tau-1,\tau} \times rate^{j}_{\tau-1,\tau}\right) + \beta_6 \cdot \left(removed^{i,j}_{\tau+1} \times rate^{j}_{\tau-1,\tau} \times stable^{i}_{\tau-1,\tau}\right) + \eta^{i}_{\tau} + \epsilon^{i,j}_{\tau-1,\tau,\tau+1}$$

where $rate^{j}_{\tau-1,\tau}$ is the average retail lending rate for loans of security j over the period $(\tau-1,\tau)$ and the other variables are as defined in eq. (2). As before, the specification employs fixed effects for every portfolio - reporting date combination, denoted by η^{i}_{τ}, which absorbs heterogeneity between funds and firms correlated with $y^{i,j}_{\tau-1,\tau,\tau+1}$ that does not vary *within* portfolio - reporting dates. For this reason, $stable^{i}_{\tau-1,\tau}$ is only identified when interacted with $removed^{i,j}_{\tau+1}$ or $rate^{j}_{\tau-1,\tau}$. The coefficient of interest is β_6, which estimates how the effect of replacing a fund manager on the informational sensitivity of share lending varies between hard-to-borrow and other securities.

	Equilibrium			Supply-Side	Demand-Side
	Avg. Retail Rate (All Loans)	Avg. Retail Rate (New Loans)	Utilization Percentage	Shares Available (Log)	Utilized Shares (Log)
$\mathbf{removed^{i,j}_{\tau+1} \times rate^{j}_{\tau-1,\tau}}$	**0.5396*** **	**0.5507*** **	**0.1354*** **	**0.0060*** **	**-0.0028**
$\times \mathbf{stable^{i}_{\tau-1,\tau}}$	**(11.19)**	**(8.54)**	**(3.24)**	**(7.94)**	**-0.82)**
$removed^{i,j}_{\tau+1}$	-0.4075***	-0.4241***	-0.1648***	-0.0061***	0.0041
$\times rate^{j}_{\tau-1,\tau}$	(-11.66)	(-7.77)	(-4.08)	(-8.49)	(1.19)
$stable^{i}_{\tau-1,\tau}$	0.0090	0.0257	0.0033	-0.0007**	0.0015
$\times rate^{j}_{\tau-1,\tau}$	(0.25)	(0.50)	(0.18)	(-2.05)	(1.34)
$removed^{i,j}_{\tau+1}$	0.0342	0.3485***	1.3396***	-0.0567***	0.0072
$\times stable^{i}_{\tau-1,\tau}$	(0.36)	(2.65)	(3.83)	(-6.70)	(0.21)
$removed^{i,j}_{\tau+1}$	0.3196***	0.3500***	-0.3213	-0.0278***	0.0034
	(8.66)	(5.26)	(-0.94)	(-3.48)	(0.10)
$rate^{j}_{\tau-1,\tau}$	-0.0826**	-0.1510***	-0.0201	0.0009***	-0.0017
	(-2.32)	(-2.98)	(-1.07)	(2.80)	(-1.59)
(Intercept)	0.1417***	0.2629***	-0.3265***	0.0273***	-0.0038***
	(12.88)	(19.28)	(-36.60)	(157.92)	(-3.60)
Observations	365,636	365,636	365,636	365,636	365,636

Robust t statistics in parentheses

The (Intercept) is the value of the linear combination of fixed effects η^{i}_{τ} which makes the prediction calculated at the means of the independent variables equal to the mean of the dependent variable.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: How Much Profit Sharing Between Lenders and Short Sellers?

This table estimates how much of the surplus to short selling is captured by institutional investors exercising market power in the share lending market. For this exercise, I limit my analysis to the primary sample limited to cases where the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund exceeds 14.6%, the 95% percentile of the sample distribution. For each firm in the "treatment" group — *i.e.*, a firm removed from portfolio of active fund whose affiliated passive funds have market power in share lending market for the security — I calculate the cumulative raw and abnormal return from the report date to 4 weeks after the report ("information value"), as well as the average share lending rate for new loans from the report date to the next report date ("surplus extraction"). I convert each of these to the daily level—the former by dividing the cumulative abnormal return by 20, the number of trading days over which that spans, and the latter by 252, the number of trading days in a year since lending rates are annualized in the data. I further divide the latter by 100 to account for the fact the returns are expressed in decimal values (*e.g.*, a 1% decline in the share price is represented as 0.01) whereas lending rates were reported in percentage points (*e.g.*, a 1% annual rate is represented as 1.00). I then estimate the following regression by ordinary least squares:

$$ret_{t,t+20} = \alpha + \beta rate_{\tau,\tau+1} + \epsilon_{t,t+20} \tag{4}$$

where $ret_{t,t+20}$ is the average daily raw (or abnormal) return from the report date to 20 trading days after, depending on the specification; $rate_{\tau,\tau+1}$ is the average daily lending rate from the report date to the following report date; and $\epsilon_{t,t+20}$ is a random error term. The coefficient of interest is β, which estimates the change in $ret_{t,t+20}$ for a one-percentage point change in $rate_{\tau,\tau+1}$. It might seem odd that the returns are estimated over one month while the lending rates are estimated from one report date to the next, which is generally three months thereafter. The reason for this disparity is that the information value exploited by short sellers is likely to diminish, not increase, with time, suggesting that most of the short seller profits are realized earlier in the window. However, as a robustness check, I repeat this analysis but examine the return from the report date to 60 trading days after.

	Raw Return		CAPM	
	$(t, t+20)$	$(t, t+60)$	$(t, t+20)$	$(t, t+60)$
$rate_{\tau,\tau+1}$	**-0.7725*** **	**-0.8573*** **	**-0.8657*** **	**-0.8678*** **
	(-3.02)	**(-3.35)**	**(-3.37)**	**(-3.38)**
(Intercept)	-0.0010***	-0.0006***	-0.0002***	-0.0002***
	(-14.74)	(-9.44)	(-3.76)	(-3.77)
Observations	14,050	14,050	14,050	14,050

	Three-Factor		Four-Factor	
	$(t, t+20)$	$(t, t+60)$	$(t, t+20)$	$(t, t+60)$
$rate_{\tau,\tau+1}$	**-0.6260*** **	**-0.6435*** **	**-0.6485*** **	**-0.6468*** **
	-6.99	**(-7.04)**	**(-7.03)**	**(-6.98)**
(Intercept)	-0.0007***	-0.0003***	-0.0000	-0.0000
	(-18.05)	(-7.94)	(-0.55)	(-0.67)
Observations	14,050	14,050	14,050	14,050

Robust t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Online Appendix

Table OA1: Summary Statistics (Full Sample)

This table presents summary statistics for the the full dataset, which has 7,306,001 security-reporting date observations. Definitions for these variables are given in the text. For the share lending data, the "difference" variables are the difference between the average of the lending variable for the security prior to and following the holding period disclosure date. For example, if an active fund reports its portfolio holdings on January 31, February 28 and March 31, and the current observation is February 28, the post-pre difference is the average of the lending variable for the security from February 28 to March 31 ("post") minus the average of the lending variable for the security between January 31 to February 28 ("pre").

Variable	Obs		Mean	Std. Dev.	Min	Max	10%	25%	50%	75%	90%
Difference in Avg. Retail Rate for All Loans	7,306,001	-.011	2.288	-413.62	319.407	-.121	-.045	-.004	.033	.096	
Difference in Avg. Retail Rate for New Loans	-.008	3.74	-381.092	361.889	-.151	-.059	-.006	.044	.115		
Difference in # of Shares Available (Log)	7,306,001	.027	.093	-3.765	4.971	-.037	-.009	.019	.054	.101	
Difference in # of Newly Borrowed Shares (Log)	7,306,001	-.01	.586	-7.467	7.168	-.695	-.356	-.016	.328	.678	
Difference in Utilization Percentage	7,306,001	-.308	4.413	-97.44	99.987	-3.58	-1.126	-.088	.586	2.587	
Share of Mgmt. Passive Ownership	7,306,001	.02	.071	0	1	0	0	0	.001	.041	
Manager Unchanged (0/1)	7,306,001	.974	.158	0	1	1	1	1	1	1	
Removed in Next Period (0/1)	7,306,001	.052	.223	0	1	0	0	0	0	0	

Table OA2: Balance Test on Pre-Treatment Trends

This table replicates the analysis in Table 3 on pre-treatment trends, examining whether future removals of a portfolio firm by "stable" active managers are preceded by an increase in the cost of borrowing shares lent by affiliated passive funds with market power in that firm's shares. I estimate the following regression by OLS on my primary sample where ownership of the security by passive index funds belonging to the same fund family as the reporting fund exceeds 14.6%, the 95% percentile of the sample distribution:

$$y^{i,j}_{\tau-2,\tau-1,\tau} = \beta_1 \cdot removed^{i,j}_{\tau+1} + \beta_2 \cdot \left(removed^{i,j}_{\tau+1} \times stable^{i}_{\tau-1,\tau} \right) + \eta^{i}_{\tau} + \epsilon^{i,j}_{\tau-1,\tau,\tau+1}$$

where $y^{i,j}_{\tau-2,\tau-1,\tau}$ is the pre-treatment difference in a share lending outcome for firm j in the portfolio of active fund i over the period $(\tau-2,\tau-1)$ to the period $(\tau-1,\tau)$, where τ is the current reporting date; $removed^{i,j}_{\tau+1}$ is equal to 1 if firm j is not present in fund i's portfolio on reporting date $\tau+1$; $stable^{i}_{\tau-1,\tau}$ is equal to 1 if the portfolio manager for fund i was unchanged from period $\tau-1$ to τ; η^{i}_{τ} is a fixed effect for portfolio i on reporting date τ; and $\epsilon^{i,j}_{\tau,\tau+1}$ is a random error term. The specification employs fixed effects for every portfolio - reporting date combination, denoted by η^{i}_{τ}, which absorbs heterogeneity correlated with $y^{i,j}_{\tau-2,\tau-1,\tau}$ that does not vary *within* portfolio - reporting dates. The coefficient of interest is β_2, which estimates the placebo difference in the difference between cases with $removed^{i,j}_{\tau+1} = 1$ and $removed^{i,j}_{\tau+1} = 0$ as between "stable" managers and "unstable" managers in the over-time difference in share lending outcomes over the period $(\tau-2,\tau-1)$ to the period $(\tau-1,\tau)$, where a "stable" manager is one who is unchanged from reporting date $\tau-1$ to τ. If the replacement of a fund manager is exogenous to subsequent changes in within-portfolio short selling demand, the placebo coefficient β_2 should be insignificant.

	Equilibrium			Supply-Side	Demand-Side
	Avg. Retail Rate (All Loans)	Avg. Retail Rate (New Loans)	Utilization Percentage	Shares Available (Log)	Utilized Shares (Log)
$\mathbf{removed^{i,j}_{\tau+1}}$	**-0.0592**	**0.0070**	**1.4435*** **	**0.0009**	**0.0122**
$\times\mathbf{stable^{i}_{\tau-1,\tau}}$	**(-0.23)**	**(0.02)**	**(4.06)**	**(0.34)**	
$removed^{i,j}_{\tau+1}$	0.3092	0.3479	-0.5248	-0.0146**	0.0004
	(1.26)	(1.31)	(-1.52)	(-2.30)	(0.01)
(Intercept)	-0.0387***	-0.0397***	-0.3659***	0.0472***	-0.0251***
	(-4.40)	(-3.16)	(-41.88)	(218.21)	(-24.03)
Observations	347,130	347,081	365,636	364,408	347,081

Robust t statistics in parentheses

The (Intercept) is the value of the linear combination of fixed effects η^{i}_{τ} which makes the prediction calculated at the means of the independent variables equal to the mean of the dependent variable.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table OA3: Supply-Side Shift in Share Lending Costs (Full Sample)

This table tests Hypothesis 1, which predicts that when exiting a portfolio firm, "stable" active managers raise the cost of borrowing shares lent by affiliated passive funds with market power in that firm's shares. I estimate the following regression by OLS on the full sample, which interacts the specification in eq. (2) with the share of ownership of the security by passive index funds belonging to the same fund family as the reporting fund:

$$y^{i,j}_{\tau-1,\tau,\tau+1} = \beta_1 \cdot removed^{i,j}_{\tau+1} + \beta_2 \cdot share^{i,j}_{\tau} + \beta_3 \cdot \left(removed^{i,j}_{\tau+1} \times stable^{i}_{\tau-1,\tau}\right) + \beta_4 \cdot \left(removed^{i,j}_{\tau+1} \times share^{i,j}_{\tau}\right) + \beta_5 \cdot \left(stable^{i}_{\tau-1,\tau} \times share^{i,j}_{\tau}\right) + \beta_6 \cdot \left(removed^{i,j}_{\tau+1} \times share^{i,j}_{\tau} \times stable^{i}_{\tau-1,\tau}\right) + \eta^{i}_{\tau} + \epsilon^{i,j}_{\tau-1,\tau,\tau+1}$$

where $share^{i,j}_{\tau}$ is the centered and standardized share of ownership of security j by passive index funds belonging to the same fund family as reporting fund i as of reporting date τ and the other variables are as defined in eq. (2). As before, the specification employs fixed effects for every portfolio - reporting date combination, denoted by η^{i}_{τ}, which absorbs heterogeneity between funds and firms correlated with $y^{i,j}_{\tau-1,\tau,\tau+1}$ that does not vary *within* portfolio - reporting dates. For this reason, $stable^{i}_{\tau-1,\tau}$ is only identified when interacted with $removed^{i,j}_{\tau+1}$ or $share^{i,j}_{\tau}$. The coefficient of interest is β_6, which estimates how the effect of replacing a fund manager on the informational sensitivity of share lending varies with the market share held by a passive investment manager.

	Equilibrium			Supply-Side	Demand-Side
	Avg. Retail Rate (All Loans)	Avg. Retail Rate (New Loans)	Utilization Percentage	Shares Available (Log)	Utilized Shares (Log)
$\mathbf{removed^{i,j}_{\tau+1} \times share^{i,j}_{\tau}}$	**0.2816*** **	**0.3741*** **	**0.3930*** **	**-0.0171*** **	**0.0041**
$\times \mathbf{stable^{i}_{\tau-1,\tau}}$	**(3.20)**	**(3.51)**	**(3.80)**	**(-5.21)**	**(0.35)**
$removed^{i,j}_{\tau+1}$	-0.1037	-0.1267	-0.2453**	0.0064**	-0.0035
$\times share^{i,j}_{\tau}$	(-1.33)	(-1.36)	(-2.44)	(1.99)	(-0.31)
$stable^{i}_{\tau-1,\tau}$	0.0812	0.1258	-0.0643	-0.0003	0.0102**
$\times share^{i,j}_{\tau}$	(0.99)	(1.02)	(-1.13)	(-0.23)	(2.01)
$removed^{i,j}_{\tau+1}$	-0.0123	0.0018	0.2133***	0.0049*	0.0027
$\times stable^{i}_{\tau-1,\tau}$	(-0.16)	(0.02)	(2.77)	(1.90)	(0.41)
$removed^{i,j}_{\tau+1}$	0.1515*	0.2333**	0.1977***	-0.0521***	0.0123*
	(1.93)	(2.20)	(2.61)	(-20.63)	(1.90)
$share^{i,j}_{\tau}$	-0.0849	-0.1323	0.0588	0.0012	-0.0110**
	(-1.05)	(-1.08)	(1.04)	(0.86)	(-2.19)
(Intercept)	-0.0178***	-0.0200***	-0.3290***	0.0293***	-0.0111***
	(-21.15)	(-14.56)	(-201.61)	(969.97)	(-51.44)
Observations	7,306,001	7,306,001	7,306,001	7,306,001	7,306,001

Robust t statistics in parentheses

The (Intercept) is the value of the linear combination of fixed effects η^{i}_{τ} which makes the prediction calculated at the means of the independent variables equal to the mean of the dependent variable.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table OA4: Supply-Side Shift in Share Lending Costs (Vanguard Funds)

This table tests whether the findings in Table 3 are concentrated in Vanguard funds. I estimate the following regression by OLS on the full sample, which interacts the specification in eq. (2) with an indicator equal to 1 if the reporting fund is a Vanguard fund:

$$y^{i,j}_{\tau-1,\tau,\tau+1} = \beta_1 \cdot removed^{i,j}_{\tau+1} + \beta_2 \cdot \left(removed^{i,j}_{\tau+1} \times stable^{i}_{\tau-1,\tau}\right) +$$
$$\beta_3 \cdot \left(removed^{i,j}_{\tau+1} \times vanguard^{i}_{\tau}\right) + \beta_4 \cdot \left(removed^{i,j}_{\tau+1} \times vanguard^{i,j}_{\tau} \times stable^{i}_{\tau-1,\tau}\right) + \eta^{i}_{\tau} + \epsilon^{i,j}_{\tau-1,\tau,\tau+1}$$

where $vanguard^{i}_{\tau}$ is equal to 1 if the fund i reporting at time τ is a Vanguard fund and the other variables are as defined in eq. (2). As before, the specification employs fixed effects for every portfolio - reporting date combination, denoted by η^{i}_{τ}, which absorbs heterogeneity between funds and firms correlated with $y^{i,j}_{\tau-1,\tau,\tau+1}$ that does not vary *within* portfolio - reporting dates. For this reason, $stable^{i}_{\tau-1,\tau}$ and $vanguard^{i}_{\tau-1,\tau}$ are only identified when interacted with $removed^{i,j}_{\tau+1}$. The coefficient of interest is β_4, which estimates how the effect of replacing a fund manager on the informational sensitivity of share lending varies with Vanguard and non-Vanguard funds.

	Equilibrium			Supply-Side	Demand-Side
	Avg. Retail Rate (All Loans)	Avg. Retail Rate (New Loans)	Utilization Percentage	Shares Available (Log)	Utilized Shares (Log)
$removed^{i,j}_{\tau+1}$	**0.5907*** **	**0.6852*** **	**1.2984*** **	**-0.0620*** **	**-0.0069**
$\times vanguard^{i,j}_{\tau}$	**(4.35)**	**(3.79)**	**(3.83)**	**(-7.94)**	**(-0.22)**
$\times stable^{i}_{\tau-1,\tau}$					
$removed^{i,j}_{\tau+1}$	-0.1566*	-0.2164*	-0.8464***	0.0254***	0.0009
$\times vanguard^{i,j}_{\tau}$	(-1.75)	(-1.71)	(-2.59)	(3.52)	(0.03)
$removed^{i,j}_{\tau+1}$	-0.0609	-0.0594	0.1233	0.0087***	0.0023
$\times stable^{i}_{\tau-1,\tau}$	(-0.72)	(-0.52)	(1.56)	(3.23)	(0.35)
$removed^{i,j}_{\tau+1}$	0.1721**	0.2597**	0.2616***	-0.0539***	0.0129**
	(2.03)	(2.26)	(3.35)	(-20.22)	(1.99)
(Intercept)	-0.0176***	-0.0197***	-0.3291***	0.0293***	-0.0111***
	(-21.30)	(-14.58)	(-202.07)	(973.12)	(-51.40)
Observations	7,306,001	7,306,001	7,306,001	7,306,001	7,306,001

Robust t statistics in parentheses

The (Intercept) is the value of the linear combination of fixed effects η^{i}_{τ} which makes the prediction calculated at the means of the independent variables equal to the mean of the dependent variable.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$