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THE INDEX EFFECT: AN INVESTIGATION OF THE PRICE, VOLUME AND TRADING EFFECTS SURROUNDING CHANGES TO THE S&P AUSTRALIAN INDICES

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ABSTRACT

This paper examines the stock price and volume effects surrounding the announcement of constituent changes to the S&P/ASX 200 and four supplementary indices. Between April 2000 and December 2002 additions to (deletions from) the ASX 200 were associated with a significant price rise (fall) over the 10 day period following the market announcement of the change. Additions (deletions) also displayed a significant rise (fall) on the announcement date itself. These findings were corroborated by significant increases in trading volume over the same intervals, suggesting heavy trading activity by index funds in response to changes to the ASX 200. Following the implementation of these changes, both additions and deletions experienced a significant price reversion, supporting the price pressure hypothesis. In contrast, none of the supplementary indices displayed evidence of stock price or volume effects, thereby precluding the information and liquidity hypotheses as viable explanations for the findings of this research.

Key Words: Index change; price effect; volume effect; index fund; price pressure.

JEL Classification Code: G14

I. INTRODUCTION

One of the growth areas in investment on the Australian sharemarket in recent years has involved index funds (or passively managed funds). Designed to closely match the performance of a specific market index, these funds provide an efficient method for gaining exposure to Australian equities, and have the added benefit of lower management fees when compared to most actively managed alternatives. The specific cost advantage of an index fund hinges upon its minimisation of portfolio turnover. Whereas the turnover of an active fund will depend on its style of management, index fund turnover is necessitated only by the addition or deletion of a stock from the index that a fund is seeking to replicate.

Several studies have examined the impact on those stocks that are added to or deleted from an index, with a vast majority finding that the prices of stocks being added (deleted) increase significantly (decrease significantly) following the change, coupled with general increases in trading volumes. The presence of index funds in many of these markets has led to the conclusion that the effects of adding or deleting a stock from an index (hereby referred to as the 'index effect') are due to demand shifts on the part of index funds. Other conclusions have supported informational and liquidity based arguments, creating a distinct lack of consensus on this topic.

Accordingly, the unresolved nature of the index effect provides the primary motivation for this research. Although a complete reconciliation of the various explanations is unlikely at the present time, particularly in light of the structural differences between many international indices and markets, it is anticipated that the provision of evidence from a smaller sized market such as Australia will contribute towards providing a more precise definition of the causes of the index effect, within different international groupings and after accounting for structural variations.

This paper uses an event study methodology over the period of April 2000 to December 2002 to analyse the price and trading volume effects surrounding additions to and deletions from the S&P/ASX 200, which is the primary index of the Australian market, and most commonly used benchmark for domestic index funds. Two approaches are used to conduct the analysis, the first being direct investigation of the index effect based upon constituent changes to the ASX 200 itself. The second approach relies on the combined investigation of four supplementary Australian indices, in order to distinguish between the competing hypotheses that will be detailed below. is relevant to market participants.

The remainder of the paper is organised as follows. Section II outlines the current hypotheses and reviews the empirical literature to date. Sections III and IV describe the Australian indices used in this study, the sample selection process, market data and methodology. Section V contains the empirical results. Section VI provides a discussion of the findings of this study. Section VII concludes.

II. Current Hypotheses & Literature Review

This section outlines the main hypotheses for the index effect and reviews the current empirical literature on the topic, including both US and recent international research.

A. Current Hypotheses

Throughout the literature on the index effect, four main hypotheses have been employed to account for the various empirical findings. These four hypotheses will be considered in turn.

When a stock is added to or deleted from an index, the demand for that stock will often change due to the presence of index funds. These funds seek to replicate the returns on selected indices by holding an index's constituent stocks (in similar weightings to the index), implying that an index addition (deletion) will lead to an increase (decrease) in demand for the particular stock(s), as funds buy or sell the necessary quantities to maintain their replication.

The price pressure hypothesis states that this change in demand is transitory only, and will exist for a short period as funds realign their portfolios, typically between the announcement of an index change and the actual date of implementation. Following the announcement of an index addition (deletion), prices would be expected to rise (fall) over the transition period in order to compensate investors and market makers for their provision of immediacy to fund managers, while the heightened trading activity implies that volume levels will increase, for both additions and deletions. However, as the transitory demand shift does not alter the equilibrium price of a stock over the long run, the price changes are not permanent, and will revert to their original level as fund trading subsides.

The imperfect substitute hypothesis contrasts the price pressure hypothesis by arguing that stocks are imperfect substitutes for one another, implying that the long run demand curve for stocks is inelastic and downward sloping. Therefore, a short term demand shift will cause a revision of the equilibrium level of a stock, leading to a permanent change in its price. In the case of an index addition, index funds will buy large parcels of the included stock, creating the short term demand spike suggested by the price pressure hypothesis. However, given the condition of imperfect substitution, the included stock is likely to be held over a longer term horizon, which has the added effect of removing a proportion of the available shares for market trading. Therefore, an initial demand increase, followed by the subsequent supply decrease will shift the equilibrium price upward over the long term, hence permanently increasing the price of the added stock.

The information hypothesis contends that the decision to add or delete a stock from an index imparts valuable information on investors, from which they will permanently revalue a stock based on their perception of this information. For example, a stock addition may be seen as an indication of the high quality of a firm's operating model and more importantly, the sustainability of its business and future earnings capacity, given that relatively stable and financially sound companies are preferred for index inclusion (in order to minimise turnover). This leads to a perceived reduction in the riskiness of the firm and increased confidence in its future prospects, both of which invite a higher share valuation. Therefore, an index addition (deletion) will cause a permanent positive (negative) revision of stock prices.[1]

The liquidity hypothesis states that an index change will alter the liquidity characteristics of the affected stock(s) and hence the costs of transacting, causing a permanent price adjustment. Typically, investors will demand a lower (higher) expected return for stocks with lower (higher) transaction costs, thus a stock that is added to an index would be expected to display higher liquidity (by way of increased awareness from the financial community), which reduces the bid-ask spread and search/selection

[1] See Scholes (1972) for a comprehensive outline of these first three hypotheses.

costs of investors. With lower transaction costs the stock's expected return will decrease, causing a permanent upward adjustment in price. The opposite logic applies to deleted stocks, whereby the costs of transacting will rise due to a drop in liquidity.[2]

B. The Empirical Literature

The index effect has been the subject of much research over the past 20 years, particularly on the US market and its indices, and more recently, on non-US indices. The key findings of these papers are summarised below.

US studies have primarily considered the index effect in connection with the S&P 500, which is the benchmark US index for replication by index funds. The stock price effect on the day that changes were announced to the market (the announcement day) is summarised for several studies in Table 1.[3] As is evident from the table, the abnormal returns on the announcement day are consistently significant. Additionally, many studies also reported significant increases in trading volume.[4]

Harris & Gurel (1986) reported significant price and volume effects on the announcement day, with the prices of added stocks reverting to their original level within two weeks of the announcement, supporting the price pressure hypothesis.

Goetzmann & Garry (1986) and Shleifer (1986) also found significant price effects in their research, although they attributed this to the imperfect substitute hypothesis given that no price reversion occurred in the post announcement period.

[2] See Amihud & Mendelson (1986) for a comprehensive model regarding this hypothesis.

[3] As the majority of deletions from the S&P 500 are due to corporate actions such as takeovers, liquidation or restructuring, the sample size of useable deletion data is greatly diminished, hence the limited scope of empirical results with respect to deletions.

[4] Trading volume results are not summarised in Table 1.

TABLE 1

Announcement Day Price Effects of Additions to and Deletions from the S&P US Indices

This table presents the announcement day price effects of additions to and deletions from various US indices, as observed in the corresponding research papers. Abnormal return is the observed return in excess of the relevant market index return, while period refers to the sample period for which observations were analysed.

Paper	Abnormal Return (%)		Period	Index
	Additions	Deletions		
Goetzmann & Garry (1986)	n/a	-1.90*	1983	S&P 500
Harris & Gurel (1986)	3.13*	-1.40*	1978-83	S&P 500
Shleifer (1986)	2.79*	n/a	1976-83	S&P 500
Jain (1987)	3.07*	n/a	1977-83	S&P 500
Dhillon & Johnson (1991)	3.33*	n/a	1984-88	S&P 500
Beneish & Whaley (1996)	4.39*	n/a	1986-94	S&P 500
Lynch & Mendenhall (1997)	3.16*	-6.26*	1990-95	S&P 500
Breazeale & Cuny (2002)	6.74*	-9.22*	2000-01	S&P 400
Breazeale & Cuny (2002)	9.00*	-15.30*	2000-01	S&P 600

Note: * Statistically significant at the 5% level.
n/a indicates that no calculation was performed in the study.

Jain (1987) found significant and permanent stock effects for the S&P 500 and several supplementary indices, in support of the information hypothesis. Dhillon & Johnson (1991) reported similar results, with the information and liquidity hypotheses being proposed as likely explanations

Pruitt & Wei (1989) reported evidence of institutional investors altering their shareholdings in association with S&P 500 index changes, further strengthening the earlier empirical results of the time.

Prior to October 1989, Standard & Poor’s would customarily announce and implement index changes on the same day, however a new policy was introduced whereby the announcement would predate the implementation by five trading days. Beneish & Whaley (1996) and Lynch & Mendenhall (1997) examined the post 1989 period, revealing significant price effects on the announcement day and in the lead up to implementation, and a partial reversion following implementation. Thus, the price pressure and imperfect substitute hypotheses seem to be supported concurrently.

Breazeale & Cuny (2002) considered the S&P MidCap 400 and S&P SmallCap 600. Consistent with Lynch & Mendenhall (1997), the results supported both the price pressure and imperfect substitution hypotheses.

In contrast to research from the US, international evidence is mixed regarding the extent of the index effect. Table 2 summarises the announcement day impact on stock prices, showing that half of the observed results are insignificant at any meaningful level. Likewise, trading volume is not universally significant.[5]

Brealey (2000), Barontini & Rigamonti (2000), Bildik & Gulay (2001) and Bechmann (2002) all revealed no index effect on the announcement date, however, consistent with Lynch & Mendenhall (1997), a significant index effect was reported for the cumulative period between the announcement and implementation dates. Across the papers, each of the four hypotheses was proposed as the likely cause.

Deininger, Kaserer & Roos (2000), Masse *et al.* (2000) and Liu (2001) reported a significant index effect both over a cumulative horizon and on the announcement day itself. Likewise, trading volume was found to increase significantly.

Li, Pinfold & Elayan (2000) found a significant negative abnormal return for deletions from the NZSE 40, which is credited to the information hypothesis.

Chan & Howard (2002) examined the All Ordinaries index between 1992 and 1998, finding significant price effects prior to the implementation date, followed by a partial reversion. Trading volume increased significantly, both before and after the announcement date, due to the predictability of constituent changes.[6]

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[5] Trading volume results are not summarised in Table 2.

[6] During the sample period of the study, the criteria used to determine index changes were different to those currently used in the Australian market by Standard & Poor's.

TABLE 2
Announcement Day Price Effects of Additions to and Deletions from International Indices

This table presents the announcement day price effects of additions to and deletions from various international indices, as observed in the corresponding research papers. Abnormal return is the observed return in excess of the relevant market index return, while period refers to the sample period for which observations were analysed. The final column lists the home market in which the researched index operates.

Paper	Abnormal Return (%)		Period	Index	Country
	Additions	Deletions			
Barontini & Rigamonti (2000)	0.84	-0.84*	1995-99	Mib 30	Italy
Brealey (2000)	0.50	-0.30	1994-99	FTSE	UK
Deininger et al. (2000)	1.72*	-1.19*	1988-97	DAX	Germany
Li, Pinfold & Elayan (2000)	-0.11	-0.91	1994-98	NZSE 10	NZ
Li, Pinfold & Elayan (2000)	0.91	-1.47*	1994-98	NZSE 40	NZ
Masse et al. (2000)	1.58*	-1.35*	1989-94	TSE 300	Canada
Bildik & Gulay (2001)	0.16	-0.38	1995-00	ISE 100	Turkey
Liu (2001)	1.54*	-2.57*	1991-99	Nikkei 500	Japan
Bechmann (2002)	0.26	-0.22	1989-01	KFX	Denmark
Chan & Howard (2002)#	2.60*	-3.30*	1992-98	All Ords	Australia

Note: * Statistically significant at the 5% level.
Abnormal returns relate to the implementation date of the change, *not* the announcement date.

III. INDICES, SAMPLE SELECTION & MARKET DATA

This section outlines the five S&P/ASX indices that are the subject of this research, the sample selection process by which index additions and deletions were included in the eventual sample for analysis, and the sources of all market data.

A. The S&P/ASX Indices

Australia's primary sharemarket index, the ASX 200, is a market capitalisation-weighted index, including the largest and most liquid stocks listed on the ASX. For the vast majority of Australian index funds, the ASX 200 serves as the replication benchmark, thus the effect of additions to and deletions from this index comprises the main focus of the study. Accordingly, and based upon evidence from research on the S&P 500, it can be anticipated that the index effect would be most evident, if at all, for the ASX 200. However, a key difference between the Australian and US markets, namely that the size of the index fund industry in terms of dollar value is significantly smaller in Australia than the US, implies that this may not necessarily be the case. While over US$1 trillion was indexed to the S&P 500 as of October 2002,[7] Australia's total stands at a more modest A$24.874 billion, as of August 2001.[8] Notwithstanding the size differential between the US and Australian equity markets, it is plausible that the impact of Australian index fund trading will either be insufficient to generate a significant index effect or, where there is a significant effect, that it will be smaller in magnitude than that observed for the S&P 500.

The supplementary indices for this study include the ASX 20, ASX 50, ASX 100 and ASX Small Ordinaries. Unlike US indices, in which constituents are only present in one index at any given time, the supplementary indices are all subsets of the next broadest index. For example, the ASX 50 is a subset of the ASX 100, which in turn is a subset of the ASX 200. Therefore, it is possible that a stock may be a constituent of several indices at once, and furthermore, that a stock may be added to or deleted from multiple indices concurrently, a concept that will be returned to in a later section.

With few exceptions, the supplementary indices are not replicated by index funds at the present time, however as discussed in Jain (1987), this produces an ideal opportunity to distinguish between several of the competing hypotheses, through utilising the supplementary indices of this study as a 'control' group. Given the lack of replication, it can be anticipated that there should be no *demand related* index effect for these supplementary indices, as there would be no abnormal trading activity on the part of index funds following the announcement of a constituent change. Under the assumption that this scenario is true, it could be concluded that any significant index

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[7] Breazeale, J.P. and C.J. Cuny (2002), "Stock Price Effects of Changes in the S&P MidCap 400 and the S&P SmallCap 600 Indices", working paper, Texas A&M University.
[8] Mace, J., "Measuring Up for Slower Growth", *Superfunds*, 250, August 2001, p. 46.

effect observed for the ASX 200 would then be attributable to the price pressure or imperfect substitute hypotheses, as index fund trading *is* expected to cause a demand related effect for that index. However, should significant effects be detected for one or more of the supplementary indices, clearly the catalyst could not be demand related, therefore the observation would be more supportive of either the information hypothesis or liquidity hypothesis (although demand related effects could not be ruled out for the ASX 200).

B. Sample Selection

The preliminary step in the sample selection process was to identify all index changes for the ASX 200 and supplementary indices between April 2000 and December 2002. The Standard & Poor's website contained a full listing of all additions and deletions over this period, yielding 556 initial observations. Due to a small number of errors in the website list,[9] and in an effort to ensure full accuracy, the initial sample was corroborated with Standard & Poor's market announcements, after which a total of 54 observations were removed due to no such announcement being found.

Next, the existing sample was screened using several criteria, to remove any observations that may have introduced a potential bias to the results. The market announcements were used to identify all index deletions that resulted from corporate actions such as a merger, takeover offer or admission to voluntary administration. These observations were removed. Furthermore, any deletions caused by bankruptcy, liquidation or delisting were omitted from the sample if there was insufficient market data (at least 30 trading days) following the announcement date. Likewise, all index

[9] Specifically, certain index changes to the ASX 100 were incorrectly listed as also applying to the ASX 200.

additions with insufficient market data (at least 150 trading days) prior to the announcement date[10] were removed.

The final step involved eliminating those observations for which the announcement of an index change coincided with a firm specific announcement, to ensure that the price and volume effects being analysed were not contaminated by events with no relationship to the index change. Accordingly, observations with a significant[11] firm specific announcement in the period two days before to two days after the index change announcement were removed.

Table 3 provides a numerical overview of the sample selection process, with the final sample containing 323 observations, including 151 additions and 172 deletions.

C. Market Data

Daily closing prices and trading volumes for observations in the final sample were collected from IRESS, for the period October 1999 to June 2003. Dividend information was collected separately, also from IRESS, and manually included in the calculation of daily stock returns. All returns in the study are continuously compounded.

Daily index closing prices and trading volumes[12] for the ASX 200 and supplementary indices were collected from IRESS over the same period. Although the first six months of collected index data predates the introduction of the Standard & Poor's indices (April 2000), the IRESS database had automatically back-calculated the

[10] Common reasons for there being insufficient market data included the index addition of recent IPO or a previously listed company which had been spun-off, restructured or merged.

[11] The ASX designates any market announcement that is expected to cause a price impact with a '**!**' symbol. Typical announcements bearing this symbol that caused removal from the sample were dividend announcements, firm acquisitions and profit reports.

[12] Volume data is expressed as total traded volume, as opposed to market turnover.

TABLE 3

Sample Selection Process for Additions to and Deletions from the ASX Indices

This table presents the process by which observations were selected for inclusion in the final sample for analysis. The Standard & Poor's website was used to formulate an initial list of all additions to and deletions from the relevant Australian indices, over the period of April 2000 to December 2002. Observations were then progressively removed according to the reasons stated in the table. The final sample yielded the candidate observations for which data was collected from IRESS. These observations were then the subject of eventual analysis.

	Additions					**Deletions**				
	20	**50**	**100**	**200**	**SO**	**20**	**50**	**100**	**200**	**SO**
Initial Total from Standard & Poor's Website	5	14	31	85	120	7	16	35	88	155
No Press Release for Announcement Date	-1	-4	-4	-9	-7	-1	-4	-4	-9	-11
Merger, Takeover or Voluntary Administration						-1	-3	-7	-16	-14
Insufficient Price Data Due to New Listing	-1	-2	-5	-21	-33					
Bankruptcy, Liquidation or Delisting						-1	-1	-4	-8	-11
Significant Market Announcement		-1	-5	-4	-7			-2	-7	-25
Final Sample	**3**	**7**	**17**	**51**	**73**	**4**	**8**	**18**	**48**	**94**

'theoretical' closing prices of the ASX 200, therefore the index prices over the transition period are seamless.[13] Trading volume data for the ASX 200 was of course non-existent prior to April 2000, therefore, for the purpose of analysing volume effects due to an index change, all observations prior to and including the September 2000 quarterly review were excluded.[14] These observations were still utilised for the purpose of examining price effects.

[13] The back-calculation is based upon the 200 stocks from the initial (April 2000) constituent structure of the ASX 200. Therefore, any 'theoretical' additions or deletions that would have taken place between October 1999 and April 2000 are not impounded in the back-calculated closing prices.

[14] The volume analysis of these observations would have required using volume data prior to April 2000. This was inappropriate given that all values before this date were 0.

IV. METHODOLOGY

An event study framework was utilised to investigate the index effect, consistent with the prior literature, with the announcement date of an index change (as opposed to the implementation date) being taken as the event date for each sample observation, allowing the entire sample to be aligned in event time. Unlike the US market where the announcement of an index change is made after the market has closed, in Australia, Standard & Poor's release their market announcement prior to the market opening. Given that participants have sufficient time to review the contents of the announcement before trading commences, the announcement date was used as the actual event date.[15] The specific methodologies applied to price and volume data are described below.

A. Price Effects

To analyse the price effects of an index change, the standard market model approach was employed, as outlined in Brown & Warner (1985), Peterson (1989) and MacKinlay (1997). Specifically, each sample observation was regressed against a market index using an ordinary least squares (OLS) regression, as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where: R_{it} is the continuous return on the shares of firm i during period t;

R_{mt} is the continuous return on the market index[16] during period t;

[15] Most US studies use the trading day after the evening announcement, AD+1, as the event date.

[16] The appropriate market index for each regression was determined by the individual sample observation, based on the index to which an addition or deletion would occur. For example, an addition to the ASX 50 took the ASX 50 index as the market index. This procedure was also repeated using the ASX 200 as the universal market index, for comparative purposes.

α_i is the intercept for firm i; and

β_i is the slope coefficient (market beta) for firm i.

An estimation window of [-150, -31] was used for the above regression. This window was deemed appropriate considering that prior studies tended to use a similar sized estimation window, and that 120 trading days strikes a balance between accurately gauging a stock's relationship to the market and incorporating too many firm specific trends that could bias the regression.

In a relatively small market such as Australia, the problem of non-synchronous data must be taken into consideration. Briefly, nonsynchronicity refers to the scenario where a firm's measured information set (indicated by its closing price) differs from its true information set (indicated by the time of last trade), and is commonly caused by relatively infrequent or thin trading. As a result, statistical estimates, such as β_i from the market model may be biased. To correct for nonsynchronicity in the study, the Scholes-Williams adjusted beta, formulated in Scholes & Williams (1977) and summarised in Peterson (1989) was calculated, such that:

$$\beta_{iSW} = \frac{\beta_i^+ + \beta_i + \beta_i^-}{(1+2\rho)}$$

where: β_{iSW} is the estimated Scholes-Williams adjusted beta for firm i;

β_i^+, β_i, β_i^- are the beta estimates from the market model regression using 1 lead, no lead/no lag and 1 lag, respectively; and

ρ is the slope coefficient of an OLS regression of the market return on its 1 period lagged value[17] (the correlation coefficient).

The corresponding Scholes-Williams adjusted alpha was calculated as:

$$\alpha_{iSW} = \left(\frac{1}{T-2}\right)\left[\sum_{t=2}^{T-1} R_{it} - \left(\beta_{iSW}\sum_{t=2}^{T-1} R_{mt}\right)\right]$$

where: α_{iSW} is the estimated Scholes-Williams adjusted alpha; and

T is the number of days in the estimation window.

The adjusted alpha and beta of the market model were used to calculate the predicted returns of each observation over a 61 day event window, [-30, +30]. The abnormal return (AR) for each observation on each event day was then calculated as the difference between the observed return and the predicted return.

Next, the observations were segregated into additions and deletions, and then further divided according to the index that was being added to or deleted from, creating 10 sub-samples. Abnormal returns were then averaged across N firms for each sub-sample, giving the average abnormal return (AAR) for each event day. Additionally, for the analysis of price effects over multiple event days, the cumulative average abnormal return (CAAR) was calculated:

17 $\rho = \frac{Cov(R_{mt}, R_{mt-1})}{\sqrt{Var(R_{mt})}\sqrt{Var(R_{mt-1})}}$

$$CAAR_N = \sum_{t=t_1}^{t=t_2} AAR_t$$

where: $CAAR_N$ is the cumulative average abnormal return over period N; and

t_1 & t_2 are the first and last event dates, respectively, of period N.

As per Beneish & Gardner (1995), an estimate of the standard deviation of the event window AAR's was calculated over 50 of the 61 trading days [-30, -6 and +6, +30], which minimises the influence of any increase in variance around the event date:

$$S_{AAR} = \sqrt{\left(\frac{1}{49}\right)\sum_{t=1}^{50}\left(AAR_t - \overline{AAR}\right)^2}$$

where: S_{AAR} is the standard deviation of the average abnormal returns; and

$\overline{AAR}$ is the mean average abnormal return over the 50 day calculation period.

Using the standard deviation estimate, one and two-tailed tests were performed to gauge the significance of both AAR's and CAAR's. One-tailed tests were applied to the AAR's of additions (deletions), given the a priori expectation of an index addition (deletion) leading to an increase (decrease) in price. Specifically, additions were tested against a null hypothesis of AAR's less than or equal to zero, while the null hypothesis for deletions stated AAR's greater than or equal to zero. Two-tailed tests were performed for CAAR's in order to examine the statistical validity of possible price reversions post the announcement date. A null hypothesis of CAAR's equal to zero was applied, for both additions and deletions. All hypotheses were accepted or rejected according to the t statistic, calculated as:

$$t = \frac{AAR_t}{S_{AAR}} \qquad \text{or} \qquad t = \frac{CAAR_N}{\sqrt{N}S_{AAR}}$$

B. Volume Effects

To analyse the volume effects of an index change, the volume ratio (VR) applied in Harris & Gurel (1986) was calculated, which expresses firm volume in relation to the volume of the market index:

$$VR_{it} = \frac{V_{it}}{V_{mt}} \cdot \frac{V_m}{V_i}$$

where: VR_{it} is the volume ratio for firm i during period t in the event window;

V_{it} & V_{mt} are the trading volumes of firm i and the market index,[18] respectively, during period t in the event window; and

V_i & V_m are the average trading volumes of firm i and the market index, respectively, during the estimation window.

Taking the VR's of each observation for each event day, cross sectional techniques were used to obtain the daily average volume ratio (AVR) across N firms in each of the 10 sub-samples, as well as the cumulative average volume ratio (CAVR) for analysis of

[18] As with the price effect methodology, the market index for each observation is dependent on which index the observation is being added to or deleted from, and again, the calculations were repeated using only the ASX 200 as the market index, for comparative purposes in Section V.

multi-day intervals. The standard deviation of the event window AVR's, S_{AVR} was calculated in an analogous fashion to that of the AAR standard deviation above. Assuming that a firm's trading volume is at 'normal' levels relative to the market, the expected value of the VR is 1, therefore the standard deviation measure was again used to conduct two-tailed significance tests to determine whether the null hypothesis of the VR equalling 1 would be upheld or rejected. Similar significance tests were applied for the N day CAVR where N is also the expected value of the VR under the null hypothesis.

V. RESULTS

The statistical analyses and main results of this study are presented below. As highlighted earlier, alternative calculations were performed using the ASX 200 as the universal market index to examine the index effect. The results that follow were not materially affected by this variation (and hence the alternative results are not reported), therefore the initial methodology was robust to the choice of the market index proxy.

A. Price & Volume Effects for the ASX 200

Detailed results are presented below for the 51 addition and 48 deletion observations relating to the ASX 200.

A1. Additions

Table 4 summarises the price effects of additions to the ASX 200 over daily and multi-day intervals. Figure 1 shows the CAAR's for the entire event window. The AAR on the event date was 0.95%, with a t statistic of 1.92. Despite being significant at the

TABLE 4

Stock Price Effects Surrounding the Announcement of Additions to the ASX 200

This table presents the stock price effects surrounding Standard & Poor's market announcement of additions to the ASX 200 index, over the sample period of April 2000 to December 2002. The event date (Day 0) is defined as the actual date of announcement by Standard & Poor's of an index change. AAR is the average abnormal return of the cross-sectionally combined observations for the relevant event day. CAAR is the cumulative average abnormal return between day -30 and the relevant event day (Panel A), and over selected multi-day intervals (Panel B). The t statistics and p values in Panel A (Panel B) are based upon the null hypothesis that AAR (CAAR) *is less than or equal to 0* (*is equal to 0*). The alternative hypothesis states that AAR (CAAR) *is greater than 0* (*is not equal to 0*). Statistical analysis was performed using both one and two-tailed tests and 49 degrees of freedom.

Panel A: Daily Average Abnormal Returns

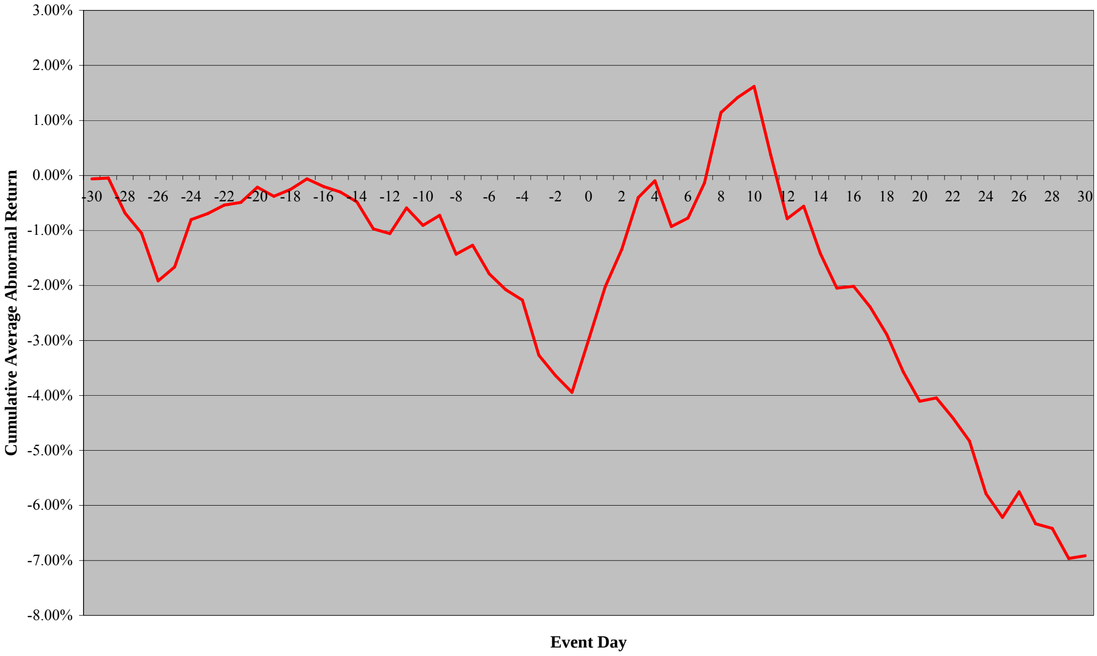
Event Day	AAR (%)	t Statistic	p Value	CAAR (%)	Median (%)
-30	-0.0611	-0.1223	0.5484	-0.0611	-0.1391
:	:	:	:	:	:
-10	-0.3156	-0.6319	0.7348	-0.9077	-0.1145
-9	0.1805	0.3615	0.3596	-0.7271	0.4309
-8	-0.7055	-1.4128	0.9180	-1.4327	-0.2226
-7	0.1644	0.3291	0.3717	-1.2683	0.0152
-6	-0.5217	-1.0447	0.8494	-1.7900	-0.1432
-5	-0.2879	-0.5766	0.7166	-2.0780	0.0152
-4	-0.1888	-0.3781	0.6465	-2.2668	0.0571
-3	-1.0014	-2.0052	0.9748	-3.2682	-0.3928
-2	-0.3688	-0.7384	0.7681	-3.6369	-0.2884
-1	-0.3066	-0.6140	0.7290	-3.9436	-0.1675
0	0.9570*	1.9164	0.0305	-2.9865	1.0243
1	0.9626*	1.9276	0.0298	-2.0239	0.1105
2	0.6794	1.3604	0.0899	-1.3446	-0.0733
3	0.9432*	1.8886	0.0324	-0.4014	0.5236
4	0.3037	0.6082	0.2729	-0.0976	-0.1283
5	-0.8321	-1.6663	0.9490	-0.9298	-0.7224
6	0.1577	0.3157	0.3768	-0.7721	0.2002
7	0.6362	1.2739	0.1043	-0.1360	0.1650
8	1.2805**	2.5641	0.0067	1.1446	0.3850
9	0.2741	0.5489	0.2928	1.4187	0.0465
10	0.1978	0.3961	0.3469	1.6165	-0.0391
:	:	:	:	:	:
30	0.0497	0.0994	0.4606	-6.9128	-0.1369

Panel B: Cumulative Average Abnormal Returns over Multiple Event Days

Interval	CAAR (%)	t Statistic	p Value
-30 to -11	-0.5921	-0.2651	0.7920
-10 to -1	-3.3515*	-2.1222	0.0388
0 to +1	1.9196**	2.7181	0.0090
+1 to +10	4.6030**	2.9147	0.0053
+11 to +30	-8.5293**	-3.8190	0.0004

Note: * Statistically significant at the 5% level.
** Statistically significant at the 1% level.

FIGURE 1
Cumulative Average Abnormal Returns (CAAR) Surrounding the Announcement of Additions to the ASX 200



5% level, as well as showing the expected positive sign, the result was considerably smaller than the announcement day price effects of US studies. The AAR on day 1 was also significant at 0.96%, as were days 3 and 8 (0.94% and 1.28%, respectively). The remaining days post the event date were all statistically insignificant at the 5% threshold.

At first glance, these results would not appear to be robustly supportive of an obvious price effect, however a different perspective is shown in Panel B of Table 4, where the CAAR's of various intervals, pre and post the event date, were calculated. The two day interval [0, +1] and ten day interval [+1, +10] showed positive CAAR's of 1.92% and 4.60% respectively, with both being strongly significant at the 1% level. The post-event CAAR over the interval [+11, +30] was -8.53% (significant at the 1% level) and indicates a strong price reversion which more than nullifies the positive price effect of the previous 10 days. Incidentally, the beginning of this reversion coincides with the approximate time of the implementation date for most observations[19] and could suggest a return to equilibrium prices following a temporary demand spike.

CAAR's prior to the event date indicate that there was no market anticipation of the index additions, confirmed by the insignificant t statistic on day -1 of 1.44.[20] Figure 1 provides a good representation of the overall price effects, clearly showing the positive price trend after the event date and the strong negative trend from day 11 onwards.

The volume effects of additions to the ASX 200 are reported in Table 5 and Figure 2. It should be noted that these volume results exclude a single observation, due to its extreme impact on the AVR and significance tests. The observation recorded a volume ratio of 266.25 on the event date, with similar sized values for the two days before and after the event. While these figures were correct and legitimate, they were of sufficient magnitude to completely bias the results therefore the observation was excluded.

The event date AVR of 1.74, although greater than 1 as would be anticipated, was statistically insignificant given the t statistic of 1.51. Despite the price effect being statistically significant, the volume figure implies that demand for those stocks added to the ASX 200 did not increase significantly, at least as far as the announcement date is concerned. Unlike the price effects however, five of the ten trading days following the event date were accompanied by significant AVR's, including two at the 1% level. This

[19] The majority of the final sample was taken from Standard & Poors' quarterly index changes, which have a gap of approximately nine to eleven trading days between the announcement and implementation dates.

[20] The t statistic refers to the interval [-30, -1]. The CAAR for shorter interval [-10, -1] is significant at the 5% level, however the sign is negative. Market anticipation of an index addition would be associated with positive returns, not negative.

TABLE 5

Trading Volume Effects Surrounding the Announcement of Additions to the ASX 200

This table presents the trading volume effects surrounding Standard & Poor's market announcement of additions to the ASX 200 index, over the sample period of April 2000 to December 2002. The event date (Day 0) is defined as the actual date of announcement by Standard & Poor's of an index change. AVR is the average volume ratio of the cross-sectionally combined observations for the relevant event day. CAVR is the cumulative average volume ratio over selected multi-day intervals, where N is the number of days in the interval. The t statistics and p values are based upon the null hypothesis that AVR *is* equal to 1 (or that CAVR *is* equal to N). The alternative hypothesis states that AVR *is not* equal to 1 (or CAVR *is not* equal to N). Statistical analysis was performed using two-tailed tests and 49 degrees of freedom.

Panel A: Daily Average Volume Ratio

Event Day	AVR	t Statistic	p Value
-30	1.3774	0.7690	0.4455
:	:	:	:
-10	0.7535	0.5023	0.6177
-9	1.0533	0.1085	0.9140
-8	1.5306	1.0813	0.2848
-7	1.0596	0.1215	0.9038
-6	0.9026	0.1985	0.8434
-5	0.7882	0.4316	0.6679
-4	1.9992*	2.0364	0.0470
-3	0.7170	0.5768	0.5667
-2	0.9736	0.0539	0.9573
-1	1.1143	0.2329	0.8168
0	1.7409	1.5099	0.1374
1	1.5254	1.0707	0.2894
2	1.3643	0.7425	0.4613
3	1.9699	1.9766	0.0536
4	2.1224*	2.2874	0.0264
5	1.4953	1.0094	0.3176
6	1.4108	0.8371	0.4065
7	2.0572*	2.1546	0.0360
8	3.7082**	5.5192	0.0000
9	2.4248**	2.9038	0.0055
10	2.0998*	2.2414	0.0295
:	:	:	:
30	1.1513	0.3083	0.7591

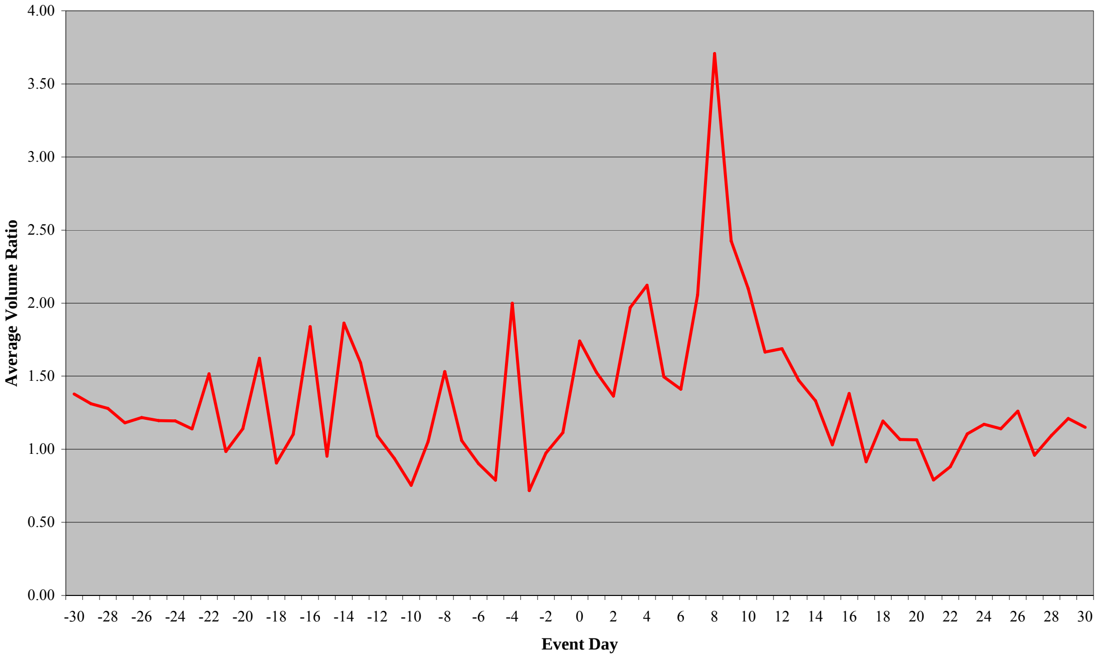
Panel B: Cumulative Average Volume Ratio over Multiple Event Days

Interval	CAVR	t Statistic	p Value
-10 to -1	10.8919	0.5748	0.5680
0 to +10	21.9190**	6.7094	0.0000
+11 to +30	23.5716	1.6276	0.1099

Note: * Statistically significant at the 5% level.
** Statistically significant at the 1% level.

FIGURE 2

Average Volume Ratio (AVR) Surrounding the Announcement of Additions to the ASX 200



was supported by the cumulative average volume ratio (CAVR) for the interval [0, +10] of 21.92 which was also strongly significant at the 1% level.[21] Thus, the significant and positive price effect over the same interval was corroborated by the associated rise in trading volume, suggesting that added stocks receive strong demand after the announcement of their inclusion. Still looking at the post-event period, the CAVR for interval [+11, +30] is statistically insignificant, implying that trading volume had returned to relatively normal levels. This supports the corresponding price reversal shown in Table 2 as being the result of a lack of sustained demand post the implementation date.

In the pre-event period, AVR's for 29 of the 30 trading days were insignificant, as was the CAVR for the interval [-10, -1], which is consistent with the lack of market anticipation suggested by the price effects.

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[21] As 11 trading days comprise the interval, the expected and null hypothesis value for the CAVR was 11.

A2. Deletions

Table 6 reports the price effects of deletions from the ASX 200, while Figure 3 represents the CAAR's for the 61 day event window. Deletions were associated with an event date AAR of -2.68% which was strongly significant at the 1% level (t statistic of -2.42). Of the 48 observations in this sample, 81% experienced a negative abnormal return on the event date, therefore the statistical significance is robust given that the price effect was not attributable to a small number of outliers. This negative AAR is noticeably larger than that observed for deletions in other international studies (including early US studies), although Lynch & Mendenhall (1997) and Australia's Chan & Howard (2002) detected larger deletion price effects in their research.

For the post event period, Panel B of Table 6 reveals large negative CAAR's of -2.72% and -6.07% for the intervals [0, +1] and [+1, +10], respectively. Both figures are statistically insignificant at the 5% level,[22] yet the sign and magnitude of the percentages would still seem to support a price effect following the deletion announcement, caused by a decrease in demand. This point is further reinforced by the graphical depiction in Figure 3, where a clear downward trend in the CAAR can be seen between days 0 and 10.

Over interval [+11, +30] the price reversion feature detected for index additions is again obvious. The positive CAAR of 17.65% is economically large and statistically significant at all levels with a t statistic of 3.56. Interestingly, as with the additions, this price reversion also begins around the approximate implementation date (day 12) and is evident in Figure 3, along with the enduring uptrend in the CAAR.

[22] The results are significant at the 10% level.

TABLE 6

Stock Price Effects Surrounding the Announcement of Deletions from the ASX 200

This table presents the stock price effects surrounding Standard & Poor's market announcement of deletions to the ASX 200 index, over the sample period of April 2000 to December 2002. The event date (Day 0) is defined as the actual date of announcement by Standard & Poor's of an index change. AAR is the average abnormal return of the cross-sectionally combined observations for the relevant event day. CAAR is the cumulative average abnormal return between day -30 and the relevant event day (Panel A), and over selected multi-day intervals (Panel B). The t statistics and p values in Panel A (Panel B) are based upon the null hypothesis that AAR (CAAR) *is greater than or equal to 0* (*is equal to 0*). The alternative hypothesis states that AAR (CAAR) *is less than 0* (*is not equal to 0*). Statistical analysis was performed using both one and two-tailed tests and 49 degrees of freedom.

Panel A: Daily Average Abnormal Returns

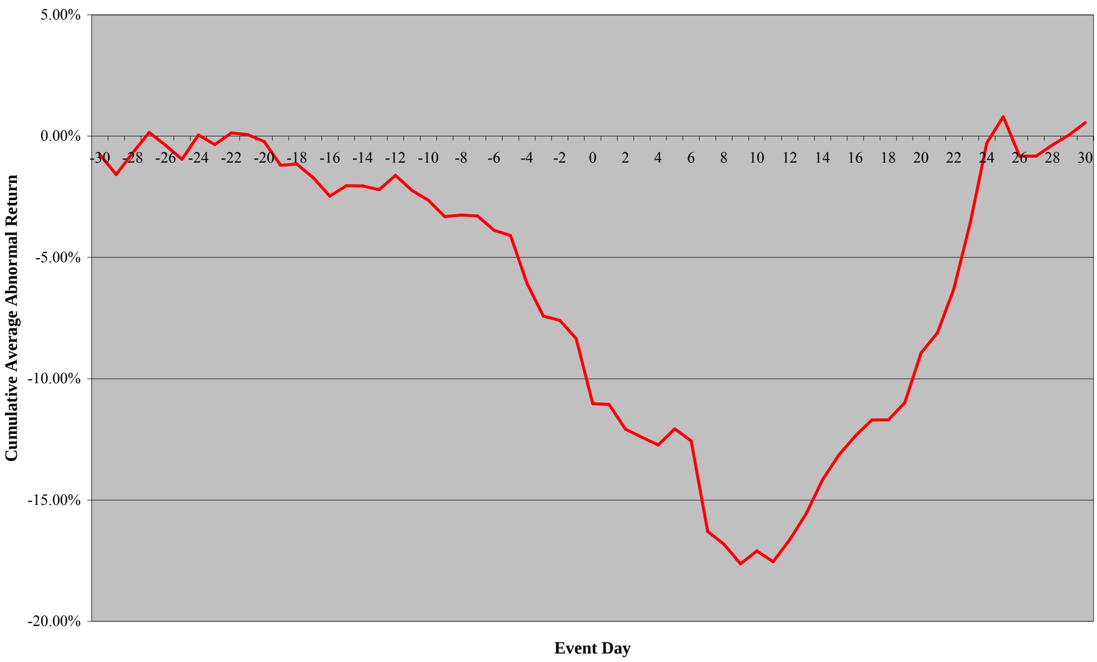
Event Day	AAR (%)	t Statistic	p Value	CAAR (%)	Median (%)
-30	-0.7617	-0.6880	0.2473	-0.7617	0.0563
:	:	:	:	:	:
-10	-0.3958	-0.3575	0.3611	-2.6421	-0.2745
-9	-0.6797	-0.6139	0.2710	-3.3218	-0.1455
-8	0.0709	0.0641	0.5254	-3.2509	0.0045
-7	-0.0392	-0.0354	0.4860	-3.2901	-0.1159
-6	-0.5935	-0.5360	0.2972	-3.8835	-0.6477
-5	-0.2125	-0.1919	0.4243	-4.0960	-0.1195
-4	-1.9740*	-1.7831	0.0403	-6.0700	0.0242
-3	-1.3493	-1.2188	0.1143	-7.4193	-0.4185
-2	-0.1767	-0.1596	0.4369	-7.5960	-0.3278
-1	-0.7490	-0.6766	0.2509	-8.3450	-0.5729
0	-2.6798**	-2.4206	0.0096	-11.0248	-1.8731
1	-0.0418	-0.0377	0.4850	-11.0665	-0.0171
2	-1.0130	-0.9150	0.1823	-12.0795	-0.6850
3	-0.3344	-0.3021	0.3819	-12.4139	0.0908
4	-0.3228	-0.2916	0.3859	-12.7367	-0.1639
5	0.6760	0.6106	0.7279	-12.0608	0.0494
6	-0.5041	-0.4554	0.3254	-12.5649	-0.1455
7	-3.7256**	-3.3652	0.0007	-16.2905	-1.6638
8	-0.5351	-0.4833	0.3155	-16.8256	-0.1929
9	-0.8034	-0.7257	0.2357	-17.6290	0.1003
10	0.5319	0.4805	0.6835	-17.0971	-0.5286
:	:	:	:	:	:
30	0.5032	0.4545	0.6743	0.5520	0.5602

Panel B: Cumulative Average Abnormal Returns over Multiple Event Days

Interval	CAAR (%)	t Statistic	p Value
-30 to -11	-2.2463	-0.4537	0.6520
-10 to -1	-6.0987	-1.7420	0.0877
0 to +1	-2.7215	-1.7383	0.0883
+1 to +10	-6.0723	-1.7345	0.0890
+11 to +30	17.6491**	3.5647	0.0008

Note: * Statistically significant at the 5% level.
** Statistically significant at the 1% level.

FIGURE 3
Cumulative Average Abnormal Returns (CAAR) Surrounding the Announcement of Deletions from the ASX 200



The pre-event period provides another example of the value of CAAR analysis over multi-day intervals. Between days -30 and -1 the CAAR was -8.35%, which is insignificant and supports a conclusion of no market anticipation of the forthcoming deletion. Over the shorter horizon of [-10, -1] however, a large result of -6.10% was recorded. The price effect is marginally insignificant at the 5% level, however the notion of market anticipation is difficult to ignore, given that AAR's on nine of the ten trading days before the event were negative.

Volume effects for ASX 200 deletions are contained in Table 7 and Figure 4. The AVR on the event date was 1.99 with a t statistic of 1.97, placing it on the borderline of being significant at the 5% level. Additionally, 60% of the sample observations recorded a volume ratio greater than normal (greater than 1) on this day, therefore it would appear that index deletions cause a significant volume effect upon their announcement. The result also corroborates the earlier finding of a significant

TABLE 7

Trading Volume Effects Surrounding the Announcement of Deletions from the ASX 200

This table presents the trading volume effects surrounding Standard & Poor's market announcement of deletions to the ASX 200 index, over the sample period of April 2000 to December 2002. The event date (Day 0) is defined as the actual date of announcement by Standard & Poor's of an index change. AVR is the average volume ratio of the cross-sectionally combined observations for the relevant event day. CAVR is the cumulative average volume ratio over selected multi-day intervals, where N is the number of days in the interval. The t statistics and p values are based upon the null hypothesis that AVR *is* equal to 1 (or that CAVR *is* equal to N). The alternative hypothesis states that AVR *is not* equal to 1 (or CAVR *is not* equal to N). Statistical analysis was performed using two-tailed tests and 49 degrees of freedom.

Panel A: Daily Average Volume Ratio

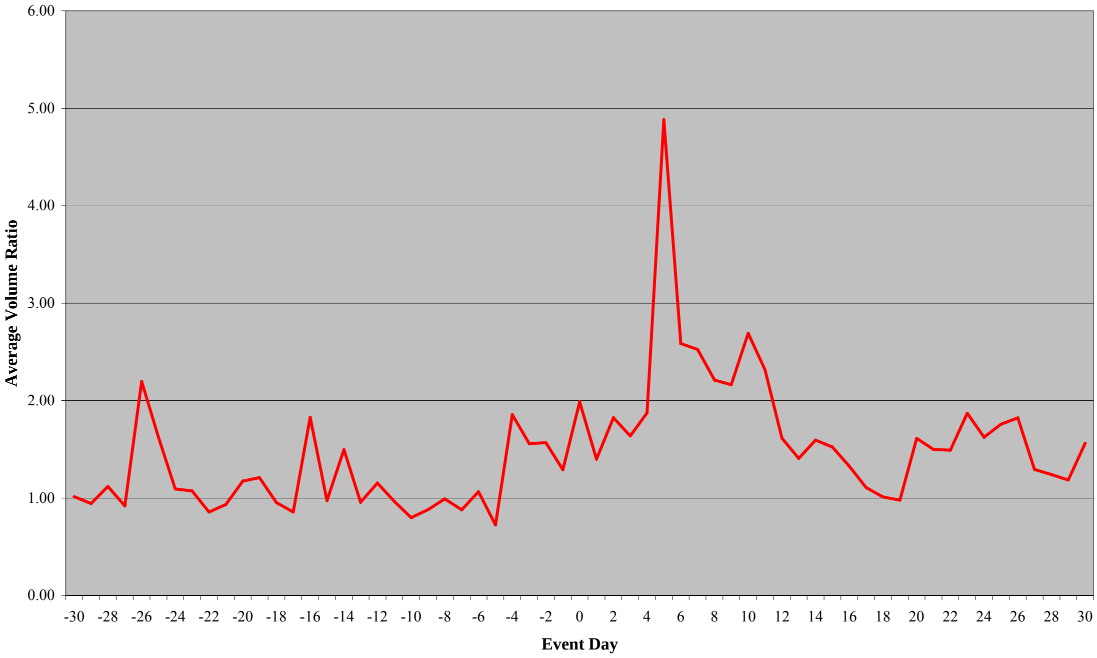
Event Day	AVR	t Statistic	p Value
-30	1.0140	0.0279	0.9779
:	:	:	:
-10	0.7976	0.4033	0.6885
-9	0.8806	0.2380	0.8129
-8	0.9920	0.0159	0.9874
-7	0.8781	0.2428	0.8091
-6	1.0634	0.1263	0.9000
-5	0.7235	0.5509	0.5841
-4	1.8538	1.7014	0.0951
-3	1.5587	1.1133	0.2709
-2	1.5684	1.1327	0.2627
-1	1.2908	0.5796	0.5648
0	1.9865	1.9659	0.0549
1	1.3992	0.7955	0.4301
2	1.8242	1.6426	0.1067
3	1.6368	1.2691	0.2103
4	1.8729	1.7396	0.0881
5	4.8829**	7.7379	0.0000
6	2.5852**	3.1591	0.0027
7	2.5236**	3.0363	0.0038
8	2.2096*	2.4105	0.0196
9	2.1632*	2.3181	0.0246
10	2.6907**	3.3693	0.0015
:	:	:	:
30	1.5633	1.1225	0.2670

Panel B: Cumulative Average Volume Ratio over Multiple Event Days

Interval	CAVR	t Statistic	p Value
-10 to -1	11.6069	1.0127	0.3161
0 to +10	25.7750**	8.8777	0.0000
+11 to +30	29.8343**	4.3822	0.0001

Note: * Statistically significant at the 5% level.
** Statistically significant at the 1% level.

FIGURE 4
Average Volume Ratio (AVR) Surrounding the Announcement of Deletions from the ASX 200



event date price effect, pointing to an overall decrease in demand for deleted stocks. As with ASX 200 additions, the volume effect was maintained for several days, with six of the ten subsequent trading days showing significant AVR's (including four at the 1% level), while the CAVR for interval [0, +10] was also strongly significant. This supports the notion that demand continued to decrease until the implementation date.

The two results that followed were interesting as they did not correlate to the observed price effects. Firstly, the CAVR for interval [+11, +30] remained statistically significant (t statistic was 4.38) implying that the strong price reversal of 17.65% was not simply a function of demand returning to normal levels, but rather the result of a subsequent increase in demand for the deleted stocks after the deletion had been implemented. This anomaly will be discussed further in Section VI. Secondly, with respect to the pre-event period, AVR's were insignificant for all 30 days prior to the event date, as was the CAVR during interval [-10, -1], despite there being a price effect that alluded to market anticipation. The lack of increased volume in excess of normal levels is suggestive of the market anticipation being influenced by risk arbitrageurs, who could be expected to trade on far lower volume than institutional players such as index funds.

B. Price & Volume Effects for the ASX Supplementary Indices

Results for the four ASX supplementary indices are summarised below for the 100 addition and 124 deletion observations.

B1. Additions

Table 8 and Figure 5 provide the results of additions to the supplementary indices. Table 8 summarises the AAR's for the two days either side of the event date, as well as the CAAR's over various intervals, sorted by index. Unlike the ASX 200, none of the four indices recorded a significant AAR on the event date, although the ASX 20 did display a strongly significant AAR on day 1, with an AAR of 2.03% and t statistic of 2.45. However, the extremely small sample size (three observations) of this index implies that the result is suspect, and consequently it will not be relied upon to form any meaningful conclusions.

Over the 61 day event window, the ASX 20, ASX 50 and ASX 100 had only a minor number of significant AAR's between them, a finding that is supported by CAAR analysis which showed all intervals bar one[23] as being statistically insignificant. Thus the evidence for these three indices supports the lack of any price effect associated with an index addition.

[23] The interval [-30, -11] for the ASX 50 is statistically significant at the 5% level, nevertheless this is not sufficient to provide evidence of a price effect (or market anticipation), as it is too far removed from the event date.

TABLE 8
Daily and Aggregate Stock Price Effects Surrounding the Announcement of Additions to the ASX Supplementary Indices

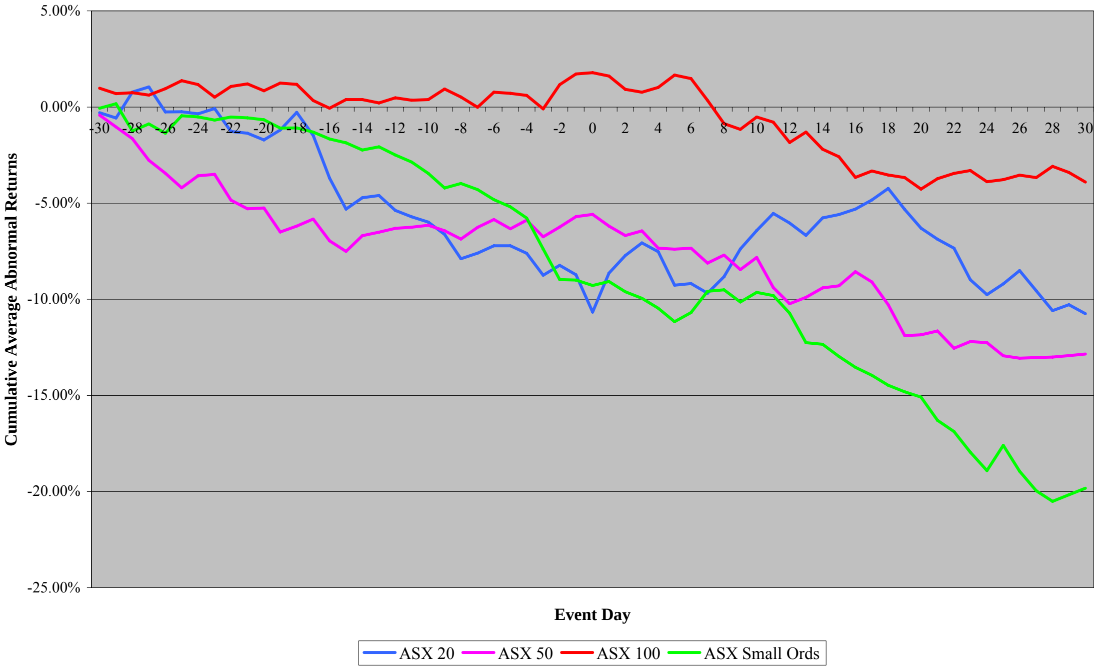
This table presents the stock price effects surrounding Standard & Poor's market announcement of additions to the ASX supplementary indices, over the sample period of April 2000 to December 2002. The event date (Day 0) is defined as the actual date of announcement by Standard & Poor's of an index change. AAR is the average abnormal return of the cross-sectionally combined observations for the relevant event day. CAAR is the cumulative average abnormal return over selected multi-day intervals. The t statistics and p values are based upon the null hypothesis that AAR (CAAR) *is less than or equal to 0* (*is equal to 0*). The alternative hypothesis states that AAR (CAAR) *is greater than 0* (*is not equal to 0*). Statistical analysis was performed using both one and two-tailed tests and 49 degrees of freedom.

Event Day	AAR (%)	t Statistic	p Value	Interval	CAAR (%)	t Statistic	p Value
S&P/ASX 20							
-2	0.5217	0.6310	0.2655	-30 to -11	-5.7046	-1.5427	0.1292
-1	-0.4991	-0.6036	0.7256	-10 to -1	-3.0215	-1.1556	0.2533
0	-1.9390	-2.3451	0.9885	0 to +1	0.0901	0.0771	0.9389
1	2.0291**	2.4541	0.0088	+1 to +10	4.2398	1.6215	0.1112
2	0.9134	1.1047	0.1373	+11 to +30	-4.3239	-1.1693	0.2478
S&P/ASX 50							
-2	0.5195	0.8233	0.2071	-30 to -11	-6.2438*	-2.2124	0.0315
-1	0.5400	0.8558	0.1981	-10 to -1	0.5491	0.2752	0.7843
0	0.1150	0.1823	0.4280	0 to +1	-0.4958	-0.5556	0.5810
1	-0.6109	-0.9680	0.8311	+1 to +10	-2.2464	-1.1257	0.2657
2	-0.4878	-0.7730	0.7784	+11 to +30	-5.0197	-1.7787	0.0814
S&P/ASX 100							
-2	1.2535*	2.3934	0.0102	-30 to -11	0.3624	0.1548	0.8776
-1	0.5604	1.0700	0.1449	-10 to -1	1.3587	0.8204	0.4159
0	0.0684	0.1305	0.4483	0 to +1	-0.1083	-0.1463	0.8843
1	-0.1767	-0.3374	0.6314	+1 to +10	-2.3097	-1.3946	0.1693
2	-0.6949	-1.3269	0.9047	+11 to +30	-3.3749	-1.4409	0.1558
S&P/ASX Small Ordinaries							
-2	-1.5937	-2.6596	0.9948	-30 to -11	-2.8638	-1.0687	0.2904
-1	-0.0253	-0.0423	0.5168	-10 to -1	-6.1315**	-3.2357	0.0022
0	-0.2895	-0.4831	0.6844	0 to +1	-0.0731	-0.0863	0.9316
1	0.2164	0.3611	0.3598	+1 to +10	-0.3616	-0.1908	0.8494
2	-0.5388	-0.8992	0.8136	+11 to +30	-10.1837**	-3.8001	0.0004

Note: * Statistically significant at the 5% level.
** Statistically significant at the 1% level.

Interestingly, for the ASX Small Ordinaries, the post-event interval [+11, +30] showed a negative and strongly significant CAAR of 10.18%. This is a curious result, as it would seem to indicate a price reversal analogous to the results for additions to the ASX 200, despite the ASX Small Ordinaries displaying no other evidence of any

FIGURE 5
Cumulative Average Abnormal Returns (CAAR) Surrounding the Announcement of Additions to the ASX Supplementary Indices



demand induced price effects during the event window. This finding will be discussed further in Section VI.

Figure 5 clearly represents the above results, specifically, the randomness in the CAAR trends for the first three indices, indicative of the absent price effects, and the apparent price 'reversal' after day 11 for the ASX Small Ordinaries.

It was mentioned in an earlier section that due to the construction of the Standard & Poor's indices, which permits a stock to be a constituent of more than one index at a time, it is possible for a stock to be added to or deleted from multiple indices on the same announcement date. Over the period of this study, this was especially common with the ASX 200 and ASX Small Ordinaries. Given the difference in index fund presence between these two indices, it is plausible that by including observations for the ASX Small Ordinaries, which were also simultaneous observations for the ASX

TABLE 9
Trading Volume Effects Surrounding the Announcement of Additions to the ASX Supplementary Indices

This table presents the trading volume effects surrounding Standard & Poor's market announcement of additions to the ASX supplementary indices, over the sample period of April 2000 to December 2002. The event date (Day 0) is defined as the actual date of announcement by Standard & Poor's of an index change. AVR is the average volume ratio of the cross-sectionally combined observations for the relevant event day. The t statistics and p values are based upon the null hypothesis that AVR *is* equal to 1. The alternative hypothesis states that AVR *is not* equal to 1. Statistical analysis was performed using two-tailed tests and 49 degrees of freedom.

Event Day	AVR	t Statistic	p Value
S&P/ASX 20			
-2	1.0041	0.0085	0.9933
-1	1.3954	0.8252	0.4132
0	1.1439	0.3004	0.7651
1	1.8759	1.8282	0.0735
2	1.3979	0.8304	0.4102
S&P/ASX 50			
-2	0.8026	0.3525	0.7259
-1	1.3147	0.5621	0.5766
0	1.1867	0.3334	0.7402
1	1.0239	0.0427	0.9661
2	1.2658	0.4747	0.6371
S&P/ASX 100			
-2	0.9113	0.2174	0.8288
-1	0.9075	0.2267	0.8216
0	1.5782	1.4166	0.1628
1	1.3822	0.9364	0.3536
2	0.9502	0.1220	0.9034
S&P/ASX Small Ordinaries			
-2	0.6959	1.0764	0.2869
-1	0.7606	0.8475	0.4008
0	0.9801	0.0703	0.9442
1	0.9668	0.1174	0.9070
2	1.2668	0.9443	0.3496

200, a bias may have been introduced in the results of the ASX Small Ordinaries.[24] Therefore, the sample for each supplementary index was screened to exclude these 'double' observations. The results and statistical analyses from this revised sample were not materially different from the results for the supplementary indices provided above.[25]

[24] As it was anticipated that price and volume effects for the ASX 200 would be more evident that the ASX Small Ordinaries, by including these 'double' observations, an effect may have been attributed to the Small Ordinaries index when it was in fact caused by the concurrent observation in the ASX 200.

[25] This also applies to the volume analysis of index additions, and both of the price and volume analyses for deletions. Therefore, the initial methodology was robust to the inclusion of the double observations.

The volume effects of additions to the supplementary indices are summarised in Table 9. As with the ASX 200, a single observation was removed due to its overbearing influence on the results. None of the indices reported an AVR of any significance on the event day. Likewise, this pattern was consistent over the entire event window for each index, and is further reinforced by the fact that the CAVR measures (not shown) were also insignificant for a number of different intervals. This is suggestive of a non-existent volume effect, consistent with the finding of no price effect. Overall, it can be concluded that additions to the supplementary indices are not associated with a significant change in demand, and therefore do not induce the index effect.

B2. Deletions

Index deletions to the supplementary indices revealed broadly similar outcomes to that of additions, and are shown in Tables 10 and 11 and Figure 6. Again the event day for each index had an insignificant AAR, combined with insignificant CAAR's for the usual intervals. Similar to the index additions, the ASX Small Ordinaries was the singular anomaly, given its positive CAAR of 10.45% over interval [+11, +30] (significant at the 1% level). Three of the four indices displayed non-significant event date AVR's, the ASX 50 being the exception with a result of 1.86, which was significant at the 5% level. As this outcome was not corroborated with an event date price effect, nor any significant CAVR's in the surrounding period,[26] the result is of limited importance and is not indicative of a volume effect. Overall, the combined lack of price and volume effects lead to the conclusion that no demand shift, and thus no index effect was apparent following deletions from the supplementary indices.

[26] Particularly the post-event period, such as interval [0, +10].

TABLE 10

Daily and Aggregate Stock Price Effects Surrounding the Announcement of Deletions from the ASX Supplementary Indices

This table presents the stock price effects surrounding Standard & Poor's market announcement of deletions to the ASX supplementary indices, over the sample period of April 2000 to December 2002. The event date (Day 0) is defined as the actual date of announcement by Standard & Poor's of an index change. AAR is the average abnormal return of the cross-sectionally combined observations for the relevant event day. CAAR is the cumulative average abnormal return over selected multi-day intervals. The t statistics and p values are based upon the null hypothesis that AAR (CAAR) *is greater than or equal to 0* (*is equal to 0*). The alternative hypothesis states that AAR (CAAR) *is less than 0* (*is not equal to 0*). Statistical analysis was performed using both one and two-tailed tests and 49 degrees of freedom.

Event Day	AAR (%)	t Statistic	p Value	Interval	CAAR (%)	t Statistic	p Value
S&P/ASX 20							
-2	-0.9564	-1.1887	0.1201	-30 to -11	-1.8868	-0.5243	0.6024
-1	-1.7140*	-2.1303	0.0190	-10 to -1	4.2515	1.6710	0.1010
0	-0.8201	-1.0192	0.1565	0 to +1	-0.8990	-0.7901	0.4332
1	-0.0789	-0.0981	0.4611	+1 to +10	2.1426	0.8421	0.4037
2	-1.2145	-1.5094	0.0687	+11 to +30	0.1848	0.0514	0.9592
S&P/ASX 50							
-2	-1.3986	-1.2457	0.1093	-30 to -11	-2.3682	-0.4716	0.6392
-1	1.6866	1.5022	0.9303	-10 to -1	-1.8081	-0.5092	0.6128
0	-1.2121	-1.0796	0.1428	0 to +1	-1.4422	-0.9083	0.3681
1	-0.2301	-0.2049	0.4192	+1 to +10	4.1276	1.1625	0.2505
2	0.2276	0.2027	0.5799	+11 to +30	-0.3036	-0.0605	0.9520
S&P/ASX 100							
-2	-1.8928	-1.6636	0.0512	-30 to -11	-2.0251	-0.3980	0.6923
-1	-1.2067	-1.0606	0.1470	-10 to -1	-4.1755	-1.1606	0.2513
0	-1.7078	-1.5011	0.0698	0 to +1	-1.6184	-1.0058	0.3193
1	0.0894	0.0786	0.5312	+1 to +10	-0.5104	-0.1419	0.8878
2	-0.2553	-0.2244	0.4117	+11 to +30	3.5489	0.6975	0.4887
S&P/ASX Small Ordinaries							
-2	-0.5519	-0.7443	0.2301	-30 to -11	2.7518	0.8298	0.4106
-1	0.1728	0.2330	0.5917	-10 to -1	0.0158	0.0068	0.9946
0	0.1711	0.2308	0.5908	0 to +1	-0.3034	-0.2893	0.7735
1	-0.4746	-0.6400	0.2626	+1 to +10	-2.0633	-0.8799	0.3831
2	0.4766	0.6427	0.7383	+11 to +30	10.4517**	3.1517	0.0027

Note: * Statistically significant at the 5% level.
** Statistically significant at the 1% level.

TABLE 11
Trading Volume Effects Surrounding the Announcement of Deletions from the ASX Supplementary Indices

This table presents the trading volume effects surrounding Standard & Poor's market announcement of deletions to the ASX supplementary indices, over the sample period of April 2000 to December 2002. The event date (Day 0) is defined as the actual date of announcement by Standard & Poor's of an index change. AVR is the average volume ratio of the cross-sectionally combined observations for the relevant event day. The t statistics and p values are based upon the null hypothesis that AVR *is* equal to 1. The alternative hypothesis states that AVR *is not* equal to 1. Statistical analysis was performed using two-tailed tests and 49 degrees of freedom.

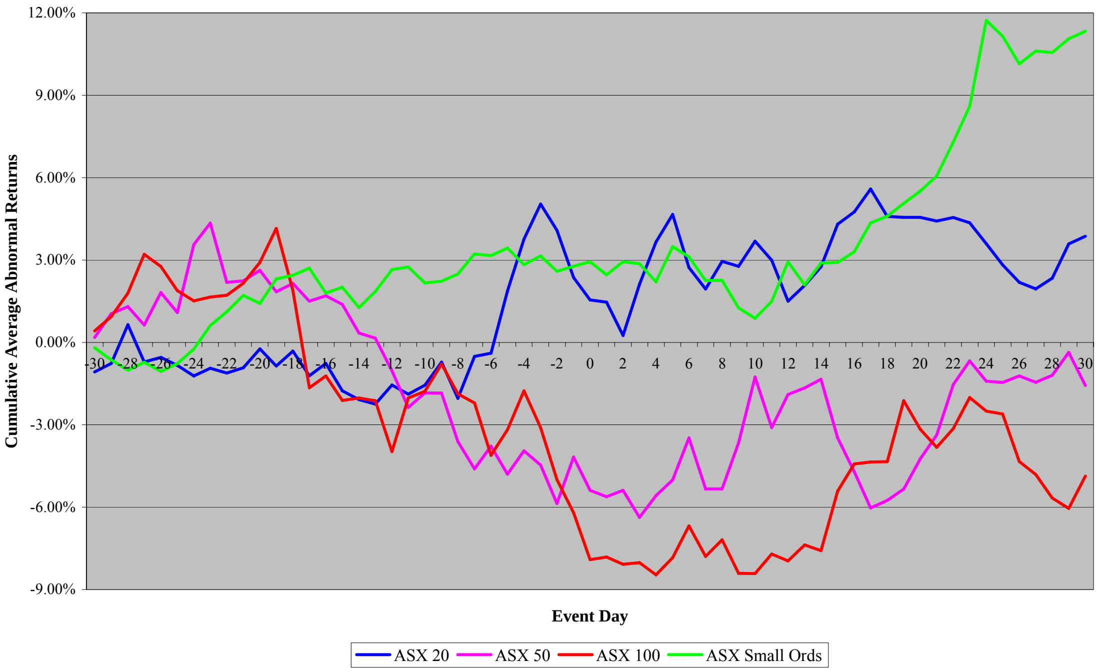
Event Day	AVR	t Statistic	p Value
S&P/ASX 20			
-2	0.3671*	2.1014	0.0407
-1	0.8924	0.3574	0.7223
0	0.9034	0.3209	0.7496
1	0.6566	1.1402	0.2596
2	1.3296	1.0945	0.2790
S&P/ASX 50			
-2	1.2463	0.7317	0.4678
-1	1.2948	0.8759	0.3853
0	1.8581*	2.5493	0.0139
1	1.3389	1.0069	0.3188
2	1.0937	0.2782	0.7820
S&P/ASX 100			
-2	1.1798	0.2641	0.7928
-1	2.4272*	2.0959	0.0412
0	2.1143	1.6364	0.1080
1	1.7728	1.1349	0.2618
2	1.4681	0.6874	0.4950
S&P/ASX Small Ordinaries			
-2	1.5222	1.9354	0.0586
-1	0.8138	0.6902	0.4933
0	1.1398	0.5181	0.6066
1	0.9461	0.1998	0.8425
2	0.8534	0.5433	0.5893

Note: * Statistically significant at the 5% level.

VI. DISCUSSION

The results of this study indicate the presence of significant price and volume effects during the period that follows the announcement of additions to or deletions from the ASX 200 index. Additionally, both additions and deletions are associated with a significant price and volume effect on the date of announcement itself. Taken together,

FIGURE 6
Cumulative Average Abnormal Returns (CAAR) Surrounding the Announcement of Deletions from the ASX Supplementary Indices



the results point towards strong evidence of the index effect, consistent with the observations from US and international research. The four supplementary indices by contrast, did not show any evidence of the index effect for either additions or deletions. The following section provides a discussion of how these key results are reconciled with the four hypotheses for the index effect, and briefly addresses certain anomalous findings from the study and their possible explanations.

Given the specifics of the observations for the ASX 200, the evidence indicates strong support for the price pressure hypothesis rather than the imperfect substitute hypothesis as the most suitable explanation for the results, in terms of the demand impact caused by index funds. The decisive factor in this conclusion was the presence of both significant price and volume effects in the 10 trading days after the announcement, coupled with significant price reversals during the latter portion of the event window. This corresponds exactly to the price pressure hypothesis, which states that index funds create a temporary demand spike as they attempt to realign their index linked portfolios. This leads to the index effect being observed for the concerned stocks, which is later reversed when demand returns to its equilibrium level as the funds complete their realignment. The imperfect substitute hypothesis predicts a similar but sustained rise in demand, a fact that is not supported by the results, hence its rejection. As the observed price reversals were sufficiently large to nullify the initial index effect, the findings are more consistent with that of Harris & Gurel (1986), than Lynch & Mendenhall (1997).[27]

At face value, the acceptance of the price pressure hypothesis would seem to preclude the information and liquidity hypotheses as viable explanations, as they, like the imperfect substitute hypothesis, predict a sustained index effect with no price reversal. However, as raised in a previous section, many studies have not been able to completely account for these two hypotheses, as they are somewhat more complex to examine empirically. The purpose of including the four ASX supplementary indices was to attempt to overcome exactly this obstacle. In order for the index effect of the ASX 200 to be linked with the information or liquidity hypotheses, the supplementary indices would also be expected to show significant index effects, as these two hypotheses are not conditional on the presence of a demand shock due to index fund activity.[28] However, the lacking evidence of any index effect in the supplementary indices provides a strong precedent for rejecting the information hypothesis and the liquidity

[27] Harris & Gurel (1986) detected full price reversion, supporting the price pressure hypothesis. Lynch & Mendenhall (1997) found partial price reversion, supporting both the price pressure and imperfect substitute hypotheses.

[28] Recall that the supplementary indices, with the odd exception, are not replicated by index funds.

hypothesis. This further reinforces the original conclusion that temporary price pressure on ASX 200 constituents accounts for the main findings of the research.

Two anomalies worthy of further discussion include the significant volume effect associated with the price reversal for ASX 200 deletions, and the significant price effect over the interval [+11, +30] for both additions and deletions involving the ASX Small Ordinaries. The former anomaly is puzzling given that price reversals are normally caused by a return to equilibrium demand levels, rather than a complete shift from decreased demand (which resulted in the initial negative price effect) to increased demand. The latter anomaly is of interest as it has characteristics of a reversion price effect, despite their being no other index effects for the ASX Small Ordinaries in the first place. In both cases, a possible explanation could involve the influences of growth based fund managers and investors, and their belief that an index deletion (addition) provides a signal that the underlying stock is sufficiently undervalued (overvalued) following the index change to warrant its purchase (sale). This is especially so considering that smaller capitalised stocks are likely to demonstrate more extreme price effects as the result of changed market awareness, than their larger, better known counterparts. Growth oriented funds/investors may feel that deleted stocks stand to receive less market scrutiny in the future, implying that the future growth prospects of these firms will not be as widely known, thereby creating a potential buying opportunity. Conversely, added stocks, by virtue of the expected increased scrutiny are likely to be traded at fair value, with most of the future growth prospects being priced in, hence reducing the attractiveness of these firms to growth investors.

VII. CONCLUSION

This paper has investigated the index effect for stocks that are added to and deleted from the ASX 200 and four supplementary indices, over the 61 day period surrounding the announcement of these changes to the market.

The results have indicated clear stock price effects over the 10 day interval following the announcement, with additions to (deletions from) the ASX 200 being associated with significant increases (decreases) in price. Additions and deletions from the ASX 200 also displayed a significant price effect on the actual date of announcement. Both types of changes were followed by full price reversions, generally commencing around the approximate date of implementation. These price effects are corroborated by the analysis of trading volume, which displayed similar significant increases in excess of normal trading levels, during the days following the announcement date. Evidence was also found for market anticipation of deletions from the ASX 200, although the lack of any corresponding volume effect points toward risk arbitrageurs as the likely cause.

Overall, the results are consistent with the notion that index funds respond to an index change by buying or selling large blocks of the necessary stocks in order to maintain their replication, in the period between the announcement and implementation dates. This, coupled with the price reversion observation provides strong support for the price pressure hypothesis, whereby index fund activity induces a temporary shift in demand, giving rise to the short term price and volume effects. The absence of an index effect in any of the supplementary indices refutes the information and liquidity hypotheses as possible explanations.

The price effects for the ASX 200, although significant, are generally of a smaller magnitude than those observed for the US market's S&P 500, which is reflective of the smaller nature of the index funds industry in Australia. The popularity and size of index funds under management has increased markedly over recent years however, and it is plausible that the index effect in Australia may grow in line with that of index funds in the coming years. Hence, continued investigation of this research question is warranted in the future.

Likewise, Australian studies focusing directly on the trading activities of index funds surrounding ASX 200 changes, in the manner of Pruitt & Wei (1989), or an emphasis on the behaviour of stock linked derivative products such as options and futures, in the manner of Dhillon & Johnson (1991) may help to shed further light on the exact nature of the index effect in the Australian market.

REFERENCES

Amihud, Y. and H. Mendelson (1986), "Asset Pricing and the Bid-Ask Spread", *Journal of Financial Economics*, 17, 223-249.

Australian Stock Exchange Website, www.asx.com.au/markets/l3/shortsales_am3.shtm

Barontini, R. and S. Rigamonti (2000), "Stock Index Futures and the Effect on the Cash Market in Italy: Evidence from Changes in Indexes' Composition", EFMA 2000 Athens Meetings.

Bechmann, K.L. (2002), "Price and Volume Effects Associated with Changes in the Danish Blue Chip Index: The KFX Index", EFMA 2002 London Meetings.

Beneish, M. and J.C. Gardner (1995), "Information Costs and Liquidity Effects from Changes in the Dow Jones Industrial Average List", *Journal of Financial and Quantitative Analysis*, 30, 135-157.

Beneish, M. and R.R. Whaley (1996), "An Anatomy of the S&P Game: The Effects of Changing the Rules", *Journal of Finance*, 51, 1909-1930.

Bildik, R. and G. Gülay (2001), "Effects of Changes in Index Composition on Stock Market: Evidence from Istanbul Stock Exchange", EFMA 2001 Lugano Meetings.

Brealey, R.A. (2000), "Stock Prices, Stock Indexes and Index Funds", *Bank of England Quarterly Bulletin*, 40, 61-68.

Breazeale, J.P. and C.J. Cuny (2002), "Stock Price Effects of Changes in the S&P MidCap 400 and the S&P SmallCap 600 Indices", working paper, Texas A&M University.

Brown, S.J. and J.B. Warner (1985), "Using Daily Stock Returns: The Case of Event Studies", *Journal of Financial Economics*, 14, 3-32.

Chan, H.W.H. and P.F. Howard (2002), “Additions to and Deletions from an Open-Ended Market Index: Evidence from the Australian All Ordinaries”, *Australian Journal of Management*, 27, 45-74.

Deininger, C., C. Kaserer and S. Roos (2000), “Stock Price Effects Associated with Index Replacements in Germany”, EFMA 2001 Lugano Meetings.

Dhillon, U. and H. Johnson (1991), “Changes in the S&P 500 List”, *Journal of Business*, 64, 75-85.

Elayan, F., W. Li and J. Pinfold (2000), “Price Effects of Changes to the Composition of New Zealand Share Indices”, working paper, Massey University.

Goetzmann W.N. and M. Garry (1986), Does Delisting from the S&P 500 Affect Stock Price?”, *Financial Analysts Journal*, March-April, 64-69.

Harris, L. and E. Gurel (1986), “Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressure”, *Journal of Finance*, 41, 815-829.

Infochoice Website, www.infochoice.com.au/investment/onlinebroking/compare.asp

Jain, P.C. (1987), “The Effect on Stock Price of Inclusion in or Exclusion from the S&P 500”, *Financial Analysts Journal*, January-February, 58-65.

Liu, S. (2000), “Changes in the Nikkei 500: New Evidence for Downward-Sloping Demand Curves for Stocks”, *International Review of Finance*, 1 (4), 245-267.

Lynch, A.W. and R.R. Mendenhall (1997), “New Evidence on Stock Price Effects Associated with Changes in the S&P Index”, *Journal of Business*, 70, 351-383.

MacKinlay, A.C. (1997), “Event Studies in Economics and Finance”, *Journal of Economic Literature*, 35, 13-39.

Mace, J., “Measuring Up for Slower Growth”, *Superfunds*, 250, August 2001, 46-51.

Masse, I., R. Hanrahan, J. Kushner and F. Martinello (2000), “The Effect of Additions to or Deletions from the TSE 300 Index on Canadian Share Prices”, *Canadian Journal of Economics*, 33, 341-359.

Peterson, P.P. (1989), “Event Studies: A Review of Issues and Methodology”, *Quarterly Journal of Business and Economics*, 28, 36-46.

Pruitt, S. and K.C. Wei (1989), “Institutional Ownership and Changes in the S&P 500”, *Journal of Finance*, June, 44, 509-514.

Scholes, M. (1972), “The Market for Securities: Substitution vs. Price Pressure and the Effect of Information on Share Price”, *Journal of Business*, 45, 179-211.

Scholes, M. and J. Williams (1977), “Estimating Betas from Nonsynchronous Data”, *Journal of Financial Economics*, 5, 309-327.

Shleifer, A. (1986), “Do Demand Curves for Stocks Slope Down?”, *Journal of Finance*, 44, 579-590.