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Is Corporate Sustainability Valued by Australian Investors?*

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Abstract

This paper analyzes a sample of Australian company stocks that are added to or deleted from the Dow Jones Sustainability World Index in terms of stock return, risks and liquidity. We find evidence that index addition (index deletion) stocks experience significant temporary increase (decrease) in stock return. Liquidity of index addition stocks improves but that of index deletion stocks worsens. Systematic risk shows little change. Index addition stocks experience no change in idiosyncratic risk while index deletion stocks display drastic changes. The overall results suggest that Australian investors value sustainability in a way that is not explained by existing theories relating to index additions and deletions.

Key words: Corporate sustainability; Dow Jones Sustainability World Index; Event studies

JEL classification: G14; M14

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1. Introduction

Although academics have started to recognize the importance of the concept of corporate sustainability, many companies often express their corporate concerns on whether investors are aware of their corporate sustainable decisions, understand their actions and are able to evaluate their progress and competitive positioning.[1] If financial markets do not value their efforts on corporate sustainability, they do not have proper incentive to become or continue to be corporate sustainable company. Therefore, the purpose of this paper is to provide direct evidence on two issues:

(a) Whether investors value corporate sustainability or not?

(b) In what way(s), if any, they value corporate sustainability?

These direct evidences are important for theory and practice. For example, they provide a sound basis on which to respond to recent calls for increased corporate accountability through mandatory disclosure on a range of social and environmental issues, and for a broadening of director's duties of care beyond their duty to shareholders. If investors do not care about corporate sustainability, what is the point of talking about mandatory disclosure and duties of care on societal and environmental issues?

To this end, this paper uses event study methodology to examine how financial markets respond to the news that a company is added to (or deleted from) the list of leading corporate sustainable companies in Australia. Only those Australian companies that are newly included in or deleted from the internationally recognized Dow-Jones Sustainability World Index (DJSWI) over the period 2002-2008 are examined and their stock price movements surrounding index addition and index deletion are analyzed. As index additions and deletions may affect stock performance in many ways, different proxies for stock price movements are used. They are stock (abnormal) returns, volatility measures and liquidity measures.

DJSWI was first published on September 8, 1999, and was the first global index to track the performance of companies that lead the field in terms of corporate sustainability. DJSWI is internationally recognized for its informational transparency and objectivity and well received by international investment communities. Each year 10% of the leading sustainability companies in

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[1] Corporate sustainability is a multi-faceted concept that recognizes the importance of corporate growth and profitability on one hand, and also requires the corporation to pursue societal goals on the other hand, specifically those relating to sustainable development. The latter refers to the aim to increase or at least stabilize the corporate performance over time without leaving present or future generations worse off. Contrary to traditional business models that aim to make a profit without explicit regard for social and environmental consequences, sustainable companies include as an explicit objective to reduce their negative economic, social and environmental externalities but in a manner that increases the wealth of the corporation. For an academic discussion on the definition of corporate sustainability and its difference from a similar concept called corporate social responsibility, see Montiel (2008).

different sectors are selected from 2000 global companies. A well-defined set of criteria and weightings is used for company selection. They assess the opportunities and risks faced by those companies in economic, environmental and social dimensions.[2]

This paper is organized as follows. Section 2 provides a selected literature review where the motivation for this paper is provided while Section 3 discusses the data and methodology. Section 4 presents empirical results and Section 5 summarizes and concludes.

2. Literature Review

This paper is related to two strands of literature. One is on the relationship between corporate sustainability and firm value while another one is on the firm value implication of index additions and exclusions. We will briefly review them in turn.

2. 1 The relationship between corporate sustainability and firm value

If one accepts the view that the concept of corporate sustainability is distinct from that of corporate social responsibility, the literature on the relationship between corporate sustainability and firm value is relatively new and considers the link mainly from an investment perspective. [3,4] The focus is either on whether corporate sustainability is "priced" in capital markets (see Lo and Sheu (2007)) or whether sustainable companies can have better financial performance than other companies (see Lopez, Garcia and Rodrigduex (2007)). However, without considering the (theoretical and/or empirical) relationship between corporate sustainability and risk, it is difficult to evaluate these studies. If corporate-sustainability is just a proxy for or highly correlated with risk, any evidence that shows corporate sustainability being priced in financial markets is nothing more than a restatement of the principle of risk and return. By the same token, any evidence that the performance of corporate sustainable firms is better (or worse) than that of other firms has to stand up to the test of distinguishing whether the profitability is due to corporate sustainability, risk or both. [5]

[2] For details, follow the link: http://www.sustainability-indexes.com. There is a similar index called FTSE4Good index that includes firms of other countries as well but its constituent data is not made available to the general public.

[3] Montiel (2008) points out that both corporate social responsibility (CSR) and corporate sustainability (CS) have similar conceptualizations of economic, social and environmental dimensions, but they differ in the way how these dimensions are integrated with each other. In particular, CSR treats social and economic dimensions as independent components while CS recognizes that these dimensions are interconnected. In addition, CSR scholars tend to view the relevancy of environmental issues to the extent that the benefits they can offer to people while CS scholars view environmental issues for their own sake, independent of their benefits to humans.

[4] See Orlitzky, et al. (2003) and the references therein for the literature on the relationship between corporate social responsibility and corporate performance.

[5] See Lee and Faff (2009) for a recent attempt that deals with this problem.

This paper takes a different approach. Standard event study methodology is used to examine events of index addition on and index deletion from the Dow-Jones Sustainability World Index (DJSWI). This approach has a number of advantages over the above approaches. First, by looking into how stock markets respond to these index addition (or index deletion) events, it can provide direct answer to the question of whether or not investors care about corporate sustainability. Second, event study methodology allows us to examine the responses of stock markets in more than one dimension. These dimensions include security returns and risks. Corporate sustainability may affect security returns, as well as the risks of a security. It helps clarify the relationship of corporate sustainability with risk and return. Third, we also look at the liquidity of a security, a dimension that is previously ignored in the literature, and check how the liquidity is affected by these events. Fourth, by varying the length of the event window, we may understand both the short term and long term stock behaviors towards corporate sustainability.

Tsai (2007) and Cheung (2009) examine US stocks only while Karlsson and Chakarova (2008) and Consolandi, Jaiswal-Dale, Poggiani and Vercelli (2009) use all events from European countries. None of these papers examine the issue in Australia.

Australia is one of the leading countries worldwide in terms of investor involvement in companies that are deemed to be sustainable, or in the so-called Socially Responsible Investment (SRI). It is the second largest SRI market (next to Japan) in the Asian region, and is the fastest growing market. From 2000 to 2006, SRI managed portfolios grew from $325 million to $11.98 billion, representing an increase of 3,587%, according to a report prepared by Corporate Monitor (2006) for the Ethical Investment Association of Australia. A number of studies (see, for instance Vyvyan, et al, 2007, among others) conducted based on surveys have also found that Australians profess high interest in investing in sustainable companies. Thus, based on these developments, there seems to be good indication that Australian investors value corporate sustainability.

However, in spite of the fast growth in the SRI market in Australia, the amount of SRI still remains very small compared to the total amount of investments. Although total SRI managed portfolios amounted to $11.98 billion, as reported by Corporate Monitor (2006), the total amount in managed portfolios was about $1 trillion. Furthermore, while surveys after surveys show that Australians profess to be interested in SRI, their actual investing behaviour did not actually bear this out (Vyvyan, et al, 2007). Still further, based on the returns of sustainable companies that are included in the portfolios of Australian investors, there is no clear evidence as to whether investors reward sustainable firms. Some studies (see, Bauer,et al, 2006, and Tippet, 2001 and Cummings, 2000) show that the performance of SRI is not significantly different with conventional investments while other studies (see, Jones, et al, 2001) found SRI to be underperforming in the Australian context.

Hence, from the literature, it is not clear yet whether Australian investors value sustainability. None of the previous investigations relating to this issue has utilised the approach we use in this paper.

Thus, our study represents the first in the Australian literature to examine this issue based on the event study methodology.

2.2 Literature on index additions and exclusions

Existing literature documents strong empirical evidence of positive (negative) permanent (temporary) price impacts upon index addition (exclusion).[6] At least five different hypotheses are formulated to explain the significant price impacts in the literature. They have been downward sloping demand curve hypothesis (Shleifer (1986)), price pressure hypothesis (Harris and Gurel (1986)), information cost hypothesis (Merton(1987)), signaling hypothesis (Jain (1987), Dhillon and Johnson (1991) and Denis et al. (2003)), and liquidity hypothesis (see Beneish and Whaley (1996), Hegde and McDermott (2003)).

The first two hypotheses assume that these index addition and index deletion events do not contain information and therefore cannot affect share price. The significant price impacts are due to changes in demand arising from non-information-based portfolio allocation. The downward sloping demand curve hypothesis posits that the increase in demand is permanent and thus the price and volume impacts so induced are also permanent, while the price pressure hypothesis assumes that the increase in demand can be temporary and likewise the price and volume impacts. The other three hypotheses assume that the events do carry information and affect the fundamental value of the security through various channels. In particular, the information cost hypothesis argues that index addition events can increase investor awareness and decrease information searching costs because they make more information available to investors and reduce information asymmetry problems. As a result, investor awareness contributes to the existence of asymmetric price responses where a permanent increase in the stock price of added firms is expected after the events but no permanent decline for deleted firms (Chen, Noronha, and Singal (2004)). The signaling hypothesis argues that the events are interpreted by investors as signals regarding the future value of the security because private information possessed by the index company can be revealed by these events. Other things being equal, an expected increase in the future value of the security leads to an increase in security prices. According to the liquidity hypothesis, index addition reduces stock volatility by enhancing the liquidity (as measured by the bid-ask spread) of the market for the underlying stock. Market makers in the stock reduce the bid-ask spread due to the flow of information-based trading to the stock market, and greater trading activities by hedgers and arbitragers. In other words, the liquidity hypothesis

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6 Some of the well-known studies are Ying, Lewellen, Schlarbaum, and Lease (1977), Brown and Barry (1984), Harris and Gurel (1986), Sanger and McConnell (1986), Shleifer (1986), Jain (1987), Dhillon and Johnson (1991), Beneish and Gardner (1995), Lynch and Mendenhall (1997), Chen, Noronha and Singal (2004). In a similar fashion, Liu (2000), Haneda and Sarita (2003) and Greenwood (2005) study the Japanese case and rebalancings in the Nikkei indices, while Kaul et al. (2000) and Masse et al. (2000) analyze this effect for the Canadian market and Toronto Stock Exchange. See Hacibedel (2008) for a recent attempt on emerging markets. Studies that focus on deletions include Lynch and Mendenhall (1997), and Beneish and Whaley (2002).

argues that the significant price impacts are due to change in discount rate resulting from change in liquidity risk.

3. Data and methodology

The sample period is from 2002 to 2008.[7] We collect data for the following from the website of DJSWI.

(i) The announcement day of index addition and index deletion events;

(ii) The effective day of index deletion and index addition events[8]; and

(iii) The names of the above companies.

Only those stocks that are listed on the Australian Securities Exchange (ASX) are selected.

We use three different proxies for stock price movements because index addition and index deletion may affect stock performance in different ways - abnormal stock returns, risk measures and liquidity. The necessary data is collected from Datastream. Abnormal returns are defined as the market model prediction errors. Risk measures tested are systematic risk (as measured by beta), and idiosyncratic risk (as measured by the residual error variance). Two liquidity measures are used to capture different aspects of liquidity. The first is log trading volume adjusted for market-wide movements. It measures the changes in volume-driven liquidity. The second is proportional bid-ask spread (PBAS) that aims to capture the changes in transaction-cost-driven liquidity. The PBAS for stock i on day t is calculated as follows: [9]

$$PBAS_{it} = (\text{Ask Price}_{it} - \text{Bid Price}_{it})/[(\text{Ask Price}_{it} + \text{Bid Price}_{it})/2] \quad (1)$$

Standard event-study methodology is used to compare these variables before and after index addition (or index deletion) events. Two sets of event days are used; the announcement days (AD) and the days of change (CD). The length between AD and CD varies, ranging from 12 trading days in 2006 to 14 trading days in 2002. For each security, the complete event window runs from 15 days before AD through to 60 days after CD. Following Lynch and Mendenhall (1997), we further divide the complete window into seven sub-windows which are designed to assess different aspects of stock

7 The website of DJSWI does not provide any information in relation to the index additions and exclusions prior to 2002.

8 Personal communication to the Director of DJSWI reveals that every announcement is first published on DJSWI website on announcement day at 06:00 CET (05:00 BST/04:00 GMT) and the press release is sent to the media on the same day at 07:15 CET in line with Swiss market regulations.

9 We delete those observations with either ask price or bid price being missing.

behavior around the events. In addition to the standard AD and CD windows, these sub-windows include:

1. Pre-announcement window that lies between AD – 15 and AD.

2. Run-up window that spans from the day after AD through to CD.

3. Three release-related windows that run from CD+1 to CD +10; they include release window (CD+1, CD+5) and two post–release windows (CD+6, CD+6) and (CD+6, CD+10), respectively.

4. Temporary price impact window that covers period within AD+1 and CD + 20.

5. Total permanent price impact window that falls within AD+1 and CD + 60.

The pre-announcement window aims to detect the existence of an anticipation effect before the announcement while the run-up window is used to test for possible price changes between AD and CD. The three release-related windows allow us to examine the impact of CD on stock prices. The final two sets of windows enable us to distinguish temporary price changes from permanent ones.

We first divide the sample into two periods with three weeks in between. The first period is called the estimation period that contains observations from t=-250 to t=-16 while the second period is labeled the event period that starts from t=0 to t=60 where a relevant window is examined. Abnormal return of stock i is measured as the difference between realized return during the event period and an estimate of its expected (or normal) return in the absence of the event.

$$A_{it} = R_{it} - E(R_{it}) \tag{2}$$

To compute $E(R_{it})$, we use the market model to remove systematic changes from equity returns:

$$\begin{aligned} R_{it} &= \alpha_i + \beta_i (R_{mt}) + \varepsilon_{it} \\ E(\varepsilon_{it}) &= 0; \quad Var(\varepsilon_{it}) = \sigma_i \end{aligned} \tag{3}$$

where $R_{it,}$ and R_{mt} are stock returns for company i, and the return on the local market portfolio to which company i belongs, respectively. ε_{it} is the disturbance term with zero mean and variance σ_i. Trading volume of individual stock i is used to measure liquidity. To remove market wide changes from trading volume, we use total trading volume of Australian Securities Exchange (Datastream code TOMKAU) as proxy for total market trading volume. Following Harris and Gurel (1986), we compute abnormal volume as follows:

$$AV_{it} = \frac{V_{it}}{V_{mt}} \cdot \frac{V_{m.}}{V_{i.}} \tag{4}$$

where V_{it} and V_{mt} are the trading volumes of security i and of the ASX at time t, respectively, and $V_{i.}$ and $V_{m.}$ are the mean trading volumes of security i and of ASX in the 8 weeks preceding the announcement week. Thus, AV_{it} is just a standardized trading volume ratio of security i, adjusted for market-wide changes in trading volume. This ratio is easy to interpret because if there is no change in trading volume at time t relative to its prior eight weeks, the ratio is expected to be one.[10]

As there is no appropriate proxy for the bid-ask spread for ASX, PBAS is scaled by its time-series average for similar purpose. The time-series average is estimated from t=-55 to t=-16 (i.e., 8 weeks).

To test for the significance of the abnormal return (or volume) over the event period, we use Patell's t statisics and Corrado and Zivney (1992) sign statistic. Patell's (1976) statistic is computed as follows:

$$t_P = \frac{\bar{S}\sqrt{n}}{\sqrt{(m-2)/(m-4)}}$$

$$S_{it} = \frac{A_{it}}{\sqrt{(\hat{\sigma}_A^2)_i}} \tag{5}$$

$$(\hat{\sigma}_A^2)_i = \frac{1}{T-1}\sum_{\tau=1}^{T}(A_{i\tau} - \frac{1}{T}\sum_{t=1}^{T}A_{it})^2$$

where $\bar{S}$ is the average of standardized abnormal returns (S_{it}) over the sample of n firms on the event day, and m is the number of observations in the estimation window. The standardized abnormal returns are calculated by dividing the event period residual by the standard deviation of the estimation window residual.

The sign statistic (SS) is computed as follows:

$$SS = \frac{1}{\sqrt{n}}\sum_{i=1}^{n}\frac{U_{it}}{S(U)_i}$$

$$U_{it} = sign(A_{it} - median(A_{it}))$$

$$S(U)_i = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(\frac{1}{\sqrt{n_t}}\sum_{i=1}^{n_t}U_{it})^2} \tag{6}$$

where sign (.) can take either -1, +1 or zero, n_t is the total number of events in year t, n is the total sum of n_t and T is the total number of years involved in estimation.

10 This also implies that in the case of hypothesis testing on cumulative abnormal trading volume the appropriate null hypothesis is one rather than zero if the window length is one. In general, the null hypothesis is k where k is the length of the window being examined.

4. Empirical Results

4.1 Summary Statistics

Panel A of Table 1 displays the frequency of index additions and exclusions per year. There are 22 index additions and 12 index deletions. The total number of events per year varies from its lowest (0) in 2007 to its highest (6) in 2003.

Panel B provides some basic information about the sample firms. The sample consists of 27 firms that were added to or deleted from the DJSWI during the period of 2002-2008. The total number of firms (i.e. 27) is less than the total number of events (i.e. 35) because several firms like Amcor Ltd, James Hardie, and Woodside Petroleum, were added and deleted in different years of the sampling period. They represent 10 different sectors, including important sectors like basic resources sector, energy sector, utilities sector, industrial sector, financial sector as well as telecommunications sector.

Table 1: Basic characteristics of the sample firms

Panel A: Number of Inclusion and Exclusion Firms in the Sample by Year and Types

Year	No. of index additions	No. of index deletions	Total
2002	4	2	6
2003	6	4	10
2004	2	1	3
2005	2	1	3
2006	3	2	5
2007	4	0	4
2008	1	2	3
Total	22	12	34

Panel B: Company names and their industries

INDUSTRY GROUPING	COMPANY	YEAR	Types
Basic Resources	Alumina Ltd.	2003	Delete
Basic Resources	BHP Billiton Ltd.	2002	Add
Basic Resources	Bluescope Steel Ltd.	2007	Add
Basic Resources	Rio Tinto Ltd.	2002	Add
Basic Resources	Wesfarmers Ltd.	2002	Add
Chemicals	Orica Ltd.	2003	Delete
Industrial	James Hardie Industries N.V.	2003	Delete
Industrial	Lend Lease Corp. Ltd.	2005	Delete
Consumer Cyclical	Qantas Airways Ltd.	2002	Delete
Energy	Woodside Petroleum Ltd.	2003	Add
Financials	AMP Ltd.	2003	Add
Financials	ASX Ltd.	2007	Add
Financials	Commonwealth Property Office Fund	2003	Add
Financials	GPT Group	2005	Add
Financials	Insurance Australia Group Ltd.	2006	Add
Financials	Investa Property Group	2003	Add
Financials	Lend Lease Corp. Ltd.	2006	Add
Financials	Macquarie Office Trust	2005	Add
Financials	Macquarie Office Trust	2006	Delete
Financials	National Australia Bank Ltd.	2003	Add
Financials	Stockland	2007	Add
Industrial	Amcor Ltd.	2008	Add
Industrial	Amcor Ltd.	2004	Delete
Industrial	Brambles Ltd.	2003	Add
Industrial	Brambles Ltd.	2008	Delete
Industrial	James Hardie Industries N.V.	2002	Add
Industrial	Transurban Group	2006	Add
Energy	Woodside Petroleum Ltd.	2007	Add
Energy	Woodside Petroleum Ltd.	2006	Delete
Retail	CFS Gandel Retail Trust	2004	Add
Telecommunications	Telstra Corp. Ltd.	2002	Delete
Utilities	AGL Energy Ltd.	2008	Delete
Utilities	Australian Gas Light Co.	2004	Add
Utilities	Australian Gas Light Co.	2003	Delete

4.2 Index additions

4.2.1 Price results

Event studies generally assume that market participants have consensus about how the news should be interpreted. This assumption cannot be warranted if, for example, one combines index addition and index deletion events together to do the analysis because market participants may have favorable reaction toward index addition and unfavorable reaction index deletion news. To isolate different responses on different events, we classify all index constituent stocks into two groups. The first group is those stocks newly deleted from DJSWI and the second one is those stocks newly included. The first group represents those stocks that no longer meet the sustainability requirements of DJSWI. The second group refers to those sustainable stocks that are newly recognized by DJSWI.

We begin by examining trading behavior of index addition stocks first to see whether there is abnormal trading behavior near the announcement day and the day of change. Using the variables described in the previous section, we report cross-sectional cumulative abnormal returns (CARs) in Panel A of Table 2

The result on the pre-AD window shows that the CAR of index addition stocks is positive and statistically insignificant at conventional levels, suggesting that the market does not anticipate the events.

To examine whether the same pattern persists on or after the announcement day, various AD windows are used with lengths ranging from one day to five days after the announcement day. In these AD windows, we find evidence that there is a positive announcement effect on index addition stocks because the CAR is positive and statistically significant on the (AD+1, AD+5) window.

However, the run-up window that covers the day after the announcements up to the day of effective change does not show similar result,. Now the CAR is 0.602% and statistically insignificant, meaning that the announcement effect is not long-lasting.

Turning to the CD windows, it is noteworthy that the CAR turns to be significantly negative (i.e., -0.673% and -0.803%) on the (CD+1, CD+1) and (CD+1, CD+2) windows but then it becomes not significantly different from zero later in other CD windows, suggesting that there is a price reversal on the day of change, regardless of whether we allow for event-induced variance or not. Neither in the release window nor in the post-release windows can we find any evidence of significant CARs.

Two sets of windows are used to examine if there is a temporary or permanent price effect. The first set lies between one day after AD and twenty days after CD while the second set is much longer in length, covering from one day after AD up to sixty days after CD. However, we still cannot find any evidence of significant CARs in these two sets of windows. This also means that changes on the AD windows and CD windows are largely temporary and cannot last long.

4.2.2 Liquidity results

We also do a similar analysis on trading volumes and bid-ask spreads. The idea here is that although opposite interpretations of an event may exist and offset each other, resulting in non-significant changes in stock prices, they are likely to cause an overall increase in trading volumes and/or decrease in bid-ask spread because any trades based on these interpretations may increase trading volumes and/or lower the bid-ask spread.

Panel A of Table 3 reports cumulative abnormal trading volume (CAV) of index addition stocks. We make one important observation with respect to trading volume. In particular, there is a persistent increase in trading volume because all of the CAVs are positive and greater than one. For examples, on the first day after AD, the CAV on index addition stocks is 1.205 (greater than one). The CAV in the first five days after AD is 5.469. By dividing this number by five (i.e., the total number of days in this window), we come up with an estimate of daily abnormal trading volume and the estimate is 1.094 (greater than one).[11] These estimates confirm that after controlling for market-driven trades the trading volume is higher than its 8-week time-series averages. We find similar significant results on the CD windows where the daily trading volume is also greater from one in statistical sense.

Analysis on other sub-window results suggests that the impacts are quite persistent. For examples, both the short-term window and the long-term window indicate that the daily CAV is usually greater than one and statistically significant.

Turning to bid-ask spreads, we construct the average proportional bid-ask spread (PBAS) and report the results in Panel A of Table 4. Two observations can be made about bid-ask spread of index addition stocks. First, the bid-ask spread is generally lower in the AD windows while it is higher in the CD windows. To see this, we first estimate the *daily* proportional bid-ask spread ratio which is defined as the cumulative proportional bid-ask spread ratio divided by the total number of days covered in the respective window. Then we check whether this daily measure is greater than one or not. The daily CPBAS on the (AD+1, AD+5) window and the (CD+1, CD+5) window is 0.848 (=4.239/5) and 1.043 (=5.217/5), respectively. One possible explanation is that after the announcement market-makers lower the spread because of lower inventory cost and lower adverse-selection cost. Inventory cost is lowered because of a temporary high trading volume observed over the same period (see Panel A, Table 3). Adverse-selection cost is lowered because the announcement helps resolve uncertainty. However, once trading volume scales back the bid-ask spread of index addition stocks becomes higher in the CD windows through to the post-release windows. Second, the immediate impact of the announcement event is a reduction of the bid-ask spread but in the long run the spread is higher than its historical average. For example, in the short-term window, the daily measure is 0.972 (=22.362/23)

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11 The number of effective trading days for a particular window can be found in the second column of Table 3 where the number for that window is shown in parenthesis.

while it is 1155 (=84.344/73) in the long run. In other words, the reduction in bid-ask spread is a temporary effect only.

4.2.3 Systematic risk results

We compare systematic risk (as measured by beta) before or after AD (and CD).

In estimating abnormal returns, the standard event study methodology suggests that we divide the sample period into two sub-periods. One is estimation period, where beta is estimated, and event period, where abnormal returns are computed using the beta estimated from the estimation period. For estimating systematic risk purpose, this procedure is problematic because the beta so estimated can only represent the systematic risk in the estimation period but not the systematic risk in the event period. In order to estimate the relevant systematic risk, we regress stock returns on the market index in the *event* period.

Panel A of Table 5 shows the results on AD comparison where the pre-announcement period is from t=AD-15 to t=AD, while the post-announcement period is from t=AD+1 to t=CD. We estimate the betas for these two periods and then use the Chow test to test for stability of beta. We do a similar comparison for CD where the pre-change period is from t=AD+1 to t=CD and the post-change period is from t=CD+1 to t=CD+30 and the results are reported in Panel B. Panel C shows the results of a comparison between pre-AD period (t=AD-15 to t=AD) and post-CD period (t=CD+1 to t=CD+60).

All of these three panels indicate that most of the index addition stocks do not experience any significant change in systematic risk because the number of stocks with significant changes in beta is generally less than 10%. In addition, the number of firms with significant increase (decrease) in beta is quite stable. It decreases from two (one) in Panel A to one (two) in Panel C, while the number of firms with insignificant change in beta remains intact over the same period.

4.2.3 Idiosyncratic risk results

Following exactly the same approach used to generate betas, we compute residual error variance based on those betas in the event period and use F-test to test for stability of residual error variance. Table 6 reveals that index addition stocks generally do not experience any significant change in idiosyncratic risk. For example, a comparison between Panel A and Panel C shows that the number of stocks with insignificant change in idiosyncratic risk increases from sixteen to eighteen over the sample period while the number of stocks with significant increase in idiosyncratic risk decreases from two to one only.

4.3 Index deletions

4.3.1 Price results

Panel B of Table 2 shows that the CAR is not statistically significant in the pre-AD window, confirming that there is no anticipation effect for index deletion stocks.

Unlike index addition stocks whose stock returns are positively affected in the AD windows, Panel B of Table 2 depicts a different picture for index deletion stocks as now the CAR is negative but statistically insignificant on average in the AD windows, meaning that there is no immediate announcement effect on index deletion stocks.

Table 2: Cumulative Abnormal Returns

This table presents the daily CARs for different types of stocks in eight smaller windows. The whole sample consists of 103 events with 56 index additions, and 47 index deletions, respectively. CAR is the cumulative cross sectional average of the market model adjusted stock returns. The abnormal return for stock i on day t (AR_{it}) is calculated as follows:

$$AR_{it} = R_{it} - E(R_{it})$$

where R_{it} is the return on stock i at day t. $E(R_{it})$ is the daily expected return from the market model. The table is divided into two main panels. In each panel, the first column specifies the event window of interest. The actual start and end days of these windows are shown in the second column where k (in parenthesis) is the effective number of trading days. CARs are cumulated separately within these windows. Notice that the announcement date and change date are denoted as AD and CD, respectively. They refer to the actual day when the actual announcement (or change) takes place. Results on two subsamples are reported. They are index additions (from Column 3 to 6) and index deletions (from Column 7 to 10). The third and seventh columns show the daily CARs for index additions and index deletions, respectively. The fourth and eighth columns are the percentage of positive CARs in the portfolio. The fifth and ninth columns show the sign-statistic (SS) values calculated as in Carrado and Zivney (1992) while Patell's t-statistic (t_patell) is shown in Columns five and ten. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Type		Panel A - Index Additions				Panel B - Index deletions			
Specific Event Window	Event Days (k)	CAR	Percent>0	SS	t_patell	CAR	Percent>0	SS	t_patell
Pre-AD	AD-10, AD (11)	2.202%	50%	0.000	1.011	-0.033%	50%	0.000	0.111
AD	AD+1, AD+1 (1)	0.018%	59%	0.853	0.236	-0.039%	67%	1.155	0.024
	AD+1, AD+2 (2)	-0.374%	45%	-0.426	-0.776	-0.593%	50%	0.000	-0.827
	AD+1, AD+3 (3)	0.075%	50%	0.000	0.324	-0.362%	50%	0.000	-0.389
	AD+1, AD+4 (4)	0.699%	68%	1.706*	1.323	-1.107%	50%	0.000	-1.357
	AD+1, AD+5 (5)	1.101%	77%	2.558**	2.010**	-1.222%	50%	0.000	-1.422
Run up	AD+1,CD (13)	0.602%	59%	0.853	0.190	-2.579%	17%	-2.309**	-1.742*
CD	CD+1, CD+1 (1)	-0.673%	27%	-2.132**	-2.475**	0.444%	67%	1.155	1.058
	CD+1, CD+2 (2)	-0.803%	36%	-1.279	-2.106**	0.692%	83%	2.309**	1.319
	CD+1, CD+3 (3)	-0.112%	59%	0.853	-0.312	0.205%	58%	0.577	0.157
	CD+1, CD+4 (4)	0.191%	59%	0.853	0.279	0.712%	58%	0.577	0.879
Release	CD+1, CD+5 (5)	0.090%	59%	0.853	-0.144	0.278%	58%	0.577	0.294
Post release	CD+6, CD+6 (1)	0.088%	59%	0.853	0.279	1.097%	75%	1.732*	2.634***
	CD+6, CD+10 (5)	-0.048%	36%	-1.279	-0.391	0.826%	58%	0.577	1.125
Short term	AD+1, CD+10 (23)	2.013%	64%	1.279	0.963	-1.916%	42%	-0.577	-0.636
Long term	AD+1, CD+60 (73)	4.170%	64%	1.279	0.990	1.379%	50%	0.000	0.097

Analysis on the run-up window shows that there is significant change in abnormal returns before CD. For example, the CAR on the run-up window is negative and statistically significant, suggesting that the selling price pressure is high for index deletion stocks before the change day. The CAR is positive on the CD windows even though it is usually not distinguishable from zero in a statistical sense. However, notice that the CAR on the (CD+6, CD+6) window is positive (1.097%) and statistically significant. This significant result is consistent with the view that there is a price reversal.

The CARs on both the short-term price window and the long-term price window are negative and positive, respectively. However, none of them is statistically significantly different from zero. We therefore find no evidence in support of temporary or permanent price effect, confirming that the significant changes in the run-up and post release windows are largely transient.

4.3.2 Liquidity results

In contrast with index addition stocks whose trading volume is generally higher in the first five days after AD, Panel B of Table 3 shows no significant result for index deletion stocks. In particular, the daily CAV of index deletion stocks is usually less than one but not statistically significant in the AD windows. Trading volume is also not statistically significant in the run up window, the CD windows and the post-release windows. However, the long term window suggests that there is a decline in trading volume.

Table 3: Cumulative Abnormal Trading Volume (CAV)

This table illustrates the CAVs over eight smaller event windows. The whole sample consists of 34 events with 22 index additions, and 12 index deletions, respectively. CAV is the cumulative cross sectional average of stock trading volumes adjusted for total market volume. The abnormal trading volume for stock i on day t (AV_{it}) is calculated as follows:

$$AV_{it} = \frac{V_{it}}{V_{mt}} \cdot \frac{V_{m.}}{V_{i.}}$$

where V_{it} and V_{mt} are the trading volumes of security i and of the ASX at time t, respectively, and $V_{i.}$ and $V_{m.}$ are the mean trading volumes of security i and of ASX in the 8 weeks before t=-15. The first column specifies the event window of interest. The actual start and end days of these windows are shown in the second column where k (in parenthesis) is the effective number of trading days and where AD (CD) is the day when the actual announcement (or change) takes places. CAVs are cumulated separately within these windows. Results on two subsamples are reported. They are index additions (from Column 3 to 6) and index deletions (from Column 7 to 10). The third and seventh columns show the daily CAVs for index additions and index deletions, respectively. The fourth and eighth columns are the percentage of CAVs being greater than k in the portfolio. The fifth and ninth columns show the sign-statistic (SS) values calculated as in Carrado and Zivney (1992) while Patell's t-statistic (t_patell) is shown in Columns five and ten. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Type		Panel A - Index Additions				Panel B - Index deletions			
Specific Event Window	Event Days (k)	CAV	Percent>k	SS	t_patell	CA V	Percent>k	SS	t_patell
Pre-AD	AD-10, AD (11)	12.176	41%	-0.853	2.759***	11.072	42%	-0.577	0.406
AD	AD+1, AD+1 (1)	1.205	77%	2.558**	2.034**	1.007	42%	-0.577	0.221
	AD+1, AD+2 (2)	2.392	50%	0.000	2.295**	2.033	42%	-0.577	0.487
	AD+1, AD+3 (3)	3.299	50%	0.000	1.433	2.939	33%	-1.155	0.056
	AD+1, AD+4 (4)	4.344	50%	0.000	1.562	3.989	33%	-1.155	0.567
	AD+1, AD+5 (5)	5.469	64%	1.279	2.095**	4.994	33%	-1.155	0.800
Run up	AD+1,CD (13)	14.241	64%	1.279	3.492***	12.115	42%	-0.577	-0.741
CD	CD+1, CD+1 (1)	1.131	59%	0.853	1.855*	1.062	33%	-1.155	0.693
	CD+1, CD+2 (2)	2.140	55%	0.426	1.674*	1.848	42%	-0.577	-0.441
	CD+1, CD+3 (3)	3.291	55%	0.426	2.080**	3.087	42%	-0.577	0.422
	CD+1, CD+4 (4)	4.428	64%	1.279	2.536**	3.827	33%	-1.155	-0.546
Release	CD+1, CD+5 (5)	5.432	59%	0.853	2.430**	4.736	33%	-1.155	-0.978
Post release	CD+6, CD+6 (1)	1.003	55%	0.426	0.362	0.982	30%	-2.771***	-0.075
	CD+6, CD+10 (5)	5.225	41%	-0.853	1.062	5.089	67%	1.155	-0.104
Short term	AD+1, CD+10 (23)	25.294	64%	1.279	4.839***	21.799	33%	-1.155	-1.131
Long term	AD+1, CD+60 (73)	74.812	50%	0.000	2.228**	71.124	50%	0.000	-2.539**

Panel B of Table 4 shows that the announcement results in a temporary reduction in the bid-ask spread of index deletion stocks. This is because the daily CPBAS changes from 1.399 (=15.391/11) in the pre-AD window to 1 in the AD windows and the run-up window where the CPBAS is not distinguishable from one in statistical sense. Analysis on the CD, the release and the post release windows reveals that the bid-ask spread is significantly larger in size afterwards. In fact, the bid-ask spread is higher in general as the daily CPBAS is 0.974 (22.402/23) and 1.014 (74.038/73) in the short-term price window and the long-term price window, respectively. In other words, the reduction in bid-ask spread is largely a temporary phenomenon.

4.3.3 Systematic risk and idiosyncratic risk results

Similar to index addition stocks which show little change in systematic risk, index deletion stocks generally experience no change in systematic risk. In most cases, the number of index deletion shocks with significant change in systematic risk is not greater than one and less than 10% of the total sample (see Panel B, Table 5).

Table 4: Cumulative Proportional Bid-ask Spread (CPBAS)

This table presents the CPBASs for different types of stocks in our sample. The whole sample consists of 34 events with 22 index additions, and 12 index deletions, respectively. CPBAS is the cumulative cross sectional average of stock's proportional bid-ask spread (PBAS) scaled by its time-series average in the 8 weeks preceding the announcement week. The time-series average is estimated from t=-45 to t=-15. The proportional bid-ask spread for stock i on day t ($PBAS_{it}$) is calculated as follows:

$$PBAS_{it} = (Ask\ Price_{it} - Bid\ Price_{it})/[(Ask\ Price_{it} + Bid\ Price_{it})/2]$$

The first column specifies the event window of interest. The actual start and end days of these windows are shown in the second column where the number k (in parenthesis) is the effective number of trading days and where AD (CD) is the actual day when the actual announcement (change) takes places. CPBASs are cumulated separately within these windows. Results on two subsamples are reported. They are index additions (from Column 3 to 6) and index deletions (from Column 7 to 10). The third and seventh columns show the daily CPBASs for index additions and index deletions, respectively. The fourth and eighth columns are the percentage of CPBASs being greater than k in the portfolio. The fifth and ninth columns show the sign-statistic (SS) values calculated as in Carrado and Zivney (1992) while Patell's t-statistic (t_patell) is shown in Columns five and ten. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Type		Panel A - Index Additions				Panel B - Index deletions			
Specific Event Window	Event Days(k)	CPBAS	Percent>k	SS	t_patell	CPBAS	Percent>k	SS	t_patell
Pre-AD	AD-10, AD (11)	11.187	45%	-0.426	0.678	15.391	42%	-0.577	6.953***
AD	AD+1, AD+1 (1)	0.667	9%	-3.838***	-2.014**	0.857	42%	-0.577	-0.599
	AD+1, AD+2 (2)	1.507	9%	-3.838***	-2.252**	1.815	33%	-1.155	-0.472
	AD+1, AD+3 (3)	2.408	14%	-3.411***	-2.237**	2.706	25%	-1.732*	-0.719
	AD+1, AD+4 (4)	3.522	18%	-2.985***	-1.739*	3.523	25%	-1.732*	-1.099
	AD+1, AD+5 (5)	4.239	18%	-2.985***	-2.392**	4.558	42%	-0.577	-0.951
Run up	AD+1,CD (13)	11.424	27%	-2.132**	-2.502**	12.679	33%	-1.155	-0.521
CD	CD+1, CD+1 (1)	1.242	41%	-0.853	2.509**	1.035	33%	-1.155	0.302
	CD+1, CD+2 (2)	2.085	36%	-1.279	0.838	2.466	50%	0.000	1.965**
	CD+1, CD+3 (3)	2.969	36%	-1.279	0.546	3.704	75%	1.732*	2.331**
	CD+1, CD+4 (4)	3.927	41%	-0.853	0.179	5.261	83%	2.309**	3.496***
Release	CD+1, CD+5 (5)	5.217	45%	-0.426	0.621	6.444	83%	2.309**	3.586***
Post release	CD+6, CD+6 (1)	0.993	41%	-0.853	0.139	1.818	83%	2.309**	4.961***
	CD+6, CD+10 (5)	5.065	36%	-1.279	-0.136	6.832	83%	2.309**	4.544***
Short term	AD+1, CD+10 (23)	22.362	41%	-0.853	-0.975	26.353	75%	1.732*	3.644***
Long term	AD+1, CD+60 (73)	84.344	59%	0.853	9.226***	87.582	75%	1.732*	9.469***

Table 5: Change in beta

This table reports the test results on change in beta before and after AD and CD. Panel A compares 3 different subsamples in terms of their betas before and after the announcement day while Panel B gives a similar comparison in relation to the day of change (CD) only. For beta estimation purpose, we divide the sample period into different sub-periods. For AD comparison, the first period is from t=AD-15 to t=AD, while the second period is from t=AD+1 to t=CD. For CD comparison, the first period is from t=AD+1 to t= CD and the second period is from t=CD+1 to t=CD+60. We also make a comparison between pre-AD period (t=AD-15 to t=AD) and post CD period (t=CD+1 to CD+60). The Chow test is used to test for change in beta at 10%.

	Summary statistics					No.(%) of firms with significant:		
	Mean Difference	Median Difference	Standard Deviation	Skewness	Kurtosis	Beta increase	Beta decrease	No Beta Change
	Panel A: AD comparison							
Index Additions	-0.267	0.093	2.163	-3.907	16.841	2 (9.09%)	1 (4.55%)	19 (86.36%)
Index deletions	0.250	0.301	1.128	0.054	-1.311	1 (8.33%)	1 (8.33%)	10 (83.33%)
	Panel B: CD comparison							
Index Additions	-0.091	-0.099	0.571	0.432	0.258	1 (4.55%)	1 (4.55%)	20 (90.90%)
Index deletions	-0.369	-0.394	1.086	0.027	-0.958	1 (8.33%)	1 (8.33%)	10 (83.33%)
	Panel C: Pre-AD and Post CD comparison							
Index Additions	-0.357	0.008	2.026	-4.129	18.425	1 (4.55%)	2 (9.09%)	19 (86.36%)
Index deletions	-0.119	-0.335	0.659	0.837	-0.582	0 (0.00%)	0 (0.00%)	12 (100.00%)

In Table 6 we notice that index deletion stocks experience drastic changes in idiosyncratic risk after the announcement day and the day of change. For examples, Panel A shows that after the announcement the number of index deletion stocks with significant decrease in idiosyncratic risk (four) is greater than that with significant increase in idiosyncratic risk (one). These numbers change from four to two and one to six in Panel B, meaning that after the day of change the number with significant decrease in idiosyncratic risk turns out to be less than that with significant increase in idiosyncratic risk. However, these two numbers drop down to two, respectively, in Panel C.

4.6 Robustness Checks

The estimation window is from t=-250 to t=-16. The first robustness check uses estimation windows of shorter length with 200 days and 150 days. The results are qualitatively the same. We also use two-week time rather than three-week time to separate the event period from the estimation period, no material change in the results is found. To examine the robustness of our trading volume measure that adjusts for market-wide movement in trading volume, we use a simpler measure that scale trading volume by its time-series averaged trading volume instead. Similar to Chae (2005), we construct a time-series averaged trading volume using historical data from the period 16 to 45 days before the announcement. The results are essentially the same.

Table 6: Change in Idiosyncratic risk

This table reports the test results on change in idiosyncratic risk before and after AD and CD. Idiosyncratic risk is defined as the residual risk from the market model. Panel A compares 3 different subsamples in terms of their idiosyncratic risk before and after the announcement day while Panel B gives a similar comparison in relation to the day of change (CD) only. For estimation purpose, we divide the sample period into different sub-periods. For AD comparison, the first period is from t=AD-15 to t=AD, while the second period is from t=AD+1 to t=CD. For CD comparison, the first period is from t=AD+1 to t= CD and the second period is from t=CD+1 to t=CD+60. We also make a comparison between pre-AD period (t=AD-15 to t=AD) and post CD period (t=CD+1 to CD+60). F-test is used to test for equality of variance at 10%.

	Summary Statistics					No.(%) of firms with significant:		
	Mean Difference	Median Difference	Standard Deviation	Skewness	Kurtosis	Risk increase	Risk decrease	No Risk change
	Panel A: AD comparison							
Index Additions	-0.003	-0.001	0.011	-3.006	11.908	2 (8.09%)	4 (18.18%)	16 (72.73%)
Index deletions	-0.002	-0.002	0.009	0.967	2.913	1 (8.33%)	4 (33.33%)	7 (58.33%)
	Panel B: CD comparison							
Index Additions	0.001	0.001	0.004	-0.221	0.696	1 (4.55%)	2 (9.09%)	19 (13.64%)
Index deletions	0.003	0.006	0.008	-1.312	2.078	6 (50.00%)	2 (16.67%)	4 (33.33%)
	Panel C pre-AD and post CD comparison							
Index Additions	-0.002	-0.000	0.010	-3.412	13.273	1 (4.55%)	3 (13.64%)	18 (81.82%)
Index deletions	0.000	-0.002	0.004	0.492	-0.931	2 (16.67%)	2 (16.67)	8 (66.66)

5. Discussions and Conclusion

In this paper, we analyze the impacts of inclusions and exclusions of the Dow Jones Sustainability World Index (DJSWI) constituent stocks in the Australian stock market from 2002 to 2008. The impacts are measured in terms of stock returns, risks and liquidity.

We find that the event announcement does have an impact on stock returns. In particular, index addition stocks experience higher stock returns in the AD windows while index deletion stocks show negative response in the Run up window. But these changes are temporary; there is a price reversal near the day of change for index addition stocks while a similar price reversal is found in the post-release windows for index deletion stocks.

Trading volume behaves differently for different types of stocks. Index addition stocks show significant and persistent increase in trading volume while index deletion stocks experience no significant change in the short term but significant decrease in the long term. Analysis on bid-ask spreads also confirms that there is a temporary reduction in bid-ask spread for both index addition stocks and index deletion stocks, albeit the result on the latter is not statistically significant.

Systematic risk shows little change after the announcement day or the day of change. Idiosyncratic risk exhibits no significant changes for index addition stocks while it varies drastically for index deletion stocks. No matter whether or not there is a drastic change in idiosyncratic risk, it should not be a concern for investors with well-diversified portfolios.

Taken together, the overall results are inconsistent with any of the hypotheses in the literature. The evidence that there is a price reversal in stock prices of index addition stocks and index deletion stocks rule out the downward sloping demand hypothesis, the signaling hypothesis, and the information cost (investor awareness) hypothesis. The first two hypotheses imply that any changes in stock prices must be permanent while the third one not just suggests a permanent change in liquidity but also a permanent increase in the price of added firms and a temporary decline for deleted firms. But we cannot find any evidence on the existence of asymmetric price responses effect. In addition, the evidence that there is permanent change in liquidity is inconsistent with the press pressure hypothesis which predicts a temporary change in liquidity only. The presence of price reversal, combined with a permanent change in liquidity does not square with the liquidity hypothesis that requires a permanent change in liquidity which leads to a corresponding (permanent) change in stock prices.

Given these findings, do Australian investors therefore value sustainability? There is some indication from the results that they do. Index addition leads to transient increase in price and a permanent increase in trading volume. On the other hand, index deletion results in temporary reduction in price and leads to permanent lower trading volume. Thus, the results suggest that Australian investors do value sustainability although they express this in a way that is not explained by existing theories relating to index additions and deletions. This may indicate that sustainable companies are treated differently by Australian investors.

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