Index Inclusion and SEO Likelihood

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Abstract

In this research paper I aim to investigate whether index inclusion has any impact on the likelihood of a firm conducting a seasoned equity offering (SEO). With the rise of passive investing, index inclusion has been documented to have a variety of impacts on securities such as increased volatility, higher liquidity and worse corporate governance outcomes. No relationship has yet been documented between index inclusion and the likelihood of equity raising via an SEO. Using a regression discontinuity research design I consider a sample of firms just around the inclusion threshold of the Russell 1000 stock index.

I find that after a firm is just included in the index, the likelihood of conducting an SEO rises by approximately six percentage points. I add control variables to account for firms which may exploit market timing as well as those which face higher capital demand. My results remain consistent. Additionally, I conduct subsample and subperiod analysis to ensure that my findings are robust, which they are. Further to this I find evidence to suggest that this increase in SEO likelihood could be a result of forced buying of securities included in an index after an SEO. I hypothesise that forced buying occurs as active and passive investors seek to hold firms in proportion to their index weighting, which increases after an SEO.

I Introduction

Does index inclusion increase the likelihood of an SEO? My research builds upon the existing literature surrounding seasoned equity offerings as well as the impacts of index inclusion and passive ownership. As I will discuss later, a gap in the literature is that a relationship between seasoned equity offerings and index inclusion has not been documented. Corporate finance practice also demands further investigation into the impacts of index inclusion. Firms are increasingly asking for index related information from their advisors, and with the monumental rise in passive investing, index inclusion has had increasingly unexpected impacts on firms. Ultimately, I aim to discover whether index inclusion impacts the probability that a firm will conduct a seasoned equity offering. I propose that being included in an index supports SEOs via two main mechanisms:

(i) Forced buying of securities by ETF providers who are required to hold additional amounts of a particular security as its rank (based on market cap) rises in an index.

(ii) Forced buying of securities by active fund managers who have their fund performance benchmarked against an index. They don't want to underperform the market only due to a lack of exposure to a particular security.

Because I hypothesise that index inclusion supports capital raising efforts, intuitively it follows that the likelihood of a firm conducting an SEO will increase when a firm is indexed.

Using a regression discontinuity research design I find that when a firm is included in the Russell 1000 index, the likelihood of conducting an SEO increases by roughly six percentage points. To conduct a regression discontinuity I compare firms 'just in' and 'just out' of the Russell 1000. The firms 'just in' the index are the 100 lowest weighted firms in the Russell 1000 and the firms 'just out' are the 100 most highly weighted securities in the orthogonal Russell 2000. When firms in the Russell 2000 become sufficiently large and meet other criteria, they move up from the Russell 2000 into the Russell 1000.

There is no clearly defined list of 'just out' securities for the S&P500 or other popular stock indices, which makes the Russell 1000 most suitable for my study. My findings remain robust to the inclusion of control variables, subsample analysis and subperiod analysis. Additionally, I find evidence of forced buying of index firm securities after an SEO which supports my hypothesis.

1.1 Seasoned Equity Offering Process

Firms issue equity for various reasons. For larger firms (as are included in my sample) the process of conducting an SEO is relatively straightforward. SEOs can be categorised by their offer type: fully marketed offers, accelerated offers, and rights offers. Rights offers are ubiquitous in both New Zealand and Australia but less common in the US. In a fully marketed offer, the issuing firm negotiates with one or more investment banks to market and distribute the new shares and to set the price at which the SEO will take place. After conducting due diligence, the lead underwriter creates and distributes a prospectus. As part of the marketing effort, the issuer visits financial institutions to discuss why they should purchase stock during the SEO. The bookrunner, who is either the sole or lead underwriter, builds an order book to assess the demand of institutional investors. Finally, the SEO takes place, and the issuer pays either a fixed or variable fee to the investment bank(s). While this type of SEO is prevalent today, accelerated SEOs, which require less marketing from an investment bank in return for a lower fee, make up almost half of all SEOs in the US (Bortolotti et al., 2008).

While in most cases an SEO is conducted after a pitch from an investment bank or other financial advisor, whether or not to conduct an SEO is a decision made by solely the individual firm itself, mostly based on private information. This is important as it means that I can study the characteristics of a firm to predict the likelihood of a seasoned equity offering, as opposed to concluding that is purely down to chance that a financial entity will approach a firm to conduct an SEO.

It is also important to note the difference between a seasoned equity offering, on which this research is based, and a secondary equity offering, which is often also labelled an 'SEO'. A seasoned equity offering is the issue of new shares by a firm after an initial public offering. In contrast, a secondary equity offering is the sale of existing shares by shareholders. While both terms are used interchangeably on some occasions, they are in fact, different.

1.2 Stock Market Indices

To frame this research proposal, it is essential to understand the history of US stock indices and why, in this day and age, they have become so important. Dow Jones and Co. published the very first daily stock market index in the *Customer's Afternoon Letter*, which eventually became the *Wall Street Journal*. Other financial newspapers eventually followed suit when the demand for stock index information became sufficiently high. Most of the initial curiosity in these indices did not come from finance researchers interested in the stock market. Instead, it came from economists who looked at index data merely as an indicator of macroeconomic performance.

In the early 20th century, indices started becoming more complex. For example, the New York Times published graphs in its newspaper which looked at the performance of a '25 Industrials' index and a '25 Railroads' index over several years. After World War I, the importance of stock market research and stock indices increased further, with universities developing separate business schools and their own journals (Wharton: 1921, Harvard: 1922, *Harvard Business Review*: 1922, *Journal of Business of the University of Chicago*: 1928).

With researchers such as Markowitz (1952) and Sharpe (1991) describing the benefits of portfolio diversification and the pitfalls of actively managed funds, demand for index funds increased and the first exchange-traded fund (ETF) listed in the US in 1993. These funds enabled investors to experience the performance of an entire index with a simple security purchase. As of 2020, there are roughly 8000 exchange-traded vehicles which track the performance of indices based on industry, risk exposure, environmental impacts and more.

Ultimately, the rise to prominence of the stock index has two critical implications for my research. First, the rise in passive ownership based on index inclusion. It is estimated that S&P 500 firms, on average, have over 20% of their shares held passively due to ETFs and index funds (Backus et al., 2019). Second, active managers are forced to buy index stocks as their performance is benchmarked against widely traded stock indices. It is estimated that roughly US $8 trillion of actively held assets are benchmarked against Russell US indices.

II Literature Review

This research contributes to three strands of literature. First, the literature which concerns the likelihood, timing and reasoning for SEOs. Second, the literature which surrounds the impacts of being included in a widely traded stock index. Third, the literature which considers the firm level impacts of passive ownership. This section provides an overview of each of these fields. Their implications and my contributions to each field will be discussed throughout the report.

2.1 SEO Timing and Reasoning

The timing of and reasons for seasoned equity offerings have long been a topic for debate amongst finance scholars. Market timing continues to persevere as an explanation for SEOs; this is the assumption that managers realise that the cost of equity appears to be low, meaning that shares are overvalued (Loughran & Ritter, 1995). Thus, they decide to raise capital while share prices are relatively high. This is further supported by Baker and Wurgler (2000b), who find that firms issue relatively more equity than debt just before a market downturn. These results violate the semi-strong efficient markets hypothesis and suggest that managers indeed can identify when share prices of the companies that they manage are overvalued. Baker and Wurgler (2000b) go further to hypothesise that market timing has significant and permanent impacts on capital structure, they find that highly leveraged firms raised equity when their valuations are relatively low, and firms with relatively low leverage raised capital when their valuations were high. Thus they conclude that "capital structure is the cumulative outcome of past attempts to time the equity market" (Baker & Wurgler, 2000b).

It is not only empirical research which supports the notion of market timing. In a survey study conducted by Graham and Harvey (2001), two-thirds of CFOs agreed that when issuing equity "the amount by which our stock is undervalued or overvalued was an important or very important consideration." A similar proportion of respondents agreed with the statement "if our stock price has recently risen, the price at which we can sell is 'high'." Arguably the most notable finding of the survey was that equity market prices were the second most important factor out of eleven factors that firms considered when issuing common stock. Bancel and Mittoo (2004) conducted a similar survey. They found that even though capital structure choices are more complicated than a single theory or concept, managers use 'windows of opportunity' when they attempt to raise capital.

In a similar vein, much research has also looked at the practical reasons that firms conduct seasoned equity offerings. Korwar and Masulis (1986) argue the use of proceeds from SEOs only as a means of external funding; they also find empirical support for the notions of Jensen and Meckling (1979) and Masulis (1983) who suggest that capital raising activity is a negative signal for firm health. Masulis (1983) also indicates that firms heavily utilise SEOs for debt reduction purposes. Hull and Moellenberndt (1994) go further to argue that firms more commonly use SEOs to retire bank debt as opposed to non-bank debt. A unique event study conducted by Hull (1999) found that stock offerings were also commonly used when firms failed to meet widely accepted industry debt standards, their results were significant for all highly leveraged industries in their sample.

Researchers Johnson et al. (1996) move away from using debt as an explanation for SEOs. They argue that stock offerings are the preferred method of financing relatively large transactions, even when debt options have not been exhausted. Interestingly, they also find that when SEOs are specified to raise proceeds for a corporate transaction, management stock ownership jumps unexpectedly, which suggests the presence of insider trading. Lastly, I want to note the work of Abraham and Harrington (2011). These researchers note the lack of cash flow metrics as an explanation for SEOs. After adjusting their predictive models, they find that cash flow measures have statistically significant predictive power when assessing the likelihood of whether a firm will conduct an SEO.

2.2 The Impacts of Index Inclusion

My research question addresses whether index inclusion impacts the likelihood of a firm conducting an SEO. While this particular impact of index inclusion hasn't been researched, other implications of index participation, particularly on price and volume have been extensively documented.

When stocks become a part of the S&P 500 index, they earn positive abnormal returns on both the announcement date and the date that they officially become an index constituent. Shleifer (1986) conducted some of the earliest research on this phenomenon. In his paper, he showed that stocks included in the S&P 500 between 1976 and 1983 experienced an increase in price of roughly 3% with no material change in firm fundamentals. He argues that index inclusion is an 'information-free' event, and price increases merely reflect a rightward shift of the demand curve due to increased demand from index-tracking funds. Researchers have documented Similar impacts for indices other than the S&P 500, such as the Russell 1000 index (Chang et al., 2015) and European stock indices (Vespro, 2006). As index tracking grew in importance, studies conducted in the late 90s found that additions to the S&P 500 experienced price gains of between five and seven per cent in the month following the announcement date of inclusion, and much of these gains would not be eroded over time (Beneish & Whaley, 1996; Lynch & Mendenhall, 1997).

However, if it were only forced buying by index tracking funds which caused price appreciation upon index inclusion, we would expect to see that deletion from an index results in sudden and permanent price decreases, this is not the case. H. Chen et al. (2004) show that an price increase is not solely due to forced buying but could also be due to a 'positive' news event as described by Denis et al. (2003). This explanation also falls in line with higher demand due to increased investor recognition, as proposed by Merton (1987). It could be the case that index inclusion increases investor recognition and an abundance of other factors emerge which cause prices to rise.

A more recent study by Chang et al. (2015) finds that price impacts are present for both index inclusion sand deletions; however, the effects of index inclusion are more significant. This asymmetry suggests that forced buying is a factor which results in price increases upon index addition, but other effects may be at play. Other research documents the non-price impacts of index inclusion. Chakrabarti et al. (2005) note the immediate and significant increase in trading volumes of stocks after they are added to an index. The impact is less significant on announcement day but remains higher throughout the time a stock remains in an index. Some researchers hypothesise that this additional trading volume provides liquidity which may even enhance the price discovery of index firms (W. Chen & Chung, 2012). Additionally, Bae et al. (2012) document the additional trading volatility of firms included in an index. They hypothesise that much of the additional volatility comes from arbitrageurs exploiting differences in the prices of ETFs and the basket of underlying securities which they track

2.3 The Impact of Passive Ownership

Firm Value.

Researchers argue that because ETF issuers (the ones that hold the basket of underlying securities) earn lower fees from management, they are more incentivised to lend their holdings for short-selling purposes (Li & Zhu, 2018). In line with the findings of Desai et al. (2002) and Boehmer et al. (2008), Bae et al. (2012) find that the increased selling pressure of stocks within ETFs (which are by far and large index securities) decreases a firm's value. However, this impact was only significant for smaller firms during their sample period of 2002 to 2010. Another school of thought develops the idea that the increase in liquidity an ETF-held firm experiences should cause the required return to decrease, thus increasing firm value (Bae et al., 2012). Empirical studies are yet to test this theory.

Corporate Governance & Decision Making.

As the level of passive investment rises, so too does the level of passive ownership of underlying firms. Researchers Schmidt and Fahlenbrach (2017) suggest that this causes a significant change to firm decision making and corporate governance. Their research found that as firms experienced higher levels of passive ownership, the shareholder's voice becomes increasingly diluted. As a result of this, CEOs become more entrenched and hire fewer independent board directors. This effect is prominent for firms of all sizes but more significantly pronounced for smaller firms. They also find, in line with the musings of Jensen (1986), that as the shareholder's voice is diluted, and managers gain power, managers are more likely to engage in value-reducing merger and acquisition activity to cement their legacies. Further to previous evidence from Bae et al. (2012), who suggested ETFs decrease firm value, this evidence also indicates that due to the rise of ETFs firm value decreases through detrimental M&A activity and higher agency costs. Additionally, the results of Schmidt and Fahlenbrach (2017) were not restricted to smaller firms.

Bradley and Litan (2011) find that ETFs slow price discovery, which inhibits firm growth, ultimately leading to firms not wanting to list on stock exchanges. They also argue that passive ownership of firms increases trading volatility, a notion also supported by Bae et al. (2012). Bradley and Litan (2011) further suggest that this increased volatility causes difficulty for managers making decisions, as they are less able to rely on stock price information. As managers rely less on stock price information to make decisions, their goals diverge from those of the shareholder.

III Methodology

3.1 Data and Sample

To conduct this research, I needed two key datasets; a sample of SEOs and a list of all securities listed in a given stock index. I gathered all the SEOs on the Thomson Reuters SDC Platinum 'New Issues' database for the 25 years between 1996 and 2018 (inclusive). The sample begins in 1995 as this is when all vital information - such as the SEO filing date and control variable data - has a higher likelihood of being reported. From here, I narrowed the SEOs based on three criteria:

(i) The issuer is a US-domiciled, publicly-traded company listed on the AMEX, NASDAQ or NYSE.

(ii) The issue is defined as a 'follow-on issue' of common stocks and is not merely a secondary equity offering or a unit offering.

(iii) The issue raised an economically meaningful amount of capital. I restricted my sample to issues which were at least 10% of the market cap of the issuing company.

From Bloomberg, I retrieved both the constituents and weightings of the Russell 1000 and Russell 2000 stock indices for each sample year. Control variable data was sourced from Factset, Refinitiv Eikon, and Compustat Global. Sentiment data used was as in Baker and Wurgler (2006). For each observation a unique ID was created which matched the index constituents with the sample of SEOs resulting in a simple dichotomous indicator which equalled one if an SEO was conducted in that firm-year and zero otherwise. Note that the firm-years in my sample differ from calendar years. The Russell indices are rebalanced in June every year, hence the calendarised years in my dataset run from June to June as opposed to January to January.

3.2 Research Design

Recently, there has been a greater emphasis on the use of random assignment to evaluate the impacts of treatment or interventions. Considered to be the 'gold standard' in research when appropriately implemented, random assignment provides unbiased estimates of treatment impacts, which are easy to understand and interpret (Jacob et al., 2012). Unfortunately, in finance, random assignment is almost impossible. For example, I want to evaluate the impacts of index inclusion; I cannot randomly specify some firms to be included in an index and some to not be included. Index inclusion is based on a set of rules that I, and firms, have no control over. But regression discontinuity design (RDD) proves to be a suitable and easy to implement method to evaluate the impacts of treatment (index inclusion in my case) after assignment. By analysing a small subset of observations which fall 'just in' or 'just out' of treatment, I observe something very close to random assignment. Thus, I can see the unbiased impacts of treatment on my sample. In my case 'treatment' is the inclusion of a firm in the Russell 1000 index. I will look at the firms which fall 'just in' the index (those with the highest index rankings in my sample) and the securities which fall 'just out' of the index (those with a Russell Universe ranking just below the inclusion threshold of 1000).

Figure 1 provides a simple explanation of how a regression discontinuity would operate in my case. P(SEO) represents the log odds of a firm conducting an SEO. The graph shows that there is some relationship between P(SEO) and φ, where φ represents a linear combination of a firm's ranking in the Russell securities universe and the control variables which I describe in the next section. At the vertical line which splits the graph, the relationship is discontinuous due to the separation of firms included in the index and those that are not. This jump in probability represents a 'sharp' regression discontinuity design, because I use a dummy variable to indicate whether a firm is in an index. Note that this is an oversimplification of what I expect to find, and the trends shown in the diagram are not necessarily exactly what I expect.

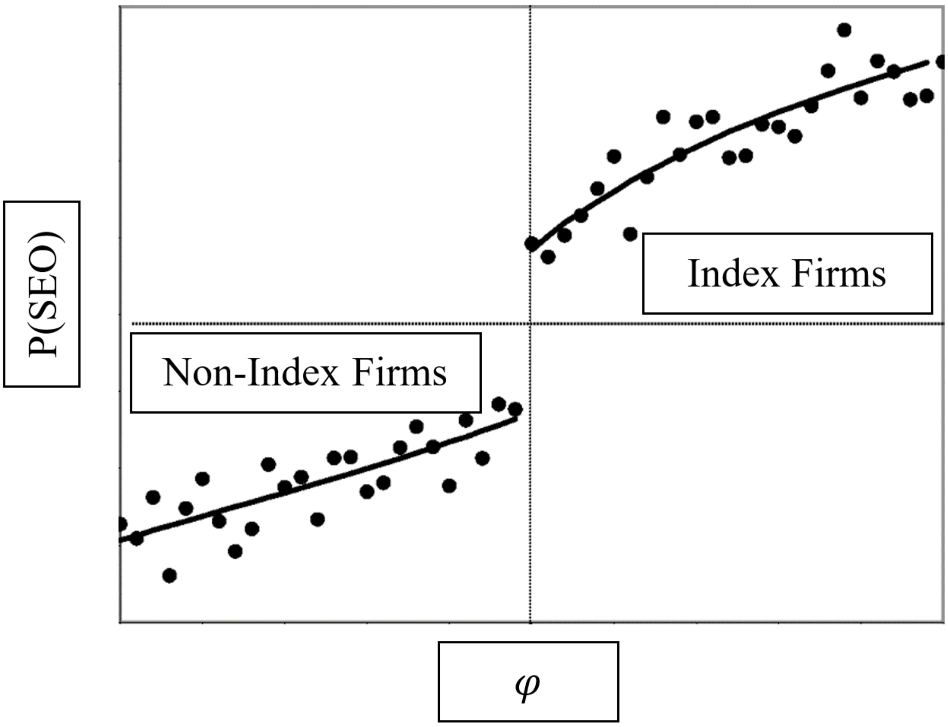

Figure 1: Regression Discontinuity Diagram

3.3 Control Variables

With a regression discontinuity design, control variables are not necessarily required. Assuming that there are no underlying differences between index and non-index firms (which I will prove later), I should be able to observe an unbiased causal impact of index inclusion on SEO likelihood. However, previous literature has determined that the likelihood of an SEO will vary with capital demand proxies, market timing proxies, measures of cash flow, and other balance sheet variables. Thus, these measures will make up the battery of control variables that I will include in my analysis. Adding these controls provides additional evidence that I am observing unbiased coefficients. The control variables are as follows:

- Debt / Total Assets: A high debt ratio is often a sign that a firm may need to raise equity for growth purposes or to meet industry debt standards.

- %Δ Sales (YOY): Sales growth is thought to be a reliable indicator of capital demand and has been found to be a statistically and economically significant factor in predicting the likelihood of an SEO.

- %Δ CAPEX (YOY): An increase in capital expenditure is also thought to be an indicator of capital demand; previous literature has found its impacts to be statistically significant in predicting the likelihood of an SEO.

- Market to Book Ratio: A high market to book ratio suggests that a company is 'overvalued' to some extent and is a common indicator that a firm will conduct an SEO.

- One-year BHR returns: High returns are common over the twelve months preceding an SEO. This is an additional measure of market timing.

- Tobin's Q: Tobin's Q has proved to be a statistically significant predictor variable when predicting the likelihood of an SEO.

- Prior: A dummy variable which takes the value one if a firm has conducted an SEO in the past three years.

- Additional Balance Sheet Controls:

  (i) Cash / Total Assets

  (ii) Dividends: A dummy variable which equals one if a firm has a dividend payout ratio of above 20%

  (iii) Current Debt / Total Assets

Model Specification.

To conduct a sharp regression discontinuity I will run the following logistic (logit) regression as specified in equation (1). *Rank* is the rank of a security in the Russell securities universe, this is centred around 0, i.e. the firm with rank 100 is the most heavily weighted sample firm in the Russell 1000 and the firm ranked -100 is the smallest weighted sample firm in the Russell 2000. *Controls* represents the variables mentioned previously and *Index* is a dichotomous variable which takes the value one if a firm is 'just in' the Russell 1000 index and a value of zero if a firm is 'just out'. *P(SEO)* represents the probability that a firm will conduct an SEO in an index year. γ_i represents industry and year fixed effects as used in some regression specifications.

$$P(SEO) = \alpha + \beta_1 \text{Index} + \beta_2 \text{Rank} + \beta_i \text{Controls} + \gamma_i + \epsilon \tag{1}$$

Optimal Bandwidth.

Bandwidth refers to the threshold of what I determine my 'just in' or 'just out' securities to be. Determining the optimal bandwidth is one of the most crucial steps in my research design. The first concern is that having a bandwidth too narrow leaves too few observations to generate meaningful results. On the other hand, having a bandwidth which is too large might result in 'oversmoothing', and the effects of treatment will be unobservable. To determine the maximum badwidth, which doesn't result in 'over smoothing' I will follow the eight-step procedure as set out by Jacob et al. (2012). The process is as follows:

1. For a given bin width h, create K dichotomous indicators, one for each bin
2. Regress the outcome variable on this set of K indicators (call this regression 1)
3. Divide each bin into two equal-sized smaller bins by increasing the number of bins to 2K and reducing the bin width from h to $h/2$
4. Create 2K indicators, one for each of the smaller bins.
5. Regress the outcome variable on the new set of 2K indicators (regression 2).
6. Obtain a restricted and unrestricted R-squared values from the regressions: R_r^2 from regression 1 and R_u^2 from regression 2
7. Create an F statistic using the following formula

$$\text{F} = \frac{\left(R_u^2 - R_r^2\right)/K}{\left(1 - R_u^2\right)/(n - K - 1)} \tag{2}$$

8. Compare the generated F-statistic to an F distribution with K and N-K-1 degrees of freedom

If the resulting F-statistic is statistically significant, the bin width of h is not over smoothing the data, as dividing the bins does not significantly decrease the explanatory power of the bin indicators. The idea is to find the smallest bandwidth which results in a statistically significant F ratio by repeating the eight-step procedure.

3.4 Where is Passive Ownership Higher?

I hypothesise that index inclusion increases passive ownership which supports capital raising. However, I must first note a question which may arise given my research design, where is passive ownership higher? I will look at securities 'just in' or 'just out' of the Russell 1000 index. For example, that could be the 100 lowest ranked securities in the Russell 1000 index are 'just in' and the 100 securities just below the threshold are 'just out' (the 'just out' firms being the highest ranked firms in the Russell 2000 index).

However, the 'just in' securities make up trivial weights in the Russell 1000 index, whereas the 'just out' securities are the 100 most highly weighted securities in the Russell 2000 index. To gain exposure to an index, active fund managers would purchase the more highly weighted securities in that index; likewise, many ETFs don't hold the least weighted securities in an index to reduce their own transaction costs. Thus, the question arises, would the 'just out' securities be more supported in their capital raising efforts because they are more highly weighted in their index?

Using a regression discontinuity design, Mullins (2014) finds that institutional ownership (both active and passive) is on average 10% higher in the bottom 100 firms of the Russell 1000 than the top 100 firms of the Russell 2000, even though there is a big discrepancy in respective index weightings. This suggests that I would expect 'just in' firms to have higher levels of support for capital raising and thus be more likely to conduct an SEO.

IV Results

4.1 Determination of Bin Size and Summary Statistics

Before I begin my analysis, I must determine the optimal bandwidth to use, that is, how many firms above and below the index cut off point I need to consider, in order to give the best results. The process for deriving the F-statistics was reported in section 3.3. As shown in Table I, a bandwidth of 100 is most appropriate, that is 100 'just in' firms and 100 'just out' firms. In my baseline findings I report results from using varying bandwidths, but the analysis that comes after my baseline findings solely uses the optimal bandwidth of 100.

Further to this, I must make sure that there are no underlying differences in the data categories. Table II shows the differences in means of various firm-level characteristics (between categories). There is some evidence to suggest a difference in the underlying market to book ratios between index and non-index SEO firms. However, the statistical significance is relatively weak, and I will control for this later on. With this result, I can be sure that the coefficients presented in my baseline regression results are not biased due to underlying differences.

Table I: Determination of the Optimal Bandwidth

Bin Size	Restricted R^2	Unrestricted R^2	F-Statistic	P-Value
200	0.028853766	0.020872309	20.3667***	1.5512×10^{-9}
160	0.036128697	0.026746336	18.0609***	1.5625×10^{-8}
120	0.050341077	0.040350205	5.3200**	0.0050
100	0.050875683	0.038956238	3.2370*	0.0401
70	0.050875683	0.031679597	2.6960	0.0693
50	0.050875683	0.038339489	1.12109493	0.3283

*,**,*** refers to significance at the 5%, 1% and .1% levels (respectively)

Table II: Difference in Means - Firm Level Variables

This table presents the averages, average differences, and the significance of the average differences of the underlying firm variables. A comparison is made between index and non-index firms in general, also reported is the comparison between firms which issued equity while 'just in' the index and 'just out' of the index. SalesYOY represents the percentage change in total sales year-on-year for the firm. It is calculated as sales in time t divided by sales in time (t-1) minus one. CAPEXYOY represents the percentage change in total capital expenditure (CAPEX) year-on-year total for the firm. It is calculated as CAPEX in time t divided by CAPEX in time (t-1) minus one. According to prior literature, both these measures serve as proxies for capital demand, hence are included as control variables later in this paper. MB is the market-to-book ratio of the firm, calculated as the market value of the firm per share divided by the book value of the firm per share, this is calculated for each firm on the index rebalancing date. Q is the Tobin's Q ratio, this is calculated as total assets plus the market value of equity minus the book value of equity, all divided by the total assets of the firm. ROA is the return on assets of a firm, calculated as the net income of a firm, divided by its total assets. Dividend is a dummy variable takes on the value one if a firm has a dividend pay-out ratio of above 20% and zero otherwise. CurrDebtRatio, is the current debt ratio of a firm calculated as the current portion of total debt divided by total assets. Leverage is calculated as the ratio of net debt to the sum of total assets and net debt. CashToAssets is calculated as cash divided by total assets.

	All Firms							SEO Firms						
	Just In		Just Out		Difference			Just In		Just Out		Difference		
	Mean	Std.Dev	Mean	Std.Dev	$\mu_1 - \mu_2$	t-stat	p-value	Mean	Std.Dev	Mean	Std.Dev	$\mu_1 - \mu_2$	t-stat	p-value
SalesYOY	0.69	7.82	0.54	6.85	0.15	1.12	0.26	1.57	11.35	2.69	23.04	-1.13	0.63	0.53
CAPEXYOY	0.86	6.19	0.60	3.29	0.26	0.32	0.75	1.84	13.15	1.22	4.04	0.62	0.78	0.43
MB	5.31	63.13	2.11	37.79	3.20	1.61	0.11	4.08	35.59	-6.31	123.05	10.39	1.64	0.10
BHR	0.61	1.11	-0.09	0.42	0.70	1.07	0.29	0.83	1.66	-0.10	0.57	0.93	0.28	0.78
Q	3.12	3.43	1.85	1.57	1.26	0.32	0.75	3.45	4.28	2.16	1.72	1.28	0.73	0.46
ROA	0.04	0.12	-0.01	0.28	0.05	1.23	0.22	0.00	0.14	-0.04	0.19	0.04	0.69	0.49
Dividend	0.23	0.42	0.25	0.43	-0.01	0.21	0.83	0.27	0.45	0.16	0.36	0.12	0.84	0.40
CurrDebtRatio	0.03	0.08	0.03	0.08	0.00	0.08	0.94	0.05	0.13	0.04	0.11	0.01	0.21	0.83
Leverage	0.08	0.38	0.14	0.38	-0.06	0.01	0.99	0.17	0.44	0.16	0.44	0.01	0.20	0.84
CashToAssets	0.19	0.22	0.15	0.19	0.04	0.78	0.44	0.19	0.26	0.20	0.26	-0.02	1.04	0.30

4.2 Hypothesis

As mentioned in the introduction, I hypothesise that index inclusion supports capital raising through the following two mechanisms:

(i) Forced buying by ETF providers who are required to hold additional amounts of a particular security as its rank (based on market cap) rank rises in an index.

(ii) Forced buying by active fund managers who have their fund performance benchmarked against an index. They don't want to underperform the market only due to a lack of exposure to a particular security.

Ultimately it follows that the central hypothesis that I have for this research is: Index inclusion will *increase* the likelihood of a firm raising capital via an SEO. This will be represented by a positive and statistically significant β_1 coefficient as described in equation (1).

4.3 Main Findings

Table III: Baseline RDD Results

	Dependent variable:				
	SEO_dummy				
	(1)	(2)	(3)	(4)	(5)
Bandwidth	50%	75%	100%	150%	200%
Rank	0.011**	0.008***	0.006***	0.003***	0.002***
	(2.292)	(3.232)	(3.645)	(3.318)	(3.725)
Index	2.090***	2.021***	1.884***	1.621***	1.531***
	(7.350)	(8.584)	(9.258)	(9.823)	(10.687)
Constant	−3.365***	−3.328***	−3.304***	−3.396***	−3.480***
	(−9.060)	(−10.885)	(−12.274)	(−14.361)	(−16.188)
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	2,500	3,750	5,000	7,500	10,000

Note: *p<0.1; **p<0.05; ***p<0.01
significance-stats in brackets

Table III shows the results of the equation (1) for varying bandwidths including the optimal bandwidth of 100. Coefficients of both the rank of the security and the dummy variable indicating whether or not a security is included in the index are positive and statistically significant. This is consistent across all bin sizes. Focusing on column (3) where the optimal bin size of 100 was used, the coefficient on the ranking variable can be interpreted as; for every unit increase in the rank of a security the probability of SEO increases by 0.6%.

Each bin confirms what was hypothesised: as a security increases in its ranking of a particular securities universe, the probability of SEO increases. However, there is a discontinuous increase in the likelihood of a firm conducting an SEO once it is included in a widely traded index. This discontinuity is best illustrated by Figure 2; we see that the probability of a firm conducting an SEO is discontinuous about the point that a firm gets included in the Russell 1000. We see an increase in the likelihood of SEO of $\sim 6\%$ when a firm becomes a part of an index.

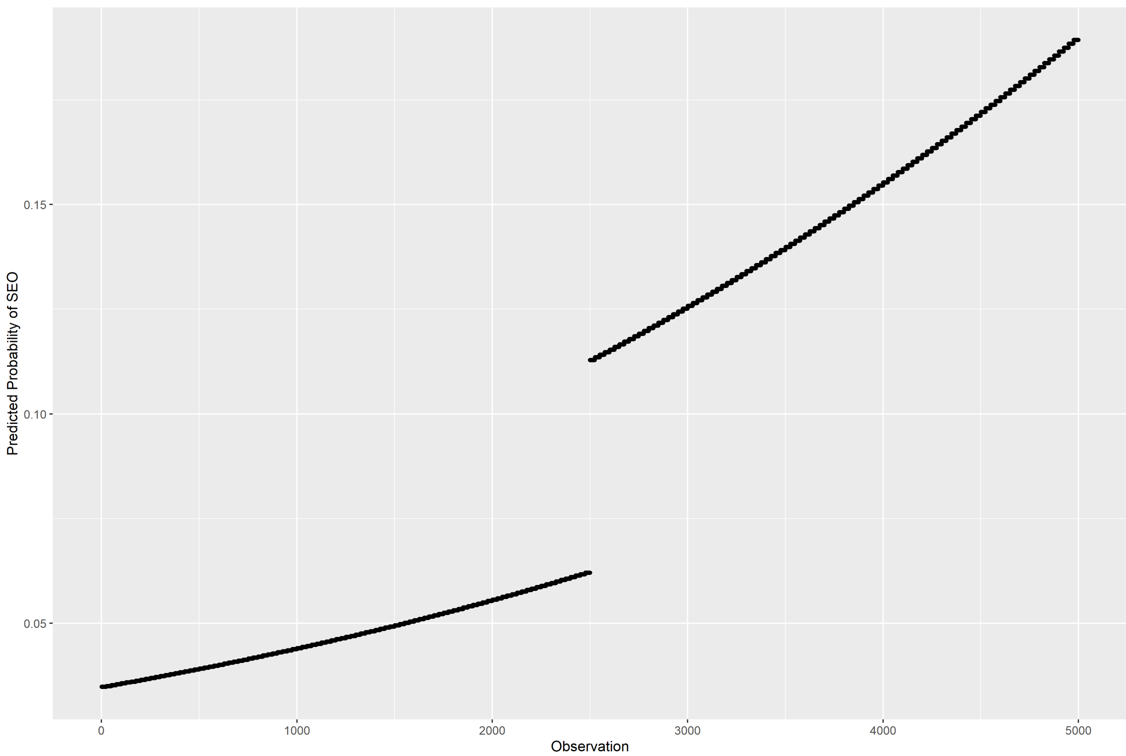

Figure 2: Predicted Probabilities of a Firm Conducting an SEO

Table II shows that the firm subsets used in this study did not have any significant underlying differences; ultimately, this ensures that regression discontinuity is an appropriate research design. While in theory RDD does not need control variables, using control variables provides additional robustness. They provide certainty that the findings of my analysis are not due to index-unrelated differences between index and non-index firms. I repeat the baseline analysis with a suite of firm-level controls. Results are reported in Table IV.

As shown, the inclusion of control variables does little to nullify the previously reported results. The primary variable of interest, the index inclusion dummy, remains both positive and statistically significant. The size, sign and significance of control variables provide support for other equity raising and capital structure theories. For example, the coefficient on the BHR control variable is positive and statistically significant, showing support for the market timing hypothesis. Additionally, the leverage coefficient is positive and statistically significant, indicating that highly levered firms use SEOs as a means to adjust their capital structure and return to an optimal capital structure. Interestingly, the *Prior* dummy variable, which indicates whether a firm has raised equity in the prior three years is positive and statistically significant. This suggests that some firms simply use SEOs as a tool to adjust their capital structure more than other firms.

4.4 Robustness

Controlling for Market Sentiment.

SEOs, and most capital market activity, may just be a result of the prevailing market sentiment. In periods of high sentiment, there is higher liquidity, demand, and other favourable market characteristics. Some could argue that the likelihood of a firm conducting an SEO is simply a result of the prevailing market sentiment and has nothing to do with whether or not a firm is included in an index. To address this concern I add the sentiment index developed by Baker and Wurgler (2006) to my model. Specifically, I add the interaction between market sentiment and the index inclusion dummy.

Table IV: Baseline RDD Results With Controls

This table builds upon the first results shown in Table III. Controls added include year on year sales and CAPEX growth to proxy for capital demand, the market-to-book ratio and one-year price returns to proxy for market timing. I also include other measures which have been shown in prior literature to impact the likelihood of capital raising.

	Dependent variable:			
	SEO Dummy			
	(1)	(2)	(3)	(4)
Rank	0.004***	0.003*	0.003	0.002
	(2.577)	(1.724)	(1.630)	(0.806)
Index	1.567***	1.320***	1.434***	1.117***
	(8.182)	(6.498)	(6.659)	(4.778)
Leverage	0.752***	1.290***	0.581***	1.231***
	(5.492)	(6.579)	(2.808)	(4.545)
SalesYOY	0.014**	0.010*	0.010*	0.007
	(2.451)	(1.825)	(1.826)	(1.486)
CAPEXYOY	0.002	0.021**	0.003	0.017*
	(0.682)	(2.317)	(1.008)	(1.933)
MB	−0.001	−0.001	−0.001	−0.001
	(−1.303)	(−1.459)	(−1.160)	(−1.131)
Q	0.054***	0.018	0.047**	0.021
	(3.072)	(0.941)	(2.234)	(0.917)
Prior	0.264***	0.293***	0.296***	0.334***
	(2.896)	(3.077)	(2.874)	(3.070)
DivDummy1	−0.151	0.051	−0.414**	−0.251
	(−1.371)	(0.436)	(−2.557)	(−1.440)
CurrDebtRatio	1.752***	1.288***	1.253**	0.939*
	(3.759)	(2.623)	(2.383)	(1.697)
ROA	−0.756***	−0.591***	−0.712***	−0.600**
	(−4.378)	(−3.256)	(−2.984)	(−2.415)
BHR		0.133***		0.184***
		(2.934)		(3.248)
CashToAssets		1.778***		1.597***
		(4.805)		(3.173)
Year FE	No	No	Yes	Yes
Industry FE	No	No	Yes	Yes
Observations	4,926	4,478	4,926	4,478
Akaike Inf. Crit.	3,383.990	3,101.110	3,609.189	3,332.238
Note:				*p<0.1; **p<0.05; ***p<0.01

Baker and Wurgler (2006) compute the monthly sentiment index based on the first principle components of five standardised sentiment proxies: the value-weighted dividend premium as defined by Baker and Wurgler (2004), first day returns on IPOs, IPO volume, closed-end fund discount, equity share of new issues. The monthly sentiment index was calendarized to reflect the index constitution periods. Sentiment data is only available up to December 2018, which is why there are fewer observations in these models. I present the results of including market sentiment as a control variable in Table V. The coefficient on the interaction between sentiment and index inclusion is positive and statistically significant. This means, conditional on a firm being included in the index; higher market sentiment increases the likelihood of a firm conducting an SEO. However, even after controlling for sentiment, index inclusion has a positive and statistically significant impact on the likelihood of capital raising, meaning the baseline findings remain true.

Table V: Controlling for Market Sentiment

	Dependent variable:			
	SEO Dummy			
	(1)	(2)	(3)	(4)
Rank	0.004**	0.003*	0.003	0.001
	(2.564)	(1.691)	(1.414)	(0.727)
Index	1.564***	1.384***	1.439***	1.204***
	(8.103)	(6.682)	(6.292)	(5.050)
Sentiment	−0.243*	−0.215	5.859***	5.327**
	(−1.837)	(−1.549)	(2.821)	(2.555)
Index:Sentiment	0.350**	0.311*	0.426**	0.431**
	(2.099)	(1.792)	(2.123)	(2.133)
Year FE	No	No	Yes	Yes
Industry FE	No	No	Yes	Yes
Firm-Level Conrols	None	All	Some	All
Observations	4,478	4,478	4,478	4,478
Akaike Inf. Crit.	3,208.707	3,101.933	3,348.303	3,329.727
Note:				*p<0.1; **p<0.05; ***p<0.01

Excluding Highly Regulated Industries.

My initial findings spark another potential concern. That is, the impact that highly regulated industries such as REITs, insurance companies, and financial institutions have on the significance of the initial findings. These industries have other incentives to conduct SEOs, for examples, regulatory authorities demand that banks maintain a certain amount of capital at all times. Banks may not be able to raise enough from deposit keepers over a particular period and may need to go to market to raise equity as a result . This decision, in theory, is entirely independent of their index positioning. REITs and insurance companies face both regulatory and industry pressure to maintain specific debt ratios. Thus, their capital raising decisions may also be independent of whether or not they are included in an index. These firms may induce noise into the initial findings of this paper. To remove this noise, I exclude these firms from my sample based on their four-digit SIC codes (6000-6799). I repeat my baseline analysis with this new restricted sample, I report my findings in Table VI. As seen, removing these firms from the sample results in a much lower coefficient on the variable of interest (the index inclusion dummy). The coefficient reduces from 1.12 in the baseline model with controls to just 0.7. However, it remains statistically significant, indicating that index inclusion is positively correlated with the likelihood of capital raising.

Subsample Analysis.

The following analysis allows us to see whether or not the results hold throughout time. To do this, I split the sample into three roughly equal subsamples:

1. From 1995, up to and including 2003 (Model 1)
2. From 2004, up to and including 2011 (Model 2)
3. From 2012, up to and including 2019 (Model 3)

I repeat the same baseline analysis with controls for each of these subsamples. The findings are presented in Table VII below. Firm-level control variables are included

Table VI: Excluding Highly Regulated Industries

	Dependent variable:			
	SEO Dummy			
	(1)	(2)	(3)	(4)
Rank	0.003	0.002	0.002	0.0002
	(1.596)	(0.881)	(0.985)	(0.112)
Index	1.161***	0.928***	1.072***	0.736***
	(5.342)	(4.119)	(4.328)	(2.816)
Year FE	No	No	Yes	Yes
Industry FE	No	No	Yes	Yes
Observations	3,799	3,799	3,799	3,799
Akaike Inf. Crit.	2,512.676	2,479.824	2,818.889	2,792.377
Note:				*p<0.1; **p<0.05; ***p<0.01

but hidden for brevity. In the first subsample, between 1995 and 2003, the coefficient on the variable interest, the index inclusion dummy, is positive and statistically significant. This indicates that during this period, index inclusion resulted in an increase in the likelihood that a firm would choose to conduct an SEO. The same can be said of the most recent period, between 2012 and 2019, reported in column (3). However, interestingly, the coefficient on the index inclusion dummy is not statistically significant for the period between 2004 and 2011. While an argument could be made that this invalidates my previous findings, I think what is much more likely is that the impacts of the global financial crisis are being observed. During this period (from roughly 2007 to the end of 2010) funding and liquidity in the capital markets dried up, demand for securities was low. The decision to conduct an SEO may have been motivated by many exogenous factors, other than whether or not a firm was in an index (such as desperate cash requirements). It makes sense that during this period the likelihood of a firm conducting an SEO was unrelated to whether or not a firm was included in the index.

Index Recognition Date.

Table VIII presents a further robustness test aimed at validating the baseline

Table VII: SEO Probability Throughout Time

	Dependent variable:		
	SEO Dummy		
	(1)	(2)	(3)
Rank	0.010**	−0.005	0.002
	(2.560)	(−1.252)	(0.416)
Index	2.010***	0.559	1.556***
	(4.398)	(1.193)	(3.373)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Firm-Level Controls	Yes	Yes	Yes
Observations	1,611	1,434	1,433
Log Likelihood	−358.989	−321.563	−333.795
Akaike Inf. Crit.	1,373.977	1,221.125	1,175.589
Note:			*p<0.1; **p<0.05; ***p<0.01

results. Thus far, the analysis conducted has focused on the year that the index is constituted. The Russell 1000 index changes in June each year, so I look at whether a firm is included in the index on the day that it changes and assess the likelihood that it will raise equity between then and June the following year. While the actual impacts of being in an index should (in theory) only be felt by firms once they are in said index. Firms typically know that they are going to be included in the index around one month before the re-balancing date. Active investors and passive investment vehicles often begin to demand increased shares in prospective index firms before they become a part of the index, and this could result in a firm behaving as though it was in the index before it actually gets placed. I change the calendarised year of SEOs to reflect this, i.e. I consider a firm to be in the index a month before it actually gets put in, to account for the potential behaviour of prospective index firms. The results are presented in Table VIII. We see that the coefficient on the main variable of interest, the index inclusion dummy, remains positive and statistically significant. One thing this analysis is not able to do is provide strong evidence to suggest that firms wait until they get included in the index before making SEO decisions, or that they make SEO decisions as soon as they can be confident that they are going to be included in the index.

Table VIII: Repeated Analysis With Altered Recognition Dates

	Dependent variable:			
	SEO Dummy			
	(1)	(2)	(3)	(4)
Rank	0.009***	0.008***	0.008***	0.007***
	(4.786)	(3.978)	(3.896)	(3.159)
Index	1.524***	1.272***	1.411***	1.115***
	(7.074)	(5.570)	(5.797)	(4.227)
Year FE	No	No	Yes	Yes
Industry FE	No	No	Yes	Yes
Firm-Level Controls	Some	All	Some	All
Observations	4,759	4,325	4,759	4,325
Log Likelihood	−1,359.407	−1,246.916	−1,068.854	−967.482
Akaike Inf. Crit.	2,744.815	2,523.833	3,053.707	2,836.965
Note:				*p<0.1; **p<0.05; ***p<0.01

Addressing Endogeneity.

The last robustness test provides a unique way to address the issue of endogeneity. The initial analysis provides strong evidence that there is a relationship between a firm being in an index and conducting an SEO. I argue that index inclusion via various mechanisms, supports capital raising efforts, and as a result increases the likelihood of a firm conducting an SEO. There is some argument to be made that in fact, seasoned equity offerings result in index inclusion, i.e. that firms select to be in an index by conducting an SEO. Firms may do this for various reasons, including increased valuation multiples, increased investor recognition and better analyst coverage. To control for this, I remove firms which may be exhibiting this selection behaviour based on the following identification strategy:

1. Firms which conduct an SEO then are removed from the index the following year

   - This could suggest that they attempted to 'select to stay in the index' but failed in doing so

2. Firms which SEO, get included in the index, then SEO again once they are in the index

   - This could also indicate a firm which uses SEOs to be included in an index

If a firm exhibits this behaviour, it is excluded from the entire sample, not just the year that it met one of the above criteria. A total of 30 firms and 336 observations were removed from the sample. While this could potentially result in over-correction, and some firms who aren't selecting to be in the index are removed due to chance, this analysis provides additional evidence to support the idea that index inclusion causes an increase in the likelihood of a firm conducting an SEO.

The results are presented in Table IX. The coefficient on the index inclusion dummy is significantly positive. This finding provides evidence of not only a positive relationship between index inclusion and SEO likelihood, but it also suggests that index inclusion *causes* an increase in SEO likelihood.

Table IX: Removing Firms Which may Select to be in the Index

	Dependent variable:			
	SEO Dummy			
	(1)	(2)	(3)	(4)
Rank	0.009***	0.008***	0.008***	0.007***
	(4.786)	(3.978)	(3.896)	(3.159)
Index	1.524***	1.272***	1.411***	1.115***
	(7.074)	(5.570)	(5.797)	(4.227)
Year FE	No	No	Yes	Yes
Industry FE	No	No	Yes	Yes
Firm-Level Controls	Some	All	Some	All
Observations	4,759	4,325	4,759	4,325
Akaike Inf. Crit.	2,744.815	2,523.833	3,053.707	2,836.965

Note: *p<0.1; **p<0.05; ***p<0.01

4.5 Post Issue Performance

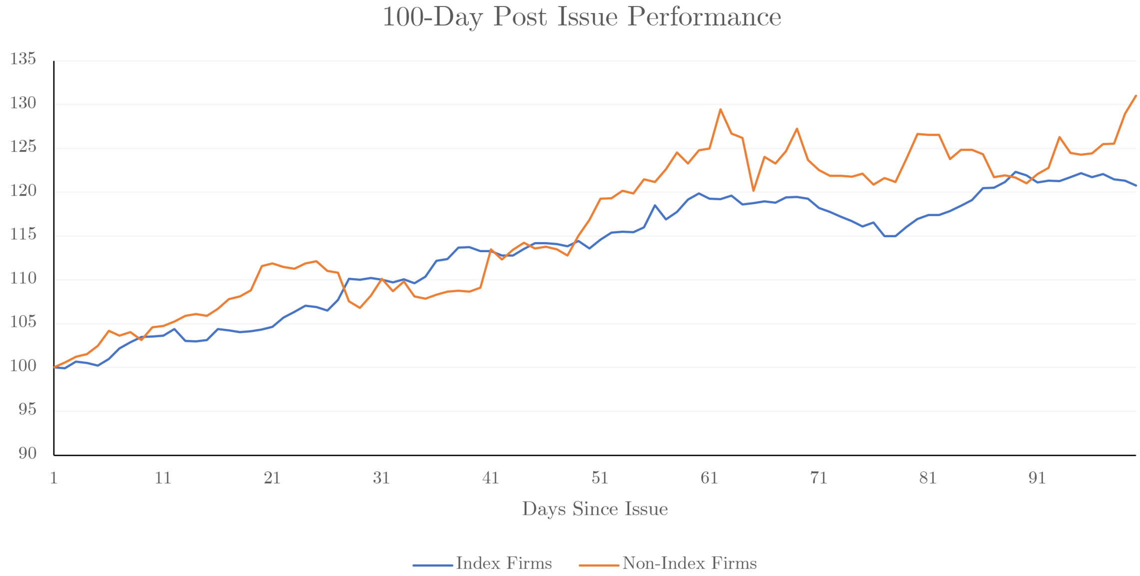

Figure 3: 100-Day Post Issue Performance

The previous analysis provides evidence of a link between index inclusion and SEO likelihood. My hypothesis was that forced buying from passive and active market participants supported capital raising efforts of index firms which would, in turn, drive the result that we observed. A simple way to evaluate the mechanism by which index inclusion increases the likelihood of SEOs is to analyse post-issue performance. The story is as follows: should my hypothesis be correct, I would expect there to be a greater degree of forced buying of securities in index firms after an SEO. These share purchases would be made for non-fundamental reasons resulting in overvalued shares and a decline in post-issue performance, relative to SEO firms not included in the index.

Figure 3 and Table X provide some evidence to suggest that this may indeed be the case. Figure 3 shows the performance of equally-weighted portfolios made up of index firms and non-index firms for the 100 days following an SEO. More often than not, over this period, the portfolio of non-index SEO firms outperforms the portfolio of index portfolio firms. This provides some evidence that the securities may be overvalued as a result of forced buying after an SEO. Table X provides further evidence in support of this argument, we can see that as time passes, the portfolio of index firms consistently underperforms realtive to the portfolio of non-index firms over the course of twenty-four months. These trends are similar when looking at performance beginning on the SEO filing date, or issue date.

Table X: Buy and Hold Price Returns - Post Issue

	1 Month	3 Month	6 Month	12 Month	24 Month
In Index	1.32%	8.56%	11.88%	16.89%	25.15%
Out of Index	4.43%	11.63%	14.23%	27.07%	35.44%
Difference	-3.11%	-3.08%	-2.35%	-10.18%	-10.29%
P-Value	0.074*	0.365	0.620	0.273	0.069*

4.6 Event Study

I gain further insight by observing the reactions of investors to SEO announcements from index firms versus non-index firms. To evaluate how investors respond, I utilise a basic event study methodology. The process is as follows. First I generated a series of 'normal returns' based on four different returns models. The standard market model, the market adjusted model, the Fama-French three-factor model (FF3), and FF3 + momentum model. Equation (3) shows how abnormal returns are generated where $R_{i,t}$ represents the expected or normal return, based on the return model chosen.

$$AR_{i,t} = K_{i,t} - R_{i,t} \tag{3}$$

To measure the total impact of an event over a particular period (known as the 'event window'), individual abnormal returns are aggregated to create a 'cumulative abnormal return'. This process is formally described in equation (4). As the event study considers multiple observations of SEOs. To represent the average impacts of these events, returns are further aggregated into 'cumulative average abnormal returns' or $CAAR$s; this process is defined in equation (5).

$$CAR\,(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{i,t} \tag{4}$$

$$CAAR = \frac{1}{n} \sum_{i=1}^{n} CAR\,(t_1, t_2) \tag{5}$$

In line with standard practice, an estimation window of 251 trading days was used, equivalent to one year. That is, days *t=-281* to *t=-30* were the estimation window. I used event windows of three, five and eleven days.

$$S^2_{CAAR} = \frac{1}{N-1} \sum_{i=1}^{N} (CAR_i - CAAR)^2 \tag{6}$$

$$t_{CAAR} = \sqrt{N} \frac{CAAR}{S_{CAAR}} \tag{7}$$

Equations 6 and 7 demonstrate how the simple cross-sectional test statistic is computed. Its output is then compared to the assumed distribution under the null hypothesis. It is assumed that the abnormal returns are spread evenly through the event window and that there is little event induced trading volatility, given the events of concern are SEO announcements, these are reasonable assumptions.

There are two competing theories as to whether SEO announcement returns will be higher or lower for index firms versus non-index firms. On the one hand, SEOs generally tend to be dilutive and attract negative share price reactions. Given that a larger proportion of index firm equity is held passively and can't 'react' to an announcement by buying or selling, CAARs should be higher for index firms relative to non-index firms. On the other hand, investors may catch on to the fact that there will be forced buying for non-fundamental reasons when the SEO is conducted. This will result in overvaluation and thus decreased future returns. As a result, this could suggest that we should expect a more negative share price reaction for index firms following an SEO announcement.

I present the results of the event study in Table XI. Overall, it appears that there is a more negative investor reaction to SEO announcements of index firms. This is in line with the second theory discussed, which is that investors bid down share prices due to the potential of forced buying. In addition to the previous analysis on post-issue performance, these results strongly support my initial hypothesis that capital raising efforts are more supported in index firms due to forced buying.

Table XI: Share Price Reactions to SEOs

	Market Model				Three and Four Factor Models			
	Standard		Adjusted		FF3		FF3 + Mom	
CAR (%)	S1	S2	S1	S2	S1	S2	S1	S2
CAR (-1,1)	-0.011	-0.028	-0.006	-0.023	-0.010	-0.030	-0.010	-0.028
	(-3.953)***	(-6.180)***	(-2.822)**	(-5.249)***	(-3.519)***	(-6.369)***	(-3.483)***	(-6.107)***
CAR(-2,2)	-0.010	-0.032	-0.003	-0.025	-0.011	-0.032	-0.011	-0.029
	(-3.004)***	(-4.965)***	(-1.491)	(-4.081)***	(-2.954)***	(-4.7926)***	(-3.027)***	(-4.461)***
CAR(-5,5)	-0.001	-0.044	0.015	-0.030	-0.005	-0.045	-0.006	-0.040
	(-0.457)	(-4.386)***	(2.096)**	(-2.952)***	(-0.915)	(-3.956)***	(-1.085)	(-3.605)***

4.7 Do Index Firms Raise *More* Equity?

The main question considered thus far has been, *does index inclusion increase the likelihood of a firm conducting as SEO?* The evidence presented suggests that in fact, it does. A natural follow on from this question is *do firms raise more significant amounts of equity when included in a widely traded index?* If so, this could indicate higher demand from investors, which further supports my hypothesis of *why* index firms are more likely to raise equity.

To evaluate this new question, I use two measures of issue size. First, I look at all the firms in the sample and look at net issuance over an index year (June to June). I calculate this as the value of securities sold minus the value of securities purchased. Data comes from Compustat Global, firms with no issue/repurchase information were excluded from the sample. The next measure of equity raising comes from my original SEO sample from SDC platinum, for the firms which conducted an economically meaningful SEO. I looked at the total funds raised by a particular SEO, I restrict this sample from 2011 onwards to avoid any bias from the GFC. Both these measures not only provide insight into whether or not index firms raise greater amounts of equity but also show whether

Table XII: Issue Size and Capital Demand

	Dependent variable:			
	Net Issuance		Issue Size	
	(1)	(2)	(3)	(4)
Rank	0.273***	0.121	1.584**	1.611*
	(2.903)	(1.256)	(1.975)	(1.732)
Index	74.440***	55.002***	200.686*	242.852*
	(6.484)	(4.663)	(1.916)	(1.977)
Leverage	39.193***	−24.276	−26.203	4.289
	(3.266)	(−1.593)	(−0.266)	(0.032)
SalesYOY	2.794***	2.522***	8.141***	7.952***
	(6.197)	(5.743)	(4.658)	(5.207)
CAPEXYOY	1.487***	1.086*	0.785	2.548
	(2.652)	(1.879)	(0.383)	(1.096)
MB	−0.006	−0.030	0.066	−0.110
	(−0.117)	(−0.615)	(0.045)	(−0.066)
Q	−2.501*	0.863	24.697*	29.292
	(−1.783)	(0.577)	(1.729)	(1.320)
DivDummy1	2.282	−17.482**	−0.878	−162.491
	(0.360)	(−2.232)	(−0.016)	(−1.439)
CurrDebtRatio	145.155***	154.993***	−47.784	19.150
	(3.588)	(3.512)	(−0.169)	(0.070)
ROA	−118.543***	−77.397***	394.771**	631.479***
	(−8.250)	(−5.178)	(2.104)	(3.176)
LnSize	12.532***	36.438***	88.375***	−0.886
	(3.595)	(6.972)	(2.865)	(−0.014)
BHR	12.175***	10.714***	−17.823	−28.620
	(3.689)	(3.033)	(−1.270)	(−1.354)
CashToAssets	89.289***	66.731**	95.541	47.800
	(4.024)	(2.525)	(0.484)	(0.201)
Year/Industry FE	No	Yes	No	Yes
Observations	3,969	3,969	212	212
R^2	0.077	0.246	0.178	0.835
Note:				*p<0.1; **p<0.05; ***p<0.01

or not investors have higher demand for shares of index included firms. Standard OLS regressions are run with the measures of issue size as the dependent variable. The security rank, the index inclusion dummy, and a suite of control variables are used as independent variables.

The results are presented in Table XII. The coefficient of interest is again on the index inclusion dummy. We can see that in every case, no matter which measure of issue size, or which fixed effects specifications are used, the coefficient is positive and statistically significant. This is even after controlling for rank, which is correlated with the size of the firm. This finding strongly suggests that index firms issue greater amounts of equity when they conduct an SEO, simply because they are in the index. In line with this finding and my initial hypothesis, it makes sense that they would do so because they face higher demand for their shares due to potential forced buying.

I must note that the best way to measure investor demand would be to look at the magnitude of oversubscription or undersubscription in the book-building process. This would alleviate the concern that index firms raising more equity is just coincidental and demand for their shares is in fact not higher than for non-index firms. However, it is reasonable to assume that an investment bank would not underwrite or market SEOs that they knew were going to be heavily undersubscribed. Thus, that demand during the pre-SEO book-build process is about the same or potentially higher for index firms versus non-index firms.

V Research Implications

5.1 Contributions

The motivation for this research came from both previous literature as well as industry observation. The rise of passive investment across the world has had a multitude of impacts on the capital markets and their participants. The documentation of these impacts in literature remains in its infancy. In investment banking / corporate finance practice, there has been an increased emphasis placed on stock indices. Economic researchers within these firms consistently speak of the relationship between various indices (not just broad market indices) and macroeconomic indicators. Additionally, a nalysts make sure to mention index placing and the fundamental support it provides when pitching both capital market and M&A activity to clients. Further to this, firms themselves are increasingly asking for index information, whether it be prices, predicted positioning after a rebalancing, or how a transaction would affect their position within an index. Thus, this research contributes both to the past literature and to corporate finance practice.

Contributions to Literature.

Section II covered three branches of relevant literature which are built upon in this paper. The literature which considers the timing, reasoning and likelihood of SEOs looks at firm characteristics, market timing proxies and other factors in determining the reasons that firms seek to raise capital via the equity capital markets. Notably missing is the inclusion of any index variable which aims to determine whether a relationship is present between index inclusion and the likelihood of a firm conducting an SEO. My contributions fill this apparent gap. The second branch of literature that I surveyed was that which looks at the impacts of index inclusion. Studies have documented price, volume, volatility and ownership impacts, but not many decision-making impacts such as the decision to conduct an SEO. Lastly, I looked at the literature which documents the impacts of passive ownership, which is higher in index included firms. Studies have concluded that higher passive ownership leads to more value-destroying M&A activity. Studies have also shown that large companies are reluctant to list if they will be included in an index due to the negative impacts of passive ownership and the price signals that result. However, studies have not looked at whether passive ownership results in a firm being more likely to issue capital via an SEO. These three gaps in the preceding literature have been partially or wholly addressed in this research paper.

Contribution to Corporate Finance Practice.

As well as building upon past literature, this research has practical implications for finance professionals. Firstly, for security analysts, an enhanced predictive model using index inclusion in some capacity will undoubtedly be useful as they value and assess the quality of a firm.

For investment bankers, the implications of this research are invaluable. First it gives grounding as they pitch for work. Dealmakers can approach larger clients and say that capital raising is a good idea because of the heavy institutional demand that comes with being included or positioned well within an index. Combined with the evidence that this study provides as well as their own industry knowledge, gaining mandates in the ECM sphere can be done with an evidence-based approach which is better for banks and firms alike. Additionally, this predictive model c ould, in theory, be used to identify firms who would be most worth the time pitching to, as their characteristics make them a prime candidate for an SEO.

5.2 Limitations

Inability to Distinguish Between Mechanisms.

I hypothesised that index inclusion supports capital raising through the the forced buying of SEO shares by active and passive investors. The results in section 4.5 show that there is some forced buying of index firms after an SEO; however, my analysis does not allow the impacts of active and passice investors to be distinguished from one another. The only way to tell the impacts apart would be to analyse the share order book at the time of of an SEO and at the index rebalance date, as well as consider the pre-SEO book build. Unfortunately, book build information is rarely shared outside of the underwriting investment bank (or syndicate). This would be very interesting future research for academics in possession of this data.

Is it all Down to Size?

A valid concern is that rank of a firm in the Russell Securities universe is driven to some great extent by size (free-float-adjusted market cap). When a security becomes ranked 1000 or lower (rank of 1 being the most heavily weighted security in the index, contrary to how I ranked firms for the purposes of my research), it becomes a part of the Russell 1000 index. Could my results simply be driven by firm size, and not index inclusion? For two reasons I think that this is most likely not the case.

Firstly, the 'rank' variable in my regressions controls for most of the variation in firm size, yet in some cases such as when, regulated industries are included, the impact of rank on the likelihood of SEO is not statistically significant. Further to this, when firm size is added as an explanatory variable in the baseline regression with controls, the coefficient on the index inclusion dummy remains statistically significant and roughly the same size (these results are not presented). I must note that adding size as an explanatory variable induces multicollinearity into the models to some extent, but this is unlikely to bias the estimates of the index dummy coefficient.

The second reason I doubt that firm size is causing the results found is because of the subsample analysis conducted in Table VII. After 2007, the Russell 1000 rebalancing process was changed to limit the number of constituent changes each year. This meant that the firms in the Russell 1000 weren't strictly larger than the firms in the Russell 2000. This was particularly evident in my sample of 'just in' and 'just out' firms. In column (3) of Table VII (the subsample of observations from 2012 onwards), up to 40 of the 100 firms in the 'just in' sample were smaller than the firms in the 'just out' sample each year. Yet, the coefficient on the index inclusion dummy remained statistically significant and similar in magnitude to the baseline finding. I would argue that this provides the most compelling argument as to why my results are not driven by size.

However, it could be possible that size-related characteristics are driving some part of the result. For example, index firms may have more analyst coverage, or more directors with banking connections. Both these factors may the increase the likelihood of a firm conducting an SEO, but are largely unrelated to index inclusion. These impacts as well as others, could be driving the results found and pose an endogeneity concern. This is where my use of a regression discontinuity as a research design is most valuable.

I argue that because I chose a narrow bandwidth of firms without underlying differences to conduct my analysis, it is highly improbable that my results are biased to the extent that they are incorrect. However, without book build data to confirm that it is the higher institutional demand causing an increase in SEO likelihood for index firms, the concern of endogeneity still lingers.

Can These Results be Extrapolated to all Stock Indices?

One of the considerations that I made early on in the research planning process is what stock index to use when assessing the impacts of index inclusion. I needed a widely tracked and traded large-cap index as large-cap stocks tend to raise equity more (Abraham & Harrington, 2011). This ensured I had sufficient SEO observations in my sample. The two obvious candidates were the S&P 500 and the Russell 1000. I chose the Russell 1000 as constituents don't experience as much of a gain in investor recognition as proposed by Merton (1987), the additional volatility and elevation in valuation multiples seen in S&P 500 are not as pronounced in Russell 1000 additions. By looking at the S&P 500, I might find the impact of being added to the S&P 500 index, as opposed to the effect of index inclusion on SEO likelihood. I think what I found by using the Russell 1000 index as my index of choice was more representative of the impacts of index inclusion on SEO likelihood in general.

In theory I could make my results more robust by repeating this analysis for firms 'just in' and 'just out' of the S&P 500. However, there is no clearly defined 'just out' firms of the S&P500. While the S&P400 is an orthogonal index of mid-cap securities, constituents are not necessarily guaranteed to move into the S&P500 if they grow in size or satisfy some other criteria. This means that my research design is not replicable for the S&P500. An alternative would be the MSCI USA index, but it contains too few securities to conduct a regression discontinuity. This leaves the concern that I am observing only the impacts of being included in the Russell 1000. However, if anything, I think the impact of index inclusion on SEO likelihood would be more pronounced for firms in the S&P500 or MSCI USA index, due to the higher institutional ownership these firms face.

I have confidence that my findings would be similar for all widely traded stock indices around the world; but until analysis is conducted on other stock indices, I cannot say this for sure.

VI Conclusion

In this paper, I documented the impact of index inclusion on the likelihood of a firm conducting a seasoned equity offering. Using a regression discontinuity approach based on firms 'just in' and 'just out' of the Russell 1000 stock index, I document that index inclusion results in an increase in the likelihood of an SEO by roughly six percentage points, compared to non-index firms. This result is robust to the inclusion of a battery of control variables related to market timing, capital demand, and firm behaviour. Even when controlling for market sentiment, and removing highly regulated industries, the baseline results remain the same. Additionally, when splitting the observations into subsamples by year, I find that the initial findings hold true for all periods outside of the years impacted by the GFC. This is likely because of the various liquidity constraints in the market and distress costs faced by firms. Further to this, I adjusted my data to control for the fact that firms may become aware that they are going to be included in the index before the actual index rebalancing date. I also address the issue of reverse causality by removing firms from the sample which may be selecting to be in the index. Neither of these two tests invalidates the initial results. Together, these results provide strong evidence to suggest that being included in a widely traded index does increase the likelihood of a firm conducting an SEO.

I hypothesised that the forced buying of index firms after an SEO by passive and active funds was driving my results. To assess this, I looked at the post-issue share price performance of index firms versus non-index firms. I found that returns were higher to non-index firms relative to index firms after an SEO was conducted. I explain this by arguing that the forced buying of index-included firms results in overvaluation due to non-fundamental trading. I also considered the reactions of investors to SEO announcements from firms in and out of the index. I found that investors reacted more negatively to SEO announcements from index firms. This could be because investors were able to foresee the forced buying and overvaluation, and bid down share prices accordingly. The analysis of post-issue performance and investor reactions provide evidence in support of my hypothesis.

Prior literature has discussed the impacts of index inclusion of firm value and share price volatility and liquidity; however, this paper provides some of the first evidence suggesting that index inclusion increases the likelihood of a firm conducting an SEO. Similarly, no previous literature which looks at the timing, reasoning and likelihood of SEOs, explores index inclusion as a driver of seasoned equity offerings. This paper also contributes to corporate finance practice, my findings allow for more robust analysis from security analysts, and better recommendations from ECM investment bankers.

Limitations do persist throughout the paper. First, I am unable to distinguish whether my results are driven by passive investors, active investors, or some combination of them both. Second, while my research design, in theory, provides unbiased causal estimates of the impacts of index inclusion on SEO likelihood, size and index inclusion bring various other exogenous factors with them such as increased analyst coverage and more directors. As a result, there could be a spurious relationship in my dataset resulting in endogeneity. Third, without further testing, it is not possible to confirm that my findings are applicable to all widely traded stock indices in all countries. These limitations provide natural extensions to this research. In the future, book building data could be used to resolve endogeneity concerns and determine whether active or passive investors drive these findings. Researchers could also conduct analysis on other widely traded stock market indices to determine if these impacts are specific to the Russell 1000.

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Appendix

Appendix A - Market Sentiment

Table XIII: Full output of Results Controlling for Market Sentiment

	Dependent variable:			
	SEO Dummy			
	(1)	(2)	(3)	(4)
Rank	0.004**	0.003*	0.003	0.001
	(2.564)	(1.691)	(1.414)	(0.727)
Index	1.564***	1.384***	1.439***	1.204***
	(8.103)	(6.682)	(6.292)	(5.050)
Sentiment	−0.243*	−0.215	5.859***	5.327**
	(−1.837)	(−1.549)	(2.821)	(2.555)
Leverage		1.298***	0.679***	1.232***
		(6.636)	(3.229)	(4.538)
SalesYOY		0.010*	0.008	0.007
		(1.863)	(1.564)	(1.497)
CAPEXYOY		0.021**	0.016*	0.017*
		(2.262)	(1.879)	(1.919)
MB		−0.001	−0.001	−0.001
		(−1.450)	(−1.114)	(−1.102)
Q		0.019	0.048**	0.023
		(1.013)	(2.228)	(1.009)
Prior		0.293***	0.315***	0.334***
		(3.083)	(2.920)	(3.074)
DivDummy1		0.050	−0.329*	−0.265
		(0.422)	(−1.890)	(−1.513)
CurrDebtRatio		1.279***	1.169**	0.934*
		(2.603)	(2.142)	(1.689)
ROA		−0.532***	−0.656***	−0.548**
		(−2.889)	(−2.723)	(−2.210)
BHR		0.137***		0.189***
		(3.015)		(3.321)
CashToAssets		1.753***		1.556***
		(4.717)		(3.086)
Included:Sentiment	0.350**	0.311*	0.426**	0.431**
	(2.099)	(1.792)	(2.123)	(2.133)
Constant	−2.881***	−3.621***	−17.627	−18.928
	(−23.179)	(−7.448)	(−0.022)	(−0.024)
Year/Industry FE	No	No	Yes	Yes
Observations	4,726	4,478	4,721	4,478
Akaike Inf. Crit.	3,208.707	3,101.933	3,348.303	3,329.727
Note:				*p<0.1; **p<0.05; ***p<0.01

Appendix B - Regulated Industries

Table XIV: Full Output of Results Excluding Regulated Industries

	Dependent variable:			
	SEO Dummy			
	(1)	(2)	(3)	(4)
Rank	0.003	0.002	0.002	0.0002
	(1.596)	(0.881)	(0.985)	(0.112)
Index	1.161***	0.928***	1.072***	0.736***
	(5.342)	(4.119)	(4.328)	(2.816)
Leverage	0.664***	1.271***	0.706***	1.378***
	(4.359)	(6.047)	(3.172)	(4.768)
SalesYOY	0.011**	0.009*	0.008	0.007
	(2.012)	(1.759)	(1.438)	(1.390)
CAPEXYOY	0.021**	0.021**	0.017*	0.017*
	(2.058)	(2.071)	(1.771)	(1.846)
MB	−0.001	−0.001	−0.001	−0.001
	(−1.424)	(−1.535)	(−1.037)	(−0.974)
Q	0.050***	0.012	0.042*	0.013
	(2.767)	(0.607)	(1.863)	(0.546)
Prior	0.308***	0.331***	0.385***	0.422***
	(2.886)	(3.069)	(3.133)	(3.389)
DivDummy1	−0.712***	−0.605***	−0.779***	−0.712***
	(−4.196)	(−3.509)	(−3.251)	(−2.949)
CurrDebtRatio	0.830	0.597	0.849	0.735
	(0.930)	(0.667)	(0.795)	(0.682)
ROA	−0.744***	−0.581***	−0.626***	−0.502**
	(−4.012)	(−3.029)	(−2.585)	(−1.990)
BHR		0.159***		0.232***
		(3.426)		(3.937)
CashToAssets		1.830***		1.844***
		(4.753)		(3.508)
Constant	−2.183***	−2.737***	−19.136	−19.195
	(−4.299)	(−5.165)	(−0.003)	(−0.003)
Year/Industry FE	No	No	Yes	Yes
Observations	3,799	3,799	3,799	3,799
Akaike Inf. Crit.	2,512.676	2,479.824	2,818.889	2,792.377
Note:				*p<0.1; **p<0.05; ***p<0.01

Appendix C - Year Subsamples

Table XV: Full Output of Year Subsamples

	Dependent variable:		
	SEO Dummy		
	(1)	(2)	(3)
Rank	0.010**	−0.005	0.002
	(2.560)	(−1.252)	(0.416)
Index	2.010***	0.559	1.556***
	(4.398)	(1.193)	(3.373)
Leverage	0.813	1.859***	0.880*
	(1.466)	(3.256)	(1.748)
SalesYOY	−0.003	−0.006	0.014
	(−0.297)	(−0.187)	(1.377)
CAPEXYOY	0.026	−0.001	−0.010
	(1.438)	(−0.052)	(−0.380)
MB	−0.0001	0.0001	−0.002
	(−0.036)	(0.073)	(−0.521)
Q	0.036	0.047	−0.125*
	(1.194)	(0.529)	(−1.791)
Prior	0.312	0.294	0.465**
	(1.505)	(1.379)	(2.250)
DivDummy1	−0.170	0.282	−0.649*
	(−0.418)	(0.872)	(−1.901)
CurrDebtRatio	1.066	0.401	1.260
	(0.974)	(0.343)	(1.356)
ROA	−0.479	−0.467	−0.382
	(−1.455)	(−0.658)	(−0.494)
BHR	0.180**	0.114	0.328*
	(2.100)	(1.030)	(1.806)
CashToAssets	1.296	1.502	2.019*
	(1.479)	(1.262)	(1.954)
Constant	−21.869	−24.278	−20.136
	(−0.009)	(−0.012)	(−0.009)
Year/Industry FE	Yes	Yes	Yes
Observations	1,611	1,434	1,433
Akaike Inf. Crit.	1,373.977	1,221.125	1,175.589
Note:			*p<0.1; **p<0.05; ***p<0.01

Appendix D - Recognition Dates

Table XVI: Full Output of Sample with Altered Index Recognition Dates

	Dependent variable:			
	SEO Dummy			
	(1)	(2)	(3)	(4)
Rank	0.008	0.007	0.008	0.007
	(4.806)***	(3.918)***	(4.116)***	(3.405)***
Index	1.856	1.719	1.750	1.632
	(9.135)***	(7.926)***	(7.567)***	(6.470)***
Leverage	0.699	1.292	0.537	1.332
	(4.988)***	(6.402)***	(2.470)**	(4.842)***
SalesYOY	0.008	0.004	0.003	0.001
	(1.796)*	(0.883)	(0.646)	(0.214)
CAPEXYOY	0.002	0.020	0.002	0.018
	(0.799)	(2.297)**	(0.797)	(2.032)**
MB	0.00004	−0.0002	−0.0003	−0.0003
	(0.046)	(−0.238)	(−0.327)	(−0.373)
Q	0.047	0.006	0.038	0.004
	(2.665)***	(0.319)	(1.761)*	(0.167)
Prior	0.196	0.203	0.155	0.156
	(2.055)**	(2.033)**	(1.435)	(1.366)
DivDummy1	0.024	0.256	−0.243	−0.0003
	(0.210)	(2.115)**	(−1.446)	(−0.002)
CurrDebtRatio	1.885	1.432	1.411	1.051
	(3.982)***	(2.854)***	(2.615)***	(1.833)*
ROA	−0.974	−0.798	−0.858	−0.757
	(−5.544)***	(−4.427)***	(−3.793)***	(−3.247)***
BHR		0.103		0.114
		(2.229)**		(1.976)**
CashToAssets		1.963		2.095
		(5.150)***		(4.075)***
Year/Industry FE	No	No	Yes	Yes
Observations	4,926	4,478	4,926	4,478
Akaike Inf. Crit.	3,145.969	2,864.270	3,369.169	3,099.372
Note:				*p<0.1; **p<0.05; ***p<0.01

Appendix E - Removing Firms Selecting to be in the Index

Table XVII: Full Output - Removing Firms Which may Select to be in the Index

	Dependent variable:			
	SEO Dummy			
	(1)	(2)	(3)	(4)
Rank	0.009***	0.008***	0.008***	0.007***
	(4.786)	(3.978)	(3.896)	(3.159)
Index	1.524***	1.272***	1.411***	1.115***
	(7.074)	(5.570)	(5.797)	(4.227)
Leverage	0.578***	1.034***	0.384	0.967***
	(3.890)	(5.171)	(1.641)	(3.311)
SalesYOY	0.010*	0.006	0.005	0.004
	(1.868)	(1.275)	(1.063)	(0.870)
CAPEXYOY	0.002	0.025***	0.002	0.017*
	(0.842)	(2.595)	(0.727)	(1.672)
MB	−0.001	−0.001	−0.001	−0.001
	(−1.444)	(−1.603)	(−1.176)	(−1.164)
Q	0.050***	0.017	0.044*	0.020
	(2.711)	(0.826)	(1.958)	(0.831)
Prior	0.329***	0.378***	0.348***	0.411***
	(3.133)	(3.453)	(2.946)	(3.298)
DivDummy1	−0.216*	−0.010	−0.472**	−0.304
	(−1.683)	(−0.070)	(−2.565)	(−1.548)
CurrDebtRatio	1.856***	1.397**	1.358**	1.058*
	(3.562)	(2.553)	(2.320)	(1.716)
ROA	−0.789***	−0.649***	−0.761***	−0.682***
	(−4.507)	(−3.539)	(−3.091)	(−2.691)
BHR		0.146***		0.195***
		(2.922)		(3.188)
CashToAssets		1.725***		1.597***
		(4.344)		(2.900)
Constant	−3.153***	−3.939***	−20.677	−21.340
	(−7.031)	(−7.496)	(−0.028)	(−0.027)
Year/Industry FE	No	No	Yes	Yes
Firm-Level Controls	Some	All	Some	All
Observations	4,759	4,325	4,759	4,325
Akaike Inf. Crit.	2,744.815	2,523.833	3,053.707	2,836.965
Note:				*p<0.1; **p<0.05; ***p<0.01