S&P 500 Inclusions and Stock Supply*

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First Draft: December 2, 2013
This Draft: December 5, 2016

Abstract

I provide new evidence of the S&P500 inclusion effect that highlights the importance of stock supply. If excess demand from S&P500-linked capital drives the inclusion effect, it should depend as well on the effective supply of a stock. Standard & Poor's index methodology provides two distinct supply proxies, which significantly predict the cross-sectional size of the effect. Switching to free-floating index weights in 2005 enables a quasi-natural experiment to one proxy and a placebo test to the other, further strengthening a supply interpretation. Finally, evidence from the most recent decade indicates that any persistence in the inclusion effect has disappeared.

JEL Classification: G12, G14, G32, D40
Keywords: S&P 500 additions, price pressure, control ownership, free-float index weight adjustment, arbitrage capital, downward-sloping demand for stocks

*The paper previously circulated under the titel "Stock Price Elasticity and Control Ownership: Cross-sectional Evidence from S&P 500 Inclusions". I would like to thank Patrick Augustin, Laurent Bach, Ramin Baghai, Bo Becker, Hamid Boustanifar, Johannes Breckenfelder, Mike Burkart, Cristina Cella, Henrik Cronqvist (discussant), Magnus Dahlquist, Daniel Ferreira, Martin Hackmann, Michael Halling, Jungsuk Han, Ulf von Lilienfeld-Toal, Kristoffer Milonas, Albert Menkveld, Daniel Metzger, Lars Nordén (discussant), Lasse Pedersen, Per Strömberg, Jeff Wurgler, Remco Zwinkels, and seminar participants at the Stockholm School of Economics, Université Paris Dauphine, Frankfurt School of Finance & Management, ESSEC Business School, VU University Amsterdam, ESADE Business School for helpful comments and discussions. All remaining errors and omissions are my own.

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1 Introduction

One of the most prominent pieces of evidence for the limits of arbitrage are price changes after a stock's inclusion in a major index. In perfect capital markets, any price impact of index funds is expected to be quickly reversed by arbitrageurs, keeping market prices at efficient levels. As pointed out by Shleifer and Vishny (1997) among others, short-sale constraints, increasing margin calls, and other frictions may limit the arbitrage capacity in practice. This makes a stock's long positions crucially important for stock supply. The easier it is to entice shareholders to sell their shares, the cheaper index funds' demand orders can be filled. Thus, market quality is dependent on a stock's ownership structure during incidences of extreme demand.

The existing index inclusion literature has largely focused on the demand side and average inclusion effects.[1] Following the announcement of an S&P 500 inclusion, stocks have indeed consistent positive abnormal returns. Harris and Gurel (1986) interpret their result as evidence of temporary price pressure meaning that stock prices revert back to initial levels shortly after the inclusion. In contrast, Shleifer (1986) stresses a longer-lasting price impact of demand and calls this the downward-sloping demand for stocks. Other studies have repeatedly confirmed this evidence, challenging the efficient markets hypothesis.[2] A more recent series of studies, however, examines various fundamental stock characteristics, which suggest that index inclusions enhance the stock value for various other reasons, such as certification of firm quality (Jain

[1]A notable exception is Wurgler and Zhuravskaya (2002) who show that stocks with close substitutes have smaller S&P 500 inclusion effects, which they interpret as evidence for the existence of arbitrage risk.

[2]Beneish and Whaley (1996), Lynch and Mendenhall (1997), Wurgler and Zhuravskaya (2002), Petajisto (2011) all give support for a lasting pricing component. Madhavan (2003) reports similar results for the Russell 2000 index. Chang et al. (2014) propose a Regression-Discontinuity Design to test for the Russell 2000 effect.

1987; Dhillon and Johnson 1991), increased investor awareness (Chen et al. 2004), increased liquidity (Beneish and Whaley 1996; Hegde and McDermott 2003), or improved analyst earnings forecasts (Denis et al. 2003). Thus, there is considerable disagreement in the literature on whether parts of the overall effect may be attributed to increased demand, or whether it simply reflects new relevant information.

This paper revisits the S&P 500 inclusion effect by looking at the corresponding price impact through a novel approach that highlights the relative importance of stock supply. If arbitrage works imperfectly, the price impact of a demand shock should not only depend on demand-side characteristics, but also on effective stock supply. When a stock is included to the index, the demand for the stock increases proportionally to its market capitalization. The stock's supply, however, may differ, since part of the total market capitalization is not traded at all times. Hence, the effect of an index inclusion on prices should depend on the relative imbalance between demand and supply.

Based on a stock's ownership structure, I make use of two proxies capturing distinct aspects of stock supply throughout the paper. First, the fraction of shares held by controlling shareholder groups represents an inverse supply proxy. Excluding pure financial investors like banks, investment companies or pension funds, corporate control holders own shares for reasons besides investment. They are unlikely to offer their shares at market prices, which decreases the total number of marketable shares and thus affects stock supply. Second, some stocks are listed on the mid-cap index S&P 400 before they are added to the S&P 500. Index funds tracking the S&P 400 are supposed to sell their shares at the time when index funds tracking the S&P 500 are buying. This creates perfectly elastic supply, at least partially filling demand from S&P 500 index funds.

Since Standard & Poor's assigned each constituent an index weight according to the company's market capitalization before March 2005, I can keep the relative size of index funds' demand virtually constant across inclusions. During this period, index funds buy approximately 10% of shares outstanding upon S&P 500 inclusion. Importantly, such an index weight definition is not mechanically related to the company's control ownership, leading to cross-sectional variation in the imbalance between demand and the first supply proxy.

S&P 500 inclusions provide a particularly useful setting to test the price impact of control ownership because Standard & Poor's decided to switch to float-adjusted index weights in 2005. Float-adjustment means that shares owned by control holders are no longer considered in the computation of capitalization-based index weights. Under the new index methodology, closely held stocks included in the S&P 500 experience relatively smaller demand shocks with respect to their overall market capitalization. However, demand shocks are now proportionate in terms of the free float. Hence, this redefinition of index weights enables a quasi-natural experiment that predicts a smaller price impact of control ownership after September 2005.[3] The second supply proxy, a previous listing on the S&P 400, provides a placebo test in the sense that it should not lose its predictive power after 2005.

I begin the analysis with a detailed study of S&P 500 inclusion returns before March 2005. In this sample, the price pressure of newly added stocks is significantly related to both supply proxies: a 1% increase in control ownership leads to an 11.6bp

[3] Kaul et al. (2000), Greenwood (2008), Hau et al. (2010), or Hrazdil (2009) analyze the direct effect of index weight re-definitions, like a float-adjustment, on stock prices. Stocks with high control ownership face a supply shock and stock with low control ownership a demand shock during the implementation of the reform. The methodological approach in this paper differs by focusing on the changing implications for the index inclusion effect. Thereby, I capture the effect of demand shifts depending on varying stock supply elasticities.

increase in abnormal returns and stocks previously listed on the S&P 400 have 5.7% smaller returns. These cross-sectional effects are particularly strong on the day of effective inclusion when most index funds change their portfolio composition. A similar, though lesser, effect exists on the day when Standard & Poor's publicly announces an inclusion, suggesting only a partial anticipation. Such timing contrasts with the average abnormal return of S&P 500 inclusions, which largely occurs on the announcement day. It appears that prices have more difficulties to incorporate cross-sectional differences than the average inclusion effect.

If the cross-sectional effect of control ownership under scrutiny is really due to price pressure, then the implementation of float-adjusted index weights in 2005 should negatively affect the magnitude of its impact. The endeavor to re-define index weights itself suggests that the financial industry perceived that control ownership distorts the balance between the demand and supply of stocks. In a sample of S&P 500 inclusions after September 2005, control ownership loses any predictive power to explain the cross-section of abnormal inclusion returns. Stocks previously listed on the S&P 400, however, remain strong predictors. The simultaneous float-adjustment of index weights for all S&P 500 stocks offers the opportunity to estimate the differential impact of control ownership using a simple difference estimator comparing inclusions before and after float-adjustment. This estimation finds a smaller statistically significant effect of control ownership on inclusion returns after the reform.

Researchers have criticized Standard and Poor's confidential selection process for new S&P 500 stocks as a potential problem for the identification strategy used in this literature. *S&P Dow Jones Indices: S&P U.S. Indices Methodology* (2012) states that the S&P 500 is designed to reflect the US economy in terms of an appropriate industry representation. Further details about index inclusion decisions are left to the US Index Committee, which makes decisions on a case-by-case basis using unclear decision rules. Since this paper focuses on cross-sectional effects of stocks included in the S&P 500, such a selection problem is less problematic except if the selection were correlated with the supply proxies. Yet, even a time-invariant selection bias cannot explain why control ownership loses its predictive power after 2005.

Results may still be confounded if there was an omitted variable that truly causes the cross-sectional effect captured by control ownership, and if that variable also transformed around the time of float-adjustment in 2005. One such factor could be stock liquidity, which significantly improved during the 2000s and at the same time may help to mitigate the price pressure of S&P 500 inclusions. However, controlling for Amihud (2002)'s illiquidity measure and year fixed-effects in regressions does not materially affect the coefficients of supply proxies. As an alternative explanation, pure risk-based arguments fail to explain why the difference in cross-sectional returns materializes precisely at the moment of index inclusion. Therefore, the aggregated evidence of cross-sectional return differences in the two supply proxies is difficult to reconcile with other explanations than an imbalance between demand and supply.

In a second step of the analysis, I distinguish between temporary or longer-lasting price impacts by evaluating the persistence of the inclusion effect on stock prices. Focusing on the sample before float-adjustment in 2005, I conduct cross-sectional regressions of long-term cumulative abnormal return models. Both supply proxies remain statistically significant for more than 20 trading days after effective inclusion. Looking instead at stock price reversals immediately after effective index inclusion, I detect only a statistically insignificant partial reversal of the average inclusion effect with respect to the cross-sectional dimensions I propose in this paper.

Similar conclusions follow if I estimate abnormal returns in a calendar-time panel, which addresses Fama (1998)'s statistical concerns about serial correlations in cumulative abnormal return measures. With this approach, I effectively separate stocks added to the S&P 500 into two portfolios, either separated by control ownership or previous S&P 400 listing. Again, I find significantly higher and more persistent abnormal returns in the sample of stocks with high control ownership and the sample of stocks not previously listed on the S&P 400. Overall, my results indicate that both cross-sectional supply proxies are as persistent as the documented S&P 500 inclusion effect, supporting demand-side explanations proposed by Shleifer (1986).

Turning to the sample of S&P 500 inclusions after 2005, not only the cross-sectional difference in control ownership vanished after the reform. The entire S&P 500 inclusion effect reverts quickly back to its initial price level. In fact, almost the entire effect is driven by stocks not previously listed on the S&P 400. If demand shocks have a non-linear price impact, an average decline in the effect is in line with the predictions in this study since the float-adjustment of index weights eliminates incidences of extreme price pressure. However, it is unlikely to explain the entire disappearance of the long-run component. Future research may help to identify the causal factors.

Supply proxies in this paper rely on the (un)willingness of some shareholders to sell their shares. Yet, supply could also be generated by increasing the number of shares outstanding. This could be done either by additional share issuance or short-selling. In final tests, I verify how these transactions relate to the cross-sections of the two supply proxies. I do not find evidence that issuing entities issue abnormal amounts of shares in subsequent months of index inclusions. Yet, short selling increases significantly in the month of S&P 500 inclusions and it is to some extent also correlated with both supply proxies. However, stocks in short supply according to my measures are actually shorted the most. This releases price pressure and makes the documented results only stronger.

This paper contributes to the existing literature on index inclusions by examining the role of stock supply. Studying the cross-section of S&P 500 inclusion returns, this work is closely related to Wurgler and Zhuravskaya (2002). They show that stocks with close substitutes experience smaller price effects from index inclusions, which they attribute to a better arbitrage environment. Supply proxies in this paper are derived from a stocks's ownership structure and therefore theoretically and statistically distinct from Wurgler and Zhuravskaya (2002)'s arbitrage risk.

Bagwell (1992) reports the closest related evidence on stock supply documenting upward-sloping supply curves in the context of share repurchases via Dutch auctions. While her results hinge on a direct contraction in the number of shares outstanding, the evidence in this paper depends on supply made available in secondary markets as a response to demand-side shocks. In addition, this study includes a quasi-natural experiment giving further support to a supply interpretation.

Other papers have used applied microeconometric tools to identify price pressure effects of index inclusions. Kaul et al. (2000) show that stock price movements are related to the change in index weights after a major index redefinition. More recently, Chang et al. (2014) exploit a regression discontinuity identifying a local average treatment effect around the Russell 2000 cutoff, at which the fraction of shares held by index-tracking funds suddenly increases. This paper complements their evidence with a structural analysis of the supply side, which provides shares to the increased demand of index-tracking funds. Furthermore, it suggests that also the long-run component in the S&P 500 inclusion effect is at least partially demand-driven.

The rest of the paper is organized as follows. Section 2 develops the main hypotheses in more detail. Section 3 discusses the sample of S&P 500 inclusions and data sources. Section 4 presents the main results related to price pressure focusing first on the cross-sectional results prior to float-adjustment and then analyzing the impact of the reform. Section 5 discusses the persistence of the inclusion effect, introducing calendar-time panel regressions. Section 6 builds a link to alternative supply measures, like share issuance and short interest. Section 7 concludes the paper.

2 Hypothesis development

New additions to major stock indices, like the S&P 500, serve as a prominent test for the limits to arbitrage. A change in index constituents requires index funds to purchase these stocks, causing a significant increase in demand. Academic interest in index inclusions is sparked by the feature that the increased demand is, arguably, not based on material information about the investment prospects of the company.[4] Therefore, any abnormal stock price performance following the announcement of an index inclusion may lead to interpretations of the price increase as price pressure.

While there was a controversial debate over the existence and interpretation of such an index inclusion effect, there is relatively scarce evidence related to cross-sectional results. Despite the literature's strong focus on the nature of demand curves for stocks, few studies explicitly address stock supply, which simultaneously helps to pinpoint prices.[5] The novelty of this study is in that it aims to explicitly model the cross-sectional dimensions of stock supply. Keeping the demand of index-linked capital constant, a given index inclusion will increase the price pressure effect if the

[4]In fact, Standard and Poor's discloses that "additions to and deletions from S&P Dow Jones Indices do not in any way reflect an opinion on the investment merits of the companies involved."

[5]Shleifer (1986) omits a separation into supply and demand in this context entirely by referring to excess demand curves instead. Harris and Gurel (1986) state that "it appears that an immediate increase in price (price pressure) is necessary to induce passive demanders to offer their shares, while the subsequent decrease allows them to reestablish their position (if desired) at a net profit."

stock has a lower supply elasticity.

For the purpose of this study, stock inclusions in the S&P 500 offer a great opportunity to conduct such cross-sectional tests. Despite a dramatic run-up in index-linked capital over the sample period, the fraction of shares purchased by S&P 500-tracking funds remained relatively constant, at least until 2005. Figure 1 illustrates this by plotting Standard & Poor's estimate for S&P 500-linked capital as a fraction of total S&P 500 market capitalization. While this fraction stays constant at slightly below 10% until 2005, it increases moderately in subsequent years, peaking at 14% in 2011.

The S&P 500 context offers two natural proxies capturing distinct dimensions of a stock's supply characteristics. The first measure is the fraction of shares held by the firm's control holders, representing an inverse proxy for the supply of a stock. This rationale is based on basic corporate finance frameworks. Control holders collect, in addition to security benefits, private benefits through their active involvement with the firm's management. These private benefits may come in various pecuniary or non-pecuniary forms. Either way, it may ultimately lead to a security valuation of control holders above current market prices. Control holders' shares are therefore not readily available to trade in secondary markets. Dahlquist et al. (2003) used a similar argument in the context of international finance to explain the strong home bias of international equity portfolios.

Before March 2005, a company's index weight in the S&P 500 was based purely on its total market capitalization of common shares outstanding. According to Figure 1, index-tracking funds have to buy approximately every tenth share outstanding for each stock included in the S&P 500. Keeping the demand from index funds almost constant across S&P 500 inclusions, cross-sectional variation in control ownership creates an imbalance between demand and supply. Demand for a company's stock with large control ownership stakes must be satisfied, ceteris paribus, with a smaller fraction of publicly available shares. Therefore, we would expect a stronger price pressure effect.

Hypothesis 1 *Firms with a larger fraction of control ownership experience a relatively stronger price reaction upon S&P 500 inclusion.*

The second supply proxy is a stock's previous membership in Standard & Poor's mid-cap S&P 400 index. There are two main options for a stock prior to its inclusion in the S&P 500: either it was previously listed on the S&P 400, or it was entirely outside of the S&P universe.[6] The difference between these options is that the former already has index-based capital invested in the stock. Thus, if a stock moves from the S&P 400 to the S&P 500, all funds replicating the S&P 400 intend to sell their shares exactly when the S&P 500-tracking funds submit their buying orders. In my sample, 58% of stocks included in the S&P 500 were previously listed on the S&P 400.

Since the S&P 400 is less popular among index-tracking funds, the stock supply created in this way may not entirely offset demand pressure from S&P 500-linked capital. Standard & Poor's estimate of capital replicating the S&P 400 is 5.9% of outstanding shares in 2004 and 7.3% in 2014, which is approximately half the S&P 500-linked capital. However, it may at least partially satisfy demand such that the price pressure effect of S&P 500 inclusions is mitigated for stocks previously listed on the S&P 400.

Hypothesis 2 *Stocks previously listed on Standard & Poor's mid-cap S&P 400 index experience a relatively smaller price reaction upon S&P 500 inclusion.*

[6] As a last option, a stock could also be listed on the small-cap S&P 600 index prior to S&P 500 inclusion. However, there are only four stocks in this paper's sample where this is the case. I treat these stocks as if they were part of the S&P 400.

On March 1, 2004, Standard & Poor's announced that it would change its computation methodology for index weights from a pure market capitalization-based index to a float-adjusted, market capitalization-weighted index. Float-adjustment thus refers to an index methodology that only considers shares available to the public, that is, when market capitalization computations for each stock exclude all shares held by controlling groups. In doing so, Standard & Poor's followed its main competitors: Russell, which was float-adjusted at its inception, and MSCI, which adjusted index weights already in 2001/2002. The change was implemented in two steps with the aim of mitigating price distortions in significantly affected securities due to index fund rebalancing. The index switched to half float-adjustment on March 18, 2005 and finally to full float-adjustment on September 16, 2005.

While this change to the index methodology leaves Hypothesis 2 unaltered, it provides a quasi-natural experiment for Hypothesis 1. After the free-float adjustment, a stock's index weight is mechanically related to a firm's control ownership and, therefore, no longer statistically independent. Stocks in low supply, as measured by high control ownership, are now confronted with relatively smaller demand shocks upon inclusion. This mitigates the imbalance between demand and supply around S&P 500 inclusions as suggested in Hypothesis 1, providing an opportunity to estimate a differential impact. The model predicts a diminishing price pressure effect of control ownership compared to the index weight scheme in place before the reform.

Hypothesis 3 *Compared to pure market capitalization-based index weights, the price impact of control ownership declined after the implementation of float-adjusted index weights in September 2005.*

3 Data

This paper analyzes a sample of firms included in the S&P 500 between January 1989 and December 2014. The study is limited to this period because it was difficult to ascertain reliable corporate ownership information for earlier periods. I obtain ownership information from proxy filings, which are electronically accessible via LexisNexis Academic from 1989 until 1996, and the SEC's EDGAR database post 1994. Standard & Poor's added 647 companies to the S&P 500 throughout this period.[7]

As suggested by previous research, I exclude 162 stocks that were involved in mergers, spin-offs, or other corporate restructurings at the time of their S&P 500 inclusion.[8] This leaves a clean sample of 485 stock newly added to the S&P 500. A few companies have no proxy filing with ownership information available before the inclusion announcement. This reduces the final sample size to 459 observations. Of these, 284 occurred before Standard and Poor's adjustment of index weights in March 2005 and 175 after the implementation in September 2005.[9]

According to Standard & Poor's announcement policy, two dates are of major importance: the announcement date of the index change and the date of effective index inclusion. Standard & Poor's informs the public about new index constituents in a press release after market closure. Therefore, I define announcement dates (AD) as the following trading day when the market incorporates this information into prices.

[7] I focus on index inclusions rather than exclusions: stocks excluded from the S&P 500 lose large amounts of market value in a short period of time implying that the companies themselves are going through a period of major changes. Furthermore, most adjustments of index constituent occur because an S&P 500 firm merges with another company. Afterwards, these stocks are not publicly traded leading to a significant decrease in the number of observations.

[8] I follow Chen et al. (2004)'s sample of S&P 500 index inclusions until 2001 and browse Standard & Poor's announcements for keywords "merger" and "spin-off" during the second half of the sample to determine whether the firms were under corporate restructuring.

[9] I dropped eight index inclusions occurring during the interim period between the half and full adjustment of index weights in 2005.

The new constituent is included in the S&P 500 within several days prior to market opening. The initial press release also contains this date. Index funds replicating the S&P 500 aim to minimize tracking errors by rebalancing their portfolios towards the closing of the previous trading day. The effective inclusion date (ED) corresponds to the day of index funds' portfolio rebalancing.

Figure 2 plots the number of trading days between announcement and effective inclusion. The sample contains 79 inclusions for which AD and ED fall on the same day. While 25 observations have more than 10 trading days between AD and ED, most index adjustments take place within a relatively short time frame.[10] Overall, the distribution has a mean of 3.74 trading days with a standard deviation of 5.44.

I follow the existing literature by defining abnormal returns (AR) as a stock's daily excess return over the value-weighted CRSP market return. Returns over longer horizons sum daily abnormal returns to simple cumulative abnormal returns (CAR), as Fama (1998) suggests. I will consider alternative abnormal return specifications, like the CAPM or the Fama-French three-factor model, only in a robustness check because previous research demonstrates that a stock's inclusion in a major index significantly transforms its beta.[11] Using these alternative return specifications does not affect this study's results materially.

For comparability with previous research, Figure 3 illustrates the average S&P 500 inclusion effect for this paper's entire sample. The graph plots the mean CARs and

[10]As already mentioned, most inclusions occur due to the merger or takeover of a company listed on the S&P 500. Some of these acquisitions depend on final regulatory approval, leading to relatively large gaps between AD and ED.

[11]Vijh (1994) documents an increase in beta relative to a broad stock market benchmark after it is added to the S&P 500. Barberis et al. (2005) refine the analysis by identifying an increased correlation with S&P 500 stocks as a cause for the result. In unreported estimations, I test whether the cross-sectional model of this paper has any explanatory power for Barberis et al. (2005)'s results related to beta, though found no meaningful correlation.

abnormal trading volumes in event-time. The graph is sorted around the effective inclusion date. Stock prices show a steep run-up prior to effective index inclusion. After inclusion, this effect only partially reverts, which is consistent with findings of most previous studies. The strong synchronization of index funds' portfolio adjustments shows in the trading volume. On the effective inclusion date, abnormal trading volume sharply peaks at 17 (median 15) times the regular trading volume.

The focus of this study, however, is the price effect of cross-sectional variations in stock supply. As mentioned in the previous section, stock supply is measured either by the fraction of outstanding shares owned by corporate control holders, or by a previous membership in the S&P 400. The precise definition of control ownership follows Standard & Poor's *S&P Dow Jones Indices: Float Adjustment Methodologies* (2012), which considers, among other things, positions by the following shareholders: officers and directors, corporate cross-holdings, holders of unlisted share classes, government entities, ESOPs, Employee and Family trusts, and individual holdings of more than 5%.[12] Maintaining Standard & Poor's definition helps pin down the vaguely formulated concept of control ownership. Furthermore, it allows the sharpest test design to evaluate changes to the index inclusion effect through the switch to float-adjusted index weights.

Table 1 reports detailed summary statistics for control ownership. Panel A summarizes the sample before the float adjustment of index weights in March 2005 and Panel B the reformed sample after September 2005. The mean decreased from 12.4%

[12]Importantly, 5% blocks of financial institutions *are not* considered a part of control ownership. This group of investors may behave in much more opportunistic ways, e.g. by building a block of stocks likely to get included into the S&P 500 and selling those shares after inclusion announcement. In contrast, unlisted share classes are part of control ownership because they are accounted for in index weights due to their convertibility into common shares, which would otherwise lead to sudden changes in outstanding shares upon conversion.

in the early sample to 9.7%.[13] For illustration and a portfolio analysis, I also use a discrete distinction between high and low control ownership firms. I use a cut-off of 10%, which gives high ownership firms a 39% share in the early sample and 28% in the later sample. Table 1 also shows separate statistics for the main building blocks of control ownership: insider holdings, dual share classes, and external blockholdings. Insider holdings account for the lion's share. This replicates Fahlenbrach and Stulz (2009)'s demonstration of a declining trend through a decrease from 8.6% to 6.3%. Additionally, the frequency of external blockholdings decreases.

In cross-sectional regressions, I account for two additional stock-specific control variables. First, if a stock is more difficult to hedge, arbitrage strategies are more risky reducing the price-stabilizing activity of arbitrageurs, as suggested by Wurgler and Zhuravskaya (2002). Their measure of arbitrage risk is based on a stock's idiosyncratic component estimated in pre-event CAPM regressions. Stocks with high control ownership could be precisely those with high arbitrage risk. To ensure that the findings in this paper differ from Wurgler and Zhuravskaya (2002)'s, it is important to control for arbitrage risk. Second, less liquid stocks may experience stronger price pressure around index inclusions. This could again be positively correlated with stock supply. I proxy stock liquidity with Amihud (2002)'s illiquidity measure computed as daily absolute returns divided by dollar trading volume ($\times 10^6$) averaged in a pre-event window. Due to tremendous improvements in stock liquidity over time, I only include Amihud's illiquidity measure jointly with year fixed-effects to actually capture cross-sectional variations.

[13] I attribute the lower fraction of control ownership in the later sample to a general decline in ownership measures. There is no reason to believe that Standard & Poor's began discarding high control ownership firms in 2005, after having fixed the imbalance between stock demand and supply through float-adjusted index weights.

Table 2 highlights differences in characteristics of high and low control ownership stocks, or whether a stock was previously listed on the S&P 400. For each supply measure, I test for differences in the other respective supply measure as well as for arbitrage risk, stock illiquidity, beta, leverage, and accounting profitability. High control ownership stocks are more likely to become S&P 500 index constituents without previous listing in the S&P 400. In the sample before 2005, high control ownership stocks also tend to have higher arbitrage risk. Companies previously listed on the S&P 400 are on average more profitable and actually less liquid in the sample after 2005.

4 Price pressure of S&P 500 inclusions

In this section, I conduct cross-sectional OLS regressions of abnormal returns to analyze the price pressure component of S&P 500 index inclusions. The first set of results focuses on the early sample before the float-adjustment in 2005. Section 4.2 covers the differential effects with respect to the index weight reform.

4.1 The cross-section of returns before the reform

To capture the entire price pressure effect of S&P 500 inclusions, I begin the analysis with cumulative abnormal returns, aggregating excess returns from the announcement date until effective index inclusion. As shown in Figure 2, announcements and effective inclusions do not necessarily fall on the same day. Table 3 reports the regression output.

Hypothesis 1 predicts a positive relationship between the size of control ownership and S&P 500 inclusion returns. Column 1 shows the most basic model that includes only control ownership on the right-hand side. A firm with fully dispersed shareholdings experiences average CARs of 5.5%. If control ownership increases by 1%, the cumulative abnormal return rises by additional 16.8bp. An increase of 13.8%, which represents one standard deviation in control ownership, translates accordingly to an additional return of 2.32%. This estimate is statistically significant and economically meaningful.

According to Hypothesis 2, the S&P 500 inclusion return is smaller if a stock was previously listed on the S&P 400. Column 2 reports a model that includes only the S&P 400 indicator. The average inclusion return for stocks outside the S&P universe is 9.7%. Previous membership in an S&P small-cap index mitigates the effect by 3.7%, which is also statistically significant.

Columns 3-5 contain alternative model specifications. Column 3 includes both supply proxies simultaneously. Due to a positive correlation, the estimates of both measures are slightly smaller, but remain statistically significant. Year fixed-effects are added in column 4. While slightly decreasing the effect of control ownership, it amplifies the impact of previous S&P 400 membership. This indicates time-series variation in the latter measure. Specification 5 includes the additional stock-specific control variables for arbitrage risk and stock illiquidity, where only the former has significant predictive power.[14] Including the full set of control variables, both supply proxies remain statistically significant with point estimates of 11.6bp and 5.8%, respectively.

Separating the effects of announcement and effective inclusion dates could provide

[14] Following the panel framework proposed in Hegde and McDermott (2003), I also test stock liquidity as a dependent variable. While I am able to replicate their finding that a stock's average liquidity improves after S&P 500 inclusion, there is no significant evidence in the cross-section of supply proxies. Results are reported in Table A-2 of the internet appendix.

meaningful results because they are different in their very nature: the former is an information event, while the latter is a mechanical trading event characterized by significant portfolio adjustments. Of particular interest is the extent to which markets can anticipate price pressure, which is ultimately triggered by an effective S&P 500 inclusion. Table 4 reports separate regressions of abnormal returns for the two dates.

Panel A covers the cross-section of announcement date returns. The abnormal stock return for a widely held firm is approximately 4%. Including the full set of control variables in column 3, I estimate a 5.1bp increase in return per 1% increase in control ownership. To separate effects in a more stringent way, Columns 4 and 5 exclude all observations for which announcements and effective inclusions fall on the same day. The effect of control ownership becomes even smaller, but remains statistically significant, suggesting that the market anticipates a larger inclusion effect for closely held stocks, at least to some extent. A similar conclusion can be drawn from stocks that are previous constituents of the S&P 400. Their announcement return is an average of 0.9% lower, though statistical support for the result is weaker. Interestingly, the coefficient for the arbitrage risk measure indicates that it does not play any role on the announcement date, which is consistent with Wurgler and Zhuravskaya (2002)'s interpretation. Stock illiquidity, however, is a significant predictor for announcement date returns.

Panel B of Table 4 looks instead at the cross-section of effective inclusion returns. The first striking difference is that the estimates for average abnormal returns are much smaller, captured by the intercept in specifications without year fixed-effects. Excluding observations with equal announcement and effective inclusion dates and controlling for control ownership, as in column 9, even makes the constant statistically insignificant. This suggests that the market is fairly efficient at anticipating the average price effect prior to effective inclusion.

Cross-sectional stock characteristics, on the other hand, seem to still carry valuable information. Apart from stock illiquidity, all cross-sectional predictors are statistically significant and economically larger than on the announcement day. For example, the coefficients for control ownership are about one third larger in all model specifications. Stocks previously listed on the S&P 400 experience a 3% smaller return on that date. Additionally, it is on the effective inclusion date that arbitrage risk gains its predictive power. These results are in line with a limits-to-arbitrage interpretation because the expected price pressure effects are partially rather than fully anticipated.[15]

4.2 The effect of the 2005 index weight reform

Standard & Poor's finalized the implementation of float-adjusted index weights on September 16, 2005. If the predictive power of control ownership is indeed related to demand pressure, its price impact should diminish or even disappear in a subsequent sample of index inclusions. I first continue with a separate analysis of cumulative abnormal returns in a sample of S&P 500 inclusions after September 2005. As in Table 3, cumulative abnormal returns aggregate excess returns from announcement to effective index inclusion. Table 5 columns 1 and 2 report these results. As predicted by Hypothesis 3, the estimated coefficient for control ownership is now statistically insignificant. On the other hand, the coefficient for the indicator of previous S&P 400 constituents remains statistically significant with a point estimate of -5.5%.

A more direct approach to address Hypothesis 3 is to test whether the impact of

[15]I implement cross-sectional tests of this section with three alternative model specifications: abnormal returns based on the market model or Fama-French model, a log transformation of control ownership, and a sub-sample excluding the dot.com bubble or high-tech stocks. The results hold and appear in Tables A-1, A-3, and A-4 in the internet appendix.

control ownership differs statistically from prior to the index-weight reform. To do so, I estimate the following differential impact estimator that covers the entire sample of S&P 500 inclusions from 1989 to 2014:

$$(C)AR_i = \alpha + \gamma \times \mathbb{1}_{post} \times ownership_i + \beta_1 \times ownership_i + \beta_2 \times \mathbb{1}_{post} + \beta X_i + \epsilon_i$$

The coefficient of interest is γ, which captures the impact of control ownership interacted with a dummy variable indicating the period after the reform. It can be interpreted as the differential price change in basis points of a 1% increase in control ownership compared to the period before the reform. The regression results for the differential impact estimation appear in columns 3-8 of Table 5. Columns 3 and 4 present announcement date returns, columns 5 and 6 effective inclusion returns, and columns 7 and 8 cumulative abnormal returns from announcement to effective inclusion.

As previously discussed, I estimate that a 1% increase in control ownership led to a 5.5bp increase in abnormal announcement date returns prior to float-adjustment. This estimate is 5.1bp smaller after the reform, which is also statistically significant. Following this interpretation, we can draw similar conclusions for the other relevant event dates. The effect decreases by 11.7bp at effective inclusion while it was 7.8bp before the reform, and the cumulative effect decreases by 14.9bp, from 13.5bp before the reform. These findings remain virtually unchanged after including year fixed-effects in each specification, reported in the even-numbered columns of Table 5. All results suggest that the pricing impact of control ownership significantly decreased after the reform.

Figure 4 graphically summarizes previous results for the control ownership dimension. This time, I divide all stocks included in the S&P 500 according to a binary distinction between high and low control ownership stocks. The threshold is set at 10% of shares outstanding. The graph plots mean cumulative abnormal returns in event-time for each group before and after the float-adjustment.

5 Persistence in the S&P 500 inclusion effect

The literature contains a debate related to the long-run effects of S&P 500 inclusions on stock prices. This section takes a closer look at the persistence of the effect.

5.1 Cross-sectional OLS regressions

I begin with a cross-sectional analysis of returns immediately after effective inclusion to test for a potential reversal in the inclusion effect. Therefore, I compute CARs over 10 subsequent trading days and provide the results in Table 6. Consistent with the previous literature, I find an average reversal of about 2%, confirming the existence of price pressure. Despite statistical significance, the effect is not large enough to balance the overall magnitude of the inclusion effect reported in Table 3, as documented in the existing literature. In addition, I find that the cross-sectional predictors are statistically insignificant and rather small in economic magnitude. These results indicate longer-lasting price distortions caused by the price pressure of index inclusions.

Similar conclusions can be drawn from cross-sectional regressions of the long-run cumulative abnormal returns of the inclusion effect. These return measures cover the period from inclusion announcement until 20 or 60 days after effective inclusion. Both cross-sectional supply proxies continue to have predictive power 20 trading days after effective inclusion. A 1% increase in control ownership leads to 13.3bp higher return, and previous S&P 400 listings imply 4.6% lower returns. After 60 days, the estimated magnitude of control ownership becomes slightly larger, while the S&P 400 indicator becomes smaller and statistically insignificant.

These results highlight the longer-lasting explanatory power of stock supply proxies for abnormal returns. It suggests that the persistence in the S&P 500 inclusion effect is at least partially related to the demand and supply of a stock. The evidence supports a downward-sloping demand interpretation of stocks for the long-run component of the inclusion effect, separating it from alternative explanations in the literature.

5.2 Panel approach to event study

Cumulative abnormal return models have been criticized of leading to biased test statistics, particularly when returns are compounded over a longer horizon.[16] I will address this issue with calendar-time panel regressions that explicitly take time-varying structures of abnormal stock returns into account. This enables me to adjust test statistics in a natural way.

I construct a panel of daily returns for all stocks listed in the S&P 500 since January 1989. Newly added stocks enter the panel 100 days prior to Standard & Poor's inclusion announcement. This section analyzes the cross-sectional dimensions control ownership and previous S&P 400 membership separately. For each test, I construct two portfolios investing in new additions to the S&P 500: one with control ownership less than 10% (previous S&P 400 constituent) and one with control ownership larger than 10% (no S&P 400 constituent).[17] If the latter portfolios significantly outperform

[16]The formal reason is concerns about serial correlations in the return measure caused by cross-sectionally dependent abnormal returns of contemporaneous events. Mitchell and Stafford (2000) and Dahlquist and Jong (2008) provide a more detailed discussion of this topic in the context of IPO underpricing.

[17]The separation threshold at 10% of control ownership may seem arbitrary, but this number

over an extended period, it provides additional evidence for the persistence of effects suggested by Hypotheses 1 and 2.

Let me briefly explain how I implement the test for high and low control ownership stocks. The application to the S&P 400 is then straightforward. I estimate the following panel regression model:

$$AR_{it} = \alpha + \beta_{1,x}\omega_i \mathbb{1}_{it,x} + \beta_{2,x}\omega_i \mathbb{1}_{it,x|ownership>10\%} + \epsilon_{it}$$

where AR_{it} is the excess return of stock i at date t, $\mathbb{1}_{it,x}$ indicates the holding period of a new S&P 500 stock (i.e., switches to one on the announcement day of the inclusion of stock i and remains so for an investment horizon of x trading days after effective inclusion), and $\mathbb{1}_{it,x|ownership>10\%}$ adds the additional qualifier that control ownership for the stock is larger than 10%. ω_i is an adjustment factor that equals 1 over the number of trading days a portfolio invests in stock i. This adjustment factor makes coefficients from estimations with different holding periods x comparable because it transforms the interpretation from average daily abnormal returns invested into cumulative abnormal returns.[18]

The coefficient of interest is $\beta_{2,x}$ since it captures the relative performance of a portfolio of stocks with high control ownership compared to a portfolio of stocks with low control ownership. Standard errors of the estimation model are clustered in two dimensions: by date and by the interaction of 3 digit SIC codes with year fixed-effects. I conduct separate regressions for the market-cap weighted sample of the S&P 500

balances the trade-off between a meaningful size of control ownership and the number of observations in each group.

[18]I exclude index inclusions with more than 10 trading days between announcement and effective inclusion from the estimation because these stocks take an over-representative statistical importance, even in estimations of longer holding periods.

before March 2005 and the float-adjusted sample thereafter.

Cumulative abnormal return estimates of the control ownership portfolios are reported for various holding periods between +0 and +100 trading days in Table 7. Holding the high control ownership portfolio from inclusion announcement until effective inclusion in the sample before 2005 yields a cumulative abnormal return of 8.2%. The portfolio of low control ownership firms increases by only 5.4% and the difference of 2.8% is statistically significant. Shifting our focus to the persistence of the inclusion effect, performance differences between the portfolios remain marginally significant until 60 days after effective inclusion. Furthermore, while the out-performance of the low control ownership portfolio with respect to the CRSP market loses its statistical significance within 60 days, the effect in the other portfolio remains significant even 100 days later. These results broadly confirm that the persistence in the cross-sectional effect in this study is equally strong as the average inclusion effect documented in the literature.

I estimate the same model in the sample after September 2005. In line with Hypothesis 3, there is no longer any measurable difference between the two portfolios after the float-adjustment of the index. Interestingly, the average inclusion effect reverts much quicker. It becomes insignificant after seven days for small control ownership firms and after nine days for high control ownership firms.

Motivated by this finding, I also test the persistence of the well-known average inclusion effect in a calendar-time portfolio after 2005. The results are reported in the last column of Table 7. The price pressure of index inclusions until effective inclusion is about 3.5%. On subsequent trading days, cumulative abnormal return estimates quickly revert back to zero. Any statistical significance of the inclusion effect vanishes after 10 trading days.[19]

Results for portfolios based on a separation of previous S&P 400 listings are reported in Table 8. As predicted by hypothesis 2, stocks previously listed on the S&P 400 have an 2.1% smaller inclusion effect in the sample before 2005. This difference remains statistically significant for more than 20 trading days after effective index inclusion. In contrast to control ownership results, this difference is also statistically significant in the sample after 2005 confirming the previously discussed placebo effect. In fact, almost the entire average inclusion effect after 2005 is driven by stocks not previously listed on the S&P 400. Their effect is significant for more than 10 trading days after effective inclusion, while the inclusion effect for S&P 400 stocks vanishes after 3 trading days.

6 Supply from share issuance and short selling

This paper focuses on a definition of stock supply that is based on shareholders' willingness to offer their shares in secondary markets. In that sense, I assume that the number of shares outstanding remains constant around S&P 500 inclusions. Yet, the number of shares outstanding may be altered: either through the issuing entity itself, who could actively manage treasury shares and initiate SEOs, or through speculators and arbitrageurs, who decide to short-sell the stock. In this section, I briefly want to discuss how these two aspects relate to the main findings of the paper.

To exploit the price pressure on their stock during an index inclusion, issuing entities may have the incentive to sell additional shares to the public. Massa et al.

[19] The float-adjustment of index weights eliminated incidences of extreme price pressure, which offers an argument in support of smaller inclusion effects. Most likely, however, this provides only a partial explanation of such a structural change. Somehow, financial markets have learned to cope with the S&P 500 inclusion effect more efficiently.

(2005) report evidence that firms issue more shares in years subsequent to their S&P 500 inclusion. I searched for increases in the number of shares outstanding in a more narrow time frame that would be relevant for this paper. In unreported results, I did not find evidence for such abnormal share issuance around S&P 500 index inclusion. Thus, the issuance of new shares does not materially affect the supply proxies proposed in this paper.

Short positions in stocks are predominantly taken by speculators and arbitrageurs. Counting on (partially) temporary price pressure effects, speculators may short a stock new to the S&P 500 just to repurchase it after index funds have rebalanced their portfolios. Alternatively, arbitrageurs may short newly added S&P 500 stocks as part of more general portfolio strategies. Either way, short-selling could have an impact on effective stock supply.

Based on Compustat's monthly recordings of short interest data, I study the short-selling activity around S&P 500 inclusions in event-time. Like in previous exercises, I divide stocks into samples with high and low control ownership. Figure 5 highlights that there is indeed a strong reaction in short interest for both groups. In the month of Standard & Poor's inclusion announcement, which is labeled as month 0 in Figure 5, the short interest of a stock increases on average by more than 0.5% of shares outstanding. This represents a significant shift compared to a mean of 2% in the sample prior to 2005 and 4.5% in the sample after 2005. Figure 5 also shows that the increase in short interest appears to be of permanent nature rather than a short-lived effect, which I would have expected for shorting strategies with speculative motives.

A visual inspection of the sample before 2005 indicates that high control ownership stocks face a stronger increase in short interest, yet the difference does not seem striking. I further examine the cross-sectional evidence in panel regressions. To distinguish between immediate and longer-lasting effects, I construct two panels: one with only two monthly observations before and after each inclusion announcement and a second one that extends the sample up to 6 months after inclusion. The coefficients of interest are the interaction terms of control ownership and previous S&P 400 membership with a post-inclusion dummy capturing how the increase in short interest correlates with the cross-sectional variation in supply proxies. The regression specifications control for firm-fixed effects and event-time. Results are reported in Table 9.

Focusing first on the sample prior to 2005, I find that control ownership significantly predicts the change in short interest. A 1% increase in control ownership leads to an additional increase of 1.5bp in short interest after index inclusion. The effect remains statistically significant even after including six post inclusion observations in column 3. Previous S&P 400 membership is statistically insignificant in the early sample.

Looking instead at the sample period after 2005, control ownership loses its predictive power. The estimate for previous S&P 400 membership, however, becomes statistically significant with the expected negative sign. S&P 400 stocks face less price pressure through the index inclusion, and therefore the short interest increases by 1 percentage points less.

The evidence on short interest suggests that there is a relationship with the supply proxies proposed in this paper. Yet, all significant coefficients point into the direction that short interest helps to release price pressure. Speculators and arbitrageurs create additional shares when stock supply from shareholders is low. Therefore, the documented change in short interest goes against the results of this paper, making their evidence only stronger.

Surprisingly, all reported evidence supports the view that the change in short interest is relatively permanent, which I would attribute to general arbitrage activity rather than speculation against the price pressure of a stock inclusion. Such speculative activity may nevertheless take place at a higher frequency that is not captured through monthly observations.

7 Conclusion

This paper proposes a new cross-sectional test to the S&P 500 inclusion effect. Explicitly taking two distinct proxies of stock supply into account, I find that price pressure is mitigated if a stock has favorable supply characteristics. Standard & Poor's float-adjustment of index weights in 2005 allows for a difference test in one of the measures, giving it a causal interpretation. This result strengthens my supply interpretation and lends additional support to a demand-side explanation of the inclusion effect that helps to differentiate it from alternative propositions in the literature.

Interestingly, I document a weaker price pressure of S&P 500 inclusions in most recent years, despite increasing amounts of capital replicating the index. According to my results at the monthly frequency, more aggressive short selling does not explain this finding. Keeping the price pressure of changes in index constituents under control is crucial in making a further expansion of index-linked investment strategies viable. Otherwise, it may impose a significant cost on passive investors, limiting the industry's growth potential. Future research may help identify the causal factors leading to this decrease in the inclusion effect.

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Figure 1: Time-varying volume of S&P 500 index tracking

This figure shows the fraction of shares held by the S&P 500-tracking fund industry over time. At the end of each calendar year, Standard & Poor's conducts a survey to estimate the amount of capital indexed to the S&P 500. These numbers include exchange traded funds (ETFs) that are directly linked to the S&P 500. However, it does not include capital that tries to replicate the S&P 500 via derivatives or fixed-income instruments. The estimate is divided by the aggregate market capitalization of the entire S&P 500 at the end of the year, which is provided by Standard & Poor's.

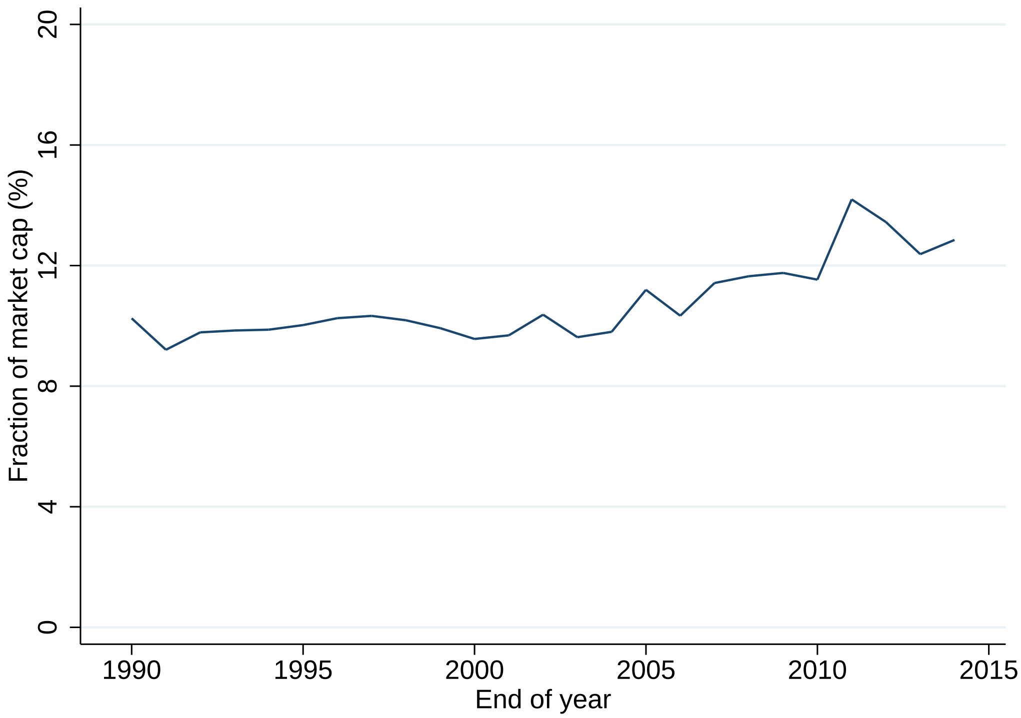

Figure 2: Time between announcement and effective S&P 500 inclusion

This figure plots the frequency distribution of the number of trading days that lie in between the official announcement of an S&P 500 inclusion and the effective index inclusion. Announcement date refers to the first trading day after the information was released. Effective inclusion date refers to the trading day before the stock is listed for the first time in the S&P 500.

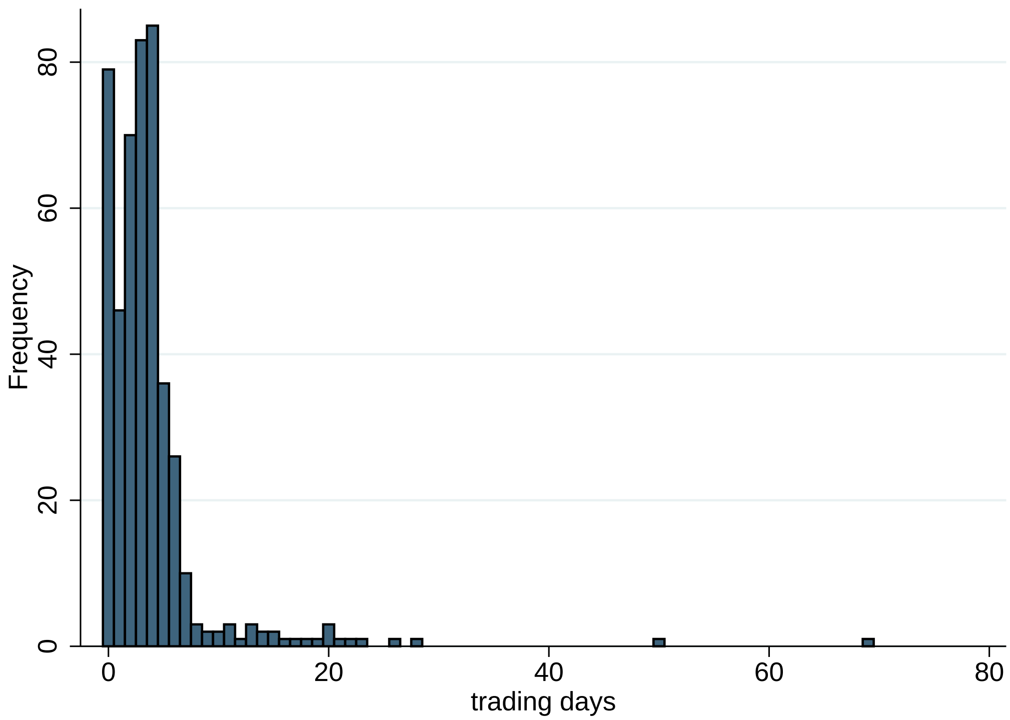

Figure 3: Average S&P 500 inclusion effect

This figure plots the average S&P 500 inclusion effect for the sample from January 1989 until December 2014. It covers the event window 20 days prior to effective index inclusion until 60 days thereafter. The mean cumulative abnormal return over the CRSP value-weighted market return is represented as a solid line and plotted on the left axis. The mean abnormal trading volume is shown by the bars and scaled on the right axis. Abnormal trading volume is defined as trading volume divided by the mean trading volume 130 to 30 days before the inclusion.

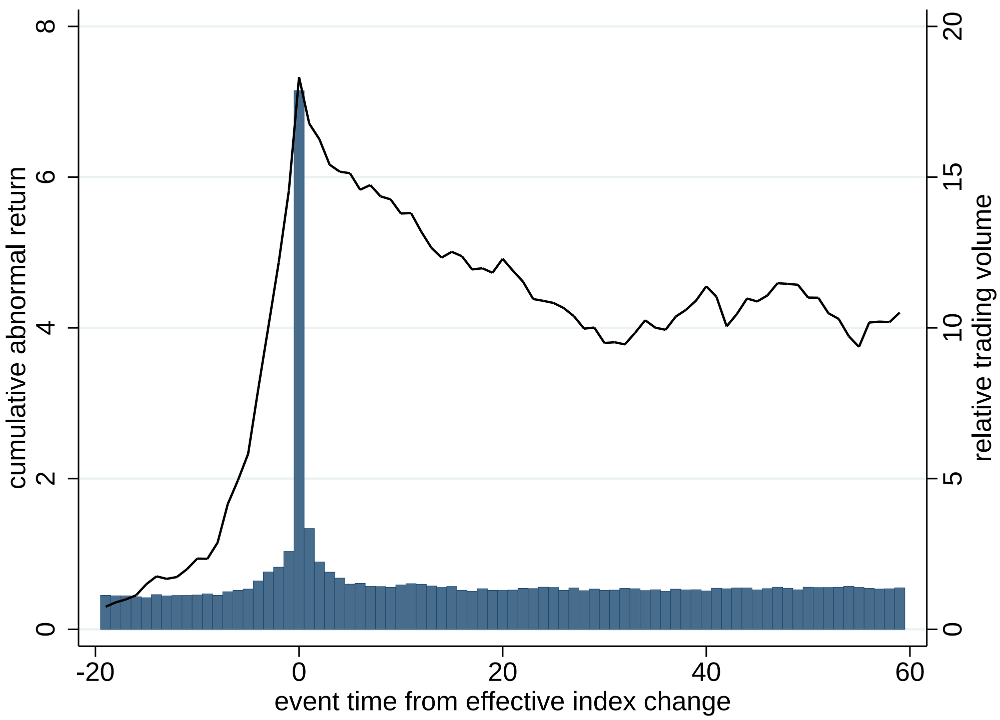

Figure 4: S&P 500 inclusions and control ownership

This figure plots cumulative abnormal returns of S&P 500 index inclusions from 20 days before effective index inclusion until 60 days after. Observations are split into two groups depending on whether the control ownership of the company was larger or smaller than 10%. The graph shows the respective mean for each group. The left-hand side considers the sample until March 2005 before the free-float index weight adjustment. The right-hand side covers the period after September 2005.

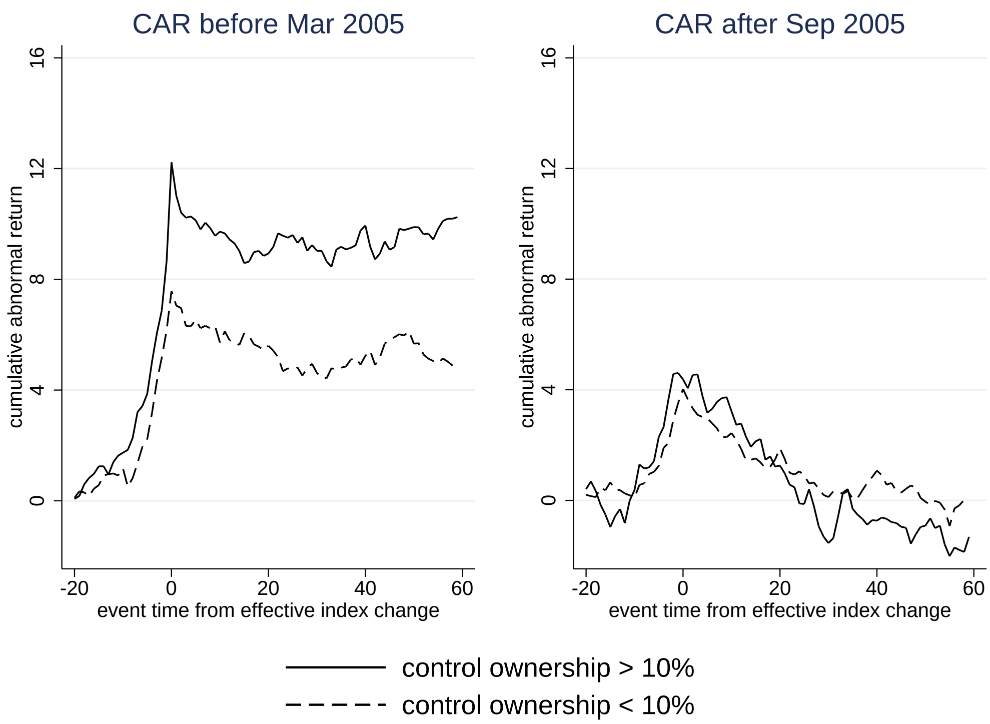

Figure 5: Short interest around index inclusions

This figure plots how short interest evolves around stock inclusions in the S&P 500. Short interest is defined as number of shorted stocks divided by shares outstanding and the reported statistics are taken from a balanced panel. The black (grey) graphs represent the sample of stocks with control ownership larger 10% (smaller 10%). Solid lines are computed as sample means and dashed lines refer to the median. The left-hand side considers the sample until March 2005 before the free-float index weight adjustment. The right-hand side covers the period after September 2005.

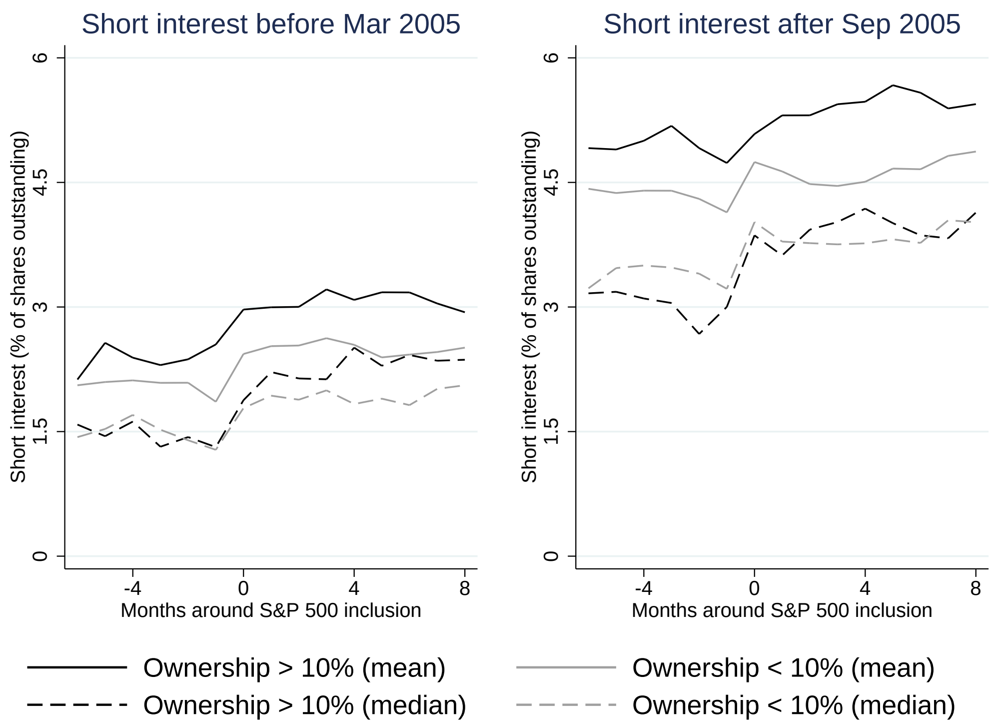

Table 1: Summary statistics for control ownership

This table reports information about the distribution of control ownership for companies before their S&P 500 index inclusion. Control ownership follows Standard & Poor's definition and includes shares owned by officers and directors, corporate cross-holdings, unlisted classes of common shares, government holdings, ESOPs, and individual holdings larger than 5% (see *S&P Dow Jones Indices: Float Adjustment Methodologies* (2012)). Ownership information is manually collected from SEC regulatory filings Def 14a via SEC's EDGAR database and Lexis-Nexis academic. Panel A lists observations before March 2005 and Panel B lists observations after September 2005. Standard & Poor's adjusted its policy from a market capitalization-weighted index to a float-adjusted market capitalization-weighted index over the period from March 2005 until September 2005. The table separately lists statistics conditional on control ownership being larger or smaller than 10%. It also reports the three main building blocks comprising the previously defined control ownership measure: insider holdings, dual share classes, and external control holdings, which aggregates government, corporate, and individual control holdings. Reported observations are conditional on being larger than zero.

Panel A: stock ownership before 2005						
	mean	median	sd	min	max	N
Control ownership	12.40	7.20	13.80	0.13	81.80	284
Ownership smaller 10%	3.91	3.10	2.71	0.13	9.92	172
Ownership larger 10%	25.42	21.50	13.83	10.10	81.80	112
Insider holdings	8.64	4.25	10.01	0.00	45.36	284
Dual class	15.67	8.23	18.18	0.06	65.72	18
External holdings	17.85	13.50	12.33	3.99	49.13	44
Panel B: stock ownership after 2005						
	mean	median	sd	min	max	N
Control ownership	9.69	3.45	13.36	0.00	54.50	175
Ownership smaller 10%	2.79	2.30	2.26	0.00	9.68	126
Ownership larger 10%	27.44	25.00	13.70	10.70	54.50	49
Insider holdings	6.33	2.90	8.65	0.00	52.10	175
Dual class	24.97	22.46	13.07	8.10	40.92	9
External holdings	22.75	15.65	17.90	5.10	52.30	16

Table 2: Mean differences in company characteristics

This table compares descriptive statistics of companies included in the S&P 500. I split the sample according to two dimensions: Panel A uses *Control ownership* as described in Table 1 (threshold 10%) and Panel B uses *S&P 400*, which indicates whether or not the stock was previously listed on the S&P 400. Since the S&P 400 was only introduced in 1991, Panel B excludes observations prior to 1991. I report separate t-tests for the sample before the float-adjustment of the S&P 500 in March 2005 and the sample after September 2005. *Arbitrage risk* follows the definition in Wurgler and Zhuravskaya (2002) and it is measured as the residual variance of the excess stock return that cannot be explained by the excess market return in the pre-announcement period (-365,-20). *Amihud ILLIQ* follows Amihud (2002) as the average of the daily absolute stock return divided by the dollar trading volume in the pre-announcement period (-365,-20). *Beta* is estimated through CAPM regressions using 1 year of pre-event data. *Leverage* is defined as total liabilities over total assets. The panel considers two accounting profitability measures: *EBITDA/Assets* and *Income/Assets*. All accounting information is taken from COMPUSTAT according to the latest fiscal year prior to index inclusion.

Panel A: Split by control ownership

	Sample before 2005				*Sample after 2005*			
	mean_{low}	mean_{high}	difference	t-stat	mean_{low}	mean_{high}	difference	t-stat
S&P 400	0.726	0.612	0.114*	1.841	0.619	0.408	0.211**	2.535
Arbitrage risk	0.661	0.861	-0.200**	-2.045	0.440	0.471	-0.031	-0.473
Amihud ILLIQ	0.161	0.189	-0.028	-0.853	0.025	0.027	-0.002	-0.548
beta	1.107	1.219	-0.112	-1.254	1.212	1.111	0.100	1.397
Leverage	0.565	0.579	-0.014	-0.439	0.537	0.496	0.041	0.960
EBITDA/Assets	0.155	0.160	-0.005	-0.346	0.171	0.182	-0.010	-0.515
N	172	112		284	126	49		175

Panel B: Split whether previously in S&P 400

	Sample before 2005				*Sample after 2005*			
	mean_{no}	mean_{yes}	difference	t-stat	mean_{no}	mean_{yes}	difference	t-stat
Control ownership	16.313	11.240	5.073**	2.402	13.304	6.857	6.447***	3.052
Arbitrage risk	0.886	0.790	0.096	0.739	0.413	0.477	-0.063	-1.127
Amihud ILLIQ	0.109	0.096	0.012	0.862	0.022	0.029	-0.007**	-2.574
beta	1.184	1.214	-0.029	-0.263	1.148	1.211	-0.064	-0.929
Leverage	0.573	0.559	0.014	0.394	0.566	0.494	0.072**	2.067
EBITDA/Assets	0.136	0.162	-0.026*	-1.678	0.149	0.192	-0.043***	-2.794
N	78	166		244	77	98		175

Table 3: Cross-section of cumulative abnormal inclusion returns

This table reports coefficients for cross-sectional regressions of cumulative abnormal returns around S&P 500 index inclusions. Cumulative abnormal returns aggregate excess returns over the value-weighted CRSP market return from inclusion announcement until effective inclusion. The table covers the sample period from January 1989 until the implementation of float-adjusted index weights began in March 2005. The following variables are used on the right-hand side: *Control ownership* follows the definition in Table 1. *S&P 400* is a dummy variable that indicates whether the stock was previously listed on the S&P 400 or S&P 600. *Arbitrage risk* is the residual variance of the stock that cannot be explained by the market return in the pre-announcement period (-365,-20). *Amihud ILLIQ* is the average of the daily absolute stock return divided by the dollar trading volume in the pre-announcement period (-365,-20). Standard errors are adjusted for heteroskedasticity and reported in parentheses.

	Sample before 2005				
	$CAR_{AD,ED}$	$CAR_{AD,ED}$	$CAR_{AD,ED}$	$CAR_{AD,ED}$	$CAR_{AD,ED}$
	(1)	(2)	(3)	(4)	(5)
Control ownership	0.168***		0.156***	0.129***	0.116***
	(0.047)		(0.045)	(0.044)	(0.043)
S&P 400		-3.711***	-3.256***	-6.197***	-5.782***
		(1.044)	(0.973)	(1.156)	(1.098)
Arbitrage risk					2.623***
					(0.785)
Amihud ILLIQ					0.041
					(1.320)
Constant	5.496***	9.772***	7.573***		
	(0.604)	(0.815)	(0.741)		
Observations	284	284	284	284	284
R-squared	0.07	0.04	0.10	0.23	0.26
Year FE	No	No	No	Yes	Yes
SE	robust	robust	robust	robust	robust

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

Table 4: Cross-section of abnormal announcement and effective inclusion returns

This table reports the coefficients for cross-sectional regressions of abnormal returns (AR) around S&P 500 index inclusions. The abnormal return is a stock's return over the value-weighted CRSP market return. Panel A shows results for the trading day after the announcement date of the index inclusion, which is the moment when the information arrives in the market. Panel B reports results for the day before the stock is effectively listed in the S&P 500 for the first time, and most index tracking funds reshuffle their portfolios. This table covers the sample period from January 1989 until the implementation of float-adjusted index weights began in March 2005. The following variables are on the right-hand side: *Control ownership* follows the definition in Table 1. *S&P 400* is a dummy variable that indicates whether the stock was previously listed on the S&P 400 or S&P 600. *Arbitrage risk* is the residual variance of the stock that cannot be explained by the market return in the pre-announcement period (-365,-20). *Amihud ILLIQ* is the average of the daily absolute stock return divided by the dollar trading volume in the pre-announcement period (-365,-20). Standard errors are adjusted for heteroskedasticity and reported in parentheses.

	Panel A: Announcement Returns					Panel B: Effective Inclusion Returns				
	Sample before 2005			*+ AD ≠ ED*		*Sample before 2005*			*+ AD ≠ ED*	
	AR_{AD}	AR_{AD}	AR_{AD}	AR_{AD}	AR_{AD}	AR_{ED}	AR_{ED}	AR_{ED}	AR_{ED}	AR_{ED}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control ownership	0.065***	0.063***	0.051**	0.044**	0.033*	0.091***	0.080***	0.073***	0.074**	0.055**
	(0.021)	(0.021)	(0.021)	(0.018)	(0.018)	(0.027)	(0.026)	(0.026)	(0.029)	(0.027)
S&P 400		-0.517	-1.482**		-0.871		-2.912***	-3.377***		-3.239***
		(0.535)	(0.651)		(0.631)		(0.582)	(0.717)		(0.643)
Arbitrage risk			0.135		0.035			1.417***		1.483***
			(0.447)		(0.466)			(0.473)		(0.510)
Amihud ILLIQ			2.343**		5.492**			0.516		-2.220
			(1.087)		(2.746)			(0.983)		(2.283)
Constant	3.994***	4.324***		4.052***		1.141***	2.998***		0.367	
	(0.292)	(0.488)		(0.322)		(0.345)	(0.445)		(0.387)	
Observations	284	284	284	217	217	284	284	284	217	217
R-squared	0.04	0.05	0.19	0.03	0.17	0.06	0.13	0.23	0.05	0.27
Year FE	No	No	Yes	No	Yes	No	No	Yes	No	Yes
SE	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust

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

Table 5: Reform to float-adjusted index weights

This table presents regression results that focus on the impact of the float-adjustment of index weights implemented between March and September 2005. Standard & Poor's definition of the float-adjustment factor follows the control ownership measure defined in Table 1. Compared to Table 4, Columns 1 and 2 report cross-sectional regressions of cumulative abnormal returns for float-adjusted index inclusions after 2005. Columns 3-8 show the results of a difference estimation of the impact of control ownership using the entire sample. *Ownership* × $Post_{2005}$ thus captures the differential impact of control ownership after the reform defined as the interaction of *control ownership* with a dummy variable indicating the period of float-adjusted index weights after September 2005. All other variables are defined as in Table 4. Columns 3 and 4 report abnormal announcement day returns and columns 5 and 6 cover effective inclusion returns. Column 7 and 8 use cumulative abnormal returns from announcement to effective inclusion. All even columns contain additional year fixed-effects. Standard errors are adjusted for heteroskedasticity and reported in parentheses.

	Sample after 2005		*Entire Sample*					
	CAR_{ED}	CAR_{ED}	AR_{AD}	AR_{AD}	AR_{ED}	AR_{ED}	CAR_{ED}	CAR_{ED}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ownership × $post_{2005}$			-0.051**	-0.049*	-0.117***	-0.122***	-0.149***	-0.147***
			(0.025)	(0.025)	(0.030)	(0.032)	(0.051)	(0.055)
Control ownership	-0.024	-0.030	0.055***	0.047**	0.078***	0.078***	0.135***	0.118***
	(0.028)	(0.031)	(0.020)	(0.021)	(0.025)	(0.026)	(0.041)	(0.044)
$Post_{2005}$			-0.900**		-0.503		-1.933***	
			(0.383)		(0.417)		(0.723)	
S&P 400	-5.394***	-5.814***	-1.449***	-2.120***	-2.231***	-2.348***	-4.302***	-5.761***
	(0.695)	(0.689)	(0.378)	(0.413)	(0.398)	(0.447)	(0.641)	(0.690)
Arbitrage risk	0.948	0.566	0.671*	0.119	0.641*	1.409***	2.472***	2.271***
	(1.177)	(1.298)	(0.363)	(0.392)	(0.377)	(0.416)	(0.643)	(0.711)
Amihud ILLIQ		38.781		2.379**		0.660		0.091
		(30.392)		(1.080)		(0.997)		(1.325)
Constant	6.073***		4.480***		2.145***		6.625***	
	(0.717)		(0.416)		(0.436)		(0.702)	
Observations	175	175	459	459	459	459	459	459
R-squared	0.25	0.41	0.12	0.26	0.16	0.24	0.23	0.33
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
SE	robust	robust	robust	robust	robust	robust	robust	robust

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

Table 6: Persistence of the S&P 500 Inclusion Effect

This table reports the coefficients for cross-sectional regressions of cumulative abnormal returns (CAR). Columns 1 and 2 study reversal effects immediately after effective index inclusions by aggregating the abnormal returns of the 10 trading days following. Columns 3 through 6 look at the longer horizon of the inclusion effect by accounting for the whole period from announcement until 20 or 60 days after effective inclusion. Right-hand side variables follow precisely the definitions given for Table 5. Standard errors are adjusted for heteroskedasticity and reported in parentheses.

	Entire sample					
	$CAR_{ED+1,ED+10}$		$CAR_{AD,ED+20}$		$CAR_{AD,ED+60}$	
	(1)	(2)	(3)	(4)	(5)	(6)
Ownership × $post_{2005}$	-0.028	-0.067	-0.180**	-0.220**	-0.297**	-0.406***
	(0.058)	(0.059)	(0.091)	(0.096)	(0.132)	(0.135)
Control ownership	0.003	0.019	0.126*	0.133*	0.221**	0.284***
	(0.037)	(0.039)	(0.068)	(0.075)	(0.087)	(0.095)
$Post_{2005}$	0.883		-1.623		-2.878	
	(0.861)		(1.275)		(2.384)	
S&P 400	-0.003	0.121	-3.445***	-4.696***	-1.497	-3.597
	(0.764)	(0.868)	(1.094)	(1.179)	(1.994)	(2.211)
Arbitrage risk	-0.131	-0.449	2.083	0.016	0.801	-3.709
	(1.012)	(1.211)	(1.318)	(1.574)	(2.834)	(3.349)
Amihud ILLIQ		-1.901		-4.110		-12.178**
		(1.836)		(2.574)		(5.096)
Constant	-2.047***		4.020***		2.777	
	(0.788)		(1.088)		(1.878)	
Observations	459	459	458	458	458	458
R-squared	0.00	0.06	0.08	0.14	0.04	0.10
Year FE	No	Yes	No	Yes	No	Yes
SE	robust	robust	robust	robust	robust	robust

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

Table 7: Event study in calendar-time portfolios (Control ownership)

This table presents results from a panel approach to S&P 500 inclusions in calendar-time. The sample before 2005 includes daily abnormal returns for all S&P 500 constituents from January 1989 until March 2005, while the sample after 2005 contains the observations from September 2005 until December 2014. I separate index inclusions into a portfolio with high control ownership (greater than 10%) and a portfolio with low control ownership (less than 10%) through the following model:

$$AR_{it} = \alpha + \beta_{1,x}\omega_i \mathbb{1}_{it,x} + \beta_{2,x}\omega_i \mathbb{1}_{it,x|ownership>10\%} + \epsilon_{it}$$

where AR_{it} is the abnormal return of stock i at time t. $\mathbb{1}_{it,x}$ is an indicator variable equal to one for stock i from the date of inclusion announcement until a pre-defined investment horizon x tradings days after effective index inclusion. $\mathbb{1}_{it,x|ownership>10\%}$ adds an additional filter that requires control ownership of stock i to be larger than 10%. ω_i is an adjustment factor defined as 1 over the number of days invested in stock i, which transforms the interpretation of estimated coefficients from average abnormal returns into cumulative abnormal returns. Columns 3 and 6 report the coefficients of interest, $\beta_{2,x}$, estimating the cumulative return difference between the two portfolios of index inclusions. Columns 1 and 2 report the coefficients of a similar regression that compares both portfolios to a zero benchmark. Column 7 neglects cross-sectional differences and estimates a pure average effect of index inclusions after 2005. Standard errors are clustered in 2 dimensions: date and 3 digit SIC codes interacted with years.

	Sample before float-adjustment in 2005			*Sample after float-adjustment in 2005*			
Invested horizon	Low ownership	High ownership	Δ ownership	Low ownership	High ownership	Δ ownership	Average
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AD to ED+0	4.724***	8.069***	3.345***	3.478***	3.211***	-0.267	3.416***
AD to ED+1	4.572***	6.836***	2.265***	2.848***	2.935***	0.087	2.869***
AD to ED+2	4.588***	6.459***	1.871**	2.499***	3.270***	0.771	2.692***
AD to ED+3	4.041***	6.402***	2.362**	2.161***	3.255***	1.094	2.440***
AD to ED+4	4.015***	6.650***	2.635***	2.043***	2.342*	0.299	2.120***
AD to ED+5	4.265***	6.702***	2.438***	1.986***	1.641	-0.345	1.896***
AD to ED+6	4.099***	6.555***	2.456**	1.726**	1.782	0.056	1.741***
AD to ED+7	4.226***	6.730***	2.504**	1.517**	2.116*	0.600	1.675**
AD to ED+8	4.122***	6.612***	2.491**	1.214	2.194*	0.980	1.473**
AD to ED+9	4.202***	6.317***	2.115*	1.214	2.271*	1.057	1.494**
AD to ED+10	3.706***	6.277***	2.572*	1.313	1.808	0.495	1.445*
AD to ED+20	3.169***	6.582***	3.413**	0.557	0.030	-0.527	0.414
AD to ED+60	1.599	6.835***	5.235*	-2.143	-2.772	-0.629	-2.321
AD to ED+100	3.189	5.654**	2.465	-1.745	-3.620	-1.875	-2.294
Cluster 1	date	date	date	date	date	date	date
Cluster 2	SIC3 × year	SIC3 × year	SIC3 × year	SIC3 × year	SIC3 × year	SIC3 × year	SIC3 × year

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

Table 8: Event study in calendar-time portfolios (Prior S&P 400 membership)

This table presents results from a panel approach to S&P 500 inclusions in calendar-time. The sample before 2005 includes daily excess returns for all S&P 500 constituents from January 1989 until March 2005, while the sample after 2005 contains the observations from September 2005 until December 2014. I separate index inclusions into portfolios based on whether a stock was previously listed on the S&P 400 or not:

$$AR_{it} = \alpha + \beta_{1,x}\omega_i \mathbb{1}_{it,x} + \beta_{2,x}\omega_i \mathbb{1}_{it,x|S\&P400} + \epsilon_{it}$$

where AR_{it} is the abnormal return of stock i at time t. $\mathbb{1}_{it,x}$ is an indicator variable equal to one for stock i from the date of inclusion announcement until a pre-defined investment horizon x tradings days after effective index inclusion. $\mathbb{1}_{it,x|S\&P400}$ adds an additional filter to capture stocks previously listed on the S&P 400. ω_i is an adjustment factor defined as 1 over the number of days invested in stock i, which transforms the interpretation of estimated coefficients from average abnormal returns into cumulative abnormal returns. Columns 3 and 6 report the coefficients of interest, $\beta_{2,x}$, estimating the difference in cumulative returns between the two portfolios. Columns 1 and 2 report the coefficients of a similar regression that compares both portfolios to a zero benchmark. Standard errors are clustered in 2 dimensions: date and 3 digit SIC codes interacted with years.

	Sample before float-adjustment in 2005			*Sample after float-adjustment in 2005*		
Invested horizon	Not in S&P 400	In S&P 400	Δ S&P 400	Not in S&P 400	In S&P 400	Δ S&P 400
	(1)	(2)	(3)	(4)	(5)	(6)
AD to ED+0	7.318***	5.181***	-2.137*	5.879***	1.561***	-4.318***
AD to ED+1	6.921***	4.468***	-2.453**	5.127***	1.137**	-3.991***
AD to ED+2	6.878***	4.306***	-2.572***	4.724***	1.145**	-3.578***
AD to ED+3	6.796***	3.769***	-3.027***	4.238***	1.084*	-3.154***
AD to ED+4	6.778***	3.935***	-2.842***	4.099***	0.661	-3.439***
AD to ED+5	7.023***	4.103***	-2.920***	4.118***	0.235	-3.884***
AD to ED+6	6.807***	3.945***	-2.862**	3.981***	0.005	-3.975***
AD to ED+7	7.047***	3.993***	-3.054**	4.038***	-0.184	-4.222***
AD to ED+8	6.883***	3.925***	-2.958**	4.189***	-0.660	-4.849***
AD to ED+9	6.879***	3.781***	-3.098**	4.159***	-0.650	-4.809***
AD to ED+10	6.747***	3.352***	-3.395**	4.090***	-0.677	-4.767***
AD to ED+20	6.818***	3.056***	-3.762**	2.144	-0.887	-3.030*
AD to ED+60	4.179*	3.697**	-0.481	0.399	-4.705**	-5.104
AD to ED+100	2.674	5.095**	2.421	-0.741	-3.729	-2.988
Cluster 1	date	date	date	date	date	date
Cluster 2	SIC3 × year	SIC3 × year	SIC3 × year	SIC3 × year	SIC3 × year	SIC3 × year

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

Table 9: Change in short interest around index inclusions

This table reports the coefficients of panel regression models in event-time. The dependent variable is short interest standardized by shares outstanding. Data comes from Compustat measured at the monthly frequency as plotted in Figure 5. $Post_{S\&P}$ is a dummy variable that takes the value zero for stock i prior to S&P 500 inclusion announcement and one thereafter. *Ownership* follows the definition of control ownership in Table 1 and *S&P 400* indicates whether a stock was previously listed on the S&P 400. The sample used in columns 1, 2, 4, and 5 includes two months prior and post the S&P 500 inclusion announcement, while the sample in columns 3 and 6 contains 4 months before and 6 months after inclusion. All regressions containing cross-sectional predictors also include firm fixed-effects. Standard errors are clustered at the firm level and reported in parentheses.

	Sample before 2005			*Sample after 2005*		
	[-2;+2]	[-2;+2]	[-4;+6]	[-2;+2]	[-2;+2]	[-4;+6]
	(1)	(2)	(3)	(4)	(5)	(6)
Ownership × $post_{S\&P}$		0.015*	0.016**		-0.009	0.000
		(0.008)	(0.008)		(0.007)	(0.010)
S&P 400 × $post_{S\&P}$		0.195	0.250		-1.088***	-1.037***
		(0.222)	(0.218)		(0.265)	(0.342)
$Post_{S\&P Announcement}$	0.491***	0.222		0.501***	1.150***	
	(0.094)	(0.188)		(0.128)	(0.232)	
Constant	2.160***			4.391***		
	(0.184)			(0.306)		
Observations	684	684	1,723	684	684	1,712
R-squared	0.01	0.89	0.84	0.00	0.94	0.85
Firm FE	No	Yes	Yes	No	Yes	Yes
Event-time FE	No	No	Yes	No	No	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm

Internet Appendix

S&P 500 Inclusions and Stock Supply

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Abstract

I provide new evidence of the S&P500 inclusion effect that highlights the importance of stock supply. If excess demand from S&P500-linked capital drives the inclusion effect, it should depend as well on the effective supply of a stock. Standard & Poor's index methodology provides two distinct supply proxies, which significantly predict the cross-sectional size of the effect. Switching to free-floating index weights in 2005 enables a quasi-natural experiment to one proxy and a placebo test to the other, further strengthening a supply interpretation. Finally, evidence from the most recent decade indicates that any persistence in the inclusion effect has disappeared.

Figure A-1: Beta-adjusted inclusion returns and control ownership

This figure plots cumulative abnormal returns beginning 20 trading days prior to effective S&P 500 inclusion until 60 trading days thereafter. Cumulative abnormal returns in this figure are based on different abnormal return specifications than in Figure 4. The black lines use simple market-adjusted abnormal returns and the gray lines use Fama-French adjusted abnormal returns. All betas are estimated in a pre-event window with 1 year of daily observations ending 30 days prior to the inclusion announcement. The graph separates index inclusions into groups with high (greater than 10%) and low control ownership. The mean cumulative abnormal return for high control ownership firms is represented as a solid line, whereas that for low control ownership firms are dashed lines. Index inclusions before the float-adjustment in March 2005 appear on the left, and those after the adjustment in September 2005 on the right.

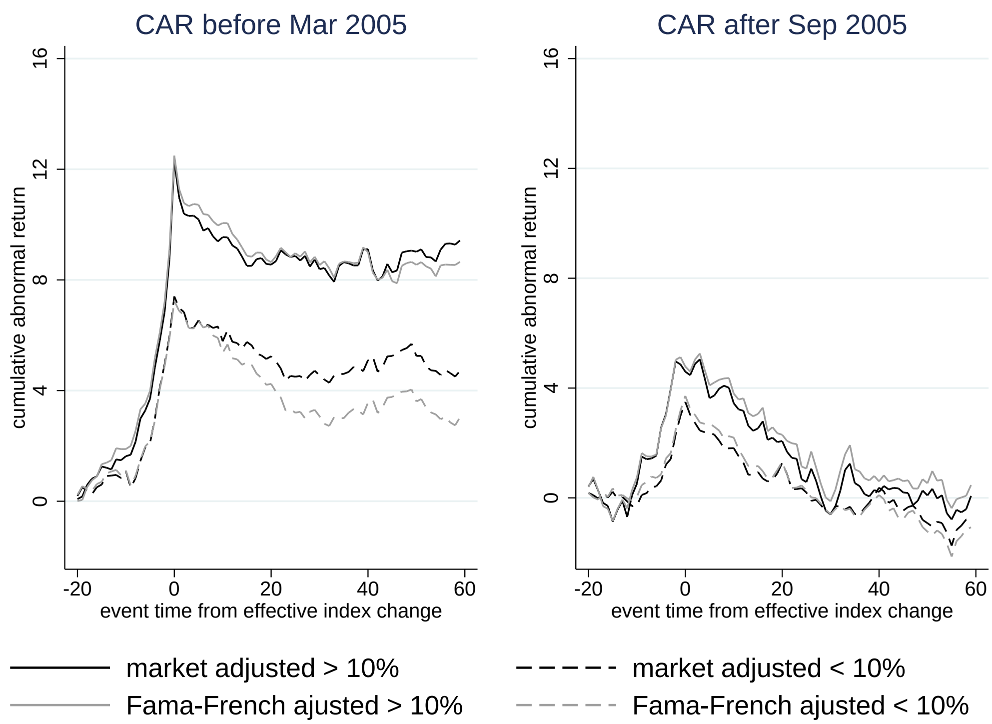

Table A-1: Beta-adjusted abnormal returns

This table reports the coefficients for cross-sectional regression models of abnormal and cumulative abnormal returns. Panel A uses abnormal returns based on a market-adjusted model, whereas Panel B uses the Fama-French model. All betas are estimated in a pre-event window with 1 year of daily observations ending 30 days prior to the inclusion announcement. Cross-sectional results for abnormal returns on the announcement date or the effective inclusion date appear in columns 1 and 2. Cumulative abnormal returns from announcement until 0, and 60 days after effective inclusion are listed in columns 3 and 4, respectively. This table covers the sample period from January 1989 until the implementation of float-adjusted index weights in March 2005. The right-hand side variables follow previous definitions. Standard errors are adjusted for heteroskedasticity and reported in parentheses.

	Market-adjusted return model				Fama-French-adjusted return model			
	AR_{AD} (1)	AR_{ED} (2)	CAR_{ED} (3)	CAR_{+60} (4)	AR_{AD} (5)	AR_{ED} (6)	CAR_{ED} (7)	CAR_{+60} (8)
Control ownership	0.046**	0.074***	0.119***	0.239***	0.046**	0.070***	0.116***	0.192*
	(0.021)	(0.027)	(0.043)	(0.091)	(0.021)	(0.026)	(0.039)	(0.106)
S&P 400	-1.607**	-3.634***	-5.932***	-2.206	-1.622***	-3.566***	-6.168***	-1.097
	(0.622)	(0.722)	(1.081)	(2.967)	(0.619)	(0.710)	(1.042)	(3.220)
Arbitrage risk	0.480	1.343***	2.332***	-0.996	0.501	1.129**	2.272***	1.295
	(0.392)	(0.493)	(0.679)	(3.224)	(0.400)	(0.493)	(0.700)	(3.175)
Amihud ILLIQ	2.282**	0.409	0.184	-9.562*	2.311**	0.558	0.470	-7.187
	(1.057)	(0.989)	(1.312)	(5.148)	(1.052)	(0.960)	(1.262)	(4.885)
Observations	284	284	284	284	284	284	284	284
R-squared	0.22	0.24	0.26	0.08	0.23	0.22	0.28	0.06
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE	robust	robust	robust	robust	robust	robust	robust	robust

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

Table A-2: Change of liquidity measures after index inclusion

This table reports the results of panel regressions of several liquidity measures based on daily observations. The estimation structure closely follows Hegde and McDermott (2003). The *effective spread* is the bid-ask spread over mid-quote. The *Amihud (2002) illiquidity measure* is the absolute return value divided by the product of price and volume. The *trading volume* is the volume per shares outstanding. All liquidity measures are log-transformed. $Post_{S\&P}$ is a dummy variable that has the value zero for observations between 60 and 10 trading days before the announcement of an index inclusion and one for trading days 10 to 60 after effective index inclusion and trading days 1 to 5 in Panel A and B, respectively. $Ownership \times Post_{S\&P}$ represents the interaction of the variables *control ownership* and the previously defined dummy $Post_{S\&P}$. The sample is divided into two parts: *Early* refers to index inclusions prior to float adjustment in March 2005 and *Late* considers additions after September 2005. All regressions include firm fixed-effects and cluster standard errors at the firm level.

	Effective spread		*Amihud Illiquidity*		*Trading volume*	
	Early	Late	Early	Late	Early	Late
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Long-run effects (+10/+60 trading days)						
Ownership × $post_{S\&P}$	-0.001	0.002	-0.003	0.002	0.001	-0.002
	(0.002)	(0.002)	(0.002)	(0.003)	(0.001)	(0.002)
$Post_{S\&P Inclusion}$	-0.093**	-0.149***	-0.222***	-0.161***	0.160***	0.139***
	(0.038)	(0.029)	(0.031)	(0.044)	(0.025)	(0.029)
Observations	22,974	17,241	27,569	17,646	28,968	17,748
R-squared	0.77	0.41	0.61	0.40	0.75	0.66
Panel B: Short-run effects (+1/+5 trading days)						
Ownership × $post_{S\&P}$	0.000	0.004**	-0.007**	0.003	0.007***	0.002
	(0.002)	(0.002)	(0.003)	(0.005)	(0.002)	(0.002)
$Post_{S\&P Inclusion}$	-0.162***	-0.212***	-0.782***	-0.643***	0.570***	0.446***
	(0.036)	(0.040)	(0.053)	(0.066)	(0.037)	(0.041)
Observations	12,690	9,474	15,086	9,695	15,904	9,744
R-squared	0.78	0.42	0.63	0.43	0.76	0.69
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm

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

Table A-3: Log-transformed ownership measure

This table reports the coefficients of cross-sectional regressions with a transformed control ownership measure, defined as the natural logarithm of 1 plus the original control ownership measure. The other right-hand side variables remain unchanged. This table covers the sample period from January 1989 until the implementation of float-adjusted index weights began in March 2005. Standard errors are adjusted for heteroskedasticity and reported in parentheses.

	all observations before 2005			
	AR_{AD}	AR_{ED}	CAR_{ED}	CAR_{+60}
	(1)	(2)	(3)	(4)
ln(1 + ownership)	6.566**	8.747***	13.651***	35.129***
	(2.573)	(3.140)	(5.228)	(12.220)
S&P 400	-1.478**	-3.394***	-5.819***	-1.228
	(0.648)	(0.718)	(1.105)	(3.133)
Arbitrage risk	0.118	1.408***	2.615***	-3.188
	(0.446)	(0.474)	(0.785)	(3.869)
Amihud ILLIQ	2.264**	0.458	-0.028	-11.997**
	(1.087)	(0.986)	(1.339)	(5.114)
Observations	284	284	284	284
R-squared	0.20	0.23	0.26	0.07
Year FE	Yes	Yes	Yes	Yes
SE	robust	robust	robust	robust

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

Table A-4: S&P 500 inclusion returns and the dot.com bubble

This table reports the coefficients for cross-sectional regressions of abnormal returns and cumulative abnormal returns for two subsamples. Columns 1-3 exclude S&P 500 inclusions during 1999-2000. Columns 4-6 consider only inclusions of non-tech companies. The following industries are considered high-tech and dropped for that reason: Computer and Office Equipment; Electronic Components and Accessories; Computer Programming, Data Processing, and other Computer Related Services; Research, Development, and Testing Services. This refers to SIC codes 3570 through 3580, 3670 through 3680, 7370 through 7380, and 8730 through 8740. Model 1 examines abnormal returns on the inclusion announcement date and Model 2 the effective inclusion date. Model 3 uses cumulative abnormal returns from the inclusion announcement until effective inclusion. *Control ownership* follows the definition in Table 1 and *S&P 400* is a dummy variable indicating whether a stock was listed in the S&P 400 or S&P 600. Standard errors are adjusted for heteroskedasticity and reported in parentheses.

	excluding 1999-2000			*excluding high-tech stocks*		
	AR_{AD}	AR_{ED}	CAR_{ED}	AR_{AD}	AR_{ED}	CAR_{ED}
	(1)	(2)	(3)	(4)	(5)	(6)
Control ownership	0.038*	0.041*	0.089***	0.033	0.061***	0.086**
	(0.020)	(0.022)	(0.034)	(0.020)	(0.023)	(0.034)
S&P 400	-0.732	-3.069***	-3.826***	-1.056	-2.908***	-4.329***
	(0.603)	(0.718)	(1.033)	(0.658)	(0.739)	(0.949)
Arbitrage risk	0.227	0.801	0.314	-0.236	1.195**	1.974**
	(0.527)	(0.722)	(0.758)	(0.445)	(0.598)	(0.789)
Amihud ILLIQ	2.010*	0.172	0.896	2.228**	0.469	0.833
	(1.049)	(0.882)	(1.072)	(1.086)	(0.954)	(1.138)
Observations	209	209	209	218	218	218
R-squared	0.20	0.22	0.26	0.23	0.23	0.33
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
SE	robust	robust	robust	robust	robust	robust

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