INDEX EFFECTS: A REVIEW AND COMMENTS
บทวิจารณ์และข้อคิดเห็นเรื่องผลกระทบต่อราคาและปริมาณการซื้อขายของหลักทรัพย์ที่ถูกปรับเข้าและออกจากดัชนีหลักทรัพย์

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บทคัดย่อ

ผลกระทบที่เกี่ยวข้องจากการเปลี่ยนแปลงหลักทรัพย์ที่นำมาใช้ในการคำนวณดัชนี (Index Effect) ได้แก่ผลกระทบที่มีต่อราคาและปริมาณการซื้อขายของหลักทรัพย์ที่ถูกปรับเข้าหรือปรับออกจากดัชนี มีงานวิจัยที่เกี่ยวกับผลกระทบนี้เป็นจำนวนมากในทศวรรษที่ผ่านมา บทความนี้อภิปรายและสรุปถึงผลการศึกษาที่เกี่ยวกับผลกระทบนี้ รวมทั้งทฤษฎีที่ใช้ในการอธิบายผลกระทบดังกล่าวและความเกี่ยวข้องของแต่ละทฤษฎีในการอธิบายผลการศึกษาในแต่ละงานวิจัย บทความนี้ยังได้อภิปรายผลการศึกษา Index Effect ที่มีต่อทฤษฎีความมีประสิทธิภาพของตลาดหลักทรัพย์ (Efficient Market Hypothesis) นอกจากนี้ บทความนี้ได้ให้แนวทางทิศทางการทำวิจัยในอนาคตที่เกี่ยวกับเรื่อง Index Effect นี้

คำสำคัญ: ผลกระทบต่อหลักทรัพย์ที่ถูกปรับเข้าหรือออกจากดัชนี ผลกระทบต่อราคา การปรับเข้า การปรับออก ตลาดหลักทรัพย์แห่งประเทศไทย

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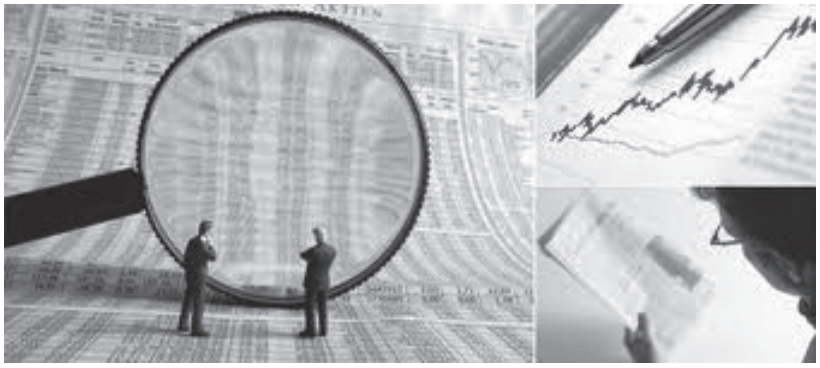
Abstract

The index effect refers to an event where the significant changes in price and trading volume are observed from stocks that are added to or deleted from a stock index. Research on the index effect has been very active in the past decades. This article provides an overview of the research on the index effect by discussing and summarizing the empirical results, the five main hypotheses that have been proposed in the existing literature to explain the index effect, and the relevance of each of the hypotheses to the empirical findings. The article then discusses the implication of the empirical findings of index effect research on the Efficient Market Hypothesis. Finally, the article provides future research opportunities on the index effect topic.

Keywords: Index Effect, Price Effect, Addition, Deletion, The Stock Exchange of Thailand



1) Introduction

In the past decades, a large number of research work has examined the so called "index effect". The index effect refers to a situation where a stock that are added to or deleted from a stock index experiences the significant changes in price and trading volume. To elaborate, when a stock is added to (deleted from) a stock index, the price of that stock jumps (drops). The included (deleted) stocks experience a significant increase (decrease) in prices after the index revision announcement and generally further rise (drop) around the actual inclusion (deletion). Though some of the price change is reversed after the actual inclusion (deletion), a permanent increase (decrease) in price is primarily evidenced over a period of time. Trading volumes for both added and deleted stocks also increase significantly around the announcement and inclusion dates.

2) Article Objectives

This article is aimed to provide an overview of the research on the index effect, which has been very active in the past decades. It also aims to motivate more researchers to be interested in doing the index effect research, particularly in the Thai stock markets.

The article discusses and summarizes the empirical results, the five main hypotheses that have been put forward in the existing literature to explain the index effect, and the relevance of each of the hypotheses to the empirical findings.

The article also discusses the implication of the general findings of index effect research on the Efficient Market Hypothesis. The understanding of an index effect should allow investors to use the publicly available information (i.e., index composition change announcement) to form appropriate trading strategies to exploit this market anomaly. Arbitrage profits that arise from forming such trading strategies are discussed. Such understanding should also have direct implication for market regulators in that it should allow regulators to appropriately regulate the market around the index composition change. Finally, the article suggests promising future work in this area.

3) Existing Hypotheses

The main existing hypotheses proposed to explain the effects of additions to or deletions from a stock index on stock returns and volumes can be classified into five groups:

Information Signaling Hypothesis

Index constitution changes are usually not accompanied with the announcement of any new fundamental information, related to earnings prospects or risk characteristics, from the added/deleted firms. New information, however, could become known from the index selection criteria, particularly the S&P 500 index, and the superior information that the S&P 500 index revision committee may possess about the added/deleted companies (for example, see Shleifer, 1986; Jain, 1987; Mase, 2007).

According to the information signaling hypothesis, the addition (deletion) of a stock to an index is considered a positive (negative) signal, with regard to the future prospects (e.g., future cash flow streams or risk characteristics) of the firm. Therefore, the information signaling hypothesis predicts that an added (deleted) firm's stock price will be associated with permanent price increase (decrease) upon the announcement of the index revision.

Price Pressure / Short-Run Downward Sloping Demand Curve

The price pressure hypothesis (Harris and Gurel, 1986) postulates that there will be a shift in the demand (supply) for stocks being added to (deleted from) an index, and assume there is no new fundamental information associated with an index revision. The shift in the demand (supply) for added (deleted) stocks is caused by a temporary increase in trading activities of index-oriented investors (e.g., index funds), who are induced by the index reconstitution to buy (sell) added (deleted) stocks, and thereby creating *short-term* price pressure. Therefore, the price pressure hypothesis predicts that increased (decreased) price and increased volume for stocks added to (deleted from) an index will be only temporary.

Imperfect Substitutes Hypothesis/Long-Run Downward-Sloping Demand Curve

Under the assumption of market efficiency, securities are perfect substitutes for each other, and demand curve for a security is perfectly elastic (i.e., horizontal). However, the imperfect substitutes hypothesis, or the downward sloping demand curve hypothesis (Shleifer, 1986), posits that every stock is unique, and cannot be perfectly substituted. The implication is that once a stock is added to an index, there will be an excess demand by index-tracking investors for such stock, which cannot be replicated. As a result, the stock price has to rise to attract sufficient supply of the stock for such excess demand. A new equilibrium in the stockholder distribution occurs, and therefore the increase in the stock price and trading volume from the initial level will be permanent. For the imperfect substitutes hypothesis to hold, the demand curve for stocks has to be downward sloping, rather than horizontal. Analogously, when a stock is deleted from an index, there will be an excess supply of the stock from index-oriented investors, resulting in a permanent, lower level of price and trading volume.

Liquidity/Information Cost Hypothesis

From a liquidity perspective, if index inclusion (deletion) is generally associated with permanent increases (decreases) in trading volume and liquidity, then there should be a price increase (decrease) upon the index addition (deletion; see Amihud and Mendelson 1986). From an information perspective too, index addition (deletion) usually attracts more (less) attention from analysts and investors, thereby resulting in a lower (higher) degree of information asymmetry, which, in turn, results in

lower trading costs and required returns. Also, the reduction in the degree of information asymmetry lowers the cost of gathering information about the firm.

Consequently, the overall transaction costs for an added (deleted) stock decrease (increase). The reduction (increase) of these costs results in a decrease (increase) in the cost of equity, and ultimately an increase (decrease) in the stock value. As a result, the liquidity/information cost hypothesis predicts that a stock that is added to (deleted from) an index will experience a permanent increase (decrease) in price and trading volume.

Investor Awareness Hypothesis

The investor awareness hypothesis, also called the shadow cost hypothesis, is based on Merton (1987). In an extension to the Capital Asset Pricing Model, Merton's work includes the possibility that investors do not have complete information about all stocks. As a result, investors will invest only in stocks that they are aware of, and some stocks (i.e., less known stocks) are only held in a subset of investors' portfolios. Therefore, investors hold incompletely diversified portfolios.

Because complete diversification does not occur, non-systematic risk (i.e., idiosyncratic risk) remains and is priced. The equilibrium return required by incompletely diversified investors will be higher than that required by the fully-diversified investors, as predicted by the Capital Asset Pricing Model. The premium, or the difference between the two returns, resulting from bearing the non-systematic risk of a stock, is the shadow cost.

According to Chen et al. (2004), if a stock is added to an index, more investors will be aware of the stock and hold such stock for its potential diversification benefit. Therefore, the stock's shadow cost will fall, thereby leading to a permanent increase in its price. By contrast, under the investor awareness hypothesis, there should be no price effect associated with the index deletion. This is because once investors already became aware of a certain stock in an index, they do not become unaware of it after it has been deleted from the index. Therefore, under the investor awareness hypothesis, no price decline is expected for stocks removed from an index.

4) Empirical Findings

Since the very first articles by Harris and Gurel (1986) and Shleifer (1986) which observed a price effect (using abnormal price returns) and volume effect on stocks added to/deleted from the S&P 500 index, a large number of studies were developed on the index effect subject. The majority of the early studies were developed using the data from the US stock market, particularly the S&P 500 index. **Table 1** presents a summary of all the relevant empirical literature on the index effect in the US stock market and relate each paper to its corresponding supporting hypothesis. In summary, most studies reported significant price increases (decreases) for stocks added to (deleted from) the S&P 500 index; however the

indication regarding whether the price change is temporary or permanent and which hypotheses are behind the change is inconclusive. For example, Harris and Gurel (1986), Beneish and Whaley (1996), and Lynch and Mendenhall (1997) found significant price increases (decreases) for added stocks (deleted stocks), but such price changes is reversed and then seem temporary, thereby supporting the price pressure hypothesis. By contrast, Shleifer (1986) and Cusick (2002), for example, observed significant and permanent price effect from index revisions, and then attribute the findings to the imperfect substitutes hypothesis.

According to Jain (1987) and Dhillon and Johnson (1991), based on the fact that the S&P committee could exercise judgment regarding the financial soundness of firms to be added/deleted, its decisions to include or exclude a stock may convey valuable information about the prospects of that firm to investors. For example, Jain (1987) reported that there existed excess returns for both main indexes (which index funds are tracking) and supplementary indexes (which no index funds are mimicking). Since both main and supplementary indexes are revised by the S&P committee, Jain attributed the findings to the information possessed by the S&P. Also, according to Denis et al. (2003), firms added to an index may be forced to perform in a more efficient way and make more value-adding decisions, due to more effective monitoring by investors and analysts on the included firms. Denis et al. (2003) showed that companies added to the S&P 500 index experience significant improvement in earnings, supporting the information signaling hypothesis.

Research work that supports the liquidity hypothesis includes Beneish and Gardner (1995), Erwin and Miller (1998), Hegde and McDermott (2003), and Madhavan (2003). For example, Hedge and McDermott (2003) found a sustained increase (decrease) in the liquidity of the added (deleted) stocks. The improvement (deterioration) in the liquidity of added (deleted) stocks leads to a decrease (increase) in the direct cost of transacting.

Finally, Chen et al. (2004) and Elliott et al. (2006) found empirical evidence in support of the investor awareness hypothesis. Chen et al. (2004), for example, reported that there exists an asymmetric price effect to index additions and deletions. That is, they observed a permanent increase in the price of added firms but no permanent decline for deleted firms.

Table 1: Announcement day price effects of additions to and deletions from the US stock market indices and the corresponding supporting hypotheses

Researcher(s)	Abnormal returns (%)		Time Period of study	Index	Hypothesis Supported
	Addition	Deletion			
Harris and Gurel (1986)	3.13*	-1.40*	1978-83	S&P 500	Price pressure
Shleifer (1986)	2.79*	n/a	1976-83	S&P 500	Imperfect substitutes
Goetzmann and Garry (1986)	n/a	-2.00	1983	S&P 500	n/a
Jain (1987)	3.07*	-1.16*	1977-83	S&P 500	Information signaling
Pruitt and Wei (1989)	-	-	1973-1986	S&P 500	Price pressure
Dhillon and Johnson (1991)	3.33*	n/a	1984-88	S&P 500	Information signaling
Edmister et al. (1994)	3.26*	n/a	1983-1989	S&P 500	Reject price pressure and imperfect substitutes
Beneish and Gardner (1995)	0.57	-2.31	1929-1988	Dow Jones Industrial Average	Liquidity
Collins et al. (1995)	-0.15	n/a	1991	S&P MidCap 400	Information signaling
Beneish and Whaley (1996)	4.39*	n/a	1986-94	S&P 500	Price pressure
Lynch and Mendenhall (1997)	3.16*	-6.26*	1990-95	S&P 500	Price pressure / Imperfect substitutes
Erwin and Miller (1998)	3.17*	n/a	1984-1988	S&P 500	Price pressure / Liquidity
Cusick (2002)	4.34*	-6.51*	1990-1999	S&P 500	Imperfect substitutes
Denis et al. (2003)	4.65*	n/a	1987-1999	S&P 500	Information signaling
Elliott and Warr (2003)	3.88*	n/a	1989-2000	S&P 500	Price pressure
Hegde and McDermott (2003)	2.30*	n/a	1993-1998	S&P 500	Liquidity / Imperfect substitutes
Madhavan (2003)	3.69*	-5.49*	1996-2002	Russell 2000 / Russell 3000	Price pressure / Liquidity
Biktimirov et al. (2004)	0.92*	-0.11	1991-2000	Russell 2000	Price pressure
Chen et al. (2004)	5.45*	-8.46*	1962-2000	S&P 500	Investor awareness
Elliott et al. (2006)	5.67*	n/a	1993-2000	S&P 500	Investor awareness
Sui (2006)	4.31*	-6.48*	1990-2002	S&P 500	Short run downward sloping demand curve / Information signaling
Kappou et al. (2010)	4.06*	-7.43*	1993-2002	S&P 500	n/a
Green and Jame (2011)	3.92*	n/a	1999-2005	S&P 500	n/a

Note: * *denotes significance level at 5%*

n/a indicates no test

Table 2: Announcement day price effects of additions to and deletions from the international stock market indices and the corresponding supporting hypotheses

Researcher(s)	Abnormal returns (%)		Time Period of study	Index	Hypothesis Supported
	Addition	Deletion			
Brealey (2000)	0.50	-0.30	1994-99	FTSE / UK	No hypothesis supported
Liu (2000)	1.54*	-2.57*	1991-99	Nikkei 500 / Japan	Imperfect substitutes
Masse et al. (2000)	1.58*	-1.35*	1989-94	TSE 300 / Canada	Imperfect substitutes
Chan and Howard (2002)	2.60*	-3.30*	1992-98	All Ordinaries / Australia	Price pressure
Hyland and Swidler (2002)	1.92*	n/a	1991-1999	NZSE 40 / New Zealand	Investor awareness
Hanaeda and Serita (2003)	5.41*	-18.79*	2000	Nikkei 225 / Japan	Imperfect substitutes
Chakrabarti et al. (2005)	3.35*	-2.59*	1998-2001	MSCI Indices/ 29 Countries	Imperfect substitutes
Okada et al. (2006)	5.16*	n/a	1991-2002	Nikkei 225 / Japan	Price pressure
Mase (2007)	-0.10	-0.20	1992-2005	FTSE 100 / UK	Short run downward sloping demand curve
Bildik and Gulay (2008)	0.16	-0.38	1995-2000	ISE 100 / Turkey	Price pressure / Imperfect substitutes
Yun and Kim (2010)	0.03	-0.81*	1995-2008	KOSPI 200 / Korea	Information signaling
Liu (2011)	4.06*	n/a	1979-2006	Nikkei 225 / Japan	Investor awareness

*Note: * denotes significance level at 5%*
n/a indicates no test

Note that only after around year 2000, we find empirical literature covering other stock markets than the US market. From **Table 2**, Brealey (2000) and Mase (2007) covered the English market; Liu (2000, 2011), Hanaeda and Sarita (2003), and Okada et al. (2006) studied the Japanese market; Masse et al. (2000) observed the Canadian market; Chan and Howard (2002) studied the Australian market; Hyland and Swidler (2002) investigated the New Zealand market; Bildik and Gulay (2008) examined the Turkish market; Yun and Kim (2010) studied the Korea market. Consistent with the index effect results in the US market (Table 1), empirical evidence on the index effect in other non-US markets in Table 2 also showed significant price increases (decreases) for stocks added to (deleted from) stock indices. Increased trading volumes as a result from the index revisions of international markets are also found. Again, the indication regarding whether the price effect is permanent or temporary and which hypotheses support the effect is mixed.

5) Market Efficiency and Arbitrage Profits

The period when there is an index reconstitution provides a natural setting for a test of the Efficient Market Hypothesis (EMH). According to the semi-strong-form EMH, one cannot make a profit from using any knowledge of the historical abnormal returns for index revisions. However, the results from a large number of index effect studies are not consistent with the semi-strong form EMH. That is, for additions (deletions), the studies find a positive (negative) significant abnormal return during an announcement period (Table 1 and 2), and further a positive (negative) abnormal return over the period starting from after the announcement period to the effective date of the index change, though some studies show a price reversal after the effective date. The significant abnormal returns following the announcement date are not consistent with semi-strong form market efficiency, thereby resulting in a possibility to construct trading strategies based on publicly available information (i.e., the announcement of a list of firms being added to or deleted from an index) to earn positive abnormal returns.

Therefore, the effect of an index composition change is important not only to index-oriented fund managers who have to rebalance their portfolios upon index constitution changes, but also to arbitrageurs who exploit these opportunities to make an arbitrage profit. That is, according to empirical evidence on index effect, buying stocks added to an index and/or selling stocks deleted from an index is proved to be a lucrative strategy for investors not involved in index tracking. Specifically, to exploit such opportunities is to buy (sell) added (deleted) stocks upon the index revision announcement, and then sell (buy) those stocks on the close of the actual change day. For the S&P 500, for example, Beneish and Whaley (1996) reported that the abnormal return from the close of announcement day till the close of the actual change day was about 5.9% during 1989-1994. Sui (2006) showed that, for S&P 500 during 1990-2002, the abnormal returns from announcement day to actual change day were 8.44% for addition and -11.10% for deletion.

Because the index revision is generally announced to the market after the market close, the first trading opportunity happens only at the open of the next day, where the stock's price generally opens at a considerably higher (lower) than the previous day's closing price. As a result, profits from buying (selling) the added (deleted) stock on the morning of the day after the announcement and selling (buying) it on the actual change day could be much less economically significant. However, according to the findings by Beneish and Whaley (1996), Cusick (2002), and Kappou et al. (2010), who all eliminated the significant overnight price changes from the close of announcement to the open of the day after, there are still significantly profitable trading opportunities beyond the day after the announcement day until the actual change day.

6) Suggestions for Future Research

So far, previous studies have mostly focused on S&P 500 index effect and its applicable hypotheses (Table 1). There were also quite a number of studies from year 2000 onwards that showed the index effects in other non-US market indices (Table 2). Those non-US markets (e.g., UK, Japan, Canada, and Australia), however, are regarded as developed stock markets. Therefore, in my opinion, there is still insufficient evidence from other international markets, particularly from emerging markets, whose different characteristics (e.g., market development levels, and investor sophistication) could have different explanation on the previous findings in the US or other developed markets. Therefore, I would like to see studies on the effects of the changes in index constitution from emerging markets, and particularly the Thai stock market. Such studies in the emerging markets would be beneficial to not only those involved in index-tracking strategies but also general investing public as well as stock market regulators.

Elliott and Warr (2003) and Kappou et al. (2010) argue that an important aspect of every stock market is its ability to absorb demand shocks for stocks, and then test the relative ability of the New York Stock Exchange (NYSE) specialists and Nasdaq dealers to absorb large demand shocks from S&P 500 index additions. Both studies found that the NYSE specialist system is better able to absorb demand shocks than is the Nasdaq dealer system – that is, additions to the S&P 500 Index of companies traded on the Nasdaq experience higher price effects than do additions of companies traded on the NYSE. However, the Stock Exchange of Thailand (hereafter, SET) is operated under a purely order-driven system, which is different from the US trading systems (both NYSE and Nasdaq). As a result, the ability of the public limit orders, as a sole liquidity supplier under the pure order-driven system of the SET, to absorb the shocks of demand (supply) for stocks added to (deleted from) the Thai stock indices would be an interesting empirical question, which also has direct implication for policy makers. For example, stocks that are added to or deleted from the SET 50 index are generally not as liquid as the stocks that consistently remain in the SET 50 index. Therefore, in order to alleviate the potentially large price impact (especially due to insufficient liquidity supply) caused by index fund rebalancing in those added/deleted stocks during an index revision period, the regulator could consider having market makers (as is the case for derivative warrants in the Stock Exchange of Thailand) to help supply liquidity in those stocks. An empirical investigation into the price and volume effects associated with the revisions of the Thai index composition, therefore, should be worthwhile.

The procedure for adding (deleting) stocks to (from) S&P 500 is somewhat subjective and possibly contain information regarding the future prospect of the added/deleted firms. For example, previous studies (Chen et al., 2004; Denis et al., 2003; Kaul et al., 2000) indicate that an added

stock into the S&P 500 index could provide a favorable signal about the firm's financial strength (because the decision to add the stock comes from a credit rating agency – that is, S&P) and expected improved operating performance (because of increased monitoring of management). However, the SET 50 index revision is based solely on certain quantitative criteria (i.e., market capitalization and trading volume), which are also publicly available. Therefore, the change in the SET50 composition, unlike that in the US, is unlikely to contain any information. As a result, the information hypothesis should not be applicable in the Thai market. Regarding the difference in the selection criteria, an empirical investigation of the changes in the SET 50 composition should therefore be beneficial.

The potential increase in demand/supply for those added/deleted stocks can be quite large, which in turn depends primarily on the total money invested in (public or private) index funds (and possibly non-index funds or other institutional investors that use the index as a benchmark in their portfolio management and performance evaluation). Also, empirical results (e.g., Shleifer, 1986; Sui, 2006) show that index effect is increasingly significant over time, parallel to the growth of index funds, implying that institutional investors (i.e., index-tracking funds) cause the index effect. However, unlike the US or other developed stock markets where main players are generally institutional, the SET is considered a retail investor-based stock market, and therefore could cause potentially less impact on added/deleted stocks than do the developed markets.

Furthermore, the size of the index funds in Thailand, though growing substantially in the past decade (from only 1 index fund with the net asset value of 217 million Baht in 2002, to 16 index funds with the total net asset value of roughly 14,000 million Baht by 2012)[1], is still relatively not large, compared to those in the US or other developed markets. The aggregate size of the SET 50 index funds relative to the SET 50 index market capitalization is quite small, accounting for only 0.16% in 2012. By contrast, the aggregate size of S&P 500 index funds accounts for about 5.46% of the S&P 500 market capitalization[2]. Another important factor is about the size of the index derivatives in the Thai derivatives market, which is also still relatively small, compared to those in the developed markets. The size of index derivatives could determine the use of index constituent stocks in arbitrage with the index derivatives, and therefore stocks added to or deleted from the index could be a focus for those involved in arbitrage opportunities between spot (i.e., index stocks) and futures (i.e., index futures) instruments. All in all, index effects in the SET are still expected to be significant, considering

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[1] Association of Investment Management Companies, www.aimc.co.th

[2] Morningstar, Inc., www.morningstar.com

the growing size of index funds in Thailand over time, though may not be as significant as those in the US.

Several studies (Beneish and Whaley, 1996; Cusick, 2002; Green and Jame, 2011; Kappou et al., 2010; Lynch and Mendenhall, 1997) indicate that many index funds are concerned primarily with tracking error and therefore wait until the effective date to rebalance their portfolios; therefore, risk arbitrageurs can step in ahead of the index funds, by buying added stocks on the day following the announcement and sell possibly at a higher price to the index funds near the effective date, thereby resulting in potentially large profits. As a result, although much of the price change of added/deleted stocks during the index composition change event is still attributable to buying/selling activity of index funds near the effective date, parts of the price change associated with index revision are likely due to buying/selling pressure from risk arbitrageurs from the announcement date towards the effective date.

The unique feature of the SET (and also of some other emerging markets) is that, though the SET is mainly driven by small investors, it consists of four main groups of traders – namely, individuals, foreign investors, domestic institutions, and proprietary traders. With the availability of the detailed dataset on investor type classification from the SET, a closer look into each market participant's behavior around the event of the index composition change is possible and could lead to a greater understanding of the driving forces behind added/deleted stocks' price changes during the index revision event. For example, research can aim to describe the behavior of each type of investors during the revision composition change. It can answer such questions as, among the four investor groups in the SET, who are risk arbitrageurs stepping ahead of index funds, and who provide(s) liquidity in times where there clearly is excess demand shock from index funds. Such empirical investigation is impossible to do in the existing US index effect literature, due to the lack of detailed data on investor classification. Also with the detailed dataset from the SET, we are able to much more clearly identify the behavior of index funds during the index revision period, in contrast to previous studies (e.g., Kappou et al., 2010) that have to rely on the assumption that high volume trading near the actual change date is caused by the purchases/sales of index funds. Therefore, explaining how the behavior of index funds (e.g., domestic institutions), foreign investors, retail investors, proprietary traders, and domestic institutions (i.e., active funds) can generate the stylized observed patterns of returns and volume for the added and deleted stocks from the Thai stock indices can contribute to the existing literature on index effect and is a promising task for future work in the SET.

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