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ABSTRACT

Limits of Arbitrage and Corporate Financial Policy*

We focus on an exogenous event that changes the cost of capital of a company – the addition of its stock to the S&P 500 index – and investigate how companies react to it by modifying their corporate financial and investment policies. This allows us to test capital structure theories in an ideal controlled experiment, where the effect of the index addition on the stock price is exogenous from a manager's point of view. Consistent with both traditional theories and Stein's (1996) market timing theory, we find more equity issues and increases in investment in response to higher index addition announcement returns. However, in the 24 months after the index addition, firms that issue equity and increase investment display negative abnormal returns and they perform worse than firms that issue but do not increase investment. This finding is consistent only with the market timing theory of Stein (1996) and supports a 'limits of arbitrage' story in which the stocks display a downward sloping demand curve and companies themselves act as 'arbitrageurs' taking advantage of the window of opportunity.

JEL Classification: G30, G31 and G32
Keywords: corporate financial policies, limits of arbitrage and market timing

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1 Introduction

The literature on "limits of arbitrage" argues that, if institutional investors are constrained by the lack of long-term resources, they cannot arbitrage away differences in price between otherwise identical — in terms of cash flow and risk profile — stocks. A classic example of this phenomenon is the abnormal announcement return observed when a stock is added to the S&P 500 index (e.g., Shleifer, 1986). Given that some investors are institutionally required to invest in stocks of S&P 500 firms (e.g., index funds), the absence of sufficient arbitrage capital implies that the addition to the index increases prices in the announcement period due to a demand effect. This price discrepancy is expected to persist in the absence of sufficient arbitrage capital.[1]

The literature has always looked for arbitrageurs focusing on investors. However, there exists one largely ignored player that could arbitrage away the difference: the company itself. That is, if a mispricing exists, we would expect companies to take advantage of this situation. For example, if the increase in equity value due to the announcement return of the S&P 500 index addition leads to overvaluation in the eyes of the managers, they should issue more equity. More generally, we expect that the increase in equity value observed around the addition to the S&P 500 index will lead managers to adjust the firm's capital structure and potentially also the investment and cash holding policies.

Since the index addition is exogenous from the point of view of the managers, the event provides an ideal setting to test the market timing theory where the firm's stock price, on average, increases for an exogenous reason — from management's perspective. Using a sample of 222 companies added to the S&P 500 index in the years 1981 through 1997, we find an average abnormal announcement return of 3.2%. We show that the cost of equity decreases significantly around the S&P 500 index addition, by about 1.2 percentage points, using the Fama-French three-factor model.

More important, we find strong evidence that firms react to the change in the stock price (drop in the cost of equity). A bigger abnormal return at the S&P 500 index addition announcement (bigger drop in the cost of equity) leads to more equity issues, even compared to matching sample firms. While this is consistent with the market timing theory, traditional capital structure theories (trade-off theory and pecking-order theory) also predict that managers will take advantage of the lower cost of capital by issuing equity. A possible way to distinguish between the traditional and market timing theory is to investigate how firms use the proceeds from the equity issues. Traditional theories are based on the assumption that the stock price change is rational, and thus posit that firms increase investment in response to a reduction in the cost of

equity since it implies a lower hurdle rate. The market timing theory of Stein (1996), on the other hand, suggests that only firms with short-horizon managers increase investment. Long-horizon managers realize that the market-implied cost of equity is wrong since it is based on mispriced equity. Thus, not increasing investment is the optimal reaction of managers who expect to manage the firm for its long-term value. We find that the average firm reacts to the drop in the cost of equity by also increasing investment. This is consistent with both traditional theories and Stein's (1996) market timing theory where the average firm is managed by short-horizon managers.

It is the analysis of long-run stock returns that allows us to differentiate between the market timing and traditional theories. Traditional models are based on the assumption that the drop in the cost of equity is not due to mispricing. This implies that issuing equity and increasing investment will lead to a *higher* firm value in the long run relative to issuing but not investing. On the contrary, according to Stein's (1996) theory, firms that issue equity and increase investment should experience a negative long-run abnormal return, while firms that issue equity but do not increase investment should perform better. The reason is that short-horizon managers will use the temporarily lower cost of equity as the hurdle rate and therefore increase investment, while long-horizon managers will use the proceeds of the equity issue to reduce debt or increase cash, but not to take projects that are value destroying given the true cost of equity.

Consistent with the market timing theory and in contrast to the prediction of the traditional theories, we do find that the subsample of firms that issue equity and increase investment display significantly negative long-run abnormal returns. Moreover, long-horizon managers who issue equity and increase cash perform better, while firms that issue equity and reduce debt do even better.

One potential issue with this interpretation is that we may just be capturing the effects of financial constraints. To address this issue we follow Baker, Stein and Wurgler (2003), who show that managers of financially constrained firms act as if they had a short horizon. Thus, we expect the long-run returns of financially constrained firms to be negative (Lamont, Polk and Saa-Requejo, 2001). Issuing and investing should not affect this negative prediction. However, unconstrained firms — potentially the ones with long-horizon managers — should exploit the window of opportunity by issuing equity and not using the proceeds to increase investment. Thus, unconstrained firms that issue and invest *reveal themselves* to be managed by short-horizon managers and should display negative long-run returns.

We find that the long-run abnormal returns for financially constrained firms, proxied by the modified KZ-index (Baker, Stein and Wurgler, 2003), are significantly negative regardless of

whether they increase investment. On the other hand, the long-run abnormal returns of financially unconstrained firms, while in general positive, turn negative if firms issue equity and increase investment. Thus, firms revealing themselves to be operated by short-horizon managers suffer significantly in the long run, consistent with Stein's (1996) market timing theory. Our findings confirm all the predictions of the market timing theory, but are inconsistent with the traditional theories.

Our paper relates to two strands of literature: the one on limits of arbitrage and the one on testing capital structure theories. The literature on the limits of arbitrage has found compelling evidence that limits of arbitrage affect individual stock prices through downward-sloping demand curves. Shleifer and Vishny (1997) theoretically show how limits to arbitrage can exist in the market if arbitrageurs are constrained in their resources. Indirect evidence is provided by the studies on the effects of compositional changes in broad indexes, block trading and international flows of funds. For example, studies analyzing additions and deletions to the S&P 500 index find that additions to the index increase share prices, while delistings decrease share prices (e.g., Garry and Goetzmann, 1986; Harris and Gurel, 1986; Shleifer, 1986; Dhillon and Johnson, 1991; Beneish and Whaley, 1996; and Lynch and Mendenhall, 1997). Similar effects have been documented in studies of index additions in other countries (e.g., Masse et al., 2000). More recently, Barberis, Shleifer and Wurgler (2003) show that the addition to the index causes the stock to co-move more with other S&P 500 firms and increases the beta with respect to the S&P 500 index. More direct evidence on the impact of flows on stocks is provided by Warther (1995), Zheng (1999), Goetzmann and Massa (2002) and Teo and Woo (2003), who show that demand pressure from mutual funds has a direct impact on stock prices and increases stocks' cross-correlations. Gromb and Vayanos (2002) investigate the welfare implications of limits of arbitrage.

The second literature is the one on capital structure and investment. Traditional capital structure theories are based on the assumption that the market is rational. The market timing theory, on the other hand, does not require market rationality. What market timing requires is mispricing. Such mispricing may be due to market irrationality or limits of arbitrage existing for rational or irrational reasons. Stein (1996) argues that, in the presence of irrational markets, rational managers time the market, issuing and investing depending on the level of market sentiment and their own investment horizons. Empirically, Baker and Wurgler (2002) find that managers time the market and that market valuation influences capital structure over many years. That is, firms with higher market-to-book ratios in previous years display comparatively lower leverage. Baker, Stein and Wurgler (2003) show that financially constrained firms display a

higher sensitivity of issuing equity to current market valuation. An extensive summary of the market timing literature can be found in Baker, Ruback and Wurgler (2004). Misvaluation in the stock market has also been shown to affect corporate investment. For example, Panageas (2004) finds this in a sample of firms that were introduced into a loan crowd in 1926, Himmelberg et al. (2004) investigate the technology boom in the 1990s, while Baker et al. (2004) look at FDI flows.

However, to our knowledge, there are no studies that focus on the impact of limits of arbitrage on corporate financial policy and in turn its impact on the market. In the present paper, we bridge this gap. Our goal is to study how the managers' choice of the capital structure, investment and cash holding policies is affected by the stock's abnormal return caused by the index addition. In other words, if limits to arbitrage prevent *investors* from arbitraging away differences in prices, how are *firms* reacting to this situation, and then how is the market reacting to the corporate reaction?

Our paper makes contributions to both literatures. First, we are able to test predictions of capital structure theories using the S&P 500 index addition as an event — an event that is exogenous to the firm's decisions. While there are many studies that analyze corporate financial policy issues, few can escape the criticism of endogeneity. Investment decisions are affected by and affect funding decisions. Payout policy is interlinked with the funding and investment decisions. The corporate financial structure (leverage) is often the result of a series of separate decisions taken over a long period of time (Baker and Wurgler, 2002) and is not necessarily based on an optimizing decision (Welch, 2004). This implies that there are very few situations where it is possible to find a proper identifying restriction that allows the researcher to break the simultaneity inherent in any corporate financial decision (Lamont, 1997). We believe the addition of a company's stock to the S&P 500 index, which is an event that is largely outside management's control and thus exogenously changes the cost of equity, is one such situation.

Second, our results suggest that equity issues offset the initial reason for the increase in stock prices by increasing the supply of shares. Thus, companies de facto act as arbitrageurs. This offers a potential reconciliation between the findings of Shleifer (1986) and Garry and Goetzmann (1986), who show that the addition to the index has a permanent effect on the share price, and Harris and Gurel (1986), Beneish and Whaley (1996) and Lynch and Mendenhall (1997), who find a reversal. Companies' reactions to the event itself seem to affect the long-run performance, thus leaving room for different findings at different time horizons.

It is also interesting to note that these results question the degree of market efficiency. Indeed, if companies are able to take advantage of stock market reactions, either the market does not rationally foresee companies' reactions, or it is prevented by some constraint from optimally

adjusting to the long-run value. This provides further indirect evidence on the limits of arbitrage and suggests the existence of constraints analogous to the ones found in the case of lack of "arbitrage capital" in mergers and acquisitions (Baker and Savasoglu, 2002).

The paper is structured as follows: In the next section, we investigate the effect of the S&P 500 index addition on stock prices and the change in the cost of equity. We then show the company's reaction to the abnormal stock price change and the change in the cost of equity and find that the reaction is consistent with the market timing as well as the traditional theories. In Section 4, we focus on the long-run market reaction to distinguish between the market timing and the traditional theories. Section 5 extends the tests by including proxies for financial constraints. In Section 6, we discuss the implications of our findings for market efficiency. A brief conclusion follows.

2 Index Addition and Change in the Cost of Equity

We start by describing the sample selection process. Then we investigate whether the commonly observed S&P 500 index addition announcement return translates into a decrease in the cost of equity.

2.1 Sample selection

We study firms that were added to the S&P 500 index over the period from 1981 through 1997. We start with a sample of 392 firms but exclude events where firms are added to the S&P 500 index due to a merger, spin-off or some other form of restructuring (85 events). We also exclude financial firms defined as firms operating in the SIC between 6,000 and 6,999, because their choice of leverage differs from those of non-financial firms (59 events). We require that our sample firms have data available in Compustat and CRSP for stock prices and financial data, I/B/E/S for analyst coverage, and TFN/Institutional for institutional ownership. We also require data on insider ownership in the year prior to the index addition. This data is collected from Valueline and proxy filings. These requirements eliminate another 26 events, so we end up with 222 firms that have all the data available to be included in our sample of S&P 500 index additions.

2.2 Announcement return and change in the cost of equity

We calculate the abnormal return over the window of -5 to +5 days around the index addition announcement. We estimate the parameters of the market model over the 254 days

ending 46 days prior to the S&P 500 index addition announcement, using the equally weighted CRSP index as the market return. In Table 1, panel A, we show that the sample firms display a significant positive average abnormal announcement return of 3.21%. This is in line with prior research on index additions (e.g., Shleifer, 1986). We also find that the institutional ownership fraction increases by an average 1.4 percentage points from the quarter before to the end of the quarter of the index addition. The increase is statistically significant at the 1% level. The increased institutional ownership is in line with the interpretation that index funds need to buy the newly added stock, thus causing an increase in demand. If the demand curve is not flat, this phenomenon can lead to a price increase.[2] These findings support Shleifer's interpretation that the announcement return is caused by a downward-sloping demand curve.

Shleifer (1986) also argues that the positive announcement return is a reflection of a drop in the discount rate[3] rather than a change in expected cash flows, because S&P does not change its stock rating around the index addition. We directly test this. We follow Foerster and Karolyi (1999) and estimate the change in the cost of equity by using the Fama-French three-factor model. We consider alternative specifications in which the factor loadings are computed in the 24 (12) months ending one month before the event and in the 24 (12) months after the event, using daily returns. For each firm, we compute the difference in the factor loadings ($Beta_{Market}$, $Beta_{SMB}$ and $Beta_{HML}$) around the event and multiply it by the average value of the factors (Market, SMB and HML) calculated over the 60 months prior to the event (or alternatively over the period from 1977 to 2000).

The results are reported in Table 1, panel B. They show that the cost of equity decreases using any of the four combinations used to calculate the change in the cost of equity. For example, when we use 24 months to calculate the betas before and after, and use the average risk premium for the factors in the 60 months prior to the event, we observe a significant drop in the cost of equity of 1.26 percentage points for the average firm[4]. The economic magnitude is similar to the change in the cost of equity found in the ADR literature (e.g., Foerster and Karolyi, 1999).[5] However, the drop in the cost of equity is quite substantial, especially compared to the abnormal announcement return. A simple growing perpetuity formula with a cost of equity of, say, 15% and a growth rate of 3% would suggest that the price at the announcement had to increase by 11% if the full 1.26 percentage point drop in the cost of equity had to be related to the announcement. This can be explained if we look at the fact that event firms experience a significant run-up equivalent to 8.9% (Table 2, panel B) in the 6 months prior to the event. Since the change in the cost of equity is calculated as the difference between the 24 months before relative to the 24 months after the index addition, this run-up might also affect the change in the cost of equity.

2.3 Liquidity and change in the cost of equity

While our finding of a drop in the cost of equity is consistent with Shleifer's argument of a downward-sloping demand curve for stocks, we cannot exclude the possibility that other factors, such as liquidity, might affect the cost of equity. Indeed, if the stocks added to the index become more liquid, some investors — e.g., institutional investors with a short-term investment horizon and/or high portfolio turnover — might prefer to invest in them. The price they would pay for this additional liquidity should be related to the abnormal return.

The literature contains mixed results about the existence of a liquidity improvement after the index addition. Beneish and Whaley (1996) find a permanent increase in the trading volume but only a temporary decrease in the quoted spread. They therefore reject the hypothesis that an increase in liquidity is the main driver of the abnormal return experienced by companies added to the index. In contrast, Hedge and McDermott (2003) find evidence of a long-term sustained increase in the liquidity of the added stocks, mostly due to a reduction in the direct cost of transacting. This takes the form of an increase in the quoted dollar depth, trading volume and trading frequency.

In order to control for the potential effects of a change in liquidity we use a proxy based on trading volume. This variable, called *liquidity change*, is the difference between the average monthly volume in the interval [+1,+12] and [-12,-1], where volume is the number of shares traded divided by the number of shares outstanding. In Table 1, panel A, we show that trading volume increases significantly, thus leaving room for the possibility that the abnormal announcement return reflects expected improvements in liquidity of the stock. One reason for the increased liquidity could be that index funds are more willing to lend the stock, thus reducing the cost of transactions for short selling.

3 Corporate Reaction to the Index Addition

The S&P 500 index addition event is a unique setting to test the predictions of the market timing theory for two reasons: First, the change in the stock price at the announcement of the index addition is exogenous from the point of view of the managers. They can neither time the index addition event, nor control the market's reaction to it. Indeed, while the market may have expectations about the pool of firms that deserve to be added, the decision of which firm finally gets into the index is not predetermined (Shleifer, 1986)[6]. Second, the existing literature leaves room for the possibility that the equity price change at the index addition announcement exists

due to limits of arbitrage. In other words, the change in the stock price can reflect mispricing, which is a necessary condition for the market timing theory.

3.1 Two hypotheses

We start by laying out the hypotheses relating to the company's reaction to the index addition, followed by the empirical tests. We consider two alternative sets of theories of capital structure: market timing and traditional theories. The latter include the trade-off and pecking-order theories. They share the assumption of market rationality. The alternative is the market timing theory brought forward by Stein (1996). It assumes rational managers and irrational investors.

3.1.1 Market timing theory

The market timing theory (Stein, 1996) is based on the assumption that the market price can be wrong and firms can take advantage of the mispricing by issuing equity.[7] Thus, we expect firms to issue more equity the higher the abnormal return at the announcement.

A unique feature of the market timing theory is that corporate decisions depend on the managers' investment horizon. Managers can have either a short horizon or a long horizon[8]. Both types of managers act rationally given their horizon. In our test setting, s*hort-horizon* managers use the market-implied lower cost of equity to discount project cash flows. Given the lower hurdle rate for new projects, short-horizon managers are expected to increase investment. Thus, if the average firm is run by short-horizon managers, the market timing theory predicts a positive correlation between the abnormal return and investment. In contrast, *long-horizon* managers realize that making investment decisions based upon the temporarily low(er) cost of capital would be detrimental to long-term shareholder value. Therefore, while they would exploit the window of opportunity and issue equity, they would not use the proceeds to increase investment. Instead of using the proceeds to invest in what essentially are negative-NPV projects (given the true cost of equity), long-horizon managers are expected to retire debt and/or increase cash instead.

3.1.2 Traditional theories

The traditional capital structure theories are based on two assumptions: first, that the change in the cost of equity is driven by rational sources, and second, that managers optimally react to it. Given a change in the cost of equity, the traditional theories posit that managers react to it by issuing equity and increasing investment. The reason is that if one source of capital

becomes cheaper, namely equity, the company should use more of it. Also, if the discount rate drops, more projects will become positive-NPV projects, requiring an increase in investment.

In addition, the trade-off theory predicts that a drop in the cost of equity shifts the optimal capital structure to include less debt.[9] However, as the relevant level of debt is gross debt minus cash, one way of reducing debt would be to increase cash.[10] Therefore, firms with higher announcement returns should increase their cash leverage more.

The pecking-order theory[11] (Myers, 1984; Myers and Majluf, 1984) posits instead that firms issue equity in response to a reduction in the cost of equity only if the firm's debt capacity is exhausted. Therefore, the proceeds from an equity issue should be used to increase investments, not to increase cash or reduce debt. These considerations allow us to formulate the following hypotheses:

H1A. Traditional theories: Managers react to the reduction in the cost of equity by issuing equity and increasing investment.

H1B. Market timing theory: Short-horizon managers react to the reduction in the cost of equity by issuing equity and increasing investment. Long-horizon managers use the window of opportunity to issue equity and do not increase investment, but rather reduce debt or increase cash.

Therefore, both the traditional and the behavioral theories predict a positive correlation between the abnormal announcement return and equity issues. However, the correlation between the abnormal return and investment can help us to differentiate between the traditional and the market timing theory. The traditional theories predict a positive correlation between abnormal return and investment, while the market timing theory predicts such a relationship only if the company's managers have a short horizon.

3.2 Empirical analysis

We now look at firms' reaction to the index addition announcement return. In particular, we relate the abnormal return to the changes in the corporate financial policies, investment and cash holdings, and other control variables that proxy for the change in the cost of debt, agency problems, asymmetric information and investment opportunities. Since all the corporate policies are interdependent, we use a simultaneous equation framework to account for these interdependencies.

3.2.1 Data description and variable definition

We first compute raw measures of the changes in the corporate policies, which are based on changes in the event firm only. The variables of interest are leverage, stock and debt issues, investment and cash holdings. We use data provided by Compustat and follow Baker and Wurgler (2002) in defining leverage as the book value of debt divided by total assets (#6)[12], where the book value of debt is total assets minus book value of equity. The *book value of equity* is defined as total assets minus total liabilities (#181) and preferred stock (#10), plus deferred taxes (#35) and convertible debt (#79). We define *cash holdings* as cash and short-term investment (#1) divided by total assets. *Investment* is capital expenditures (#128) plus acquisitions (#129), divided by total assets.

We define *stock issues* as the common and preferred stock issued minus common and preferred stock repurchased (#108-#115), divided by total assets.[13] Similarly, *debt issue* is long-term debt issued minus long-term debt retired (#111-#114) plus changes in short-term debt (#301), divided by total assets. For the leverage and cash holdings, we use the change from the fiscal year end before to the fiscal year end one year after the event, i.e., the level at year t+1 minus the level at year t-1. For investment, stock issue and debt issue, we use the average of the variables in year 0 and year 1. We choose these definitions because firms may have a target leverage and cash holding, which requires studying the change from the previous levels, while for investment, stock issue and debt issue, no such target level exists. Flow measures are thus appropriate to study the cross-sectional implications of the capital structure theories. [14]

The use of raw measures has two main limitations. First, over the two-year period over which we gauge these changes other common factors could affect a company's choice of leverage, investment or cash holding. Second, during the long period on which our analysis focuses (1981–1997), many changes may have taken place in the way both the market and managers react to the index addition announcement. This could affect our analysis. In order to control for these two potentially confounding effects, we compute a net measure. The net measure is based on the difference between the *event firm* and a sample of *control firms*. To implement this, we construct a portfolio of three comparable firms for each event firm. These comparable firms are not in the S&P 500 index and are not added to it during the event year. To find the comparable firms, we match the event firm with all the other non–S&P 500 firms in the same industry, measured at the one-digit SIC level. The three matching firms are selected according to five criteria: size, market-to-book, leverage, number of analysts and institutional ownership. In particular, we first compute the absolute value of the percentage difference between the event and non-event firms along all the five criteria. Then, we rank the non-event firms according to the

overall difference, which we define as the sum of the percentage difference of each of these five criteria. Finally, we choose the three non-event firms with the smallest overall difference to form an equally weighted portfolio, which we call the *matching sample firms*. Based on the differences between the event and matching sample firms, we construct net measures as our primary proxies to assess the changes in capital structure, investment and cash holdings around the index addition.

In Table 2, panel A, we report univariate statistics of the corporate financial policies, investment and cash holding variables. Consistent with the argument that the announcement return has reduced the cost of equity, we find an increase, albeit insignificant, in the average net stock issues of 0.56 percentage points (median 0.48 percentage points and significant at the 5% level)[15]. There is no significant increase in the net debt issues. Overall, this leads to a significant reduction in net leverage of -1.67 percentage points (median -2.77 percentage points and significant at the 1% level). These univariate statistics seem to lend some support to the notion that managers are reacting to the change in the cost of equity implied by the index addition by issuing more equity and reducing leverage.

We do not find a consistent result for the change in net investment. The mean increases significantly by 1.29 percentage points; the median, however, decreases by 0.05%. We also do not find any significant change in net cash holdings around the event. Therefore, it is difficult to argue that the event had a significant effect on the asset side. However, a word of caution is required in interpreting these univariate results. Based on our hypotheses developed in subsection 3.1, it is obvious that the corporate policies are heavily interlinked. Before drawing any conclusions about managers' reactions to the event, we will have to study the changes in a simultaneous equation framework using additional control variables.

3.2.2 Methodology

We proceed to test how companies change their corporate policies as a function of the change in the cost of equity due to the S&P 500 index addition. The predictions of the models outlined in subsection 3.1 above can be tested only if we study all the corporate policies simultaneously. For example, equity issues may simultaneously affect cash holdings, investment and debt issues. By the same token, an equity issue can also be affected by the need for cash, investment opportunities or adjustments to leverage. To control for these factors, we use a simultaneous equation framework. The system contains four equations determining the corporate policies, and one determining the abnormal return.

To estimate the system, we use a three-stage least squares (3SLS) estimator. This procedure is consistent and asymptotically efficient for normally distributed disturbances (e.g.,

Greene, 1997). Moreover, it has the advantage of estimating the full covariance matrix, thus properly accounting for the correlations in error terms across regressions. This is especially important in our test setting, as all four corporate policy equations refer to the same company and time.[16] We estimate the following system:

$$
\begin{aligned}
AR_i &= a_1 + a_2 \times InstownerChange_i + a_3 \times NetStockIssue_i + a_4 \times NetDebtIssue_i + a_5 \times NetCashChange_i \\
&\quad + a_6 \times NetInvestment_i + \mu_1 C_{1i} + \varepsilon_{1i} \\
NetStockIssue_i &= b_1 + b_2 \times AR_i + b_3 \times NetDebtIssue_i + b_4 \times NetCashChange_i + b_5 \times NetInvestment_i + \mu_2 C_{2i} + \varepsilon_{2i} \\
NetDebtIssue_i &= c_1 + c_2 \times AR_i + c_3 \times NetStockIssue_i + c_4 \times NetCashChange_i + c_5 \times NetInvestment_i + \mu_3 C_{3i} + \varepsilon_{3i} \\
NetCashChange_i &= d_1 + d_2 \times AR_i + d_3 \times NetStockIssue_i + d_4 \times NetDebtIssue_i + d_5 \times NetInvestment_i + \mu_4 C_{4i} + \varepsilon_{4i} \\
NetInvestment_i &= e_1 + e_2 \times AR_i + e_3 \times NetStockIssue_i + e_4 \times NetDebtIssue_i + e_5 \times NetCashChange_i + \mu_5 C_{5i} + \varepsilon_{5i}
\end{aligned}
\tag{1}
$$

where $NetStockIssue_i$, $NetDebtIssue_i$, $NetCashChange_i$ and $NetInvestment_i$ are the corporate policies of company *i*. AR_i is the abnormal return in the interval -5 to +5 days around the index addition announcement, and C_{xi} is a vector containing control variables. Since the sets of control variables are specific to each regression in order to identify the system, we next define and describe in which regression they are included. The univariate statistics of these variables are reported in Table 2, panel B, and the exact definitions are given in the Appendix.

3.2.3 Regression specification

We include the change in institutional ownership in the AR regression, as the index addition creates demand for the stock from index funds. With a downward-sloping demand curve for stocks, we expect a positive coefficient on this variable in the AR regression. We also include institutional ownership in the other regressions to control for the possibility that institutional owners affect corporate policy directly, for example, through their shareholder activism. In particular, one could expect that increased institutional ownership could lead to better access to external capital. Not controlling for the change in institutional ownership could thus lead to a spurious correlation between the event abnormal return, and equity or debt issues.

In the AR regression, we also include our proxy for the changes in liquidity of the stock. This variable is also added to the net stock issue regression to control directly for the effect of changes in liquidity around the event on net stock issues. In addition, we control for the lagged level of liquidity in the net stock issue regression to control for the possibility that the level of liquidity affects the amount of stock issues.

Insider ownership, an inverse proxy for agency problems between managers and shareholders, could affect the abnormal return as well as the reaction to it on the corporate side. We therefore include this variable in all the regressions.

The change in the number of analysts is used as a proxy for variations in information asymmetry around the event. The pecking-order theory predicts a positive correlation between the change in the number of analysts and investment, equity and debt issues, but a negative correlation with changes in cash holdings. The variable is thus included in all regressions.

The net change in bond ratings is used to control for the potential change in the cost of debt and is included in all regressions.

We also control for prior stock market conditions, both market wide and stock specific. The former include the prior market return and the prior market volatility. Potentially, marketwide fluctuations can affect a company's decision to issue equity and determine the intensity of the market's reaction to the index addition. We thus include these two variables in the AR and net stock issue regressions. The stock-specific conditions are proxied by the stock's net run-up. Net run-up controls for prior firm-specific excess stock return that has been shown to affect equity issue decisions (Lucas and McDonald, 1990) as well as for market expectations. For example, if the market anticipates the company's likelihood of being added to the index, then arbitrageurs might increase their investment prior to the announcement. Thus, net run-up is included in the AR, equity issue and investment regressions.

We include the term premium as a proxy for the slope of the term structure in the debt issue, and AR regression. This allows us to control for the fact that the interest rate environment in the early 1980s was very different from that in the 1990s.

According to the trade-off theory, the benefits of debt are smaller the riskier the cash flows. We use earnings volatility, measured as the standard deviation of earnings over the five years prior to the index addition, as a proxy for the tax benefits and bankruptcy cost of debt. Given that the trade-off theory is concerned with debt minus cash, we also include earnings volatility in the cash regression.

In all corporate policy regressions, we control for the effects of size and market-to-book and level of cash holdings in year -1. If there is an optimal cash leverage, then it is possible that the changes in cash holdings reflect mean reversion.

Finally, we include identifying instruments for each equation separately. In the AR regression we add the prior stock return volatility measured over the 12 months before the index addition. According to Pastor and Veronesi (2003), higher return volatility implies higher informational uncertainty and, according to Baker and Savasoglu (2002), higher arbitrage risk.

These effects are expected to weaken arbitrage, thus increasing the abnormal return around the event. We argue that the prior stock return volatility does not affect the net corporate policies because the risk factor is controlled for by the matching procedure.

In the net stock issues equation we add the lagged dividend to asset ratio. John and Williams (1985) predict a positive correlation arguing that dividends serve to reveal the true value of the stock and making equity issues less costly. On the contrary, Loderer and Mauer (1992) find evidence rejecting this hypothesis. Thus, we expect the difference between the sample and matching firm's stock issue to be negatively affected by the level of the dividend.

The identifying instrument in the net debt regression is the lagged level of the ratings. We expect firms with lower ratings to be more likely to differ from their matching sample firms because debt issues are more difficult/expensive for such firms. Since firms that do not have a debt rating cannot be fitted into this ordinal rating variable, we add separately a dummy variable equal to 1 if the firm is rated.

The identifying instrument in the net cash change regression is the sales volatility, measured as the standard deviation of the logarithm of sales over the five years prior to the index addition. A higher sales volatility is expected to negatively affect the change in net cash, because firms with higher sales volatility hold a higher cash-to-asset ratio, and thus any change is expected to be relatively smaller.

In the net investment regression, we include the ratio of investment to total assets of the event firm in year -1. This allows us to control for the possibility that investment — which includes acquisitions — is lumpy. We expect it to be positively related to net investment.[17] We do not expect the lagged investment to affect current net financing decisions.

In the first-stage regression, we use as instrumental variables all the exogenous variables plus year dummies.[18] The R-squares of the first-stage regressions (not reported) are between 12% (net debt issue regression) and 41% (net equity issue regression).

3.2.4 Results

The results of the estimate of the system of equations are reported in Table 3. First, the change in institutional ownership is significantly positively correlated with the abnormal announcement return. This finding is in line with earlier studies (e.g., Shleifer, 1986) arguing that at least a part of the market's reaction is due to a downward-sloping demand curve for stocks. The insignificant coefficient on the proxy for the change in liquidity suggests that either our proxy is not good enough or that liquidity is in fact not a major determinant of the announcement return. This is in line with the conclusion drawn by Beneish and Whaley (1996)[19]. We also find a

negative but insignificant coefficient on the net run-up. The negative sign is consistent with the interpretation that some institutional investors already buy stocks in anticipation of their being added to the index, thus reducing the market impact at the announcement.

Second, and more important, there is evidence that inclusion in the index induces managers to increase the share of equity in the capital structure. The coefficient in the net stock issue regression is 0.811, significant at the 1% level, indicating that firms with a higher abnormal announcement return issue more equity than the matching sample firms do in the same period. This finding is important as it suggests a potential role for the companies themselves as arbitrageurs. However, by itself it does not allow us to differentiate between the market timing and more traditional capital structure theories.

Third, regarding the asset side, the abnormal return is significantly positively correlated with net investment, significantly negatively correlated with changes in net cash holdings, and insignificantly negatively related to net debt issues. The first correlation is in line with our earlier finding that the cost of equity decreases after the event and suggests that investment is increased in response to the equity price change. The increase in investment is consistent with the traditional theories as well as with the market timing theory, under the assumption that the average firm is run by managers with a short horizon. The negative correlation between the abnormal return and the change in cash holdings instead is the opposite of what the traditional theories imply. One potential explanation for the negative correlation is that firms where the abnormal return is higher use more of the cash for investments or reductions in debt.

The finding of an insignificantly negative correlation between the abnormal return and net debt issues does not support the trade-off theory argument that the change in the cost of equity reduces the amount of debt raised. However, the coefficient is -0.338 with a p-value of 11%. This is not a strong rejection of the trade-off theory.

Let us now focus on the change in the degree of information asymmetry. According to the pecking-order theory, a reduction in information asymmetry should induce firms to issue more equity and have lower cash holdings[20]. The findings support this prediction. Indeed, there is a positive and significant correlation between our proxy for the reduction in the level of information asymmetry — net change in the number of analysts — and net stock issues. Moreover, there is a negative, albeit only marginally significant, correlation between the net change in the number of analysts and the net change in cash.

However, the pecking-order theory also posits that a reduction in information asymmetry should induce firms to underinvest less, as they are now, on average, more valued in line with managers' view. In other words, firms should raise external capital primarily to cover investment

expenses. This prediction is not supported by the data, given the lack of correlation between the change in information asymmetry and investment as well as equity issues and investment. Therefore, the analysis of the changes in the corporate policies conditional on changes in information asymmetry is only partially consistent with the predictions of the pecking-order theory.

Firms with higher insider ownership raise significantly more equity, reduce net cash holdings, and do not display a difference in either investment or debt issues. Thus, assuming that higher insider ownership proxies for fewer agency problems, the data does not support the prediction of agency models that higher agency problems lead to higher investment (more overinvestment), higher use of equity and lower use of debt. Also, the lack of correlation between equity issues and investment is contrary to the predictions of agency models based on empire building managers.[21] Finally, we find that our identifying variables are all significant and, with the exception of the coefficient on the stock return volatility in the AR-regression, display the expected sign.

3.2.5 Robustness tests: a different measure of change in the cost of equity

Thus far, we have used the abnormal return as a proxy for the change in the cost of equity. This measure has the advantage of being exogenous from the point of view of the managers. As a robustness test, we now use the change in the cost of equity as computed in Table 1. However, the cost of equity cannot be considered exogenous from the manager's point of view. Indeed, if the managers respond to the market's reaction to the addition by increasing equity as a function of the abnormal return, the change in the cost of equity, measured over a long period of time, is potentially affected by the firm's reaction to the initial announcement return. We therefore explicitly account for this potential endogeneity of the cost of equity by estimating a system of equations similar to equation 1, replacing AR with our proxy of the change in the cost of equity and allowing the corporate policies to affect the change in the cost of equity.

The results are reported in Table 4. They show that, as the cost of equity decreases, both equity issues and investment increase significantly. This suggests that firms can exploit the change in the cost of equity to issue more equity.

If we explore the endogeneity of the change in the cost of equity, we find that the change in the cost of equity is affected by net equity issues and net debt issues, while the other corporate policy changes do not significantly affect it. Interestingly, the change in the cost of equity is not significantly affected by the change in liquidity. However, since the sign is negative, the p-value is 0.14, and our proxy for the change in liquidity is not perfectly contemporaneous with the

change in the cost of equity, we refrain from making a strong statement about the role of liquidity in our setting.

Finally, it is worth noting that the change in institutional ownership is not significantly related to the change in the cost of equity. This supports the interpretation that, on average, firms act as arbitrageurs by issuing equity and thus reversing, in the long run, part of the short-run abnormal return.

3.2.6 Robustness of 3SLS analysis

While the 3SLS estimator is consistent and in general more efficient than the 2SLS estimator (e.g., Greene, 1997), it is generally more sensitive to the specification. In particular, if one equation is misspecified, coefficients of any regression could be biased. We thus compute Basmann's (1960) specification test to investigate whether exogenous variables have been inappropriately omitted from any given equation. The findings are reported in Tables 3 and 4. They provide evidence in favor of the robustness of our specification by failing to reject the null for any of the equations.[22] Thus, if the system is appropriately identified, we expect the difference between the 2SLS and 3SLS estimation to be a matter of efficiency. Robustness checks show that the inferences do not change even if we use 2SLS (not reported for brevity), although the test statistics are almost uniformly weaker.

As an additional check, we also compute the simple correlations between our instruments and the dependent variables and find them to be significant and of the same sign as in the system estimation. Moreover, all our identifying instruments are significant and consistent across the two measures of the market's reaction to the index announcement (i.e., abnormal return and change in cost of equity). These findings give us some confidence in the inferences we have drawn from the analysis so far.

Finally, we employ a methodology developed by Shyam-Sunder and Myers (1999) and Frank and Goyal (2003) for their tests of the pecking-order theory. This methodology does not consider the investment and financing to be simultaneously determined. However, the idea of the test is to investigate whether the financing deficit is covered by debt or equity. If we define D as net debt issues in year t, E as net equity issues and DEF as the financing deficit defined as dividends plus net investment plus change in working capital minus cash flow after interest and taxes, we can express the financing deficit as $DEF_t = \Delta D_t + \Delta E_t$. We run a regression similar to the one used by Frank and Goyal (2003).[23]

$$\Delta E_{it} = a + b_1 DEF_{it} + b_2 \text{ x } AFTERDUMMY_i \text{ x } DEF_{it} + e_{it}, \qquad (2)$$

where AFTERDUMMY is a dummy variable equal to 1 in event year 0 and +1. This specification allows us to investigate whether firms are more likely to issue equity after the index addition. The market timing theory predicts that b_2 is significantly positive. That is, a higher portion of the financing deficit is covered by new equity issues after the index addition. Table 5 displays the results.

Using data only for the event firms, column 2 shows that our event firms cover more of their financing deficit with new equity issues after the index addition event. The coefficient b_2 is 0.134 and significant at the 1% level. Relative to before the index addition, firms increase their use of equity to cover the financing deficit by about 40% (b_2/b_1-1). The results obtain if we use net measures, net of our matching sample firms (column 5).

Interestingly, when we disaggregate DEF into the investment and the remaining components, we find a result consistent with our 3SLS analysis. Increases in investment are significantly more likely to be financed with new equity issues after the index addition. This result again holds for the firm level as well as the net measure. The remaining components, however, show a significant increase only in the sensitivity in the firm level variables, not in the net regression. This is consistent with the interpretation that the main driver of the increased sensitivity of equity issues to the financing deficit is investment. It also suggests that it is important to control for the corporate policies simultaneously.

4 Market Reaction

The previous findings suggest that managers' actions are broadly consistent with both the market timing theory, under the assumption that the average firm is run by a short-horizon manager, and the traditional theories, in particular the trade-off theory. In order to further distinguish between the two, we investigate the stock market's reaction to the event firms' behavior after the index addition.

4.1 Two hypotheses

The traditional theories predict that firms issue more equity and increase investment in response to a lower cost of equity. Given the assumption that the change in the cost of equity reflects a permanent change in the investment opportunities of the firm, this is value enhancing. Indeed, the drop in the cost of equity lowers the hurdle rate for new projects, thus making more investment the better choice. Therefore, we expect firms that issue equity and increase investment to outperform firms that issue equity and do not increase investment. However, there is no clear

prediction as to which firm does better, the one that uses the proceeds from equity issues to reduce debt, the one that uses them to increase cash, or the one that chooses to increase investment.

The implications from the market timing theory, instead, depend on how the proceeds from the equity issuance are used. Any increase in investment is bad for long-term value because the investment decision is based on the market-implied discount rate, which is assumed to be wrong. Such a decision would be taken only by managers with short horizons, i.e., managers who, by definition, do not care about the long-term value of the company. Long-horizon managers would use the proceeds to either reduce debt or increase cash rather than investing in a project that, according to the true cost of capital, has a negative NPV. The considerations allow us to formulate the following two hypotheses.

H2A. Traditional theories: Firms that issue equity and increase investment outperform firms that issue equity but do not increase investment.

H2B. Market timing theory: Firms that issue equity and increase investment display negative long-run stock returns and underperform firms that issue equity but do not increase investment.

4.2 Empirical tests

In order to test these hypotheses, we focus on the long-run abnormal returns. We use two proxies for the long-run abnormal returns, both based on the Fama-French three-factor model. For the first proxy, we use the 12 months prior to the event in order to estimate the factor loadings. We then use these loadings and multiply them by the corresponding monthly factor premium to obtain firm level long-run abnormal returns. For the second proxy, we use the Fama-French three-factor model combined with Ibbotson's (1975) returns across time and security method (e.g., Peyer and Vermaelen, 2004). The following regression is run each month *t*:

$$\left(R_{i,t} - R_{f,t}\right) = a_t + b_t\left(R_{m,t} - R_{f,t}\right) + c_t SMB_t + d_t HML_t + \varepsilon_{i,t}, \qquad (3)$$

where $R_{i,t}$ is the monthly return on security *i* in month *t*, with t = 0 being the month of the index addition. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and book-to-market factor in month *t*, respectively. The numbers reported are the sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods.

The results with the first method of estimating long-run abnormal returns are reported in Table 6, while the ones with the second method are reported in Table 7. For the full sample, the

data in panel A do not show any significant long-run abnormal returns at the 12-, 24- or 36-month horizon with either methodology. These findings are consistent with Shleifer (1986), Garry and Goetzmann (1986) and Beneish and Whaley (1996), who do not find a reversal of the short-term announcement return.

While it is interesting to see that, on average, there is no reversion, our previous analysis suggests that we should observe negative abnormal returns for certain subsamples. Panel B of Table 6 reports correlations between changes in the corporate policies and the firm-level long-run abnormal returns estimated using the first proxy. Consistent with previous studies on equity issues, we find that firms with higher net stock issues have lower long-run abnormal returns. However, the correlations are significant only at the 24- and 36-month horizon.[24] Consistent with both the market timing and trade-off theories, net debt issues and long-run abnormal returns are negatively correlated. In addition, firms that increase net investment (net cash holdings) display a negative (positive) and mostly significant correlation with long-run abnormal returns. The negative correlation between the long-run return and investment supports the market timing theory where increases in investment based on too low a discount rate are not increasing the long-run value of the firm.

Using the second method of estimating long-run abnormal returns, we find results similar to those discussed above. In particular, the average long-run abnormal return for firms that issue equity is negative, but significant only at certain horizons, as shown in Table 7 (e.g., -9.23% in the window [+1,+36], significant at the 10% level). The subsample of firms that issue equity and increase investment displays the worst long-run performance (e.g., -16.56% in the window [+1,+36], significant at the 5% level). Issuing equity and increasing cash is also related to negative, and sometimes significant, long-run abnormal returns (e.g., -6.48% in the window [+1,+36], insignificant). Only the subsample of firms that issue equity and retire debt does not show any significant abnormal returns (e.g., -2.82% in the window [+1,+36], insignificant).[25]

In sum, the long-run study supports the conclusion that managers seem to exploit a window of opportunity, since long-run returns for firms that issue equity are negative, as is the correlation between the equity proceeds and long-run returns. This is consistent with the interpretation that the company itself acts as an arbitrageur that, by issuing new equity, sells potentially overvalued stock.

4.3 The window of opportunity and the change in the cost of equity

The conclusion from the previous section suggests that the change in the cost of equity is not permanent. In fact, the very definition of a "window of opportunity" implies that the

mispricing disappears at some point. Since the company is potentially acting as an arbitrageur after the index addition, we investigate whether the change in the cost of equity varies with the time after companies implement a policy that may close the widow of opportunity provided by the index addition.

Table 8 contains our measures for the change in the cost of equity for the firms that exploit the window of opportunity – i.e., the subsample of firms that issues equity and the one that issues and increases investment. We use the Fama-French three-factor model as reported in Table 2. The results are consistent with the interpretation that the window of opportunity closes less than 2 years after the index addition. In particular, as shown in Panel A, the subsample of firms that issues equity displays a drop in the cost of equity of 2.24 percentage points (measured over the months +1 to +12 relative to the 24 months prior to the index addition). However, the difference in the cost of equity from before to after the index addition (measured over the months +13 to +24, and +25 to +36, respectively) is not significant anymore. Panel B shows that the change is even faster for the subsample of firms that issues equity and increases investment. This indicates that there is a window of opportunity that closes over time, probably in part as a reaction to the companies' behavior.

5 A More Direct Test of Market Timing

Overall, the results tell a story that is most consistent with the predictions of Stein's (1996) market timing framework. It also complements recent evidence in Baker and Wurgler (2002) and Baker, Stein and Wurgler (2003) testing Stein's (1996) model. That is, capital structure decisions are not necessarily related to the investment policy of the company. They are instead based on the exploitation of windows of opportunity provided by the market.

One potential criticism of our analysis is that our results could be driven by firms that face financial constraints. Stein (1996) shows that the existence of financial constraints induces long-horizon managers to behave as short-horizon ones, thus investing even if the market-implied discount rate is wrong and managers know it. This has three directly testable implications, two based on a cross-sectional analysis and one based on long-run abnormal returns.

The first implication is that financially constrained firms ought to be more "equity dependent" — i.e., display a higher sensitivity of equity issues to the change in the stock price due to the event. This testing dimension has already been exploited by Baker, Stein and Wurgler (2003), who show that firms that are equity dependent rely more heavily on external capital when making investment decisions. We add to this test a setting in which the stock price changes for an exogenous reason.

Second, financially constrained firms should also react more to changes in the stock price due to the index addition by increasing investment. Again, in line with Baker, Stein and Wurgler (2003), investment for equity-dependent firms should display most sensitivity to stock price changes.

The third test is based on the long-run abnormal returns *after* the index addition. This test is unique to our setup. The addition to the index allows both the financially constrained and the unconstrained firms to issue equity and invest. However, the long-run equity return implications of this equity issue/investment decision are different. Financially constrained firms are, according to Stein's theory, the ones run by managers who act as if they had a short horizon. The long-run return implications of their financial and investment decisions are therefore negative, being based on a too-low market-implied discount rate. The addition to the index is unlikely to alter the market's expectation about these companies that have revealed themselves to be managed by short-horizon managers.[26]

Managers of unconstrained firms, however, should exploit the temporary overvaluation without using the implied lower hurdle rate to increase investment but rather buy back debt or increase cash holdings. Such managers would have a long horizon. If, however, managers of unconstrained firms were to issue equity and increase investment, they would reveal themselves to be short-horizon managers. Consequently, we expect unconstrained firms to underperform in the long run if they issue equity and increase investment relative to the firms that issue equity but do not increase investment.

To test these implications we construct a measure of financial constraints based on Kaplan and Zingales (1997) and Lamont, Polk and Saa-Requejo (2001). This index ("KZ-Index") is:

$$KZIndex_{it} = -1.002\frac{CF_{it}}{A_{it-1}} - 39.368\frac{DIV_{it}}{A_{it-1}} - 1.315\frac{C_{it}}{A_{it-1}} + 3.139LEV_{it} + 0.283Q_{it}, \quad (4)$$

where CF_{it}/A_{it-1} is cash flow divided by assets; DIV_{it} is cash dividends; C_{it} is cash balances; LEV_{it} is leverage measured in book value terms (long- and short-term debt divided by long- and short-term debt plus book value of equity); Q_{it} is the Tobin's *q* measured as the market value of equity plus the book value of debt minus the book value of equity all divided by assets. Since Q is endogenous, we follow Baker, Stein and Wurgler (2003) and define the KZ-Index by dropping the Q_{it} part in equation 4 to avoid potential endogeneity issues.

We find a mean (median) KZ-Index of -0.28 (-0.20) for our sample of S&P 500 index addition firms (Table 2, panel B). While our sample firms are likely to be large and rather "older" firms, the cross-sectional variation in the KZ-Index is nonetheless important. A higher value

indicates a higher equity dependence. We form a dummy variable, KZ dummy, which is equal to 1 if the KZ-Index is above the sample median.

5.1 Corporate reaction and financial constraints

We investigate whether financially constrained firms react differently to the index addition abnormal return by reestimating the system of equations, including the dummy variable for financial constraints and the interaction between the dummy and the announcement abnormal return.

The results are reported in Table 9. Net equity issues are still positively and significantly affected by the abnormal return, even after controlling for financial constraints.[27] Financially constrained firms display a higher sensitivity of their equity-issuing activity to the event abnormal return, although only significant at the 7% level. This finding is consistent with Baker, Stein and Wurgler (2003). Moreover, net investment is significantly more sensitive to the event abnormal return for financially constrained firms. The coefficient on the interaction variable between AR and the financial constraints dummy is 0.236 and significant at the 6% level, while the coefficient on AR is 0.367 with a p-value of 0.12.

Debt issues and cash holdings are significantly negatively related to the interaction between our proxies for financial constraints and AR. In particular, financially constrained firms reduce both cash and debt more than unconstrained firms. The fact that they also reduce debt suggests that not all the equity proceeds are invested, and, as predicted by theory, even in the case of financially constrained companies, the decision to invest is always traded off against adjusting the financial structure (Stein, 1996).

As an additional robustness test, we include the corporate policy variables as right-hand side variables in the AR regression. The idea, similar to Denis et al. (2003), is to test whether the market's initial reaction to the index addition already reflects expected changes in corporate policies. AR is positively affected by net stock issues and negatively affected by net debt issues and net cash change. Net investment is not significantly correlated with AR. One possible explanation of the unexpected positive correlation between net stock issues and AR is that the expected changes in the corporate financial policies proxy for the intensity of the change in the cost of equity itself. That is, investors, when expecting a higher amount of new equity issues, also expect better short-term (and potentially long-term) abnormal returns. In this case, the bigger the equity issue, the more they will invest in the stock to gain from the abnormal return.

Taken together, all these findings suggest that the firms that are more constrained from optimally investing due to the potential deviation of the stock price from the "fundamental" value, respond more to stock price changes by issuing more equity and increasing investment.

5.2 Market reaction and financial constraints

As we mentioned before, the equity issue/investment decision following the addition to the index allows the identification of short-term managers. We can therefore use the reaction to the equity price increase following the addition to the index as an ideal experiment to separate short-horizon and long-horizon managers and study the market reaction. We report the results of these tests in Table 10. We consider the entire sample stratified by financially constrained firms (first column) and unconstrained firms (second column), as well as the subsample of the firms that issue equity and increase investment, still stratified by financially constrained firms (third column) and unconstrained firms (fourth column).

The results are very striking and supportive of Stein's market timing theory. The first thing to note is the very strong negative long-run abnormal returns of the financially constrained firms, measured by a high KZ-Index. This is consistent with previous findings in Lamont, Polk and Saa-Requejo (2001). More interesting, however, is the finding that for the subsample of firms that issue equity and increase investment, the long-run abnormal return is indistinguishable from the high KZ-Index firms in column 1. In other words, financially constrained firms that issue and increase investment perform poorly in the long run but not worse than the remaining financially constrained firms.

While issuing equity and investing does not alter the negative performance of financially constrained firms, the subsample of unconstrained firms displays remarkably different long-run returns. Unconstrained firms overall display a significant positive long-run performance. However, the decision to issue equity and increase investment leads to a negative long-run performance (although only marginally significant after 14 to 28 months), whereas issuing and not increasing investment leads to positive long-run performance (marginally significant at certain horizons). Thus, issuing equity and increasing investment sets firms' long-run returns apart as predicted by the market timing theory. Furthermore, our results support the notion that firms with short-horizon managers (or managers who act as if they have a short horizon due to financial constraints) underperform in the long run, at least in part because their investment decisions are based on stock mispricing.

6 Considerations on the Limits of Arbitrage and the Efficiency of the Market

These findings raise an important question: Why is it that the market does not foresee the reaction of the firm? If the market were foreseeing it, we should find that the firm would not be able to exploit the differential in cost of capital generated by the addition to the index. There are three possible answers. The first is simply that this is an anomaly, and the market has not yet fully rationalized it. Over time it is bound to disappear as the market gets better educated.

The second possibility is that investors are, at least to a certain degree, irrational, in the sense that equity can be mispriced, and the corporate reactions to the mispricing are only slowly and over time used to update the value of equity.

A third possibility assumes that investors are rational, but that there are limits to arbitrage. Thus, investors are optimally reacting, but with a delay. The intuition is similar to the one for arbitrage capital around merger and acquisitions (Baker and Savasoglu, 2002). Investors ("arbitrage capital") know that the company will, on average, experience an increase in price. However, they also know that there will be underperformance in the long run if the company issues equity and increases investment, and are uncertain about the issue-and-invest decision of the firm. They know that this will happen only with a certain probability, and account for the risk involved in this strategy in a way analogous to arbitrage capital in mergers and acquisitions. In that case the risk is completion risk; here the risk is that the company issues new equity and increases investment. The investor's gain would accrue in cases in which the company does not issue new equity.

Thus, the data is consistent with a broad version of market timing, in which there are rational and irrational investors and limits of arbitrage prevent the rational investors from arbitraging away the mispricing. This provides a new dimension to the "S&P 500 game," outlining the role of two players: the companies, who act as arbitrageurs, and the investors, who act as capital providers. It also sheds new light on the literature on the limits of arbitrage and links it to Stein's theory of corporate finance.

7 Conclusion

We study an event — the addition of the stock of a company to the S&P 500 index — that allows the company itself to act as an arbitrageur. We find that the higher the index addition's abnormal announcement return, the more equity a firm issues. We show that the long-run abnormal returns are negative for the subsample of firms that issue equity after the event. This supports the interpretation that managers exploit the window of opportunity when issuing

equity. We conclude that the data is consistent with the interpretation that companies themselves act as arbitrageurs. This provides a potential reconciliation between the findings of Shleifer (1986) and Garry and Goetzmann (1986), who show that the index addition has a permanent effect on the share price, and Harris and Gurel (1986), Beneish and Whaley (1996) and Lynch and Mendenhall (1997), who find a reversal. The very fact that a company's reactions to the event itself seems to affect long-run performance leaves room for different findings at different time horizons.

We also use the S&P 500 index addition as an experiment where the equity valuation changes — but is exogenous from a manager's point of view — to test alternative capital structure theories. We show that the addition to the index reduces the cost of equity. We find that firms react to a higher abnormal announcement return by issuing more equity and increasing investment. This supports the predictions of both Stein's (1996) market timing theory and traditional theories. The analysis of the long-run market reaction supports the market timing theory. Firms that are unconstrained but issue equity and increase investment display negative long-run abnormal returns, consistent with the firms being managed by short-horizon managers. We believe that these findings provide an important step toward a better understanding of the interactions between asset pricing and corporate finance, which should be a promising area for future research.

Appendix

Definition of the variables

Panel A. Measures of abnormal return, institutional ownership change and cost of capital change

Abnormal Return	Abnormal Return is defined as the cumulative abnormal return from day -5 to day +5 of the announcement of S&P 500 addition using the market model with the CRSP equally weighted index as the market return. In estimating the market model, we use the firm's daily return and the return on CRSP equally weighted index over days -300 to -46, where date 0 is the S&P 500 announcement date.
Instowner Change	Instowner Change is defined as the institutional ownership at quarter +1 minus institutional ownership at quarter -1, where institutional ownership is the total number of shares owned by institutions as reported by TFN/Institutional divided by the number of shares outstanding.
Liquidity Change	Liquidity Change is the average monthly volume in (+1, +12) months minus the average monthly volume in (-12, -1) months, where volume is number of shares traded divided by number of shares outstanding and month 0 is the month in which the index addition was announced.
$Beta_{Mkt}$ $Beta_{SMB}$ $Beta_{HML}$	$Beta_{Mkt}$, $Beta_{SMB}$ and $Beta_{HML}$ are the factor loadings in the Fama-French three-factor model. We use the firm's daily return in the 24 (12) months before the event to estimate the parameters of the regression model before the index addition announcement, and use the firm's daily return in the 24 (12) months after the event to estimate the parameter of the regression model after the index addition announcement, where month 0 is the month of the index addition announcement.
Cost of Equity Change	Cost of Equity Change is obtained by evaluating the change of risk characteristics ($Beta_{Mkt}$ Change, $Beta_{SMB}$ Change, $Beta_{HML}$ Change) at the average market, SMB, HML risk premium over the 60 months prior to the event months or in the period 1977 to 2000, respectively.

Panel B. Measures of corporate financial policies

Net Leverage Change	Net Leverage Change is defined as the leverage change of event firms minus the leverage change of comparable firms. Leverage change is defined as leverage at year +1 minus leverage at year -1, where leverage=(book value of assets (#6) minus book value of equity (#6-#181-#10+#35+#79)) / book value of assets (#6), where year 0 is the event year.
Net Stock Issue	Net Stock Issue is defined as the stock issue of event firms minus the stock issue of comparable firms. Stock issue is defined as the average of year 0 and year +1 common and preferred stock issued minus common and preferred stock repurchased (#108-#115) / book value of assets (#6), where year 0 is the event year.
Net Debt Issue	Net Debt Issue is defined as the debt issue of event firms minus the debt issue of comparable firms. Debt issue is defined as the average of year 0 and year +1 long-term debt issued minus long-term debt retired (#111-#114) plus changes in short-term debt (#301) / book value of assets (#6), where year 0 is the event year.
Net Cash Change	Net Cash Change is defined as the cash change of event firms minus the cash change of comparable firms. Cash change is defined as cash ratio at year +1 minus cash ratio at year -1, where year 0 is the event year. Cash ratio=cash and short-term investment (#1) / book value of assets (#6)
Net Investment	Net Investment is defined as the investment of event firms minus the investment of comparable firms. Investment is defined as the average of year 0 and year +1 capital expenditure (#128) plus acquisition (#129) / book value of assets (#6), where year 0 is the event year.
$Leverage_{t-1}$	$Leverage_{t-1}$ is defined as the leverage at year -1, where year 0 is the event year. Leverage=(book value of assets (#6) minus book value of equity (#6-#181-#10+#35+#79)) / book value of assets (#6).
$Cash_{t-1}$	$Cash_{t-1}$ is defined as the cash ratio at year -1, where cash ratio=cash and short-term investment (#1) / book value of assets (#6), where year 0 is the event year.
$Investment_{t-1}$	$Investment_{t-1}$ is defined as the investment at year -1. Investment is defined as the average of year 0 and year +1 capital expenditure (#128) plus acquisition (#129) / book value of assets (#6), where year 0 is the event year.
$Size_{t-1}$	$Size_{t-1}$ is defined as the log of the book value of assets (#6) at year -1, where year 0 is the event year.
M/B_{t-1}	M/B_{t-1} is defined as the market to book ratio at year -1, where the market-to-book ratio is the market value of equity (#25*#199) plus the book value of assets (#6) minus the book value of common equity (#60) / book value of assets (#6), where year 0 is the event year.

Panel C. Measures of control variables

Insider Ownership	Insider Ownership is defined as the level of insider ownership at year -1.
Net Analyst Change	Net Analyst Change is defined as the analyst change of event firms minus the analyst change of comparable firms. Analyst change is defined as the number of analysts at year +1 minus the number of analysts at year -1, where the number of analysts is the number of analysts of the first one-year forecast for a certain fiscal year. The data is from IBES.
Net Rating Change	Net Rating Change is defined as the rating change of event firms minus the rating change of comparable firms. Rating change is defined as (-1) × credit rating at year +1 minus credit rating at year -1, where credit rating=S&P long-term domestic issuer credit rating (#280). When the rating data is not available in Compustat, we use the rating data in SDC. For the firms with missing rating in either year +1 or year -1, we set the rating change to zero.
Prior Market Return	Prior Market Return is defined as the sum of the monthly value-weighted market return in the interval -7 to -1 months.
Prior Market Volatility	Prior Market Volatility is defined as the standard deviation of the daily value-weighted market return in the interval -7 to -1 months.
Term Premia	Term Premia is defined as 10-year Treasury constant maturity rate minus 1-year Treasury constant maturity rate in the month prior to the event.
Net Run-up	Net Run-up is defined as the run-up of event firms minus run-up of comparable firms. Run-up is defined as the sum of the firm's monthly return in the interval -7 to -1 months.
Stock Return Volatility	Stock Return Volatility is defined as the standard deviation of the daily stock return in the (-12, -1) months.
Rating	Rating is defined as the credit rating, where credit ratings are from S&P as reported in Compustat (#280) and SDC. We multiply the rating by -1. The best-rated companies thus have the highest value, which is -2. Lower-rated firms have a lower rating, i.e., more negative. If a firm's rating is missing, it is set equal to the median of the non-missing ratings of the matching firms.
Sales Volatility	Sales Volatility is defined as the standard deviation of the logarithm of sales (#12) in the prior five years.
Earnings Volatility	Earnings Volatility is defined as the standard deviation of the cash flow (#13) divided by assets (#6) in the prior five years.
Dividends	Dividends are defined as the dividends (#21) divided by assets (#6).
Liquidity_{t-1}	Liquidity_{t-1} is defined as the average monthly volume in (-12, -1) months, where volume is number of shares traded divided by number of shares outstanding.

Panel D. Measures of long-term abnormal return

Long-run Abnormal Return (+1, +12) months Long-run Abnormal Return (+1, +24) months Long-run Abnormal Return (+1, +36) months	Long-run Abnormal Return (+1, X) months is defined as the sum of the difference between actual return and expected return in (+1, X) months after the index addition announcement, where X is 12, 24 or 36, respectively. The expected return is obtained by using the factor loadings in the Fama-French three-factor model estimated in the period of (-60, -1) months, using the firm's monthly return.

References

Asquith, P., and D.W. Mullins, 1986, Equity issues and offering dilution, *Journal of Financial Economics* 15, 61–89.

Baker, M., C.F. Foley, and J. Wurgler, 2004, The stock market and investment: evidence from FDI flows, Harvard University working paper.

Baker, M., R. Ruback, and J. Wurgler, 2004, Behavioral corporate finance: A survey, forthcoming in *The Handbook of Corporate Finance: Empirical Corporate Finance*.

Baker, M., and S. Savasoglu, 2002, Limited arbitrage in mergers and acquisitions, *Journal of Financial Economics* 64, 91–116.

Baker, M., J. Stein, and J. Wurgler, 2003, When does the market matter? Stock prices and the investment of equity-dependent firms, *Quarterly Journal of Economics* 118, 969–1006.

Baker, M., and J. Wurgler, 2002, Market timing and capital structure, *Journal of Finance* 57, 1–32.

Baltagi, B.H., 1998, *Econometrics*. New York: Springer.

Barberis, N., A. Shleifer, and J. Wurgler, 2003, Comovement, *Journal of Financial Economics*, forthcoming.

Basmann, R.L., 1960, On finite sample distributions of generalized classical linear identifiability test statistics, *Journal of the American Statistical Association* 55, 650–659.

Beneish, M.D., and R.E. Whaley, 1996, An anatomy of the "S&P game": The effects of changing the rules, *Journal of Finance* 51, 1909–30.

Chan, L., and J. Lakonishok, 1993, Institutional trades and intraday stock price behavior, *Journal of Financial Economics* 33, 173–99.

Chan, L., and J. Lakonishok, 1995, The behavior of stock prices around institutional trades, *Journal of Finance* 50, 1147- 74.

Denis, D.K., J.J. McConnell, A.V. Ovtchinnikov, and Y. Yu, 2003, S&P 500 index additions and earnings expectations, *Journal of Finance* 58, 1821–1840.

Dhillon, U., and H. Johnson, 1991, Changes in the Standard and Poor's 500 list, *Journal of Business* 64, 75–85.

Fama, E.F., and K. French, 2002, Testing trade-off and pecking-order predictions about dividends and debt, *Review of Financial Studies* 15, 1–33.

Fazzari, S.M., R.G. Hubbard, and B.C. Petersen, 1988, Financing constraints and corporate investment, *Brookings Papers on Economic Activity*, 141–195.

Foerster, S.R., and G.A. Karolyi, 1999, The effects of market segmentation and investor recognition on asset prices: Evidence from foreign stocks listing in the United States, *Journal of Finance* 54, 981–1014.

Frank, M., and V. Goyal, 2003, Testing the pecking-order theory of capital structure, *Journal of Financial Economics* 67, 305–350.

Froot, K.A., P.G.J. O'Connell, and M. Seasholes, 2001, The portfolio flows of international investors, *Journal of Financial Economics* 59, 151–93.

Garry, M., and W.N. Goetzmann, 1986, Does delisting from the S&P 500 affect stock price? *Financial Analysts Journal* 42, 64–69.

Goetzmann, W.N., and M. Massa, 2002, Index funds and stock market growth, *Journal of Business* 76, 1–28.

Greene, W.H., 1997, *Econometric analysis*, Prentice Hall.

Gromb, D., and D. Vayanos, 2002, Equilibrium and welfare in markets with financially constrained arbitrageurs, *Journal of Financial Economics* 66, 361–408.

Harris, L., and E. Gurel, 1986, Price and volume effects associated with changes in the S&P 500: New evidence for the existence of price pressure, *Journal of Finance* 41, 851–60.

Hedge, S.P., and J.B. McDermott, 2003, The liquidity effects of revisions to the S&P 500 index: An empirical analysis, *Journal of Financial Markets*, 413–459.

Himmelberg, C., S. Gilchrist, and G. Huberman, 2004, Do stock price bubbles influence corporate investment?, Columbia working paper.

Ibbotson, R., 1975, Price performance of common stock new issues, *Journal of Financial Economics* 2, 235–272.

Jensen, M.C., 1986, Agency costs of free cash flow, corporate finance and takeovers, *American Economic Review,* 323–329.

Jensen, M.C., and W.H. Meckling, 1976, Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of Financial Economics* 3, 305–360.

John, K., and J. Williams, 1985, Dividends, dilution, and taxes: A signaling equilibrium, *Journal of Finance* 40, 1053–1070.

Kaplan, S.N., and L. Zingales, 1997, Do investment-cash flow sensitivities provide useful measures of financing constraints?, *Quarterly Journal of Economics*, 169–705.

Kaul, A., V. Mehrotra, and R. Morck, 2000, Demand curves for stocks *do* slope down: New evidence from an index weights adjustment, *Journal of Finance* 55, 893–912.

Lakonishok, J., A. Shleifer, and R.W. Vishny, 1991, Do institutional investors destabilize stock prices? Evidence on herding and feedback trading, NBER Working Paper no. 3846, Cambridge, Mass.: National Bureau of Economic Research.

Lakonishok, J., A. Shleifer, and R.W. Vishny, 1992, The impact of institutional trading on stock prices, *Journal of Financial Economics* 32, 23–43.

Lamont, O., 1997, Cash flow and investment: Evidence from internal capital markets, *Journal of Finance* 52, 83–110.

Lamont, O., C. Polk, and J. Saa-Requejo, 2001, Financial constraints and stock returns, *Review of Financial Studies*, 529–554.

Loderer, C., J. Cooney, and L. Van Drunen, 1991, The price elasticity of demand for common stock, *Journal of Finance* 46, 621–651.

Loderer, C., and D.C. Mauer, 1992, Corporate dividends and seasoned equity issues: An empirical investigation, *Journal of Finance* 47, 201–225.

Lucas, D.J., and R.L. McDonald, 1990, Equity issues and stock price dynamics, *Journal of Finance* 45, 1019–1043.

Lynch, A.W., and R.R. Mendenhall, 1997, New evidence on stock price effects associated with changes in the S&P 500 index, *Journal of Business* 70, 351–83.

Masse, I., R. Hanrahan, J. Kushner, and F. Martinello, 2000, The effect of additions to or deletions from the TSE 300 Index on Canadian share prices, *Canadian Journal of Economics,* 341–360.

Mayer, C., and O. Sussman, 2004, A new test of capital structure, unpublished working paper.

Modigliani, F., and M. Miller, 1963, Corporation income taxes and the cost of capital: A correction, *American Economic Review* 53, 433–443.

Morellec, E., 2004, Can managerial discretion explain observed leverage ratios? *Review of Financial Studies* 17, 257–294.

Myers, S.C., 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147–176.

Myers, S.C., 1984, The capital structure puzzle, *Journal of Finance* 39, 575–592.

Myers, S.C., and N. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 187–221.

Opler, T., L. Pinkowitz, R. Stulz, and R. Williamson, 1999, The determinants and implications of corporate cash holdings, *Journal of Financial Economics* 52, 3–46.

Panageas, S., 2004, Speculation, overpricing and investment: Theory and empirical evidence, University of Pennsylvania working paper.

Pastor, L., and P. Veronesi, 2003, Stock valuation and learning about profitability, *Journal of Finance* 58, 1749–1791.

Peyer, U.C., and T. Vermaelen, 2004, The many facets of privately negotiated stock repurchases, *Journal of Financial Economics*, forthcoming.

Shleifer, A., 1986, Do demand curves for stocks slope down? *Journal of Finance* 41, 579–590.

Shleifer, A., and R.W. Vishny, 1997, Limits of arbitrage, *Journal of Finance* 52, 35–56.

Shyam-Sunder, L., and S.C. Myers, 1999, Testing static trade-off theory against pecking-order models of capital structure, *Journal of Financial Economics* 51, 219–244.

Stein, J., 1996, Rational capital budgeting in an irrational world, *Journal of Business* 69, 429–55.

Teo, M., and S.J. Woo, 2002, Style effects, unpublished working paper.

Warther, V.A., 1995, Aggregate mutual fund flows and security returns, *Journal of Financial Economics* 39, 209–35.

Welch, I., 2004, Capital structure and stock returns, *Journal of Political Economy* 112, 106–131.

Zheng, L., 1999, Is money smart? A study of mutual fund investors' fund selection ability, *Journal of Finance* 54, 901–33.

[1] We use the term limits of arbitrage interchangeably with limited arbitrage to include the case where all market participants are rational but arbitrageurs' resources are limited (Shleifer and Vishny, 1997).

[2] In the regression framework we will further investigate the correlation between AR and the change in institutional ownership.

[3] This can be seen most easily by thinking of the present value of a perpetuity with cash flow CF and discount rate r_1. The event increases the present value from PV_1 to PV_2 without changing CF. Thus the new discount rate r_2 would need to be lower than r_1.

[4] In what follows we use this version of computing the change in the cost of equity. However, similar results are obtained using the other versions (not shown).

[5] The most significant change is the drop in $Beta_{SMB}$. Also significant is the drop in $Beta_{HML}$. In contrast to Barberis, Shleifer and Wurgler (2003), we do not find a significant change in $Beta_{Market}$ although the index addition is moving the market beta closer to 1. This can be explained by our use of a three-factor model where the market return is the value-weighed CRSP index, as opposed to Barberis et al. (2003), who use a one-factor model with the S&P 500 index as the market. Indeed, if we reestimate the change in the cost of equity using a single-factor model, the results are consistent with the ones of Barberis et al. (2003) (not tabulated).

[6] Criteria for inclusion in the S&P 500 index are objective as well as subjective. A potential index company must be profitable (for at least four quarters), not closely held (a minimum of 50% of its stock should be public) and large (at least $4 billion market capitalization is the standard in 2004), and must have a significant share trading volume (one-third of its total shares per year). Besides the objective criteria, industry composition and representation of the economy are factors the eight-member committee considers. However, once added to the index, S&P 500 companies do not need to meet these criteria to stay in the index (www2.standardandpoors.com/spf/pdf/index/US_Methodology.pdf; September 2004).

[7] The market timing theory predicts equity issues only if the company's equity is overvalued. Undervalued firms should not issue equity. However, in our sample, higher abnormal announcement returns increase the probability of being overvalued.

[8] Stein (1996) defines managers as having a short horizon if they can realize gains from their actions before the "truth" is revealed. Essentially, the gains are based upon wealth transfers between new and old investors.

[9] The trade-off theory predicts that leverage is set to a level at which the costs and benefits of debt are balanced. The benefits of debt are its tax shield (Modigliani and Miller, 1963) and a potential reduction in the free cash flow problem (Jensen, 1986). In particular, a reduction in the cost of capital increases the number and size of the positive-NPV projects. This lowers the free cash flow at hand and thus the agency cost of equity. At the same time, more valuable investment opportunities increase the cost of financial distress and agency cost of debt. These three effects — lower agency cost of equity, higher financial distress and agency cost of debt — coincide to reduce the amount of debt in the optimal capital structure. A feature that is unique to our experiment is that the change in the equity value is due to a change in the discount rate, not a change in the expected cash flows. If the change in equity value were primarily due to changes in expected cash flows, the optimal leverage could increase because tax shields become more valuable. This sets this experiment apart from prior results (Baker and Wurgler, 2002; Welch, 2004).

[10] However, if firms also choose an optimal cash leverage (e.g., Opler, Pinkowitz, Stulz and Williamson, 1999), our tests need to consider the impact of the change in the cost of equity on debt and cash separately. According to Opler et al. (1999), a drop in the cost of capital increases investment opportunities and thus raises the value of the precautionary motive of cash. Also, a reduction in the opportunity cost of holding cash due to the lower cost of capital increases the optimal level of cash holdings.

[11] The pecking-order theory (Myers, 1984; Myers and Majluf, 1984) is based on the assumption that managers have superior information and act in the interest of current shareholders. The existence of an information asymmetry between the managers and the market implies that equity issues, by signaling overvaluation, induce the price to drop. Therefore, managers would use internal funds first before raising capital through bond and equity issues. A strict interpretation of the pecking-order theory posits that firms will never issue equity (Myers, 1984; Mayer and Sussman, 2004) or will issue equity only if they have found a "way out of the asymmetric information problem" (Fama and French, 2002). Thus, once we control for changes in the level of information asymmetry, the strict version of the pecking-order theory predicts that managers do not react to the change in the price of equity by issuing equity, because of the high cost of adverse selection. A more flexible interpretation of the pecking-order theory (Myers, 1984, and Myers and Majluf, 1984) allows for equity issues if information asymmetries exist only for a short period and the cost of underinvesting is sufficiently large. That is, if the change in the cost of capital increases the value of the investment opportunities, firms should first use cash and issue debt and only as a last resort issue equity to make investments.

[12] The numbers in parentheses indicate the reference to the Compustat data item number.

[13] Qualitatively similar results obtain if we use the change in the book value of equity using the balance sheet information instead of the cash flow statement. Equity issues not for cash are also included in the balance sheet measure.

[14] For robustness tests we have also used SDC data on equity issue and repurchase announcements to select only equity transactions in the 24 months after the index addition. SDC data also excludes increases in equity due to option exercises. Results are similar to the ones reported below and are omitted for brevity.

[15] While it is interesting to note that equity issues have marginally increased relative to the matching sample firms after the index addition, the average increase is economically relatively small. One possible explanation is that the average change in the stock price due to the index addition is small compared to the transaction costs of issuing equity. However, the transaction cost argument should not affect the cross-sectional predictions of the capital structure theories, i.e., higher abnormal announcement returns should be positively related to higher net equity issues.

[16] Using 2SLS instead, we find the coefficients to be similar but less significant, as expected (e.g., Greene, 1997).

[17] Imposing this structure on the system of equations makes all equations overidentified. Also, the rank conditions are satisfied since we excluded at least four exogenous variables from each equation. See subsection 3.2.6 for a discussion of the robustness tests of the 3SLS estimation.

[18] As shown in Baltagi (1998, p. 278), all exogenous variables need to be included in each first-stage regression.

[19] Notice that our finding supports their conclusion that liquidity is not a major determinant of AR by relating liquidity directly to AR, while they come to their conclusion based on the lack of a permanent change in the bid-ask spread, despite the fact that the average trading volume increased.

[20] However, it is worth noting that a similar prediction is made by the trade-off theory as highlighted in Opler, Pinkowitz, Stulz and Williamson (1999). If the wedge between the cost of internal and external capital decreases, the precautionary motive for holding cash loses importance, therefore predicting a negative correlation between changes in the net number of analysts and cash holdings.

[21] However, the negative correlation between net equity issue and net debt issue is in line with the predictions of agency models (Jensen and Meckling, 1976; Jensen, 1986; Morellec, 2004). Indeed, this would be consistent with a story in which managers react to an unexpected increase in stock value by issuing more equity and using the proceeds to reduce debt, given their preference for low(er) leverage (Morellec, 2004).

[22] The same inferences can be drawn from a Hausman test based on the Lagrange multiplier principle (e.g., Greene, 1997, p.762).

[23] Frank and Goyal (2003) run the following regression: $\Delta D_{it} = a + b \times DEF_{it} + e_{it}$. The pecking order predicts the coefficient b to be 1.

[24] Notice that, in contrast with the existing literature on equity issues, we measure the long-run abnormal return from the index addition, not from the equity issue date, because we are interested in the long-run return after the event conditional on the corporate reaction to the index addition event.

[25] We also investigate whether the occurrence of the different subsamples is correlated with business cycles. In particular we were concerned whether the "issue and invest" subsample displays a higher frequency toward the end of a business cycle, thus displaying negative long-run returns due to the effect of the business cycle downturn on the value of the investments. We could not find any evidence of such clustering (not tabulated).

[26] The only exception is the case in which the event, by relaxing the financial constraints of the firm, allows the firm to undertake positive-NPV projects it could not take before. Then the long-run stock returns could be positive *relative* to firms that are financially constrained and do not issue and invest.

[27] We get similar results if we define net equity issues using SDC as a source for seasoned equity issues or if we use the balance sheet change in equity.

Table 1
Univariate Statistics on Abnormal Return, Institutional Ownership and Cost of Equity Change

The table reports univariate statistics on abnormal return, institutional ownership change and cost of capital change. Panel A shows univariate statistics on abnormal return and institutional ownership change. *Abnormal Return* is the cumulative abnormal return from day -5 to day +5, where day 0 is the announcement of the S&P 500 index addition, using the market model with the CRSP equally weighted index as the market return. *Instowner Change* is the institutional ownership at quarter +1 minus institutional ownership at quarter -1, where institutional ownership is the total number of shares owned by institutions as reported by TFN/Institutional divided by the number of shares outstanding. *Liquidity Change* is the average monthly volume in (+1, +12) months minus the average monthly volume in (-12, -1) months, where volume is number of shares traded divided by number of shares outstanding and month 0 is the month in which the index addition was announced. Panel B shows univariate statistics on the change in the cost of equity. We estimate the change of beta using the model: $(R_{i,t} - R_{f,t}) = a + b_1 \times (R_{m,t} - R_{f,t}) + b_2 \times SMB_t + b_3 \times HML_t + c_1 \times After_t \times (R_{m,t} - R_{f,t}) + c2 \times After_t \times SMB_t + c3 \times After_t \times HML_t + \varepsilon_t$, where $After_t$ is a dummy variable that is 1 after the index addition and 0 before the index addition. b_1, b_2, and b_3 are the betas before the index addition. c_1, c_2, and c_3 are the change of the betas after the index addition. The period for estimating betas is indicated in the table. *Change in cost of equity* is obtained by evaluating the change of betas at the average risk premium over the periods indicated in the table.

Panel A. Abnormal Return and Institutional Ownership Change

Variable	Mean	Median	25th Percentile	75th Percentile	Standard Deviation	Mean Test	Median Test
Abnormal Return	0.0321	0.0378	-0.0041	0.0713	0.0661	0.01	0.01
Instowner Change	0.0140	0.0103	-0.0182	0.0415	0.0597	0.01	0.01
Liquidity Change	0.0124	0.0081	-0.0034	0.0201	0.0479	0.01	0.01

Panel B. Cost of Equity Change with different methods of calculation

Period for Estimating Changes of Betas	Period for Average Risk Premium	Cost of Equity Change (Mean)	Mean Test
(-24, -1) and (+1, +24) months	(-60, -1) months	-0.0126	0.03
(-24, -1) and (+1, +24) months	From 1977 to 2000	-0.0114	0.01
(-12, -1) and (+1, +12) months	(-60, -1) months	-0.0168	0.02
(-12, -1) and (+1, +12) months	From 1977 to 2000	-0.0124	0.02

Table 2
Univariate Statistics on Corporate Financial Policies and Control Variables

The table reports univariate statistics of 222 companies that are added to the S&P 500 index. Panel A shows univariate statistics on corporate financial policies. *Leverage Change* is the leverage at year +1 minus the leverage at year -1, where leverage is defined as the book value of assets minus book value of equity, divided by book value of assets. *Stock Issue* is the average of year 0 and year +1 common and preferred stock issued minus common and preferred stock repurchased divided by assets. *Debt Issue* is the average of year 0 and year +1 long-term debt issued minus long-term debt retired plus changes in short-term debt divided by assets. *Cash Change* is the cash ratio at year +1 minus the cash ratio at year -1, where the cash ratio is defined as cash and short-term investment divided by assets. *Investment* is the average of year 0 and year +1 capital expenditures plus acquisitions divided by assets. *Size* is the natural log of assets. *M/B* is the market-to-book ratio, measured as the market value of equity plus the book value of assets, minus the book value of common equity, divided by the book value of assets. Panel B shows univariate statistics on control variables. *Insider Ownership* is the total number of shares owned by insiders divided by the number of shares outstanding. *Analyst Change* is the number of analysts at year +1 minus the number of analysts at year -1. *Rating Change* is defined as (-1) × credit rating at year +1 minus credit rating at year -1. Credit ratings are from S&P as reported in Compustat and SDC. *Prior Market Return* is the sum of the monthly value-weighted market return in the interval -7 to -1 months. *Prior Market Volatility* is the standard deviation of the daily value-weighted market return in the interval -7 to -1 months. *Term Premia* is the 10-year Treasury constant maturity rate minus the 1-year Treasury constant maturity rate in the month prior to the event. *Run-up* is the sum of the firm's monthly return in the interval -7 to -1 months. *KZ-Index* is calculated as KZ-Index = -1.002 x cash flow/assets – 39.368 x dividends/assets – 1.315 x cash balances/assets + 3.139 x leverage (long- and short-term debt divided by long- and short-term debt plus book value of equity). *Stock Return Volatility* is the standard deviation of the daily stock return in the (-12, -1) months. *Rating* is the (-1) x credit rating, where credit ratings are from S&P as reported in Compustat and SDC. The multiplication by -1 is for ease of interpreting the regression coefficients. The best-rated companies have the highest value, which is -2. Lower-rated firms have a lower rating, i.e., more negative. *Sales Volatility* is the standard deviation of the logarithm of sales in the prior five years. *Dividends* is the dividends divided by assets. *Earnings Volatility* is standard deviation of the cash flow divided by assets in the prior five years. *Liquidity* is number of shares traded divided by number of shares outstanding. *Net* refers to a variable value net of the comparable firm's value by taking the difference.

Panel A. Corporate Financial Policies

Variable	Mean	Median	Mean Test	Median Test
Net Leverage Change	-0.0167	-0.0277	0.04	0.01
Net Stock Issue	0.0056	0.0048	0.20	0.03
Net Debt Issue	0.0045	-0.0022	0.33	0.56
Net Cash Change	0.0045	-0.0014	0.47	0.57
Net Investment	0.0129	-0.0005	0.02	0.08
Leverage $_{t-1}$	0.4208	0.4132	0.01	0.01
Cash $_{t-1}$	0.1200	0.0769	0.01	0.01
Investment $_{t-1}$	0.1275	0.1036	0.01	0.01
Size $_{t-1}$	20.5434	20.4507	0.01	0.01
M/B $_{t-1}$	2.3338	1.8881	0.01	0.01

Panel B. Control Variables

Variable	Mean	Median	Mean Test	Median Test
Insider Ownership	0.1473	0.0800	0.01	0.01
Net Analyst Change	1.7988	1.3333	0.01	0.01
Net Rating Change	0.0961	0.0000	0.18	0.08
Prior Market Return	0.0841	0.0811	0.01	0.01
Prior Market Volatility	0.0080	0.0072	0.01	0.01
Term Premia	1.0488	1.1850	0.01	0.01
Net Run-up	0.0894	0.0621	0.01	0.01
KZ Index	-0.2803	-0.1983	0.01	0.01
Stock Return Volatility	0.0216	0.0201	0.01	0.01
Rating $_{t-1}$	-9.3739	-9.0000	0.01	0.01
Sales Volatility	0.3651	0.2768	0.01	0.01
Dividends $_{t-1}$	0.0160	0.0140	0.01	0.01
Earnings Volatility	0.0354	0.0264	0.01	0.01
Liquidity $_{t-1}$	0.0946	0.0620	0.01	0.01

Table 3
Changes in Corporate Financial Policies around S&P 500 Index Addition

The table reports coefficients and p-values in brackets based on a system of five equations, estimated using 3SLS. The sample consists of 222 companies that were added to the S&P500 index in the years 1981 through 1997. *Abnormal Return* is the cumulative abnormal return from day -5 to day +5 of the announcement of S&P 500 addition using the market model with the CRSP equally weighted index as the market return. *Liquidity Change* is the average monthly volume in (+1, +12) months minus the average monthly volume in (-12, -1) months, where volume is number of shares traded divided by number of shares outstanding. *Instowner Change* is the institutional ownership at quarter +1 minus institutional ownership at quarter -1, where institutional ownership is the total number of shares owned by institutions as reported by TFN/Institutional divided by the number of shares outstanding. *Insider Ownership* is the total number of shares owned by insiders divided by the number of shares outstanding. *Analyst Change* is the number of analysts at year +1 minus the number of analysts at year -1. *Rating Change* is defined as (-1) × credit rating at year +1 minus credit rating at year -1. Credit ratings are from S&P as reported in Compustat and SDC. *Stock Issue* is the average of year 0 and year +1 common and preferred stock issued minus common and preferred stock repurchased divided by assets. *Debt Issue* is the average of year 0 and year +1 long-term debt issued minus long-term debt retired plus changes in short-term debt divided by assets. *Cash Change* is the cash ratio at year +1 minus the cash ratio at year -1, where the cash ratio is defined as cash and short-term investment divided by assets. *Investment* is the average of year 0 and year +1 capital expenditures plus acquisitions divided by assets. *Prior Market Return* is the sum of the monthly value-weighted market return in the interval -7 to -1 months. *Prior Market Volatility* is the standard deviation of the daily value-weighted market return in the interval -7 to -1 months. *Run-up* is the sum of the firm's monthly return in the interval -7 to -1 months. *Term Premia* is the 10-year Treasury constant maturity rate minus the 1-year Treasury constant maturity rate in the month prior to the event. *Earnings Volatility* is standard deviation of the cash flow divided by assets in the prior five years. *Rating Dummy* is 1 if the rating is available and 0 otherwise. *Liquidity* is number of shares traded divided by number of shares outstanding. *Size* is the natural log of assets. *M/B* is the market-to-book ratio, measured as the market value of equity plus the book value of assets, minus the book value of common equity, divided by the book value of assets. *Stock Return Volatility* is the standard deviation of the daily stock return in the (-12, -1) months. *Dividends* is the dividends divided by assets. *Rating* is (-1) x credit rating, where credit ratings are from S&P as reported in Compustat and SDC. *Sales Volatility* is the standard deviation of the logarithm of sales in the prior five years. *Net* refers to a variable value net of the comparable firm's value by taking the difference.

Variable	Abnormal Return		Net Stock Issue		Net Debt Issue		Net Cash Change		Net Investment	
	coef	p-value	coef	p-value	coef	p-value	coef	p-value	coef	p-value
Intercept	0.071	(0.01)	-0.041	(0.74)	0.124	(0.30)	0.163	(0.21)	-0.255	(0.03)
Abnormal Return			0.811	(0.01)	-0.338	(0.11)	-0.575	(0.03)	0.515	(0.03)
Instowner Change	0.239	(0.01)	-0.283	(0.02)	0.279	(0.01)	0.400	(0.01)	-0.437	(0.01)
Liquidity Change	0.063	(0.50)	-0.050	(0.60)						
Insider Ownership	-0.001	(0.97)	0.089	(0.02)	0.000	(0.99)	-0.111	(0.01)	0.035	(0.36)
Net Analyst Change	0.001	(0.20)	0.004	(0.01)	0.001	(0.25)	-0.003	(0.09)	0.001	(0.27)
Net Rating Change	0.005	(0.24)	-0.012	(0.03)	0.000	(0.98)	0.014	(0.02)	-0.009	(0.11)
Net Stock Issue					-0.247	(0.05)	0.506	(0.01)	0.003	(0.98)
Net Debt Issue			-0.357	(0.18)			-0.398	(0.19)	0.887	(0.01)
Net Cash Change			0.569	(0.01)	-0.295	(0.08)			0.517	(0.01)
Net Investment			0.203	(0.12)	0.360	(0.01)	0.146	(0.32)		
Prior Market Return	0.011	(0.79)	0.004	(0.93)	-0.056	(0.17)				
Prior Market Volatility	0.987	(0.47)	1.471	(0.33)	-0.712	(0.60)				
Net Run-up	-0.013	(0.47)	0.029	(0.16)					0.056	(0.01)
Term Premia	-0.004	(0.28)			0.004	(0.27)				
Earnings Volatility					-0.316	(0.03)	0.305	(0.08)		
Rating Dummy					0.014	(0.17)				
Liquidity $_{t-1}$			-0.170	(0.01)						
Size $_{t-1}$			0.001	(0.91)	-0.008	(0.13)	-0.006	(0.33)	0.009	(0.08)
M/B $_{t-1}$			-0.003	(0.51)	0.004	(0.35)	0.016	(0.01)	-0.006	(0.18)
Cash $_{t-1}$			0.137	(0.06)	-0.109	(0.10)	-0.266	(0.01)	0.169	(0.02)
Stock Return Volatility	-2.248	(0.01)								
Dividend $_{t-1}$			-1.074	(0.01)						
Rating $_{t-1}$					-0.007	(0.01)				
Sales Volatility							-0.058	(0.01)		
Investment $_{t-1}$									0.301	(0.01)
Basmann's test (p-value)	0.66		0.12		0.79		0.74		0.98	
System R-square					0.25					

Table 4
Changes in Corporate Financial Policies and Cost of Equity Change

The table reports coefficients (coef) and p-values in brackets based on a system of five equations, estimated using 3SLS. The sample consists of 222 companies that were added to the S&P 500 index in the years 1981 through 1997. *Cost of Equity Change* is estimated by using the change of betas in the period of (-24, -1) months and (+1, +24) months, and the period of (-60, -1) months for average risk premium. *Liquidity Change* is the average monthly volume in (+1, +12) months minus the average monthly volume in (-12, -1) months, where volume is number of shares traded divided by number of shares outstanding. *Instowner Change* is the institutional ownership at quarter +1 minus institutional ownership at quarter -1, where institutional ownership is the total number of shares owned by institutions as reported by TFN/Institutional divided by the number of shares outstanding. *Insider Ownership* is the total number of shares owned by insiders divided by the number of shares outstanding. *Analyst Change* is the number of analysts at year +1 minus the number of analysts at year -1. *Rating Change* is defined as (-1) × credit rating at year +1 minus credit rating at year -1. Credit ratings are from S&P as reported in Compustat and SDC. *Stock Issue* is the average of year 0 and year +1 common and preferred stock issued minus common and preferred stock repurchased divided by assets. *Debt Issue* is the average of year 0 and year +1 long-term debt issued minus long-term debt retired plus changes in short-term debt divided by assets. *Cash Change* is the cash ratio at year +1 minus the cash ratio at year -1, where the cash ratio is defined as cash and short-term investment divided by assets. *Investment* is the average of year 0 and year +1 capital expenditures plus acquisitions divided by assets. *Prior Market Return* is the sum of the monthly value-weighted market return in the interval -7 to -1 months. *Prior Market Volatility* is the standard deviation of the daily value-weighted market return in the interval -7 to -1 months. *Run-up* is the sum of the firm's monthly return in the interval -7 to -1 months. *Term Premia* is the 10-year Treasury constant maturity rate minus the 1-year Treasury constant maturity rate in the month prior to the event. *Earnings Volatility* is standard deviation of the cash flow divided by assets in the prior five years. *Rating Dummy* is 1 if the rating is available and 0 otherwise. *Liquidity* is number of shares traded divided by number of shares outstanding. *Size* is the natural log of assets. *M/B* is the market-to-book ratio, measured as the market value of equity plus the book value of assets, minus the book value of common equity, divided by the book value of assets. *Stock Return Volatility* is the standard deviation of the daily stock return in the (-12, -1) months. *Dividends* is the dividends divided by assets. *Rating* is (-1) × credit rating, where credit ratings are from S&P as reported in Compustat and SDC. *Sales Volatility* is the standard deviation of the logarithm of sales in the prior five years. *Net* refers to a variable value net of the comparable firm's value by taking the difference.

Variable	Cost of Equity Change		Net Stock Issue		Net Debt Issue		Net Cash Change		Net Investment	
	coef	p-value	coef	p-value	coef	p-value	coef	p-value	coef	p-value
Intercept	-0.002	(0.95)	0.184	(0.10)	-0.068	(0.52)	0.154	(0.23)	-0.133	(0.22)
Cost of Equity Change			-0.462	(0.01)	-0.123	(0.33)	0.213	(0.19)	-0.380	(0.01)
Instowner Change	-0.033	(0.79)	-0.009	(0.93)	0.144	(0.07)	0.207	(0.06)	-0.263	(0.01)
Liquidity Change	-0.183	(0.14)	-0.127	(0.18)						
Insider Ownership	0.021	(0.64)	0.042	(0.24)	0.045	(0.17)	-0.112	(0.01)	0.010	(0.78)
Net Analyst Change	0.002	(0.27)	0.004	(0.01)	0.002	(0.08)	-0.003	(0.02)	0.002	(0.27)
Net Rating Change	-0.010	(0.13)	-0.009	(0.07)	-0.006	(0.19)	0.014	(0.02)	-0.009	(0.11)
Net Stock Issue	-0.469	(0.01)			-0.458	(0.01)	0.546	(0.01)	-0.054	(0.71)
Net Debt Issue	-0.392	(0.25)	-0.773	(0.01)			0.263	(0.42)	0.459	(0.08)
Net Cash Change	0.487	(0.01)	0.476	(0.01)	0.001	(0.99)			0.525	(0.01)
Net Investment	-0.280	(0.14)	0.125	(0.41)	0.390	(0.01)	0.109	(0.52)		
Prior Market Return	0.028	(0.64)	0.041	(0.41)	-0.048	(0.26)				
Prior Market Volatility	0.420	(0.82)	-0.993	(0.50)	0.141	(0.91)				
Net Run-up			0.035	(0.03)					0.078	(0.01)
Term Premia					0.003	(0.41)				
Earnings Volatility					-0.351	(0.01)	0.325	(0.07)		
Rating Dummy					0.008	(0.40)				
Liquidity $_{t-1}$			-0.099	(0.06)						
Size $_{t-1}$			-0.009	(0.09)	0.000	(0.96)	-0.007	(0.26)	0.005	(0.37)
M/B $_{t-1}$			0.004	(0.27)	-0.001	(0.82)	0.021	(0.01)	0.001	(0.86)
Cash $_{t-1}$			-0.018	(0.76)	-0.017	(0.75)	-0.235	(0.01)	0.058	(0.32)
Stock Return Volatility	-0.629	(0.48)								
Dividend $_{t-1}$			-0.659	(0.02)						
Rating $_{t-1}$					-0.008	(0.01)				
Sales Volatility							-0.079	(0.01)		
Investment $_{t-1}$									0.223	(0.01)
Basmann's test (p-value)	0.67		0.14		0.49		0.86		0.98	
System R-square					0.27					

Table 5
Stock Issue and Financing Deficit

The table reports univariate statistics and regressions on stock issue and financing deficit in the (-3, +3) years, where year 0 is the year of the index addition event. Panel A shows univariate statistics for the 222 events of S&P500 index additions with data available in 1981-1997. *Stock Issue* is common and preferred stock issued net of repurchases divided by assets (ΔE). *Debt Issue* is long-term debt issued net of retirements divided by assets (ΔD). The *Financing Deficit* (DEF) is the sum of dividends (DIV), investment (I), change in working capital (ΔW = change in operating working capital + changes in cash + changes in short term debt), minus the cash flow after interest and taxes (C), divided by assets. DEF = ΔD + ΔE. Panel B shows coefficients and p-values underneath from OLS regressions. *After-dummy* is a dummy variable equal to 1 for the year 0 and year +1, and 0 otherwise. *Net* refers to a variable value net of the comparable firm's value by taking the difference.

Panel A. Stock Issue, Debt Issue and Financing Deficit

Variable	Mean
Stock issue	0.012
Debt issue	0.023
Financing Deficit	0.035

Panel B. Regressions

	Stock Issue	Stock Issue	Stock Issue	Net Stock Issue	Net Stock Issue	Net Stock Issue
Intercept	-0.001	-0.001	0.003	-0.003	-0.003	-0.003
	(0.44)	(0.49)	(0.15)	(0.04)	(0.04)	(0.10)
Financing Deficit	0.373	0.333		0.398	0.375	
	(0.01)	(0.01)		(0.01)	(0.01)	
Financing Deficit x After-dummy		0.134			0.085	
		(0.01)			(0.01)	
Net Investment			0.310			0.328
			(0.01)			(0.01)
Net Investment x After-dummy			0.140			0.138
			(0.01)			(0.01)
(DIV+ΔW-C)			0.343			0.401
			(0.01)			(0.01)
(DIV+ΔW-C) x After-dummy			0.167			0.050
			(0.01)			(0.17)
Adjusted R-square	0.35	0.36	0.37	0.37	0.38	0.38

Table 6
Long-run Abnormal Return and the Correlation with Corporate Financial Policies

Variables are defined in the Appendix in detail. The table reports long-term abnormal return and the correlation with corporate financial policies. Panel A shows univariate statistics on long-run abnormal return. *Long-run Abnormal Return* (+1, 12) months, *Long-run Abnormal Return* (+1, 24) months, and *Long-run Abnormal Return* (+1, 36) months are defined as the sum of the difference between actual return and expected return in (+1, 12), (+1, 24) and (+1, 36) months after the index addition announcement, where month 0 is the month of the S&P 500 index addition announcement. The expected return is obtained by using the factor loadings in the Fama-French three-factor model estimated in the period of (-60, -1) months, using firm's monthly return. Panel B shows the correlation between long-term abnormal return and corporate financial policies. *Stock Issue* is the average of year 0 and year +1 common and preferred stock issued minus common and preferred stock repurchased divided by assets. *Debt Issue* is the average of year 0 and year +1 long-term debt issued minus long-term debt retired plus changes in short-term debt divided by assets. *Cash Change* is the cash ratio at year +1 minus the cash ratio at year -1, where the cash ratio is defined as cash and short-term investment divided by assets. *Investment* is the average of year 0 and year +1 capital expenditures plus acquisitions divided by assets. *Net* refers to a variable value net of the comparable firm's value by taking the difference.

Panel A. Univariate Statistics on Long-run Abnormal Returns

	Mean	p-value
Long-run Abnormal Return (+1, +12) months	0.97%	0.70
Long-run Abnormal Return (+1, +24) months	-0.42%	0.91
Long-run Abnormal Return (+1, +36) months	0.82%	0.87

Panel B. Correlation between Long-run Abnormal Return and Corporate Financial Policies

	Correlation coefficient (p-value)			
	Net Stock Issue	Net Debt Issue	Net Cash Change	Net Investment
Long-run Abnormal Return (+1, +12) months	-0.062	-0.127	0.199	-0.085
	(0.36)	(0.06)	(0.01)	(0.21)
Long-run Abnormal Return (+1, +24) months	-0.114	-0.187	0.207	-0.143
	(0.09)	(0.01)	(0.01)	(0.03)
Long-run Abnormal Return (+1, +36) months	-0.171	-0.174	0.199	-0.130
	(0.01)	(0.01)	(0.01)	(0.05)

Table 7
Long-run Abnormal Return Using the Fama-French Three-factor Model with Ibbotson's RATS Method

Variables are defined in the appendix in detail. The table reports monthly cumulative average abnormal return in percent using Ibbotson's (1975) returns across time and security (RATS) method combined with the Fama-French (1993) three-factor model for the sample of 222 firms added to the S&P500 index between 1981 and 1997 and various subsamples (number of observations in parentheses). The following regression is run each month t:

$$\left(R_{i,t} - R_{f,t}\right) = a_t + b_t\left(R_{m,t} - R_{f,t}\right) + c_t SMB_t + d_t HML_t + \varepsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in month t, with t=0 being the month of the S&P 500 index addition announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and book-to-market factor in month t, respectively. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The significance levels of the window cumulative abnormal returns are indicated by $, *, **, and ***, and correspond to a significance level of 10%, 5%, 1%, and 0.1%, respectively, using a two-tailed test.

Months Relative to S&P 500 Index Addition	Entire Sample (Obs: 222)	Subsample: Net Stock Issue>0 (Obs: 126)	Subsample: Net Stock Issue>0 and Net Investment>0 (Obs: 72)	Subsample: Net Stock Issue>0 and Net Investment<0 (Obs: 54)	Subsample: Net Stock Issue>0 and Net Debt Issue<0 (Obs: 70)	Subsample: Net Stock Issue>0 and Net Cash Change>0 (Obs: 64)
(+1,+1)	-0.80	-1.09	-0.84	-1.58	-0.41	-2.80**
(+1,+2)	-1.98*	-2.16$	-2.10	-2.35	-1.25	-3.54*
(+1,+3)	-1.11	-0.13	-0.85	0.44	1.17	-1.64
(+1,+4)	-0.78	-0.86	-1.83	0.11	0.43	-0.44
(+1,+5)	-0.36	-1.64	-3.84	0.77	1.74	-1.85
(+1,+6)	0.01	-1.74	-4.34	1.62	2.14	-1.26
(+1,+7)	0.27	-1.46	-5.10	2.54	3.08	-0.36
(+1,+8)	-0.02	-1.69	-6.72*	4.50	3.12	1.26
(+1,+9)	-1.25	-3.03	-8.41*	3.81	1.55	0.30
(+1,+10)	-0.77	-3.30	-8.41*	3.13	2.11	-1.13
(+1,+11)	-0.01	-2.67	-7.07$	2.89	3.65	-0.22
(+1,+12)	-0.77	-3.90	-7.70$	0.83	2.01	-1.64
(+1,+13)	-1.29	-4.90	-9.49*	1.00	0.67	-2.71
(+1,+14)	-2.72	-6.60$	-12.33**	0.98	-0.25	-4.98
(+1,+15)	-3.14	-7.25*	-13.06**	0.01	-1.94	-6.82
(+1,+16)	-2.87	-8.16*	-13.35**	-2.41	-2.79	-9.36$
(+1,+17)	-3.07	-8.35*	-15.54**	-0.48	-2.89	-9.70$
(+1,+18)	-4.12	-8.48*	-15.23**	-1.34	-3.49	-8.61
(+1,+19)	-4.32	-8.43*	-14.57**	-1.93	-3.42	-9.27
(+1,+20)	-4.49	-8.29*	-14.27*	-2.24	-3.95	-9.16
(+1,+21)	-4.36	-8.43*	-14.78*	-1.83	-2.48	-9.18
(+1,+22)	-3.09	-6.60	-13.90*	1.08	-0.53	-4.86
(+1,+23)	-2.35	-6.56	-13.87*	1.16	0.93	-4.69
(+1,+24)	-2.36	-7.13	-13.71*	-0.67	-0.39	-6.12
(+1,+25)	-2.84	-8.06$	-15.06*	-1.49	-1.64	-6.79
(+1,+26)	-3.17	-8.05$	-14.99*	-1.22	-1.80	-5.88
(+1,+27)	-3.09	-8.46$	-15.47*	-1.48	-2.57	-7.65
(+1,+28)	-2.69	-8.96$	-15.38*	-2.74	-2.27	-8.76
(+1,+29)	-1.81	-8.10	-15.14*	-0.81	-1.85	-7.50
(+1,+30)	-1.69	-8.06	-15.24*	-0.21	-1.22	-7.43
(+1,+31)	-3.27	-9.92$	-15.78*	-3.90	-2.90	-8.87
(+1,+32)	-3.66	-10.77*	-15.75*	-5.96	-4.62	-10.08
(+1,+33)	-3.83	-9.69$	-15.06*	-4.77	-5.15	-6.85
(+1,+34)	-2.03	-8.15	-13.71$	-3.46	-3.33	-4.58
(+1,+35)	-2.27	-7.86	-13.97$	-2.62	-2.21	-6.28
(+1,+36)	-3.29	-9.23$	-16.56*	-2.46	-2.82	-6.48

Table 8
Change in the Cost of Equity at Different Horizons

The table reports univariate statistics of the change in the cost of equity. We estimate the change of beta using the model: $(R_{i,t} - R_{f,t}) = a + b_1 \times (R_{m,t} - R_{f,t}) + b_2 \times SMB_t + b_3 \times HML_t + c_1 \times After_t \times (R_{m,t} - R_{f,t}) + c2 \times After_t \times SMB_t + c3 \times After_t \times HML_t + \varepsilon_t$, where $After_t$ is a dummy variable that is 1 after the index addition and 0 before the index addition. b_1, b_2 and b_3 are the betas before the index addition. c_1, c_2 and c_3 are the change of the betas after the index addition. The period for estimating betas is indicated in the table. *Change in Cost of Equity* is obtained by evaluating the change of betas at the average risk premium over the periods indicated in the table. We separately consider firms where net equity issues >0 (Panel A: 126 events) and firms where net equity issues>0 and net investment>0 (Panel B: 72 events).

Panel A. Firms that issue equity after the index addition

Period for estimating changes of betas	Period for average risk premium	Cost of Equity Change (Mean)	Mean Test
(-24, -1) and (+1, +12) months	(-60, -1) months	-0.0224	0.02
(-24, -1) and (+13, +24) months	(-60, -1) months	-0.0114	0.23
(-24, -1) and (+25, +36) months	(-60, -1) months	0.0055	0.63

Panel B. Firms that issue equity and increase investment after the index addition

Period for estimating changes of betas	Period for average risk premium	Cost of Equity Change (Mean)	Mean Test
(-24, -1) and (+1, +12) months	(-60, -1) months	-0.0219	0.08
(-24, -1) and (+13, +24) months	(-60, -1) months	-0.0042	0.75
(-24, -1) and (+25, +36) months	(-60, -1) months	0.0209	0.20

Table 9
Changes in Corporate Financial Policies around S&P 500 Index Addition and "Equity Dependence"

The table reports coefficients (coef) and p-values in brackets based on a system of five equations, estimated using 3SLS. The sample consists of 222 companies that were added to the S&P 500 index in the years 1981 through 1997. *Abnormal Return* is the cumulative abnormal return from day -5 to day +5 of the announcement of S&P 500 addition using the market model with the CRSP equally weighted index as the market return. *KZ Dummy* is a dummy variable equal to 1 for firms whose KZ-index is above the sample median and 0 otherwise. The definition of the KZ-Index is given in the appendix. *Liquidity Change* is the average monthly volume in (+1, +12) months minus the average monthly volume in (-12, -1) months, where volume is number of shares traded divided by number of shares outstanding. *Instowner Change* is the institutional ownership at quarter +1 minus institutional ownership at quarter -1, where institutional ownership is the total number of shares owned by institutions as reported by TFN/Institutional divided by the number of shares outstanding. *Insider Ownership* is the total number of shares owned by insiders divided by the number of shares outstanding. *Analyst Change* is the number of analysts at year +1 minus the number of analysts at year -1. *Rating Change* is defined as (-1) × credit rating at year +1 minus credit rating at year -1. Credit ratings are from S&P as reported in Compustat and SDC. *Stock Issue* is the average of year 0 and year +1 common and preferred stock issued minus common and preferred stock repurchased divided by assets. *Debt Issue* is the average of year 0 and year +1 long-term debt issued minus long-term debt retired plus changes in short-term debt divided by assets. *Cash Change* is the cash ratio at year +1 minus the cash ratio at year -1, where the cash ratio is defined as cash and short-term investment divided by assets. *Investment* is the average of year 0 and year +1 capital expenditures plus acquisitions divided by assets. *Prior Market Return* is the sum of the monthly value-weighted market return in the interval -7 to -1 months. *Prior Market Volatility* is the standard deviation of the daily value-weighted market return in the interval -7 to -1 months. *Run-up* is the sum of the firm's monthly return in the interval -7 to -1 months. *Term Premia* is the 10-year Treasury constant maturity rate minus the 1-year Treasury constant maturity rate in the month prior to the event. *Earnings Volatility* is standard deviation of the cash flow divided by assets in the prior five years. *Rating Dummy* is 1 if the rating is available and 0 otherwise. *Liquidity* is number of shares traded divided by number of shares outstanding. *Size* is the natural log of assets. *M/B* is the market-to-book ratio, measured as the market value of equity plus the book value of assets, minus the book value of common equity, divided by the book value of assets. *Stock Return Volatility* is the standard deviation of the daily stock return in (-12, -1) months. *Dividends* is the dividends divided by assets. *Rating* is (-1) × credit rating, where credit ratings are from S&P as reported in Compustat and SDC. *Sales Volatility* is the standard deviation of the logarithm of sales in the prior five years. *Net* refers to a variable value net of the comparable firm's value by taking the difference.

Variable	Abnormal Return		Net Stock Issue		Net Debt Issue		Net Cash Change		Net Investment	
	coef	p-value	coef	p-value	coef	p-value	coef	p-value	coef	p-value
Intercept	0.075	(0.01)	0.019	(0.89)	0.017	(0.87)	0.045	(0.73)	-0.200	(0.09)
Abnormal Return			0.661	(0.01)	-0.224	(0.25)	-0.520	(0.05)	0.367	(0.12)
KZ dummy			0.012	(0.45)	0.025	(0.03)	-0.003	(0.84)	-0.011	(0.44)
AR x KZ dummy			0.241	(0.07)	-0.456	(0.01)	-0.446	(0.01)	0.236	(0.06)
Instowner Change	0.371	(0.01)	-0.321	(0.01)	0.275	(0.01)	0.441	(0.01)	-0.431	(0.01)
Liquidity Change	0.058	(0.52)	-0.042	(0.66)						
Insider Ownership	-0.027	(0.41)	0.096	(0.02)	0.043	(0.22)	-0.099	(0.02)	0.012	(0.77)
Net Analyst Change	0.000	(0.74)	0.003	(0.01)	0.002	(0.16)	-0.003	(0.07)	0.001	(0.39)
Net Rating Change	0.008	(0.11)	-0.013	(0.02)	0.000	(0.93)	0.015	(0.01)	-0.008	(0.15)
Net Stock Issue	0.338	(0.01)			-0.258	(0.03)	0.611	(0.01)	0.043	(0.76)
Net Debt Issue	-0.612	(0.01)	-0.226	(0.47)			-0.357	(0.30)	1.019	(0.01)
Net Cash Change	-0.301	(0.01)	0.720	(0.01)	-0.080	(0.63)			0.436	(0.01)
Net Investment	0.081	(0.56)	0.186	(0.23)	0.364	(0.01)	0.120	(0.44)		
Prior Market Return	-0.030	(0.52)	0.012	(0.80)	-0.048	(0.24)				
Prior Market Volatility	0.750	(0.60)	1.544	(0.31)	-0.265	(0.85)				
Net Run-up	-0.008	(0.66)	0.024	(0.24)					0.050	(0.01)
Term Premia	0.000	(0.97)			0.001	(0.72)				
Earnings Volatility					-0.289	(0.01)	0.313	(0.06)		
Rating Dummy					0.010	(0.22)				
Liquidity $_{t-1}$			-0.130	(0.01)						
Size $_{t-1}$			-0.003	(0.65)	-0.003	(0.50)	0.000	(0.98)	0.008	(0.17)
M/B $_{t-1}$			-0.005	(0.29)	0.001	(0.80)	0.015	(0.01)	-0.005	(0.27)
Cash $_{t-1}$			0.154	(0.05)	-0.005	(0.94)	-0.232	(0.01)	0.124	(0.08)
Stock Return Volatility	-2.212	(0.01)								
Dividend $_{t-1}$			-1.066	(0.01)						
Rating $_{t-1}$					-0.005	(0.03)				
Sales Volatility							-0.062	(0.01)		
Investment $_{t-1}$									0.282	(0.01)
Basmann's test (p-value)	0.87		0.13		0.76		0.67		0.97	
System R-square					0.29					

Table 10
Long-run Abnormal Return and Financial Constraints

This table shows the long term abnormal return in the subsample with higher or lower financial constraints measured by the KZ-index. The definition of the KZ-index is given in the appendix. *High KZ* are the sample firms with a KZ-index above the sample median KZ-index. *Low KZ* are the firms with a KZ-index below the sample median KZ-index. The variables are defined in the appendix in detail. The table reports monthly cumulative average abnormal return in percent using Ibbotson's (1975) returns across time and security (RATS) method combined with the Fama-French (1993) three-factor model for the sample of 222 firms added to the S&P 500 index between 1981 and 1997 and various subsamples (number of observations in parentheses). The following regression is run each month t:

$$\left(R_{i,t} - R_{f,t}\right) = a_t + b_t\left(R_{m,t} - R_{f,t}\right) + c_t SMB_t + d_t HML_t + \varepsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in month t, with t=0 being the month of the S&P 500 index addition announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and book-to-market factor in month t, respectively. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The significance levels of the window cumulative abnormal returns are indicated by $, *, **, ***, and correspond to a significance level of 10%, 5%, 1%, 0.1%, respectively, using a two-tailed test. The sample is stratified into financially constrained and non-financially constrained companies.

Months Relative to S&P 500 Index Addition	Entire Sample		Subsample: Net Stock Issue>0 and Net Investment>0		Sub-sample: Net Stock Issue>0 and Net Investment<0
	High KZ (Obs: 111)	Low KZ (Obs: 111)	High KZ (Obs: 40)	Low KZ (Obs: 32)	Low KZ (Obs: 25)
(+1,+1)	-1.15	-0.58	-1.54	-0.07	-0.73
(+1,+2)	-3.70**	-0.44	-4.25*	0.85	-0.67
(+1,+3)	-3.46*	1.04	-4.32$	2.52	2.60
(+1,+4)	-3.43$	1.55	-4.28	0.39	2.94
(+1,+5)	-4.16*	3.06	-7.59*	-0.27	4.59
(+1,+6)	-4.96*	4.94*	-8.40*	-0.45	8.08
(+1,+7)	-6.23*	6.29*	-11.10**	1.16	8.04
(+1,+8)	-7.65**	7.21**	-13.17**	-0.42	10.12
(+1,+9)	-9.52***	6.58*	-13.46**	-5.02	11.59$
(+1,+10)	-9.35**	7.39*	-12.95*	-5.51	10.59
(+1,+11)	-10.24**	9.89**	-12.69*	-2.96	13.72$
(+1,+12)	-12.00***	10.00**	-12.72*	-5.05	12.24$
(+1,+13)	-13.68***	10.59**	-13.42*	-8.86	14.80$
(+1,+14)	-14.99***	9.06*	-15.82*	-12.12$	14.25$
(+1,+15)	-15.98***	9.22*	-16.04*	-13.00$	15.00$
(+1,+16)	-15.40***	9.20*	-16.94*	-13.20$	11.77
(+1,+17)	-16.41***	9.75*	-20.70**	-13.59$	14.50
(+1,+18)	-18.92***	10.16*	-18.82*	-14.13$	16.21$
(+1,+19)	-19.60***	10.74*	-17.62*	-13.49	15.08
(+1,+20)	-19.19***	9.76*	-16.55*	-16.81*	15.05
(+1,+21)	-18.83***	9.64*	-17.51*	-16.95$	13.87
(+1,+22)	-17.65***	11.24*	-16.73*	-15.53$	15.94
(+1,+23)	-17.36***	12.53**	-17.00*	-15.03$	16.44
(+1,+24)	-18.35***	13.35**	-17.54*	-13.27	18.32$
(+1,+25)	-18.76***	12.72**	-18.10*	-15.53$	16.61
(+1,+26)	-19.31***	12.93**	-18.43*	-14.68	16.87
(+1,+27)	-19.08***	13.14**	-18.33*	-16.50$	18.23
(+1,+28)	-18.90***	13.76**	-18.62*	-17.00$	16.78
(+1,+29)	-18.55***	15.59**	-19.30*	-14.76	21.31$
(+1,+30)	-19.07***	16.32**	-20.40*	-12.85	20.94$
(+1,+31)	-20.55***	14.83**	-21.38*	-12.82	17.65
(+1,+32)	-20.08***	13.51*	-21.21*	-12.92	14.18
(+1,+33)	-20.78***	13.83*	-20.91*	-12.36	14.63
(+1,+34)	-20.11***	16.27**	-19.29$	-11.32	15.92
(+1,+35)	-20.75***	17.46**	-19.97$	-9.99	19.17
(+1,+36)	-21.31***	16.14**	-22.79*	-12.35	19.69