The Indexer´s Dilemma

Rational choices and irrational volatility

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Abstract:

This paper examines whether institutional fund flows, driven by index inclusion, affects stock volatility and performance in the Swedish equity market — with an S&P 500 sample serving as a comparative benchmark. Using a mediation analysis framework on two panel datasets covering 2016 to 2025, we find no evidence of ownership-related index effects in the Swedish market. This suggests that the findings of prior US-based literature may not be directly transferable to markets dominated by mutual funds rather than ETFs, where the arbitrage mechanism of the latter may play a crucial role in transmitting such effects. We do, however, observe volatility enhancing index effects in the Swedish market through alternative channels. Thus, we are unable to rule out that ownership effects do exist in the Swedish market but go undetected due to noise in our institutional ownership proxy variable. Due to the endogeneity issues inherent to index construction, causal inference regarding return effects is not possible in either market, although we do observe a relative underperformance of indexed stocks – possibly attributable to hindsight bias, differences in dividend policy or index bubble mechanics. Whilst index-related return effects require no immediate action from the passive investor, the volatility findings do give cause for attention as OMXS30 stocks appear to carry genuinely higher price variation at both at the individual stock and portfolio level.

Keywords: Index effects, ownership effects, demand shocks, ETF-arbitrage, passive investing, mutual funds, stock volatility, OMXS30, S&P500

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1.0 Introduction

The popularization of passive investment strategies represents one of the most significant structural shifts in modern financial markets. Partly, this trend can be attributed to the rise of online brokerage platforms - commonly called "neobrokers" - that provide access to index-tracking ETFs and mutual funds at close to zero cost. Sweden exemplifies this transformation, with retail platforms like Avanza and Nordnet serving millions of investors, while substantial equity portfolios accumulate through the Swedish premium pension (Premiepension) and occupational pension (Tjänstepension) schemes. As of December 2023, financial corporations—including mutual funds, pension funds, and insurance companies—held approximately 31% of Swedish listed equities, with foreign institutional investors controlling an additional 37% (Statistics Sweden, 2024). This high concentration of institutional ownership raises fundamental questions about how passive ownership affects asset prices in the Swedish market.

Traditional asset pricing theory, grounded in Modern Portfolio Theory (Markowitz, 1952), the Capital Asset Pricing Model (Sharpe, 1964), and the Efficient Market Hypothesis (Fama, 1970), assumes that stock demand curves are perfectly flat and infinitely elastic - with prices reflecting only fundamental values and ownership structure being economically irrelevant (Modigliani and Miller, 1958). However, later research has undermined these assumptions, with Shleifer (1986) providing early evidence of inelastic stock demand with the study of S&P500 index effects. Similarly, De Long et al. (1990) as well as Koijen and Yogo (2019) have shown that under conditions of limited arbitrage capital, institutional fund flows may induce additional volatility and persistent deviations from fundamental values. Ben-David et al. (2018) also provides evidence that US ETF ownership directly affects long-term stock volatility and that investors earn return premiums for bearing this additional risk.

However, it remains poorly understood if these dynamics observed in an American ETF-dominated market, are transferable to a Swedish mutual fund dominated context. **This paper seeks to examine whether institutional fund flows, driven by index inclusion, increase stock volatility and performance in the Swedish equity market, where passive investment flows occur primarily through open ended mutual funds rather than ETFs.**

Using institutional ownership as a proxy variable for institutional fund flows, we will be constructing a mediation effect model, with institutional ownership acting as the mediator between index inclusion and stock volatility and performance. If index inclusion raises institutional ownership (H1), and the elevated ownership levels also generate non-fundamental trading pressure that affects stock volatility and performance (H2) - then they would together constitute an indirect effect (H3) of index inclusion on our dependent variables, through the institutional ownership channel. We also test whether index inclusion exerts direct effects on stock volatility and performance, through channels independent of institutional ownership levels (H4). Testing whether the relationship runs primarily through institutional ownership or through other index-related channels allows us to isolate the specific mechanism at work. If no significant indirect effect is found, this would indicate that ownership-related index effects may be specific to the US context and possibly dependent on the market presence of the ETF arbitrage mechanism.

The result of the study may be of interest to retail investors and academics alike, as it will provide evidence on whether ownership effects extend beyond ETFs to also encompass mutual funds, providing first evidence from Swedish markets. The findings will also improve the wider understanding of the implication of passive investing strategies on market efficiency and risk.

2.0 Background

This section reviews the theoretical and empirical foundations for understanding how institutional fund flows affect stock prices and volatility, as well as how the Swedish institutional landscape distinguishes our setting from prior US-focused research.

2.1 Challenging the Perfect Elasticity of Stock Demand Curves

Traditional asset pricing models, such as the Capital Asset Pricing Model (Sharpe, 1964) assume that stock demand curves are perfectly elastic, with equilibrium prices unaffected by the size of demand. In extension, this assumption also implies that ownership structure is economically irrelevant (Modigliani and Miller, 1958), as prices are seen to equal the discounted value of expected future cashflows regardless of who holds the shares and how frequently they trade. Similarly, the expected return of a stock is determined solely by exposure to undiversifiable risk factures (under the CAPM captured by the market beta).

However, later research seriously challenges some of these assumptions, with Shleifer (1986) providing among the first evidence of inelastic stock demand in his study of S&P500 index inclusion effects. Modern research also highlights the fact that traditional asset pricing models require unlimited arbitrage capital to enforce pricing discipline and uphold market efficiency. For example, De Long et al. (1990) demonstrate that capital constrained arbitrageurs may be unable to fully absorb the demand shocks propagated by large institutional fund flows or investors trading on non-fundamentals, resulting in sustained deviations from fundamental values. Furthermore, if institutional investors (such as index tracking ETFs) hold correlated portfolios and trade simultaneously, the demand shocks they induce may constitute systematic rather than diversifiable risk, for which investors demand a risk premium. The inelasticity of stock demand curves is further supported by Koijen and Yogo (2019), who demonstrate that heterogenous stock preference among investors also makes for heterogenous stock demand, with increased institutional demand able to raise the price of individual stocks by up to two percent. Much like De Long et al. (1990), Koijen and Yogo (2019) attribute these findings to limited arbitrage capital preventing arbitrageurs from fully exploiting the mispricings arising when large institutional investors rebalance their portfolios.

Ultimately, the existence of inelastic demand curves establishes that ownership structure may be economically relevant in the markets, as stocks with concentrated institutional ownership possibly become more sensitive to the trading decisions of their owners.

2.2 Index Effects and their relation to Institutional Ownership

The empirical foundation of our identification strategy comes from the extensive literature documenting that index inclusion affects stock prices through institutional ownership changes. The existence of the traditional “index effect” has been well-documented since Shleifer (1986). Studying the performance of stocks added to the S&P500 between 1976 and 1983, Shleifer (1986) shows that these stocks experience average abnormal returns of around three percent upon their inclusion announcements. Shleifer argues that these price increases demonstrate the increased demand pressure from index funds purchasing the new index-constituents (also providing early evidence against the perfect elasticity of demand). These findings are confirmed by Harris and Gurel (1986) and later extended upon by Chen, Noronha, and Singal (2004) who demonstrate that a reversed (negative) effect can be observed upon deletion from the S&P500. Chen, Noronha, and Singal (2004) also illustrate how such effects seem to have increased over time with the growing popularity of index funds, seeing ever growing AUM.

Together, these foundational studies establish that index inclusion may induce institutional demand shocks capable of moving stock prices independent of fundamentals, forming the basis for using index membership as an identification strategy of ownership effects in subsequent research.

However, recent evidence suggests that the traditional “index effect” phenomenon may have disappeared or even reversed. Greenwood and Sammon (2024) document that the abnormal returns of stocks added to the S&P500 fell from around 7% in the 1990s, to less than 1% during the 2010s – despite index tracking practices being more prevalent than ever before. Even more strikingly, Vijh and Wang (2022) find that over the period 2016 to 2020, stocks added to the S&P500 from the S&P400 experienced negative announcement returns (-2.5%), while deletions experienced positive returns (+1.2%) - indicating a complete reversal of the historical pattern. The authors attribute the observed results to changes in ownership dynamics, where the midcap stocks of the S&P400 see substantial institutional ownership just like the large cap stocks in the S&P500. Thus, migrating from the top of the S&P400 to the bottom of the S&P500 (both being market weighted indexes) no longer induces a noticeable institutional demand shock.

These developments may work to compromise the use of S&P500 index inclusion as an identification strategy for studying institutional ownership effects.

2.3 ETF Ownership and Volatility Transmission Mechanisms

The extent of index inclusion effects is taken further by Wurgler (2010) who demonstrates that index inclusion not only induces non-fundamental price pressure but also increases the co-movement of constituent stocks, which may affect volatility through enhanced trading activity. These effects are expanded upon by Ben-David et al. (2018), who demonstrate how passive investment strategies may directly affect stock volatility. Studying the firms of the popular Russel 2000 and Russel 1000 indexes between 2000 and 2012, Ben-David et al. find that the largest companies in the Russel 2000 index experience substantially higher rates of ETF ownership and significantly greater return volatility, than the smallest stocks in the Russel 1000 index. By comparing the similarly sized companies on either side of the arbitrary cut-off point of the Russel indexes in a quasi-natural experiment setup, Ben-David et al. are able to establish a positive relationship between the rate of ETF ownership and return volatility - even when controlling for other characteristics such as firm size, liquidity and bid-ask spreads. The establishment of this causal link is crucial, as it cements that ETF ownership causes higher volatility rather than volatile stocks attracting ETF ownership.

Ben-David et al. (2018) theorize that the observed effect operates through the creation-redemption mechanisms of the ETF arbitrage process, where authorized participants (APs) can profit by trading on the divergence between the market price of the ETF and the NAV of the basket of underlying securities. For example, when an ETF experiences large inflows, its market price may temporarily rise above NAV – creating an arbitrage opportunity that the APs utilize by purchasing the basket of underlying stocks, thus propagating the flow shock to all underlying securities and inducing non-fundamental volatility. In addition, Ben-David et al. find that stocks being exposed to such additional volatility also earn higher average returns even when controlling for traditional systemic risk factors, as is consistent with investors demanding a risk premium for bearing additional undiversifiable risk. Brown et al. (2021) support this interpretation, illustrating that whilst flow-induced returns tend to reverse over subsequent days (as is consistent with temporary price pressure) long-term return premiums remain – suggesting that persistent exposure to flow induced volatility constitutes a systemic risk factor that is recognized and priced by the market. Brown et al. (2021) also finds that ETF creation- and redemption flows provide powerful signals of short-term return reversals - indicating genuine non-fundamental price distortion.

2.4 The Swedish Institutional Landscape

As of December 2023, financial corporations (mutual funds, insurance companies etc.) controlled around 30% of Swedish public equities, with an additional 37% controlled by international institutional investors (Statistics Sweden, 2024). These concentrated ownership dynamics makes the Swedish equity market an interesting arena for testing ownership-related effects in a non-American context.

As documented by Dahlquist and Robertsson (2001), institutional ownership dynamics exhibit noticeable differences from US patterns. Although Swedish retail investors hold around 13% of publicly traded equities (Statistics Sweden, 2024), Dahlquist and Robertsson (2001) find that most ownership patterns reflect institutional preferences rather than individual investor behaviors, cementing the Swedish equity market as highly institutionalized through mutual fund structures. Partly, these dynamics may be attributed to the design of the Swedish pension system with the AP funds, premium pension (Premiepension) and occupational pension (Tjänstepension) schemes, playing an outsized role relative to foreign ownership. These pension schemes also generate consistent capital flows and demand pressure on Swedish equities through regular mandatory contributions, independent of market conditions or valuations - making the Swedish market an interesting testing ground for ownership-induced demand shocks.

Perhaps most critically to the study of ownership effects, the vast majority of institutional holdings of Swedish public equities are held through traditional mutual funds rather than ETFs (Morningstar, 2025). Whilst both constitute passive investment vehicles, there are several important differences between the two: with the intraday trading and arbitrage mechanisms of the ETF possibly being able to amplify or even generate ownership-driven demand shocks (Ben David et al., 2018). Traditional mutual funds differ fundamentally as they utilize cut-off times and always trade at end-of-day net asset value (NAV), thus eliminating arbitrage opportunities and the need for immediate coordinated trading across a basket of stocks. Mutual fund managers can also absorb flows gradually over hours or days using volume-weighted average price algorithms or block trading to limit market impact. Furthermore, the difference in institutional features also imply that mutual funds do not exhibit the same arbitrage mechanisms as ETFs do – shedding doubt on the transferability of the effect to a Swedish, mutual fund dominated setting.

3.0 Research Design

Previous literature establishes that when stock demand is inelastic and arbitrage capital is limited, institutional owners can move stock prices through fund-flow induced demand shocks (De Long et al., 1990, Koijen and Yogo, 2019). These ownership-related effects have been seen to effect both stock volatility (Wurgler, 2010) and risk premiums through ETF arbitrage-driven transmission (Ben-David et al., 2018). However, whether these ownership-related effects operate universally or depend on specific institutional mechanisms like ETF arbitrage being present in the market, remains poorly understood. With its high rates of institutional ownership and large selection of mutual funds, we perceive the Swedish equity market to be an ideal testing ground for studying the transferability of ownership-related effects to a non-US, mutual fund dominated setting.

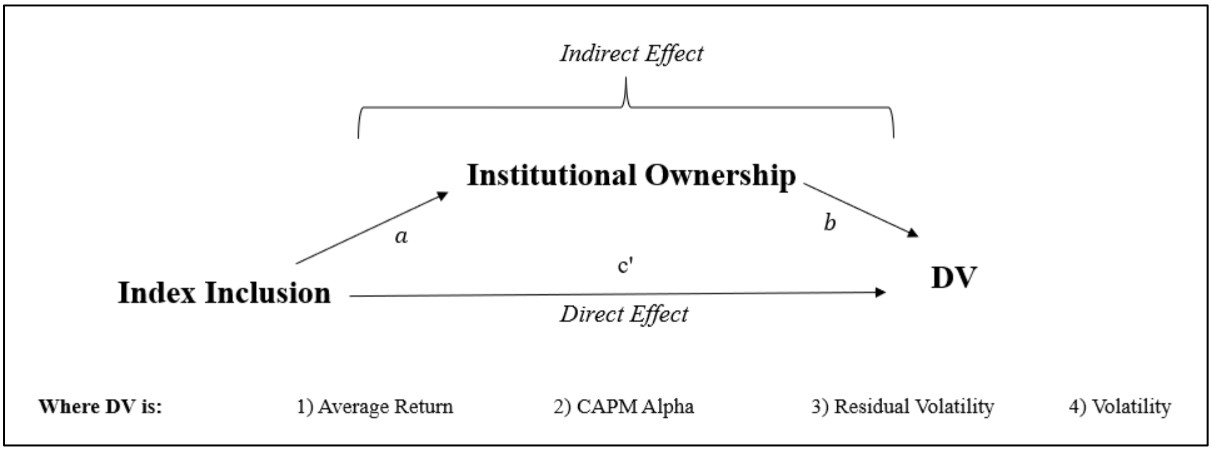
Our research employs a mediation analysis framework using panel data to test for ownership-related effects on stock volatility and performance. With previous literature indicating that index inclusion can be considered a reliable predictor of ownership changes (Shleifer, 1986; Harris and Gurel, 1986, Chen, Noronha and Singal, 2004), our identification strategy seeks to exploit the positive variation in institutional ownership historically associated with index membership - where passive investing practices lead to index constituents experiencing higher rates of institutional ownerships than similar stocks outside the index. However, given the previously highlighted institutional differences between the US and Swedish markets, there is no upfront guarantee that our identification strategy - historically deployed in US-based research - is directly transferable to a Swedish setting. Furthermore, despite its historical validity, recent research highlights a fading or reversal of traditional index effects (Greenwood and Sammon, 2024; Vijh and Wang, 2022) which may infer that this identification strategy have become less viable over time (even in the US market) as a result of saturated institutional ownership also among non-large cap stocks.

By dividing our samples into two treatment- and control groups based on index inclusion, we seek to test if the presumed differences in institutional ownership (arising from the trading behavior of institutional investors) influence stock volatility and performance. This RDD-style design, with treatment- and control groups being exposed to the same macroeconomic environment, mitigates the risk of any observed differences being driven by common time-varying factors over the sample period (such as the Covid-19 pandemic) rather than by our variable of interest. Whilst not completely satisfactory, the RDD-style construction of the tests also partly mitigates potential endogeneity concerns as firms near the OMXS30 cutoff are similar by construction – with the rule-based cutoff constituting a semi-natural quasi experiment (potential endogeneity issues related to index construction are elaborated in *Section 5.3.2*.). Additionally, the deployment of a mediation framework allows us to distinguish between ownership-related mechanisms (captured by the indirect effect), and index effects operating through alternative channels (captured by the direct effect).

In our analysis, we make use of two different panel datasets to test institutional ownership effects across different market contexts. The Swedish sample consists of the 30 stocks in the OMXS30 index, observed daily over the period January 2016 to December 2025, and the 30 largest non-index constituents over the same period. Institutional ownership, index membership, and firm characteristics are all observed on an annual basis, with a control group of 30 firms striking a balance between maintaining comparability to the treatment group and ensuring sufficient statistical power. As the OMXS30 is extensively tracked by Swedish mutual funds - particularly those included in the mandatory Swedish Pension schemes – we are led us to believe that the previously documented differences in institutional ownership between S&P500 and S&P400 stocks or Russel 1000 and Russel 2000 stocks may also be visible across our two groups. The panel structure allows us to compare differences across firms and over time, while controlling for time fixed effects as well as known systemic risk factors and observable firm characteristics. To ensure identification from within-firm variation over time, rather than cross-sectional differences between firms, we also include firm fixed effects. This is particularly relevant to the study of institutional demand shocks who are thought to arise from changes in institutional ownership by index membership, rather than cross-sectional difference in the level of institutional ownership per se.

For comparison, we also make use of a US sample consisting of the 30 smallest stocks in the S&P500 index (by market cap), observed daily over the period January 2016 to December 2025, and the 30 largest non-index constituents over the same period. This comparison serves three purposes. First, it explores whether ownership-related index effects persist among large-cap stocks in highly developed markets where the literature would suggest institutional ownership levels to be similar across S&P500 stocks and non-index constituents. Second, by covering a more recent period than much of the existing literature, it assesses whether previously documented index effects have persisted, diminished, or reversed over time — a question made particularly relevant by the arguments of Vijh and Wang (2022) and Greenwood and Sammon (2024). Lastly, it provides methodological validation, as finding common patterns across both the Swedish and US markets would suggest the existence of a real phenomenon rather than an artifact of single sample issues. Just as for the Swedish sample, we also control for time- and firm fixed effects, as well as for selected firm characteristics and systemic risk factors.

Figure 1. Illustration of the mediation effect model



This illustration pictures the mediation effect model used in the empirical analysis, separating indirect effects through the institutional ownership channel, from index effects operating through alternative channels captured by the direct effect.

The result of the study may be of interest to retail investors and academics alike, as it would contribute to the understanding of institutional ownership effects and help answer if these effects extend to mutual fund structures and international markets. If index membership can be seen to increase the volatility of Swedish stocks through the institutional ownership channel, this would demonstrate that ownership effects operate independently of the ETF arbitrage mechanisms. Alternatively, if no such significant effects can be found, this may suggest that the ETF arbitrage mechanism - absent for the mutual fund dominated Swedish market - may be essential to the transmission of ownership-related effects. Based on the results of the study, retail investors will be able to make more informed decisions when deciding to place their money in passive investment vehicles – considering the possible added risks associated with index tracking practices. Additionally, the findings will help clarify if the popularization of index investing strategies may, paradoxically, increase the very volatility said strategies seek to avoid in the first place.

3.1 Hypotheses

Our mediation model framework tests the following four sequential relationships using panel regressions:

Hypothesis 1: First-stage Effect

The first-stage effect (H1) examines whether index inclusion (our dummy variable) has a significant effect on the rate of institutional ownership of individual stocks. We would expect this effect to be positive and significant in the case of the Swedish sample, as stocks in the OMXS30 index should exhibiting higher rates of institutional ownership as a result of passive index tracking behavior. If such effects could be observed in the sample, we would reject the null hypothesis. Previous US-based research indicates that this should be the case also in the study of the S&P500 companies. However, recent literature questions this assumption, implying a possible erosion of ownership-differences over time, resulting from extensive index tracking also of American midcap-stocks.

H_0: Index inclusion has no significant effect on the rate of institutional ownership.
$\beta\_IndexInclusion = 0$

H_1: Index inclusion has a significant effect on the rate of institutional ownership.
$\beta\_IndexInclusion \neq 0$

Hypothesis 2: Second stage Effect

The second-stage effect (H2) tests whether institutional ownership (used as a proxy variable for the fund-flows whose effects we seek to study) has a significant effect on performance and stock volatility, independent of index membership. In the case we observe such effects, we reject the null hypothesis. If one is to believe the literature, we would expect institutional ownership to exert positive and significant effects on volatility but not residual volatility, as the correlated demand shocks arising from the simultaneous trading of index constituents should induce systematic rather than idiosyncratic risk. If so, one would also expect to observe positive and significant return effects as the market would presumably price the added systematic risk. On the other hand, if the ETF arbitrage mechanism is essential to ownership related effects, we should observe no significant effects on our neither of our dependent variables in the Swedish sample. Furthermore, if institutional flows are uncorrelated across Swedish funds, any observed effects on volatility may be idiosyncratic rather than systematic.

H_0: Institutional ownership has no significant effect on stock volatility and performance.
$\beta\_InstitutionalOwnership = 0$

H_1: Institutional ownership has significant effects on stock volatility and performance.
$\beta\_InstitutionalOwnership \neq 0$

Hypothesis 3: Indirect Effect

The indirect effect (H3) quantifies whether index inclusion influences stock volatility and performance through institutional ownership. This is done by calculating the product of the first and second-stage coefficients. The finding of significant indirect effects would support that index effects are partly attributable to changes in ownership structures and the associated trading behavior of institutional owners, which would lead us to reject the null hypothesis.

H_0: There is no significant indirect effect of index inclusion on stock volatility and performance, mediated through institutional ownership.
$\beta\_IndexInclusion \times \beta\_InstitutionalOwnership = 0$

H_1: There is a significant indirect effect of index inclusion on stock volatility and performance, mediated through institutional ownership.
$\beta\_IndexInclusion \times \beta\_InstitutionalOwnership \neq 0$

Hypothesis 4: Direct Effect

The direct effect (H4) estimates whether index inclusion exerts significant effects on stock volatility and performance through other channels than institutional ownership. Thus, the relative size and significance of the direct- and indirect effects will vary depending on what channel the index effects primarily operate through. In the case of significant direct effects being observable, we reject the null hypothesis. Testing these competing explanations across Swedish and US contexts reveals both whether ownership-related effects are transferable to non-American contexts and what mechanism may drive the index effects documented in previous literature.

H_0: Index inclusion has no significant direct effect on the non-fundamental volatility and stock performance of individual stocks.
$\beta\_IndexInclusion = 0$

H_1: Index inclusion has a significant direct effect on the non-fundamental volatility and stock performance of individual stocks.
$\beta\_IndexInclusion \neq 0$

3.2 Data Collection

The panel data used in the empirical analysis has all been compiled and sourced from CapitalIQ (owned and operated by S&P Global). Capital IQ is a widely used data source in the finance industry, offering comprehensive coverage of financial data across a wide variety of market and time periods. As a source, it is perceived to be highly reliable, as it is extensively used in peer-reviewed research and trusted by our host institution, the Stockholm School of Economics, lending credibility to findings derived from its data.

For the analysis, we will utilize 10 years of daily market price data collected over the period January 2016 to December 2025. This includes daily market returns (OMXSPI and Russell 3000) and returns of individual stocks, in addition to yearly data on a collection of controlling variables like ROA, Leverage, P/BV, and Market Capitalization (also gathered from Capital IQ). The rationale behind the use of daily stock performance data is that annual observations are insufficient to provide meaningful estimates of return-based metrics such as residual volatility and market beta, which by construction require a time series of returns. Using daily data yields hundreds of observations per company and year, providing additional statistical precision to detect effects or differences that would be indistinguishable at an annual frequency. Index inclusion and ownership data are observed at an annual frequency, as institutional ownership data is typically disclosed on a year-end basis.

During the collection of ownership data, we also allowed Capital IQ to define what owners qualify as "institutional". In the absence of publicly accessible direct fund flow data, institutional ownership is used as a proxy on the basis that, on the margin, ownership levels should rise and fall in line with net fund flows. This logic holds the best when institutional ownership is dominated by active, flow-sensitive investors. This is, however, not necessarily the case for our institutional ownership data which captures a broad range of investors, many of which may be considered “quiet” long-term owners less likely to generate the flow-driven demand shocks we seek to study. Notable examples include the Swedish AP funds, Alecta, the Norwegian Sovereign Wealth Fund and family-controlled investment companies such as Investor and Industrivärden.

It shall also be mentioned that reporting practices may at times distort ownership data through significant stock lending or shorting practices. This means that heavily shorted stocks in our sample, or stocks involved in significant stock lending activity, may exhibit rates of institutional ownership that exceed 100% of common shares outstanding (as shorted stocks are not regarded as “negative ownership”). This may act as an additional compromising factor to skew our institutional ownership data.

Ultimately, this problem becomes central to identification. As our institutional ownership variable also captures investors unlikely to generate the effects of interest, the sensitivity of the test is reduced, and non-findings should be interpreted with appropriate caution rather than as definitive evidence. While manually cleaning the data from suspected “quiet” owners could in theory provide us with a cleaner measure of institutional ownership relevant to the study of institutional demand shocks, we have refrained from such measures to avoid introducing subjectivity into the sample construction. Selectively excluding certain owners based on assumed historical or future trading behaviors would risk biasing the analysis in ways that make the study less scientific and more difficult to replicate. This of course comes at the cost of a noisier proxy variable. The implications of this trade-off should be kept in mind throughout the interpretation of our results.

3.3 Empirical model

To examine the effect of index inclusion on stock performance and volatility through institutional ownership, we have constructed a Mediation effect model estimated using panel regressions with firm and time fixed effects. The mediation analysis is implemented through three regressions corresponding to paths a, b, and c′, allowing the total effect of index inclusion to be decomposed into direct and indirect components.

Stock performance is measured using both average and risk-adjusted returns, where risk-adjusted performance is captured by the CAPM alpha. Non-fundamental volatility is measured as the standard deviation of the residuals, referred to as residual volatility. Average returns and total volatility are calculated using standard formulas for the geometric mean and sample standard deviation, while alpha, market beta, and residual volatility are estimated for each stock using the traditional CAPM regression framework.

The variables from the CAPM are used to examine how index inclusion is related to different aspects of stock behavior:

Beta is used to compare the level of market exposure between index and non-index firms. This helps ensure that any differences in returns are not simply due to index firms being more or less sensitive to overall market movements.

Alpha is used to test whether indexed firms perform better or worse than non-index firms after controlling for market risk and other systemic risk factors (our control variables). This allows us to evaluate the argument if index inclusion causes persistent deviations from fundamental values, or whether institutional ownership constitutes a systemic risk factor that warrants a corresponding risk premium.

Residual Volatility is used to analyze whether index inclusion affects the stability of stock prices. Focusing on the part of volatility not explained by exposure to market risk allows us to distinguish between systematic and idiosyncratic sources of variation – where one should be priced by the market and the other should not.

Although models such as Fama–French include more factors, the CAPM is used in this study because of its simplicity and interpretability - clearly separating market-related returns from abnormal returns, which is useful when studying index effects. To make sure that other firm characteristics do not drive the results, control variables are included for known risk factors such as size, valuation, profitability, and leverage. This makes it easier to understand whether our results are linked to index inclusion itself, rather than to differences in firm characteristics.

The hypotheses are evaluated based on the estimated coefficients of the Mediation model. Evidence of mediation requires that (i) index inclusion has a statistically significant effect on institutional ownership (path a), and (ii) institutional ownership has a statistically significant effect on the outcome variable when controlling for index inclusion (path b). The indirect effect is given by the product a×b and is assessed for statistical significance using bootstrapped standard errors.

A significant indirect effect indicates that institutional ownership acts as a mediating channel through which index inclusion affects stock performance and volatility. The direct effect (c′) captures the remaining impact of index inclusion after accounting for ownership.

In the first step of our analysis, the CAPM model is estimated for each firm using daily returns in order to obtain estimates for market-beta, alpha (abnormal returns) and residuals:

$$R_{it} - R_{ft} = \alpha_i + \beta_i\left(R_{mt} - R_{ft}\right) + \epsilon_{it}$$

Where:

R_{it}	The return of firm i at time t
R_{ft}	The risk-free rate (EURIBOR - EUR - 3 Month - Rate Value for Sweden and United States Treasury Constant Maturity - 3 Month (%TCMSM03) - Rate Value for the U.S.)
R_m	The market return (OMX Stockholm All Share Index (^OMXSPI) - Index Value for Sweden and Russell 3000 Index (^RUA) - Index Value for the U.S.)
α_i	Represents the abnormal return of stock i.
β_i	Captures the exposure to systematic market risk of stock i.
ε_{it}	Represents the stock-specific return component that cannot be attributed to broad market movements, capturing non-fundamental price variation

In the second step, we estimate a series of panel regressions using average returns, volatility, residual volatility, and CAPM alpha as dependent variables in turn. The main explanatory variables include index inclusion and institutional ownership, alongside the firm-level control variables: leverage, return on assets, price-to-book ratio, and market capitalization.

All regressions include year fixed effects to control for common macroeconomic shocks. This specification allows us to identify the relationship between index inclusion, institutional ownership, and firm performance using within-firm variation over time, while accounting for observable firm characteristics known to influence stock returns and volatility. Firm fixed effects are also included in the analysis as to absorb time-invariant firm heterogeneity and ensure that any observed index effects are driven by within-firm changes as stocks move in and out of the indexes, rather than cross-sectional differences between index and non-index firms.

To facilitate comparison across variables of different units, both dependent and independent variables are standardized to have mean zero and unit variance.

Standardization formula:

$$Z_i = \frac{x_i - \mu_x}{\sigma_X}$$

Where:

z_i	The standardized value. Represents the number of standard deviations an observation lies above or below the mean.
x_i	The observed value of the variable in original units.
μ	The mean value of the variable X, used to calculate how far an individual observation lies from the average value of the sample.
σ	The standard deviation of the variable. Captures the typical dispersion of observations around the mean.

In total, three regressions are estimated as a part of the mediating effect model:

First, the **first stage effect** of index inclusion on institutional ownership is estimated as:

$$Ownership_{it} = \beta_0 + \beta_1 Index_{it} + X'_{it}\delta + \alpha_i + \gamma_t + \varepsilon_{it}$$

Second, the **total effect** of index inclusion on the outcome variable Y_{it} is estimated as:

$$Y_{it} = \beta_0 + \beta_1 Index_{it} + X'_{it}\delta + \alpha_i + \gamma_t + \varepsilon_{it}$$

Third, the **direct and indirect effects** are estimated by including both index inclusion and institutional ownership:

$$Y_{it} = \beta_0 + \beta_1 Index_{it} + \beta_2 Ownership_{it} + X'_{it}\delta + \alpha_i + \gamma_t + \varepsilon_{it}$$

The **indirect effect** is computed as the product of the coefficients from the first and third regressions (i.e.,$\beta_1^{(a)} \times \beta_2$).

Where Y_{it}(DV) is one of four dependent variables:

1. Average Return
2. CAPM Alpha (from previous CAPM regression)
3. Volatility
4. Residual Volatility (from previous CAPM regression)

And where the independent variables are:

$Index_{it}$	Binary variable, equal to 1 if firm i is included in the OMXS30 or S&P500 indexes at time t, and equal to 0 otherwise
$Ownership_{it}$	The percentage of outstanding shares owned by institutional investors.
α_{it}	Represents firm fixed effects, capturing unobserved time-invariant firm characteristics.
γ_{it}	Represents year fixed effects, capturing common shocks affecting all firms over time.
X_{it}	A vector of control variables, including the logarithm of market capitalization (firm size), return on assets (profitability), leverage (liabilities over assets), and price-to-book ratio (value effects).
β_0	The intercept term.
β_1	The effect of index inclusion on the dependent variable.
β_2	The effect of institutional ownership on the outcome variable (conditional on index inclusion).
δ	The vector of coefficients associated with the control variables.
e_{it}	The error term.

To complement the panel regression analysis and assess the economic significance of the results, a long–short portfolio approach is implemented as a robustness check. While the panel regressions are conducted at the individual firm-year level, the long–short analysis is conducted at the portfolio level and evaluates whether index inclusion leads to economically meaningful return differentials. This approach provides a direct test of whether the relationships identified in the regression framework translate into potentially exploitable investment strategies.

For each year in the sample period, a zero-investment portfolio is constructed by taking long positions in firms included in the index and short positions in firms outside the index. In this setting, index inclusion is not introduced as a regression variable but is instead used to sort firms into index and non-index portfolios. To ensure comparability, the portfolio contains an equal number of firms on each side. When the number of index and non-index firms differs, the smaller group determines portfolio size, and firms are selected based on market capitalization (to enhance comparability). Within each long and short portfolio, firms are equally weighted. Using these yearly portfolio compositions, daily long–short returns are computed and combined into a continuous time series covering the full sample period.

Prior to constructing the long–short portfolios, the dependent variables are residualized using panel regressions including firm fixed effects and time fixed effects, together with controls for firm size, profitability, valuation, leverage, and market beta where applicable. The residualized variables therefore represent the portion of returns and volatility not explained by observable firm characteristics or fixed effects. Daily long–short spreads are then computed as the difference between the equally weighted averages of the residualized outcomes for index and non-index firms. Average return and CAPM alpha are annualized using 252 trading days, while volatility and residual volatility are measured as annualized standard deviations based on firm-year return distributions. Statistical significance of the long–short portfolio spreads is evaluated using t-tests on the daily portfolio series.

Residualization regressions before portfolio formation:

$$Alpha_{it} = \beta_0 + X_{it}'\delta + \alpha_i + \gamma_t + \varepsilon_{it}^{\alpha}$$

$$R_{it} = \beta_0 + X_{it}'\delta + \alpha_i + \gamma_t + \varepsilon_{it}^{R}$$

$$Volatility_{it} = \beta_0 + X_{it}'\delta + \alpha_i + \gamma_t + \varepsilon_{it}^{Vol}$$

$$ResidualVolatility_{it} = \beta_0 + X_{it}'\delta + \alpha_i + \gamma_t + \varepsilon_{it}^{ResVol}$$

Long-Short Return:

$$LSt = \frac{1}{N_t} \sum_{i \in Index_t} \hat{\varepsilon}_{it} - \frac{1}{N_t} \sum_{j \in NonIndex_t} \hat{\varepsilon}_{jt}$$

Annualization:

For alpha and average return:

$$Annualized\ LS = LS_t \times 252$$

For Volatility and Residual volatility:

$$AnnualizedLS = LS_t \times \sqrt{252}$$

Where:

$Alpha_{it}$	CAPM abnormal return (alpha) for firm i at time t, estimated before the residualization regressions
R_{it}	The daily stock return for firm i at time t
$Volatility_{it}$	The total volatility proxy for firm i at time t, measured as the absolute value of daily returns
$ResVol_{it}$	The firm-specific volatility proxy for firm i at time t, measured as the absolute value of CAPM alpha
β_0	The regression intercept
X'_{it}	The vector of control variables for firm i at time t, including market capitalization, ROA, PBV, leverage
δ	The vector of coefficients associated with the control variables
α_i	The firm fixed effects controlling for time-invariant firm characteristics
γ_t	The time fixed effects controlling for common market-wide shocks and daily market conditions
$\varepsilon_{it}^{\alpha}$	The residualized CAPM alpha after removing the effects of controls and fixed effects
ε_{it}^{R}	The residualized daily return after removing the effects of controls and fixed effects
$\varepsilon_{it}^{Volatility}$	The residualized volatility after removing the effects of controls and fixed effects
$\varepsilon_{it}^{ResVol}$	The residualized residual volatility after removing the effects of controls and fixed effects
LS_t	The long-short portfolio spread at time t
N_t	The number of firms included on each side of the portfolio at time t
$i \in Index_t$	The firms included in the long index portfolio at time t
$j \in NonIndex_t$	The firms included in the short non-index portfolio at time t
$\hat{\varepsilon}_{it}$	The estimated residualized outcome variable for indexed firm i at time t
$\hat{\varepsilon}_{jt}$	The estimated residualized outcome variable for non-indexed firm j at time t

4.0 Empirical Results

The following section contains the results of the previously outlined empirical tests, as well as interpretations of their results.

4.1 Descriptive Statistics

The following section presents the regression outputs in table format, including portfolio level cross-sectional estimates, panel regression estimates, and the decomposed effects of the mediation model. For the summary statistics, please see Appendix A.

Table 1. Average institutional ownership across treatment- and control groups.

	Mean Institutional Ownership %
OMXS30 Stocks	56.2
Non-constituent Swedish stocks	48.9
S&P500 Stocks	85.6
Non-constituent American stocks	90.4

This table shows the mean levels of institutional ownership for firms in the treatment and control groups, separated for index inclusion and domicile. These comparisons provide pre-regression evidence on differences in ownership structure across groups.

Table 2. Panel regression estimates for mediation model on Swedish stocks

	CAPM Alpha	Average Return	Volatility	Residual Volatility
Path A (Index -> IO)	0.1014*	0.1014*	0.1014*	0.1014*
Path B (IO -> CV)	-0.0011	-0.0013	0.0226	0.0224
Path c' (Index -> DV)	-0.0247**	-0.0219**	0.3022*	0.2599*
Leverage	0.0079	0.0056	0.0052	-0.0057
ROA	0.0036	0.0046.	-0.0134	-0.0233*
PBV	0.0157*	0.0158*	0.0412.	0.0331
Market Cap	0.0411***	0.0371**	-0.0983.	-0.120*
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
R^2	0.117	0.214	0.731	0.724

This table shows the standardized coefficient estimates for the fixed-effect panel regression models underlying the mediation analysis. Path A captures the effect of Index inclusion on Institutional Ownership. Path B captures the effect of Institutional Ownership on our dependent variables (Alpha, Average Return, Volatility, and Residual Volatility), when controlling for Index Inclusion. Path c' reflects the direct effect of Index Inclusion on each of the dependent variables. Controlling variables are expressed with regard to their explanatory power of the total effect.

*Notes: . $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*

Table 3. Panel regression estimates for mediation model on US stocks

	CAPM Alpha	Average Return	Volatility	Residual Volatility
Path A (Index -> IO)	-0.1289	-0.1289	-0.1289	-0.1289
Path B (IO -> CV)	-0.0002	0.0003	-0.1417	-0.1519
Path c' (Index -> DV)	-0.0187**	-0.0161**	-0.0169	-0.0319
Leverage	0.0313*	0.0276**	0.0619*	0.0527.
ROA	0.0105***	0.0091***	0.0291***	0.0241***
PBV	0.0041.	0.0032.	-0.0075	-0.0017
Market Cap	0.0458***	0.0397***	-0.0375.	-0.0504*
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
R^2	0.059	0.279	0.759	0.706

This table shows the standardized coefficient estimates for the fixed-effect panel regression models underlying the mediation analysis. Path A captures the effect of Index inclusion on Institutional Ownership. Path B captures the effect of Institutional Ownership on our dependent variables (Alpha, Average Return, Volatility, and Residual Volatility), when controlling for Index Inclusion. Path c' reflects the direct effect of Index Inclusion on each of the dependent variables. Controlling variables are expressed with regard to their explanatory power of the total effect.

*Notes: . p < 0.10, * p < 0.05, ** p < 0.01, *** p <0.001*

Table 4. Long–short portfolio performance (indexed minus non-indexed stocks)

	CAPM Alpha	Average Returns	Volatility	Residual Volatility
Swedish Sample	0.0457	0.0430	0.0156***	0.0129***
US Sample	-0.0571	-0.0577	-0.0027***	-0.0013***

This table reports the results from the controlled long–short portfolio analysis examining the relationship between index inclusion and stock performance. The portfolio is constructed by taking long positions in firms included in the S&P 500 (U.S.) or OMXS30 (Sweden) and short positions in non-index firms.

*Notes: . p < 0.10, * p < 0.05, ** p < 0.01, *** p <0.001*

Table 5. Decomposition of total, direct, and indirect effects on Swedish stocks

	CAPM Alpha	Average Returns	Volatility	Residual Volatility
Direct Effect	-0.0247**	-0.0219**	0.3022*	0.2559*
Indirect Effect	-0.000006	-0.000009	0.000078	0.000081
Total Effect	-0.0247	-0.0219	0.1199	0.1026

This table summarizes the standardized results of our mediation analysis by decomposing the total effect of Index Inclusion on each dependent variable into its direct (c') and indirect (A × B) components. The indirect effect is computed as the product of the estimated coefficients from Path A and Path B. The total effect equals the sum of the direct and indirect effects.

*Notes: . $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*

Table 6. Decomposition of total, direct, and indirect effects on US stocks

	CAPM Alpha	Average Returns	Volatility	Residual Volatility
Direct Effect	-0.0187**	-0.0161**	-0.0203	-0.0305
Indirect Effect	0.000003	-0.000002	0.000129	0.000095
Total Effect	-0.0187**	-0.0161**	-0.0202	-0.0304

This table summarizes the standardized results of our mediation analysis by decomposing the total effect of Index Inclusion on each dependent variable into its direct (c') and indirect (A × B) components. The indirect effect is computed as the product of the estimated coefficients from Path A and Path B. The total effect equals the sum of the direct and indirect effects.

*Notes: . $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*

4.2 Results of Hypothesis 1: First-stage effect

As can be seen in table 1, companies in the OMXS30 appear to have slightly higher average rates of institutional ownership than their non-index counterparts. Similarly, as suggested by the panel regression outputs in table 2, inclusion in the OMXS30 can be seen to have a significant and positive marginal effect on institutional ownership. This supports our theory that Swedish mutual funds tracking the OMXS30 results in significant differences in ownership levels between indexed and non-constituent stocks. Thus, data supports that OMXS30 stocks exhibit significantly higher rates of institutional ownership, leading us to **reject the null hypothesis** at the five percent confidence level, with regards to the **Swedish sample**.

However, as also seen in table 1, the reverse relationship can be observed in the US sample – with S&P500 companies displaying lower average rates of institutional ownership. Similarly, table 3 indicates that inclusion in the S&P500 has no significant marginal effect on institutional ownership levels. This result confirms the findings of recent research, foreshadowing a possible reversal of traditional index effects. Thus, data does not support that inclusion in the S&P500 has a significant effect on the rate of institutional ownership of constituent stocks. This means we **fail to reject the null hypothesis** at the five percent confidence level for the **US sample**.

4.3 Results of Hypothesis 2: Second-stage effect

Looking at the regression results in tables 2 and 3, we find no evidence of institutional ownership exhibiting a significant standalone effect on either of our dependent variables. This holds true for both the Swedish and the US part of the sample. Thus, data does not support that institutional ownership would have a significant effect on both stock volatility and performance in either market, meaning we **fail to reject the null hypothesis** at the five percent confidence level for **both samples**.

4.3 Results of Hypothesis 3: Indirect effect

Observing the summarized effects of the mediation model in tables 5 and 6, we find no evidence of a significant indirect mediation effect on either of our dependent variables. This result indicates that our institutional ownership variable is not a significant driver of the return differentials associated with traditional index effects, in either the US or the Swedish market. Thus, data does not support that index inclusion would have a significant indirect effect on stock volatility and performance mediated through institutional ownership. Therefore, we **fail to reject the null hypothesis** at the five percent confidence level for **both samples**.

4.4 Results of Hypothesis 4: Direct Effect

As indicated by the cross-sectional analysis in table 4, there appears to be significant differences in volatility- and residual volatility between indexed and non-indexed firms in both the Swedish and US market. These direct effects in the Swedish sample also survive the panel regression framework (tables 5), with the addition of direct effects on abnormal- and average returns (tables 2). Thus, data supports that inclusion in the OMXS30 has a significant direct effect on both stock volatility and performance, leading us to **reject the null hypothesis** at the five percent confidence level for the **Swedish sample**. However, the volatility effects observed at the portfolio level in the US sample (table 4) do not persist under the panel regression framework, meaning that data does not support that inclusion in the S&P500 has a significant direct effect on both stock volatility and performance. We thus **fail to reject the null hypothesis** at the five percent confidence level for the **US sample**. For elaborations regarding the potential endogeneity issues of the observed return effects, please see *Section 5.3.2*.

Table 7. Summary of double-sided hypothesis tests

	Swedish Sample	**US Sample**
Hypothesis 1 (First-stage effect)	Reject H_0	Fail to reject H_0
Hypothesis 2 (Second-stage effect)	Fail to reject H_0	Fail to reject H_0
Hypothesis 3 (Indirect effect)	Fail to reject H_0	Fail to reject H_0
Hypothesis 4 (Direct effect)	Reject H_0	Fail to reject H_0

This table summarizes the outcomes of the double-sided hypothesis tests for both the Swedish and U.S. samples. The results indicate whether the null hypothesis (H_0) is rejected or not rejected for each stage of the mediation framework.

4.5 On the observed effects of our Controlling Variables

Turning to the control variables, our results display some variation across the two samples. In the US sample, leverage and ROA both exhibit positive and significant effects across all dependent variables, as is consistent with a positive value premium. Market capitalization is positively and significantly associated with returns, whilst exhibiting a negative relationship to residual volatility. This pattern interferes with the risk-based explanation which would predict the observed return premium to be accompanied by increased systemic risk. It is thus possible that part of the observed effect is generated by alternative mechanisms – perhaps reflecting the diversified income streams of large corporations or the increased institutional attention afforded to larger firms, reducing non-fundamental and total price variation.

In the Swedish sample, ROA is negatively and significantly associated with residual volatility, suggesting that more profitable firms experience less firm-specific price variation. Price-to-book exerts a positive and significant effect on returns, as is consistent with a positive value premium, but is not accompanied by the expected increase in systemic risk. Thus, it is possible that the observed value effects arise from other mechanisms such as systematic underpricing stemming from limited international investor interest. Lastly, market capitalization is positively associated with returns whilst exhibiting a significant negative association with residual volatility, mirroring the US finding.

5.0 Discussion

The following section will seek to provide interpretations and explanations of the test results presented in the previous section, as well as address the limitations of the analysis.

5.1 Institutional Ownership and Volatility Effects

This section discusses the observed relationship between index inclusion, institutional ownership, and volatility.

5.1.1 OMXS30: Idiosyncratic Noise and the Absence of Ownership Effects

Looking at the results in table 2, we find support for the theory that stocks included in the OMXS30 exhibit significantly higher rates of institutional ownership. Whilst this finding does not in itself confirm that ownership-related index effects are transferable to a Swedish context, it does support the validity of our identification strategy. However, as our institutional ownership proxy variable is unable to differentiate between long- and short-term owners, we cannot say that the observed differences in ownership dynamics stem exclusively from the index tracking practices of Swedish mutual funds. In theory, such an effect could also arise from active investors perceiving OMXS30 stocks to be attractive due to historical performance, internationally diversified income streams, high liquidity, or other factors.

Whilst the identification strategy in the Swedish market is supported by a significant positive first-stage effect, **we find no evidence of significant ownership-related effects on stock volatility in the Swedish market** (tables 2 and 5). Whilst perhaps being a dramatic explanation, the results do support that ownership-related volatility effects either do not exist in the Swedish market, or that the institutional ownership channel previously documented in the US operates differently in a Swedish setting. The results are also consistent with the Swedish investing landscape to a larger extent being composed of long-term investors such as pension funds with decade long investment horizons, infrequent rebalancing practices (monthly rather than the daily rebalancing of ETFs) and less noise trading. Unlike ETFs who trade continuously throughout the day in a secondary market, mutual funds trade at end of day NAV, with their flows being determined by the amount of redemption- and subscription orders put in by their clients before the daily cutoff. These dynamics allow for the possibility of netting subscription and redemption orders, thereby decreasing the number of shares having to be bought or sold ("market interactions"), hence dampening effects on volatility as trading volumes constitute a smaller share relative to stock liquidity. Furthermore, one can also argue that the institutional setup of the mutual fund provides additional predictability, allowing fund managers to plan and adjust to expected in- or outflows. If known in advance, fund managers may, for example, choose to deal with large fund flows using block trading – bypassing the open stock market entirely, and thus not affecting volatility. Altogether, these differences in market dynamics may be enough to negate or prevent the manifestation of institutional-ownership effect in the Swedish market.

Alternatively, one could interpret the absence of a significant indirect effect as the underlying mechanisms linking index inclusion to stock volatility perhaps being more complex than we initially assumed. One could also claim that institutional demand should intuitively be the primary driver of index effects, but that our institutional ownership proxy variable is too noisy to capture these effects. If so, we would expect institutional demand shocks to instead exert a positive direct index effect on volatility - just like we see in the sample - given the significantly higher rates of institutional ownership among OMXS30 stocks. This would suggest that whatever ownership-related index effects may be present in the Swedish market are not captured by our institutional-ownership proxy variable but operate through other channels.

Another possible explanation behind the positive direct effects on volatility in the Swedish sample is that indexed stocks experience increased visibility and therefore attract higher trading volumes (Hedge and McDermott, 2003) – perhaps driven by a more heterogeneous and speculative investor base able to amplify trading activity and volatility. Said attention is usually accompanied by increased analyst coverage, resulting in more efficient pricing (Cai, 2007) and perhaps leading to more frequent price adjustments to new information. This would be especially impactful on volatility if driven by large institutional investors through active rebalancing or rapid responses to new information. Altogether, these mechanisms may serve as an argument that heightened trading intensity may be the primary mechanism of index-related volatility effects, rather than institutional demand shocks.

Although the cause of the positive direct effect on volatility remains unclear, it is worth noting that it does appear to operate through the idiosyncratic volatility component. Index-related risks manifesting themselves as idiosyncratic is also consistent with the lack of positive effects on stock performance (table 2), as the market does not appear to price said risk in the form of a risk premium. This finding lends support to the ETF-arbitrage hypothesis of Ben David et al. (2018) as the **absence of a risk premium may imply the absence also of ownership-related effects** in the Swedish market. However, this does not necessarily exclude the institutional ownership mechanism as a source of the observed effects - especially if one considers the possibility that the direct effect also captures ownership-related index effects that our mediator fails to proxy adequately. If so, we would expect the effects on performance and volatility to operate in the same direction, as consistent with the existence of a risk premium. However, as the observed direct effects on stock performance and volatility seemingly operate in opposite directions, this argument does not hold.

One may also challenge the argument of Ben David et al. (2018) by questioning the reasoning that ownership-related risks should manifest through the systemic volatility component. Ben David et al. (2018) argue that as all companies are to some extent owned by institutional owners, ownership-related risks should be undiversifiable as they affect all publicly traded stocks. However, if institutional flows are uncorrelated across Swedish funds, any observed effects on volatility need not necessarily be systematic in nature. If different stocks have different institutional owners, they do not necessarily experience the same or even correlated flows. Hence, their ownership-induced volatility is not necessarily correlated - making the case for the risk being idiosyncratic and diversifiable in both markets by avoiding holding a portfolio with highly concentrated institutional ownership. This theory is further supported by the results of our cross-sectional analysis in table 4, which indicates that the observed differentials in residual volatility are present also at the portfolio level – suggesting that **the observed index effects on volatility are at least partly idiosyncratic in nature**. However, even in the case of ownership-related risks manifesting themselves as increased idiosyncratic volatility through channels not captured by our proxy variable, we would still expect the direct effects on residual volatility and performance to be in the same direction – which is not what we see. Thus, the argument that the absence of an observable risk premium may imply an absence of ownership-related effects, still holds.

5.1.2 S&P 500: Identification Failure and Proxy Limitations

As shown in Table 3, S&P500 inclusion appears to have no significant effect on institutional ownership in the US sample. This finding undermines our identification strategy, since our core assumption - that index membership isolates variation in institutional ownership — does not hold. Although disappointing, this finding is in line with the saturation in institutional ownership proposed by Greenwood and Sammon (2024). As index tracking has grown in popularity, the largest mid-cap S&P400 stocks appear to have accumulated institutional ownership levels comparable to the smallest S&P500 constituents. As a result, this finding implies that the US results should be interpreted with caution as they capture general index-related effects rather than separately identifiable ownership mechanisms.

With the identification strategy compromised, we are unable to draw conclusions about the indirect ownership channel in the US market. Nor do we find any significant standalone effect of institutional ownership on volatility — mirroring the Swedish result. On the surface, this sheds doubt not only on the previous "differences in market dynamics" explanation, but also on the quality of our institutional-ownership proxy variable, as the existence of volatility-enhancing ownership-related effects have previously been documented in the US market. In extension, this would also weaken the findings from the Swedish sample by raising the possibility that non-findings in both samples are the product of a noisy proxy variable rather than a confirmation or rejection of theory. In context, however, these results are less surprising. If ownership-related demand shocks are the primary driver of index volatility effects, and there is no significant difference in ownership dynamics between the treatment- and control groups, there is no reason to expect a volatility differential either. This explanation is strengthened by the failure to establish also a significant direct effect of S&P500 inclusion on volatility, through channels other than institutional ownership – pointing towards a genuine null result rather than a measurement artifact. This does, however, not rule out the existence of such effects elsewhere in the US market, where differences in institutional ownership and index tracking intensity are more pronounced.

5.2 Index-effects on Stock Performance

As shown in table 2, no significant standalone effect can be established between institutional ownership and stock performance in the Swedish sample. Nor do we find evidence that institutional ownership mediates any significant relationship between index inclusion and stock performance (table 5). These findings oppose what we would expect to see from stocks exposed to the ownership-related demand shocks theorized by Koijen and Yogo (2019), who argue that such shocks, if present, should cause persistent price deviations from fundamental values (which should be observable as significant effects on CAPM alpha). However, the absence of indirect effects on stock performance in the Swedish market is expected under a risk-based framework where investors should not be able to realize additional returns without taking additional risk - given that we also find no evidence of ownership-related effects on volatility.

The insignificance of the indirect effect means that our mediation model is unable to identify the origin of the observed effects on performance, which appear to operate exclusively through direct channels. These direct channels represent mechanisms different than or not captured by the institutional ownership proxy variable. Consequently, the opposite signs of the direct effects on stock performance (negative) and volatility (positive) does constitute a puzzling finding – with the easiest explanation simply being that the observed effects originate from unrelated but compatible mechanism.

One framework that fits both the positive direct effects on volatility and the significant underperformance of OMXS30 stocks, is that of an "index bubble". As the mutual funds tracking the OMXS30 are among the most popular in Sweden – both for retail investors and Swedish pension schemes - stocks in the index receive steady passive inflows. With stock demand curves not being perfectly inelastic, indiscriminate buying creates non-fundamental demand pressure on index constituents - inflating prices above fundamentals and generating excess co-movement, as consistent with the findings of Wurgler (2010). This co-movement manifests itself through additional non-fundamental, idiosyncratic volatility as prices disconnect from fundamentals – decreasing future expected returns. Meanwhile, firms outside the index who do not experience the same indiscriminate buying pressure appear cheap and exhibit higher relative returns. Thus, investors in OMXS30 stocks experience (unpriced) flow-induced idiosyncratic volatility but lower returns as they consistently buy shares that trade at a "passive ownership premium". This "passive ownership premium", not captured within the limitations of the CAPM or our controlling variables, also offers a possible explanation of the observed negative Alpha of OMXS30 stocks. This finding is compatible with those of Koijen and Yogo (2019), supporting the theory that institutional demand may cause persistent deviations from fundamental values.

Whilst fitting for the Swedish part of the sample, the "index bubble" explanation does not hold for the US part of the sample. This is partly because both the treatment- and control group are saturated with institutional ownership, and because the negative direct effects on stock performance are not accompanied by any significant effects on volatility at the panel regression level. An alternative explanation for the relative underperformance of index constituents is therefore that our firm fixed effects do not fully account for the possible differences in dividend policy across the treatment- and control groups in both markets. Taking the OMXS30 as an example, its constituent stocks are typically large and mature firms with stable cash flows, meaning dividends are likely to constitute a larger share of total shareholder return. In contrast, smaller, non-index firms tend to retain a larger share of their earnings to finance growth and therefore often pay little to no dividends – instead relying on capital gains to satisfy equity holders. If stock performance is measured solely based on price appreciation, the exclusion of dividend distributions risks biasing the estimations of average- and abnormal returns. Specifically, firms that distribute a larger share of returns through dividends may appear to underperform relative to firms that primarily generate returns through capital gains – when really displaying comparable total returns (defined as the sum of price appreciation and dividend yield). This implies that the observed underperformance of indexed firms could, at least partially, be an artifact of measurement and firm heterogeneity rather than an effect of index inclusion itself. For non-index firms (especially growth stocks), where dividends are presumably lower, stock price changes constitute a closer approximation of total shareholder returns. As a result, comparisons based solely on price returns may overstate the relative performance of these firms.

Alternative causes of the negative direct effects on stock performance include greater visibility resulting in higher trading volumes, tighter bid-ask spreads and lower liquidity premiums (Hedge and McDermott, 2003), greater analyst coverage resulting in more efficient pricing (Cai, 2007), or (perhaps most likely) the inherent endogeneity issues of index construction.

5.3 Limitations and Implications for interpretation

This section outlines some of the key limitations of the study's research design — particularly the noisy institutional ownership proxy, issues with beta estimation, as well as the inherent endogeneity concerns associated with the study of index effects. We also discuss how these constraints limit our interpretations of the empirical results.

5.3.1 On limitations of the Proxy, Beta Estimation and Omitted Variables

Before making any conclusions regarding the existence of ownership-related effects in the Swedish market, there are several limitations of the analysis that one needs to consider. For example, an alternative explanation for our lack of observable indirect effects is that what we are observing is the product of measurement issues rather than a confirmation or rejection of theory. As previously discussed, the ownership data used in the analysis is fundamentally flawed, with excessive noise being introduced both through unclear reporting practices and the lack of separation between long-term block holders and short-term flow-generating owners. These issues could possibly have interfered with the test results, giving the appearance of a non-existent effect of institutional ownership on stock volatility and performance. Even in the case of the data not posing any problems, one may still question if institutional ownership is a reliable proxy for the trading flows thought to drive the theorized effect. Whilst easily accessible for collection, institutional ownership levels are not synonymous with trading flows or rebalancing activity – which would both constitute better proxies for the demand shocks we seek to study, but which are also much more difficult to gather data on as it is generally kept private by the institutions themselves. This explanation is further supported by the lack of significant effects between institutional ownership and our dependent variables also in the US part of the sample, in a market where the proxied demand shock effects have previously been shown to exist. Thus, the insignificant total effect of our mediation model (on the Swedish sample) may serve as guidance for future research on the topic to consider alternative proxies for the relevant demand shocks.

Further concerns relate to the reliability of the estimated beta coefficients. The summary statistics indicate that the average beta for OMXS30 stocks is approximately 0.67. While this may be considered reasonable for index constituents (albeit at the lower end), given that these firms are generally stable companies that tend to exhibit lower volatility than the overall market, the average beta of stocks outside the index is unexpectedly low at 0.63. In contrast, the U.S. sample displays an average beta of approximately 1.0 for index constituents and 1.2 for non-index constituents. This raises concerns regarding whether daily annualized beta is an appropriate measure of systematic risk in this context – with daily return data perhaps introducing a considerable degree of noise that biases the beta estimates downward. At the same time, extending the estimation window (e.g., by using weekly or monthly data) would reduce the number of observations, potentially limiting statistical power given the sample size and time horizon. Consequently, it is plausible that part of the estimated direct index effects on CAPM alpha captures systematic risk that is not adequately reflected in the beta measure.

Moreover, since the analysis relies on the Capital Asset Pricing Model (CAPM), the estimated Alpha may partly reflect omitted risk factors. Employing multifactor models, such as the Fama–French five-factor model, could potentially reclassify part of the estimated alpha as compensation for additional sources of systematic risk. Although our regressions include several firm-level controls, firm fixed effects and time fixed effects, omitted time-varying firm characteristics such as changes in liquidity, dividend policy or analyst coverage, may still bias the estimated effects. In the presence of omitted variables, variation attributable to unobserved factors may incorrectly be attributed to our index inclusion dummy variable – giving the impression of real index effects. Consequently, part of the estimated direct effect of index inclusion may reflect unobserved factors correlated with both index membership and stock outcomes, rather than index inclusion itself.

5.3.2 Endogeneity Issues and Unreliable Performance-related Index Effects

Perhaps most importantly, one should not put too much trust in the observed index effects on stock performance, in neither the US nor the Swedish sample. This is due to the endogeneity issues inherent to the composition and construction of the S&P500 and OMXS30 indexes. This is most striking in the case of the S&P500 where index inclusion or exclusion is not rule-based, but rather decided by a committee who make alterations to the index when deemed necessary due to mergers, delistings or companies growing to meet market cap and profitability thresholds (Corporate Finance Institute, 2020). Thus, on the margin, the composition of the S&P500 is essentially a result of active stock picking practices – with the committee typically adding stocks following a period of strong performance and deleting them after bad runs. This introduces an "index lag" effect where poorly performing stocks are kept inside the S&P500 whilst firms just outside the index may be growing and approaching inclusion. Due to this index inertia, such firms are not immediately reclassified, leading to a temporary mismatch between firm fundamentals and index membership. As a result, the non-index control group may contain relatively stronger firms compared to the weakest index constituents, biasing the estimated index effect in the negative direction (which is what we see in the US sample). Thus, the smallest stocks in the S&P500 – consisting of companies in decline or recently added mean reverting rising stars - are seen to underperform relative to their non-incumbent equivalents, with the observed return differences reflecting selection timing (picking post-peak winners and dropping pre-recovery losers) rather than a causal relationship between index inclusion and stock performance. Put in simpler terms: the selection process of the committee is endogenous to the past performance we seek to measure – making the causality between index inclusion and stock performance unclear.

In contrast, the rule-based construction of the OMXS30 provides more plausibly exogenous variation in index membership, reducing endogeneity concerns. However, as stocks do still enter the index after periods of strong performance where they appreciate to meet market cap thresholds, the Swedish sample is not free from endogeneity issues. Furthermore, the anomalous behavior of our control variables, where established risk premiums are not accompanied by expected volatility effects, further corroborates endogeneity concerns also in the Swedish sample.

On the other hand, the same endogeneity issues (while still present to some extent) are less severe in the case of the observed index effects on volatility. Intuitively, the S&P500 committee is less likely to make inclusion- and exclusion decisions based on historical volatility, with the OMXS30 market-cap rule being largely unrelated to past volatility measurements. Therefore, the significant direct effects on volatility and residual volatility observed in both the Swedish and the US sample still carry credibility.

Ultimately, we are **unable to conclude that inclusion in the S&P500 or the OMXS30 has a causal effect on stock performance, as any observed effect may be produced or skewed by issues of endogeneity.** This also means that any observed return effects should be interpreted with considerable caution.

5.3.3 Implications for Further Study

If one wishes to determine which out of the competing explanations presented in this paper is the most valid, one could start with attempting to decompose institutional owners by investor type and run the same panel regressions using the "cleaned" ownership data, and with additional control variables (such as liquidity or dividend policy). If both types of investors show no significant effects on stock performance, this would suggest that institutional-ownership effects are truly absent in the Swedish market and that the ETF-arbitrage mechanism likely is central to ownership-related index effects. However, when implementing such a methodology one would have to pay close attention to how one categorizes single institutional investors, as this procedure risks being highly subjective and possibly skewing the results. If one has access to the data, one could and should of course substitute institutional ownership for a more fitting proxy variable.

Future research could also improve the accuracy of beta estimates by reducing noise in return data and increasing the number of observations used in estimation. One approach would be to use lower-frequency data, such as weekly, monthly, or yearly returns, which tend to smooth out short-term fluctuations present in daily data. In addition, applying rolling estimation windows over several years would allow beta to vary over time while not losing too many observations. However, lower-frequency data would require a longer sample period in order to maintain statistical precision. Alternatively, expanding the cross-section of firms could further improve statistical precision. In the Swedish context, this is challenging, as the

OMXS30 represents the most relevant index but includes a limited number of firms, restricting the size of comparable groups.

As for combatting the endogeneity issues of index effects on stock performance, one could consider adopting a “purer” regression discontinuity design (RDD) by studying firms just around the market cap cutoff of the OMXS30 and a similar rule-based index in the US (such as the Russel 2000). By comparing stocks just above and below the threshold at rebalancing dates, you get groups that are near-identical in all relevant characteristics, making index membership as good as randomly assigned. However, even this approach is not completely free from endogeneity issues as the threshold itself is endogenous to past performance. Similarly, an event study design - although able to isolate the immediate market response of index inclusion - would still struggle with issues of endogeneity as the studied inclusion/exclusion events are not only endogenous to past performance but also anticipated by the market. Thus, regardless of research design or use of firm- and time fixed effects, the endogeneity issues inherent to the study of index effects are inescapable and to be considered a shared limitation of the index effect literature.

5.4 The Exploitability of the observed Index Effects

Whilst the observed index effects on stock performance (tables 2 and 3) suffer from issues of endogeneity, this does not necessarily mean the effects are not real or unexploitable – only that we cannot prove their underlying cause. Thus, the question of whether one can trade on the observed effects becomes highly relevant to seasoned investors.

The most intuitive way of capitalizing on return differentials between indexed stocks and non-constituents would be to construct a long-short portfolio. As both the treatment group portfolio and the control group portfolio should contain a mix of "rising stars" and "fallen giants", the samples are not necessarily fraught with issues of survivorship bias. Instead, investors could in theory realize any potential return differentials simply by holding the largest 30 stocks outside of the index, shorting the portfolio of indexed stocks, and rebalancing every year. Providing that the treatment and control groups have similar betas, a simple long-short portfolio would provide a market neutral position, isolating the Alpha component. Although, given the significant transaction costs of long-short strategies (e.g. bid-ask spreads, commissions and borrowing costs), such procedures are more fit for a larger hedge fund than for the retail investor.

However, whilst possible in theory, the results of our cross-sectional analysis in table 4 (mimicking the aforementioned long-short portfolio strategy) is not able to capitalize on the return differentials observed in our panel regressions (tables 2 and 3) – implying that the observed return differentials may be a result of backward-looking selection bias or hindsight bias on the individual company level. This would mean that replicating the observed abnormal returns would not be as simple as just reversing our long-short portfolio. Rather, one´s ability to exploit the observed index effects would rely on one's capacity to consistently pinpoint the rising stars outside of the indexes, as well as declining index incumbents', ex-ante - using only the information available at the time of the investment. Even if within the realm of possibility for advanced quantitative traders, such sophisticated investors would soon realize that this long-short strategy would be very similar to simply buying promising mid-cap growth stocks with positive momentum and increasing profitability. Thus, even if the observed return effects were to be exploitable in practice, there would be little meaningful difference between such a strategy and existing factor investing frameworks. With that said, since the cross-sectional framework of the long-short portfolio analysis relies on substantially fewer observations, the lack of significant portfolio level return effects may also reasonably be attributed to a lack of statistical power rather than the inability to replicate said effects on a portfolio level. The possibility and difficulty of replicating the observed abnormal returns thus remains unclear.

Whilst index membership does not constitute a return anomaly at the portfolio level in either market, the robustness of the observed index effects on volatility in the Swedish market - surviving both cross-sectional and panel regression analysis - indicates that the observed effect is real and not a product of a subpar test methodology, unreliable data or inherent sample biases. For the passive investor, this is highly important as it implies that **OMXS30 stocks may carry a hidden, unpriced "volatility cost" in the form of higher idiosyncratic volatility.**

At first glance, one could attribute these effects to a lack of diversification of the OMXS30 index. If so, this would imply that the "exploitability" of the observed index effects in the Swedish market may have less to do with realizing additional returns but rather avoiding unnecessary volatility by switching to a broader index such as the OMXSPI.

However, the fact that these volatility differentials persist also at the individual company level under the panel regression framework (table 2) indicates that the observed effects are not purely a product of subpar portfolio level diversification. Instead, this indicates that the observed volatility differentials should (in theory) be exploited by investors using options trading. More specifically, if individual stocks in the OMXS30 exhibit higher realized volatility than the implied volatility of options on the market – said options may be mispriced and provide for an arbitrage opportunity. Whilst this relationship is likely too obvious to not be efficiently priced by the options market, investors with knowledge of future fund flows (if causing said volatility differentials) could in theory profit from trading on the difference between realized- and implied volatility. In practice, this would likely involve buying straddles on high volatility stocks in the OMXS30, pairs-trading stocks inside and outside the OMXS30, or mean reversion strategies. The validity of this strategy is further supported by the observed volatility differentials not being subject to the same level of endogeneity issues as the return effects in the US market. One is however unable to use options to exploit portfolio-level volatility differentials, as the availability of options trading is generally restricted to single stocks, indexes and ETFs (not our constructed control group). Furthermore, given the small size of the OMXS30, the general ambiguity surrounding the causal mechanism, and the general efficiency of the options market, such strategies are unlikely to be worthwhile pursuing in the long run – especially when also factoring in transaction- and opportunity costs.

Ultimately, the advice to the passive investor becomes to not attempt to exploit the observed index effects but rather remain a passive investor.

6.0 Conclusion

This paper examines if institutional fund flows, driven by index membership, affects stock volatility and performance in the Swedish equity market. Whilst such effects have previously been documented in the US market, it remained unknown if they are present also in a Swedish, mutual-fund dominated setting.

Our study employs a mediation analysis framework to separate index effects operating through the institutional ownership channel, from those arising from alternative mechanisms. The analysis draws on two panel datasets — the OMXS30 and the 30 largest companies outside of the index, and the smallest S&P500 constituents alongside the largest non-constituents — observed over the period January 2016 to December 2025.

Our study finds **no evidence of ownership-related effects on stock volatility or performance in the Swedish market**, supporting the theory of Ben David et al. (2018) that the ETF arbitrage mechanism may be central to the materialization of such effects. This argument is strengthened by the lack of an observable risk premium and the fact that the observed direct effects on volatility operate, at least partially, through the idiosyncratic volatility component. The latter suggests the presence of alternative index-effect mechanisms, as previous literature theorizes ownership-related index risks to be systematic in nature. The most important contribution of this paper is therefore a non-finding: with the absence of evidence for ownership-related effects in the Swedish market pointing to that **US-based index effect theory may not be directly transferable to markets with lower ETF penetration**. However, we still cannot rule out the possibility that these effects do exist but are not captured by our noisy institutional ownership proxy variable.

For our US sample, the identification strategy breaks down, with the control group exhibiting higher levels of institutional ownership than the S&P500 treatment group, rendering causal inference impossible.

Because of the endogeneity issues inherent to index construction, we are unable to make any causal inferences regarding performance-related index effects in either market. Nevertheless, differences in dividend policy and liquidity premiums, potential index bubble dynamics or simple hindsight bias, offer plausible alternative explanations for the relative underperformance of stocks in the OMXS30 and S&P500.

Whilst unable to pinpoint the cause of the observed index effects, the endogeneity issues do not imply that the observed effects cannot be exploited by investors. However, even if clever stock picking practices could in theory serve as the basis for replicating observed abnormal returns, such strategies would likely offer little incremental value over established factor investing approaches. Seasoned investors could also look to use options to exploit the observed volatility differentials in the Swedish market (which are also subject to less endogeneity issues). However, we deem it unlikely for such a strategy to be profitable in the long run considering the general efficiency of the options market.

With the primary limitations of the study lying in the endogeneity issues of index construction, concerns regarding beta estimation and the quality of the institutional ownership proxy variable, future research on the topic should prioritize seeking a more appropriate proxy variable (for example direct fund-flow data, if accessible) whilst also considering making alterations to our RDD-style research design. Such a study may also seek to decompose ownership data by investor type – separating long term holders from flow inducing traders. However, even this “ideal” setup would still be unable to fully escape issues of endogeneity as index inclusion is inevitably endogenous to past performance.

For the passive investor, the most important takeaway is one of awareness rather than action: that ownership-related index effects appear neither detectable nor exploitable in the Swedish market. However, the evidence of genuinely higher volatility and residual volatility among OMXS30 constituents at both the firm and portfolio level suggests that passive investors with concentrated exposure to the Swedish market should be aware of the added price variation associated with index membership — even if its origin and exploitability remain open questions.

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AI declaration

This thesis has made use of artificial intelligence (ChatGPT 5.3 and Claude Sonnet 4.6) tools as a supporting resource during the research process. Specifically, AI has been used to assist in writing and refining code used for empirical analysis, as well as for improving the clarity and grammatical correctness of the written text.

All analytical decisions, model specifications, interpretation of results, and final conclusions are the author’s own. The use of AI has been limited to technical assistance and language refinement, and the author takes full responsibility for the content, accuracy, and integrity of the work.

Appendix A: Summary statistics

This appendix contains summary statistics tables used to convert standardized regression estimates to raw regression outputs.

Table A1. Summary statistics for Swedish sample stocks split Index – Non-index

Group	Variable	Mean	SD	n
Index	CAPM Alpha	0.0025	4.94	52917
Non-index	CAPM Alpha	0.151	5.15	60799
Index	Avg_Return	0.063	5.36	52917
Non-index	Avg_Return	0.206	5.50	60799
Index	Beta	0.673	0.285	52917
Non-index	Beta	0.614	0.286	60799
Index	Volatility	0.308	0.259	52917
Non-index	Volatility	0.329	0.139	60799
Index	Res_Volatility	0.192	0.245	52917
Non-index	Res_Volatility	0.218	0.241	60799
Index	Inst_Own	56.2	15.5	52917
Non-index	Inst_Own	48.9	22.0	60799
Index	MarketCap	256174.	342387	52917
Non-Index	MarketCap	70067.	63134	60799
Index	ROA	0.0564	0.0583	52917
Non-Index	ROA	0.0628	0.0517	60799
Index	Leverage	0.531	0.188	52917
Non-Index	Leverage	0.509	0.149	60799
Index	PBV	3.23	2.12	52917
Non-Index	PBV	4.94	6.17	60799

This table shows the mean, standard variation, and number of observations for the main variables of the Swedish sample. The variables are split between index constituents and non-index constituents.

Table A2. Summary statistics for US sample stocks split Index – Non-index

Group	Variable	Mean	SD	n
Index	CAPM Alpha	-0.03	4.84	65091
Non-index	CAPM Alpha	0.103	6.39	63576
Index	Avg_Return	0.0846	5.76	65091
Non-index	Avg_Return	0.234	7.32	63576
Index	Beta	1.00	0.371	65091
Non-index	Beta	1.19	0.339	63576
Index	Volatility	0.235	0.276	65091
Non-index	Volatility	0.297	0.352	63576
Index	Res_Volatility	0.194	0.235	65091
Non-index	Res_Volatility	0.251	0.314	63576
Index	Inst_Own	85.6	16.6	65091
Non-index	Inst_Own	90.4	15.1	63576
Index	MarketCap	13368.	6885.	65091
Non-Index	MarketCap	7525.	6139.	63576
Index	ROA	0.0609	0.0439	65091
Non-Index	ROA	0.0800	0.627	63576
Index	Leverage	0.606	0.198	65091
Non-Index	Leverage	0.544	0.205	63576
Index	PBV	8.83	22.5	65091
Non-Index	PBV	4.81	7.36	63576

This table shows the mean, standard deviation, and number of observations for the main variables of the US sample. The variables are split between index constituents and non-index constituents.

Table A3. Summary statistics for Swedish sample stocks without index split

Variable	Mean	SD	n
CAPM Alpha	0.0818	5.06	113716
Avg_Return	0.140	5.44	113716
Beta	0.641	0.287	113716
Volatility	0.319	0.124	113716
Res_Volatility	0.292	0.128	113716
Inst_Own	52.3	19.6	113716
MarketCap	156671.	255538.	113716
ROA	0.0599	0.0549	113716
Leverage	0.520	0.169	113716
PBV	4.15	4.82	113716

This table shows the mean, standard deviation, and number of observations for the main variables of the Swedish sample. The table does not split the firms between index and non-index constituents. Market Cap in millions of SEK

Table A4. Summary statistics for US sample stocks without index split

Variable	Mean	SD	n
CAPM Alpha	0.0356	5.66	128667
Avg_Return	0.159	6.58	128667
Beta	1.10	0.367	128667
Volatility	0.266	0.318	128667
Res_Volatility	0.222	0.278	128667
Inst_Own	88.0	16.0	128667
MarketCap	10481.	7151.	128667
ROA	0.0704	0.442	128667
Leverage	0.575	0.204	128667
PBV	6.84	17.0	128667

This table shows the mean, standard deviation, and number of observations for the main variables of the US sample. The table does not split the firms between index and non-index constituents. MarketCap in millions of USD.

Table A5. Panel regression estimates for mediation model on Swedish stocks (raw numbers)

	CAPM Alpha	Average Return	Volatility	Residual Volatility
Path A (Index -> IO)	3.8287*	3.8287*	3.8287*	3.8287*
Path B (IO -> CV)	-0.0003	-0.0004	0.0005	0.0005
Path c' (Index -> DV)	-0.2743**	-0.2581**	0.0989*	0.0849*
Leverage	0.2263	0.1705	0.0314	0.0095
ROA	0.3486	0.4614	-0.1196	-0.1741*
PBV	0.0185*	0.0198*	0.0030	0.0027
Market Cap	0.2030***	0.1937***	-0.0411*	-0.0462*
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
R^2	0.117	0.214	0.731	0.724

This table shows the raw coefficient estimates for the fixed-effect panel regression models underlying the mediation analysis. Path A captures the effect of Index inclusion on Institutional Ownership. Path B captures the effect of Institutional Ownership on our dependent variables (Alpha, Average Return, Volatility, and Residual Volatility), when controlling for Index Inclusion. Path c' reflects the direct effect of Index Inclusion on each of the dependent variables. Controlling variables are expressed with regard to their explanatory power of the total effect.

Table A6. Panel regression estimates for mediation model on US stocks (raw numbers)

	CAPM Alpha	Average Return	Volatility	Residual Volatility
Path A (Index -> IO)	-4.1612	-4.1612	-4.1612	-4.1612
Path B (IO -> CV)	-0.0001	0.0001	-0.0014	-0.0013
Path c' (Index -> DV)	-0.2149**	-0.2148**	-0.0056	-0.0090
Leverage	0.8110*	0.8307**	0.1554*	0.1180*
ROA	0.0795***	0.0804***	0.0130***	0.0085**
PBV	0.0014.	0.0013.	-0.0002	0.0000
Market Cap	0.3540***	0.3568***	-0.0217.	-0.0240.
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
R^2	0.059	0.279	0.759	0.706

This table shows the raw coefficient estimates for the fixed-effect panel regression models underlying the mediation analysis. Path A captures the effect of Index inclusion on Institutional Ownership. Path B captures the effect of Institutional Ownership on our dependent variables (Alpha, Average Return, Volatility, and Residual Volatility), when controlling for Index Inclusion. Path c' reflects the direct effect of Index Inclusion on each of the dependent variables. Controlling variables are expressed with regard to their explanatory power of the total effect.