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THE DILUTION EFFECT OF ACCOUNTING INFORMATION[1]

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ABSTRAK

Riset ini meneliti efek gabungan antara kejutan-kejutan dividen dan laba. Dengan menggunakan belief-adjustment theory *yang dikenalkan oleh Hogarth and Einhorn's (1992), riset ini menguji perilaku dari reaksi investor terhadap waktu (*timing*) dari pengumuman-pengumuman dividen dan laba. Teori ini memprediksi bahwa untuk kejutan-kejutan konsisten yang terjadi pada waktu bersamaan, mereka mempunyai pengaruh yang lebih kecil di return saham dibandingkan dengan kejutan-kejutan konsisten yang terjadi secara berurutan (hipotesis ini disebut dengan hipotesis efek dilusi atau* the dilution effect hypothesis*).*

Hipotesis-hipotesis efek dilusi ini didukung di satu dari empat skenario yaitu terjadi pada waktu kejutan-kejutan laba positip. Hipotesis-hipotesis ini tidak didukung untuk kejutan-kejutan dividen negatip, kejutan-kejutan dividen positip dan kejutan-kejutan laba negatip.

Key words: *the dilution effect, belief adjustment theory, belief revision, Hogarth and Einhorn, behavioral finance, behavioral accounting, behavioral market research, contemporaneous announcements, simultaneous announcements, joint announcements, noncontemporaneous announcements, sequential announcements, mixed evidence, consistent evidence.*

INTRODUCTION

Hartono (2004a) found evidence of recency effect of a sequential orderly accounting information. He found that when dividend and earnings surprises are considered together, only positive dividend surprises that follow negative earnings surprises create a combined recency effect. This means that the order of positive dividend surprises that follow negative earnings surprises has a greater positive effect on stock returns than when the order is reversed.

Hartono (2004b) also found evidence of 'no-order effect' of a sequential orderly accounting information. He found that for consistent positive evidence (good news followed by another good news), the order of surprises whether the positive dividend surprise follows or precedes a positive earnings surprise does not matter.

Both Hartono (2004a) and Hartono (2004b) only addressed the issue of **how** investors react to a sequential of orderly accounting information, but did not addressed the issue of **when** they react. The former more focuses on the **order** of the information to answer the

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question of how order of the information can change investors' belief about stock prices. The latter more focuses on the **timing** of the information to answer the question of when timing, contemporaneously or sequentially, of the information can change investors' belief about stock prices.

While order is defined as the sequence of the surprises whether dividend surprises precede or follow earnings surprises and whether bad news precedes or follows good news,[2] timing is defined as the interval between two announcement dates. Eddy and Seifert (1992) defined two announcements as contemporaneous announcements (simultaneous announcements or joint announcements) if they occur within two trading days, whereas noncontemporaneous announcements (sequential announcements) are those that are separated by more than two trading days. In this study, simultaneous announcements are defined when two surprises occur on the same day.

Therefore, this study addresses the **issue** of when investors revise their belief to stock prices, whether they react on contemporaneous announcements or on sequential announcement. Using Hogarth and Einhorn's (1992) belief-adjustment theory, this study predicts that for consistent evidence when dividend and earnings surprises occur at the same time, they have less impact on stock returns than when they occur sequentially (dilution effect hypothesis).

Hogarth and Einhorn's (1992) belief-adjustment theory is used in this study to test the behavior of investors' reaction to the timing of dividend and earnings surprises. The **objective** of this dissertation is to test the dilution effect hypothesis using accounting information to determine whether individual behavior as predicted by the theory is consistent with the aggregate behavior of investors.

THEORY AND HYPOTHESES DEVELOPMENT

The Belief-Adjustment Theory

Beliefs are the critical component in the decision making process (Beaver 1989). The level of beliefs determines decision making behavior. The role of information is to alter beliefs. Therefore, decision making behavior is altered when newly arrived information changes beliefs. Beaver (1989), using this argument, also stated that the role of accounting information is to alter the beliefs of investors.[3] Investor beliefs are unobservable. Stock prices can be viewed as arising from an equilibrium process of investors' beliefs (Bamber 1987; Lev 1988; Beaver 1989; Kim and Verrecchia 1991; and Bamber and Cheon 1995).[4]

Dividend and earnings surprises are chosen because not only are they individually important accounting information but they also possess characteristics that can alter beliefs. The timing of dividend and earnings surprises varies. Some companies routinely announce dividend and earnings surprises simultaneously. Other companies make the announcements separately. The question thus arises as to whether the presentations of timing of dividend and earnings surprises can alter investors' beliefs differently.

Application of the theory in this study may expand our understanding of when two different pieces of accounting information

[2] The terms surprise, evidence, news and unexpected change are used interchangeably in this study.

[3] The use of the term investors as shareholders is consistent with the primary user orientation of FASB (1978). Other groups of users are bondholders, corporate raiders, and suppliers, among others.

[4] There is a conceptual difference between stock price and trading volume. While price changes reflect changes in the aggregate market's average *beliefs*; in contrast, trading volume is the sum of all individual investors' *actions* (Bamber and Cheon 1995).

jointly considered by investors may affect their beliefs. In accounting settings, the theory has been applied in auditing (for example, Ashton and Ashton 1988, 1990; and McMillan and White 1993), in management accounting (Dillard et al. 1991) and in taxation (Pei et al. 1990), but not in financial market studies.

Because of differences in type, order and timing of evidence, belief-adjustment theory predicts different effects in belief adjustment. The type of evidence is determined by whether all of the evidence is in the same direction (consistent evidence) or not (mixed evidence). Recall that the definition of evidence is an unexpected change (surprise) in value of dividends or earnings. Consistent evidence is a series of surprises that have the same direction, either all positive (increasing value) or all negative (decreasing value). Mixed evidence is a series of negative and positive surprises. Order classifies the sequence of evidence. It distinguishes between dividend surprises followed by and preceding earnings surprises (DE versus ED, where D and E stand for dividend and earnings surprises, respectively), and between negative surprises and positive surprises. Timing of evidence refers to the mode of evidence whether surprises are presented sequentially or simultaneously.

The belief-adjustment model can be formulated as follows (Hogarth and Einhorn 1992).

$$B_k = B_{k-1} + w_k \cdot E_k(d), \qquad (1)$$

Where:

- B_k = current belief about stock price after evaluating k pieces of dividend and, or earnings evidence,
- B_{k-1} = anchor or prior belief about stock price,
- w_k = the adjustment weight for the k^{th} piece of dividend or earnings evidence,
- $E_k(d)$ = magnitude of the k^{th} piece of dividend or earnings evidence,
- d = the direction of the evidence, whether it is negative or positive evidence.

Evidence or a surprise is defined as a change in value of dividends or earnings from prior to current quarters. The value of the adjustment weight, w_k, depends on the direction of the evidence. Hogarth and Einhorn (1992) argued that for negative evidence, $E_k(-)$, the adjustment weight (w_k) is specified as proportional to the anchor (B_{k-1}):

$$w_k = \alpha \cdot B_{k-1} \text{ for } 0 \le \alpha < 1. \qquad (2a)$$

This argument implies an effect called the contrast effect: larger anchors (B_{k-1}) are "hurt" more than smaller ones by the same negative evidence. Hogarth and Einhorn (1992) gave a rationale for this treatment as follows. The same negative evidence causes a larger reduction in high anchors than it does in low anchors. They argued that it is the behavior of the people who have a tendency to perceive that low anchors are already low and will not reduce them as much as if the anchors are high.

With the same argument, it is assumed that for positive evidence, w_k is inversely proportional to the anchor or in other words, the same positive evidence increases more for small anchors than it does for large anchors (Hogarth and Einhorn 1992):

$$w_k = \beta \cdot (1-B_{k-1}) \text{ for } 0 \le \beta < 1. \qquad (2b)$$

The adjustment weight is also affected by one's sensitivity toward negative or positive evidence, α and β, respectively. Values of α=1 and β=1 indicate high sensitivity to negative and positive evidence, respectively. Similarly, α=0 and β=0 indicate no sensitivity to negative and positive evidence, respectively.[5]

Substituting equation (2a) and (2b) into equation (1) yields:

$$B_k = B_{k-1} + \alpha \cdot B_{k-1} \cdot E_k(-), \text{ and} \qquad (3a)$$

$$B_k = B_{k-1} + \beta \cdot (1 - B_{k-1}) \cdot E_k(+). \qquad (3b)$$

[5] For α=0 and β=0, the models are equivalent to the random walk model.

Equation (3a) refers to a belief-adjustment model for negative evidence and equation (3b) refers to a belief-adjustment model for positive evidence.

Two response modes are recognized by the belief-adjustment theory: the Step-by-Step (SbS) and the End-of-Sequence (EoS). In the SbS, evidence is presented and evaluated sequentially, while in the EoS, evidence is presented and evaluated simultaneously or at once. Under the condition that attitudes toward evidence are sensitive, sequential presentation of consistent evidence will yield greater belief revision than will simultaneous presentation of consistent evidence. This effect is called the dilution effect in simultaneous processing (Ashton and Ashton 1988).

DEVELOPMENT OF HYPOTHESES

A dilution effect is predicted for simultaneous, consistent evidence. It suggests that the effect of simultaneous evidence on the belief adjustment is smaller than that of sequential evidence (Ashton and Ashton 1988). Studies in experimental psychology using accounting settings (Ashton and Ashton 1988; McMillan and White 1993; Dillard et al. 1991; and Pei et al. 1990) supported the predictions of the theory. This study tests the theory whether such behavior holds for share price data at the market level.

The issue of whether dividend and earnings surprises are interactive when they are announced jointly was not formally addressed until the Kane et al. (1984) study. This study used 352 observations of quarterly earnings and dividend surprises that occurred within 10 days of each other between the fourth quarter of 1979 and the second quarter of 1981. A naive dividend expectation model and the Box-Jenkin's earnings expectation model were used. Cumulative abnormal returns were calculated for days -10 to +10 using a market model. This study found that both earnings and dividends convey information. Including dummies that represent the signs of dividend and earnings surprises made the earnings and dividend coefficients insignificant, but left the dummies significant. They concluded that a corroborative effect exists between earnings and dividend surprises in the sense that markets interpret surprises in relationship to each other.[6]

Chang and Chen (1991) reexamined the Kane et al. (1984) study. They used a sample of 2,688 earnings and dividend announcements from 1981 to 1984. Initially, they used the same methods employed in Kane et al. They found support for the corroborative effect. But they suspected that the long event window (30 days) used by Kane et al. might account for the effect. So, they conducted tests to vary the interval between announcements and the length of CAR windows. They did not find any systematic patterns of earnings effect, dividend effect and corroborative effect across different intervals. The interaction dummies were only significant when the CAR windows were more than 10 days. They concluded that the corroborative effect did not exist and that the Kane et al. finding was due to corporate noise (other events) within the long window interval.

Leftwich and Zmijewski (1994) also conducted a joint study of dividend and earnings surprises. Their focus was on contemporaneous announcements. The contemporaneous announcements were identified

[6] Freeman and Tse (1989) extended the analysis of corroborative effect to earnings postannouncement events. They argued that additional postannouncement information causes investors to adjust their belief regarding the permanent nature of earnings. They defined two type of corroboration news: “confirmed earnings” (an increase in both previous quarter and current quarter random walk forecast errors) and “contradicted earnings” (a different sign of random walk forecast errors in previous and current quarters). They tested the corroboration hypothesis that positive prior quarter forecast errors are associated with positive (negative) current quarter abnormal returns if the corroboration news is confirmed (contradicted). Similarly, negative prior quarter forecast errors are associated with negative (positive) current quarter abnormal returns if the corroboration news is confirmed (contradicted). Their findings supported the hypothesis.

when the CRSP dividend declaration dates and Compustat earnings announcement dates were within the same trading day of each other. Their final sample consisted of 972 observations from 1977 to 1987. Three-day excess returns were regressed on earnings forecast error and the dividend forecast error. The coefficients from the earnings and dividend forecast errors were 0.490 (t statistic of 4.03) and 2.412 (t statistic of 2.99), respectively. They concluded, without presenting statistical evidence, that quarterly dividend surprises conveyed information beyond that contained in contemporaneous quarterly earnings surprises. Considering the signs of the surprises, their univariate tests showed that when there is no dividend surprises, the negative and positive earnings surprises earned excess returns of 0.68 percent and –0.46 percent, respectively. On the contrary, if there is no earnings surprise, none of the dividend surprises produced excess returns that were statistically greater than zero.

Further, Leftwich and Zmijewski regressed the excess returns on six dividend and six earnings interaction variables. The interactions variables represent interaction between the magnitude of the dividends or earnings and their signs (positive, zero or negative forecast errors). From the six dividend coefficients, only one coefficient for positive earnings and negative dividend surprises was reliably greater than zero. All six coefficients for the earnings interaction variables were statistically greater than zero. From these results, again without comparing them statistically, they concluded that earnings provide information beyond that provided by dividends, especially when dividends and earnings provide consistent surprises or when dividends provide no surprise. Since this study focused only on the contemporaneous announcements, the order of surprises, whether dividend surprises follow or precede earnings surprises or whether good news follows or precedes bad news was not investigated.

Eddy and Seifert (1992) also investigated the joint effects of dividend and earnings surprises. They defined announcements as joint announcements if they occurred within two trading days of each other. They used a sample of 1,111 firms from 1983 to 1985. The naive dividend expectation model and the Value Line analyst's earnings forecast model were used. They found that dividend and earnings surprise effects were not substitutes for each other. This means that the effects of joint surprises in contemporaneous (simultaneous) announcements and single surprise in noncontemporaneous (sequential) announcements are different. From their univariate test, they found that stock price reactions were significantly greater for contemporaneous consistent positive surprises than those for single noncontemporaneous surprises. Eddy and Seifert (1992) compared the means price reaction of the two types of announcements. Based on the univariate test, they found that the reaction to joint dividend and earnings surprises was significantly higher than the reaction of a single dividend or earnings surprises announced separately by more than two days. This result was not surprising since they compared the effect of two pieces of evidence to that of only one piece of evidence. Other things equal, of course, the former will yield a greater effect than the latter. Had they compared the mean price reaction of joint dividend and earnings surprises to that of two single surprises added together, the result could be different. The belief-adjustment theory predicts that the former will yield a smaller effect (dilution effect) than the latter.

The dilution effect can be demonstrated as follows. For consistent evidence, consider again the basic model in equations (3a) and (3b). For first evidence, the equations can be written as:

$$B_1^- = B_0 + \alpha \cdot B_0 \cdot E_1(-)$$
$$= B_0 \cdot [1 + \alpha \cdot E_1(-)], \text{ and} \quad (4a)$$

$$B_1^+ = B_0 + \beta \cdot (1 - B_0) \cdot E_1(+). \quad (4b)$$

After consistent second evidence, equations (3a) and (3b) can be written as:

$$B_2^{-,-} = B_1^{-} + \alpha \cdot B_1^{-} \cdot E_2(-)$$

$$= B_1^{-} \cdot [1 + \alpha \cdot E_2(-)], \text{ and} \quad (5a)$$

$$B_2^{+,+} = B_1^{+} + \beta \cdot (1 - B_1^{+}) \cdot E_2(+). \quad (5b)$$

For the consistent negative evidence, substituting B_1^{-} from equation (4a) into equation (5a) will yield:

$$B_2^{-,-} = B_0 \cdot [1 + \alpha \cdot E_1(-)] \cdot [1 + \alpha \cdot E_2(-)] \quad (6a)$$

When two pieces of negative evidence are presented sequentially, from equation (6a), the final belief becomes:

$$B_2^{-,-} = B_0 \cdot [1 + \alpha \cdot E_1(-)] \cdot [1 + \alpha \cdot E_2(-)]$$

$$= B_0 \cdot [1 + \alpha \cdot E_1(-) + \alpha \cdot E_2(-) + \alpha \cdot E_1(-) \cdot \alpha \cdot E_2(-)]$$

$$= B_0 + B_0 \cdot [\alpha \cdot E_1(-) + \alpha \cdot E_2(-) + \alpha \cdot E_1(-) \cdot \alpha \cdot E_2(-)].$$

For simultaneous presentation of consistent evidence, Ashton and Ashton (1988) argued that information is evaluated as a whole based on the accretion model as follows:

$$\overset{*}{E}_2(-) = E_1(-) + E_2(-) + E_1(-) \cdot E_2(-). \quad (7)$$

When two pieces of negative evidence are presented simultaneously, from equation (3a), the final belief is:

$$\overset{*}{B}{}_2^{-,-} = B_0 + \alpha \cdot B_0 \cdot \overset{*}{E}_2(-)$$

$$= B_0 + \alpha \cdot B_0 \cdot [E_1(-) + E_2(-) + E_1(-) \cdot E_2(-)].$$

The difference between belief resulting from sequential consistent evidence and that from simultaneous consistent evidence is the size of the dilution effect, which can be stated as follows:

$$B_2^{-,-} - \overset{*}{B}{}_2^{-,-} = B_0 + B_0 \cdot \alpha \cdot E_1(-) + B_0 \cdot \alpha \cdot E_2(-) + B_0 \cdot \alpha \cdot E_1(-) \cdot \alpha \cdot E_2(-) - B_0 - B_0 \cdot \alpha \cdot E_1(-) - B_0 \cdot \alpha \cdot E_2(-) - B_0 \cdot \alpha \cdot E_1(-) \cdot E_2(-)$$

$$= B_0 \cdot \alpha \cdot E_1(-) \cdot \alpha \cdot E_2(-) - B_0 \cdot \alpha \cdot E_1(-) \cdot \alpha \cdot E_2(-)$$

$$= B_0 \cdot \alpha \cdot E_1(-) \cdot \alpha \cdot E_2(-) \cdot (\alpha - 1). \quad (8)$$

Since $0 < \alpha < 1$, i.e., one's attitude toward negative evidence is disconfirmation prone (sensitive toward negative evidence), $(\alpha - 1)$ is negative. Therefore $B_2^{-,-} - \overset{*}{B}{}_2^{-,-}$ is negative. This result shows that for negative consistent evidence, the negative impact of sequential processing on the final belief is greater than that of simultaneous processing.[7] This dilution effect indicates that simultaneous processing weakens the impact of the negative evidence.

The dilution effect in simultaneous processing also occurs for consistent positive evidence. When two pieces of positive evidence are presented sequentially, from equation (5b), the final belief is:

$$B_2^{+,+} = B_0 + \beta \cdot (1 - B_0) \cdot [E_1(+) + E_2(+) - \beta \cdot E_1(+) \cdot E_2(+)]$$

$$= B_0 + \beta \cdot (1 - B_0) \cdot E_1(+) + \beta \cdot (1 - B_0) \cdot E_2(+) - \beta \cdot (1 - B_0) \cdot \beta \cdot E_1(+) \cdot E_2(+).$$

[7] For example, assume that the initial stock price (B_0) is \$10; that strengths of the evidence are –0.2 and –0.3 for first negative evidence, $E_1(-)$, and second negative evidence, $E_2(-)$, respectively; and that investor sensitivity toward negative evidence, α, is 0.5. If evidence is presented sequentially, the new stock price, $B_2^{-,-}$, will be \$10 + \$10[(0.5)·(–0.2) + (0.5)·(–0.3) + (0.5)·(–0.2)·(0.5)·(–0.3)] = \$7.65. The change of initial and new prices is \$7.65 - \$10 = –\$2.35. If negative evidence is presented simultaneously, the new stock price, $\overset{*}{B}{}_2^{-,-}$, will be \$10 + (0.5)·(\$10)[·(–0.2) + (–0.3) + (–0.2)·(–0.3)] = \$7.80. The change of initial and new prices is \$7.80 - \$10 = –\$2.20. The difference of –\$0.15 is the dilution effect.

When two pieces of positive evidence are presented simultaneously, from equation (3b), the final belief becomes:

$$\overset{*}{B}{}_2^{+,+} = B_0 + \beta\cdot(1 - B_0)\cdot E^*_2(+)$$

$$= B_0 + \beta\cdot(1 - B_0)\cdot[E_1(+) + E_2(+) - E_1(+)\cdot E_2(+)]$$

$$= B_0 + \beta\cdot(1 - B_0)\cdot E_1(+) + \beta\cdot(1 - B_0)\cdot E_2(+) - \beta\cdot(1 - B_0)\cdot E_1(+)\cdot E_2(+).$$

The difference between the two beliefs is:

$$B_2^{+,+} - \overset{*}{B}{}_2^{+,+} = - \beta\cdot(1 - B_0)\cdot\beta\cdot E_1(+)\cdot E_2(+) + \beta\cdot(1 - B_0)\cdot E_1(+)\cdot E_2(+)$$

$$= \beta\cdot(1 - B_0)\cdot E_1(+)\cdot E_2(+)\cdot (1 - \beta). \quad \text{.....(9)}$$

Since $0 < \beta < 1$, i.e., one's attitude toward positive evidence is confirmation prone (sensitive toward positive evidence), $(1 - \beta)$ is positive. Therefore $B_2^{+,+} - \overset{*}{B}{}_2^{+,+}$ is positive. This suggests that for positive consistent evidence, the positive impact of sequential processing on the final belief is greater than that of simultaneous processing. The dilution effect in simultaneous processing of consistent positive evidence weakens the impact of the positive evidence.

The results of the dilution effect lead to the following hypotheses:

H1 The dividend response coefficient of a negative dividend surprise is smaller for simultaneous consistent negative evidence than the dividend response coefficient of a negative dividend surprise for sequential consistent negative evidence.

H2 The earnings response coefficient of a negative earnings surprise is smaller for simultaneous consistent negative evidence than the earnings response coefficient of a negative earnings surprise for sequential consistent negative evidence.

H3 The dividend response coefficient of a positive dividend surprise is smaller for simultaneous consistent positive evidence than the dividend response coefficient of a positive dividend surprise for sequential consistent positive evidence.

H4 The earnings response coefficient of a positive earnings surprise is smaller for simultaneous consistent positive evidence than the earnings response coefficient of a positive earnings surprise for sequential consistent positive evidence.

METHODOLOGY

Sample Selection

Data for this study are collected from quarterly Compustat and Center for Research in Security Prices (CRSP) tapes from 1979-1993. The sample contains firms that initiate dividend changes after maintaining constant payouts for at least five quarters in a row. There are two reasons for this restriction. First, some firms have a consistent payout pattern, that is they pay constant dividends for the first three quarters and increase the payouts for the fourth quarter. They employ this pattern from year to year. In this case, the increase of dividends in the fourth quarter is probably already expected by the market. Restriction to a five-quarter constant payout will exclude these firms. Second, this dissertation, like other studies, uses a naive dividend random-walk expectation model. The justification of this model is based on the assumption that firms are reluctant to change their dividend policy unless they expect changes in the future prospects of the firms. When firms initiate a change in their dividend policy, the change will be unexpected by the markets (Asquith and Mullins 1983). Consistent with this assumption, five quarters of constant dividends is required. Five quarters are considered long enough for the market to learn that firms did not change their dividend policy. Therefore, initial dividend changes after five consecutive quarters of constant payouts reduce the possibility that the changes were expected.

Announcement dates for the corresponding earnings per share are collected from Compustat tapes. Dividend announcement dates are collected from CRSP tapes. When dividends and earnings are announced on the same day, they are categorized as simultaneous (joint or contemporaneous) announcements. When the interval is three or more days, they are considered as sequential (noncontemporaneous) announcements. A total of 2,413 pairs of surprises are collected for sequential announcements and 157 pairs for simultaneous announcements. Table 1 shows the sample selection.

Table 1. Sample Selection Process

Description	Simultaneous Announcements		Sequential Announcements		Total	
	Firm-quarter	Number of firms	Firm-quarter	Number of firms	Firm-quarter	Number of firms
Pairs of announcements dates collected	159	117	2528	1072	2689	1126
Pairs are dropped due to:						
- non-recurring or unspecified frequency of cash dividend	-	-	(2)	(2)	(2)	(2)
- Dividend reinvestment plans	(1)	(1)	(95)	(52)	(97)	(53)
- Extra or special dividends	-	-	(2)	(2)	(2)	(2)
- Foreign currency cash dividend converted to U.S. dollars	-	-	(1)	(1)	(1)	(1)
- Cash dividend paid for liquidation or reorganizations (4)	-	-	(3)	(3)	(3)	(3)
- Stock splits	(1)	(1)	(11)	(11)	(13)	(12)
- Stock Dividend	-	-	(1)	(1)	(1)	(1)
Final Pairs	157	115	2413	1000	2570[a]	1052[b]

Notes:

[a] These observations include 16 late announcers in which firms announced their earnings in the fourth quarter at least one week late compared to their announcement date in year t-1. Investors' beliefs may be affected if they perceived that the late announcement was due to an auditing problem. Sensitivity analysis was conducted to test for any significant differences between late announcers and timely announcers. The results remain the same.

[b] The total number of firms should be 1115 (115 + 1000). The difference is due to the fact that the same 63 firms were included in both the simultaneous and sequential announcement groups.

Empirical Models

The following equations (10) and (11) are used to test the dilution effect hypotheses that simultaneous surprises have less impact on stock price changes than sequential surprises.

$$MRR^T_{SEQ} = \lambda_0 + \lambda_1\, MIMR^T_{SEQ} + \lambda_2\, X_{SEQ}(-,-)\cdot\Delta DPS + \lambda_3\, X_{SEQ}(-,-)\cdot\Delta EPS + \lambda_4\, X_{SEQ}(+,+)\cdot\Delta DPS + \lambda_5\, X_{SEQ}(+,+)\cdot\Delta EPS + \varepsilon. \quad (10)$$

$$MRR^T_{SIM} = \psi_0 + \psi_1\, MIMR^T_{SIM} + \psi_2\, X_{SIM}(-,-)\cdot\Delta DPS + \psi_3\, X_{SIM}(-,-)\cdot\Delta EPS + \psi_4\, X_{SIM}(+,+)\cdot\Delta DPS + \psi_5\, X_{SIM}(+,+)\cdot\Delta EPS + \varepsilon. \quad (11)$$

Where:

1. The dependent variables are MRR^T_{SEQ} and MRR^T_{SIM}. For the sequential group, MRR^T_{SEQ} is the average of the mean raw return for dividend and earning surprises. It is calculated as $(MRR^D + MRR^E)/2$. For the simultaneous group, MRR^T_{SIM} represents the mean of three-day raw returns (days -1, 0 and +1, for day 0 is the same dividend and earnings announcement day). MRR_i for each firm is calculated as the mean of relative price changes (raw returns) at the announcement day (t = 0), one day before (t=-1) and one day after the announcement day (t = +1) as follows: [8]

$$MRR_i = \frac{1}{3}.\sum_{t=-1}^{1}\frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$$

$$= \frac{1}{3}.\left(\frac{P_{i,-1} - P_{i,-2}}{P_{i,-2}} + \frac{P_{i,0} - P_{i,-1}}{P_{i,-1}} + \frac{P_{i,1} - P_{i,0}}{P_{i,0}}\right) \quad \cdots\cdots (12)$$

where $P_{i,t}$ and $P_{i,t-1}$ are stock prices at the announcement date and one day before the announcement date, respectively, for each firm.

2. $MIMR^T$ is the mean index of market returns and is explained below. This model is similar to the return models used by Ahmed (1994) and Kallapur (1994). $MIMR^T$ is the mean of the CRSP value-weighted index of market returns at the announcement date, one day before and one day after. The purpose of using $MIMR^T$ is to control for market factors that affect stock returns, such as interest rates or market risk premia (Kallapur 1994). Further, Kallapur used the market returns index to transform the raw returns in the dependent variable into market- and risk-adjusted returns.

3. Naive dividend and earnings expectation models are used to determine ΔDPS and ΔEPS.[9] ΔDPS (ΔEPS) is calculated as the quarterly change in dividends (earnings) deflated by the last quarter stock price since it can reduce cross-section dependency bias (Christie 1987).

4. The dilution effect occurs in consistent evidence. Therefore, only interaction dummies for consistent evidence are included in the models. The dummy variable $X_{SEQ}(-,-)$ is the combination of dummies DE(-,-) and ED(-,-), while $X_{SEQ}(+,+)$ is the combination of dummies DE(+,+) and ED(+,+) for sequential announcements. For simultaneous surprises, the dummy variable $X_{SIM}(-,-)$ is the combination of dummies DE(-,-) and ED(-,-), while $X_{SIM}(+,+)$ is the combination of dummies DE(+,+) and ED(+,+). The dilution effects occur when coefficients ψ_2, ψ_3, ψ_4 and ψ_5 are smaller than coefficients λ_2, λ_3, λ_4 and λ_5.

RESULTS

Descriptive Statistics of the Sample

The following table provides descriptive statistics for variables used in this study.

[8] This measurement differs from Kane et al.'s (1984). Kane et al. calculated CAR as the accumulation of abnormal returns started 10 days before the first announcement and ended 10 days after the second announcement. But long intervals between the two announcements create noise in the measurement. To avoid this noise, days between two announcements are not used in the return calculation; rather, returns are calculated separately for each surprise.

[9] Using the random walk process means that ΔDPS (ΔEPS) measures unexpected surprises. But unexpected dividends and earnings as proxies for unobservable market expectations are subject to measurement errors, which lead to regression coefficients that are downward biased. The leading return period procedure can be used to reduce the measurement errors (Brown 1987; Youn-Cho and Jung, 1991). Hence, the one quarter stock return as the leading return period is added to the regression model for sensitivity analysis. The one quarter stock return (RETQ) is measured as $(P_q - P_{q-1} + DIV_q) / P_{q-1}$, where DIV_q is the cash dividend per share, P_q and P_{q-1} are the current and prior quarter stock returns. The results using this procedure are qualitatively similar in this research.

Table 2 Descriptive Statistics

Panel A. DIV, ΔDPS, EPD dan ΔEPS.

		DIV		ΔDPS		EPS		ΔEPS	
Case	Pattern	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	DE(-,-)	0.1520	0.1437	-0.0051	0.0053	-0.0542	0.7249	-0.0191	0.0246
2	DE(+,+)	0.2651	0.1897	0.0008	0.0006	0.8093	0.5205	0.0088	0.0135
3	ED(-,-)	0.1433	0.1181	-0.0062	0.0066	-0.2801	1.2893	-0.0344	0.0639
4	ED(+,+)	0.3461	0.2300	0.0009	0.0007	0.9060	0.6110	0.0112	0.0163
5	DE(-,+)	0.1712	0.1295	-0.0041	0.0046	0.4684	0.6120	0.0403	0.0983
6	DE(+,-)	0.2852	0.2107	0.0008	0.0005	0.5630	0.5980	-0.0110	0.0178
7	ED(-,+)	0.3188	0.2149	0.0009	0.0007	0.5329	0.5944	-0.0153	0.0290
8	ED(+,-)	0.1757	0.1416	-0.0056	0.0049	0.1868	0.5869	0.0389	0.0582
1-8		0.2805	0.2070	0.0002	0.0025	0.6405	0.6488	-0.0008	0.0308

Panel B. TASSET, MRR^D, MRR^E and MRR^T.

Case	Pattern	TASSET		MRR^D		MRR^E		MRR^T	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	DE(-,-)	2987.83	4398.34	-0.0011	0.0121	-0.0003	0.0206	-0.0007	0.0112
2	DE(+,+)	5078.76	12468.80	0.0005	0.0103	0.0020	0.0154	0.0013	0.0096
3	ED(-,-)	1967.43	4469.22	-0.0050	0.0268	-0.0015	0.0168	-0.0033	0.0144
4	ED(+,+)	4443.11	11408.43	0.0010	0.0122	0.0017	0.0135	0.0013	0.0090
5	DE(-,+)	5426.88	16805.10	-0.0018	0.0167	0.0239	0.0421	0.0110	0.0229
6	DE(+,-)	4489.27	13841.26	0.0005	0.0116	-0.0024	0.0192	-0.0009	0.0118
7	ED(-,+)	4544.73	11920.83	0.0021	0.0123	-0.0016	0.0155	0.0002	0.0102
8	ED(+,-)	6246.90	22446.74	-0.0090	0.0372	0.0045	0.0164	-0.0022	0.0204
1-8		4693.39	12883.38	0.0004	0.0138	0.0004	0.0177	0.0004	0.0114

[*] p-values are based on one-tail tests.

DIV = dividend per share in dollar, ΔDPS=change of dividend divided by total assets, EPS= earnings per share in dolar, ΔEPS=change of earnings divided by total assets, TASSET=total assets in millions of dollars, MRR^D=three-day mean raw return at dividend announcement date, MRR^E=three-day mean raw return at earnings announcement date, MRR^T=three-day mean raw return at dividend and earnings announcement dates.

Diagnostics

The hypotheses are tested using ordinary least squares regressions. Diagnostics are conducted to ensure that the multicollinearity and heteroskedasticity problems do not bias the results. Multicollinearity occurs when two or more explanatory variables in the regression model are highly correlated. For the sequential sample, correlations between $MIMR^T_{SEQ}$ and ΔDPS, $MIMR^T_{SEQ}$ and ΔEPS, and ΔDPS and ΔEPS are 0.00566, -0.02587 and -0.12175, respectively (see Panel A of Table 3). For the simultaneous sample, correlations between $MIMR^T_{SIM}$ and ΔDPS, $MIMR^T_{SIM}$ and ΔEPS, and ΔDPS and ΔEPS are 0.03550, 0.14103 and 0.39673, respectively (see Panel B of Table 3). All of the correlations are relatively small which suggests that multicollinearity is not a serious problem. The condition number can also be used to detect multicollinearity problems. All the condition number reported for each regression model is below 20, the critical value of potential multicollinearity problem (Greene 1993). Again, this suggests that multicollinearity is not a serious problem in this study.

Table 3. Correlation Matrixes
Panel A. Sequential Announcement Sample

	MRR^D	MRR^E	MRR^T_{SEQ}	ΔDPS	ΔEPS	$MIMR^D$	$MIMR^E$
MRR^E	0.03239						
	(0.1121)						
MRR^T_{SEQ}	0.63167	0.79529					
	(0.0001)	(0.0001)					
ΔDPS	0.03151	-0.06037	-0.02771				
	(0.1223)	(0.0030)	(0.1741)				
ΔEPS	-0.00630	0.08690	0.06359	-0.12175			
	(0.7576)	(0.0001)	(0.0018)	(0.0001)			
$MIMR^D$	0.29644	0.07176	0.23546	0.02341	-0.00407		
	(0.0001)	(0.0004)	(0.0001)	(0.2510)	(0.8419)		
$MIMR^E$	0.02178	0.25628	0.21199	-0.01016	-0.03161	0.14787	
	(0.2854)	(0.0001)	(0.0001)	(0.6184)	(0.1210)	(0.0001)	
$MIMR^T_{SEQ}$	0.18381	0.23163	0.29115	0.00566	-0.02587	0.67553	0.82912
	(0.0001)	(0.0001)	(0.0001)	(0.7814)	(0.2046)	(0.0001)	(0.0001)

Panel B. Simultaneous Announcement Sample

	MRR^T_{SIM}	ΔDPS	ΔEPS
ΔDPS	0.14827		
	0.0639		
ΔEPS	0.12756	0.39673	
	0.1114	0.0001	
$MIMR^T_{SIM}$	0.24452	0.03550	0.14103
	0.0020	0.6589	0.0781

Definition:

MRR^D = mean of the raw returns in the three day period at, before, and after the dividend announcement day.

MRR^E = mean of the raw returns in the three day period at, before, and after the earnings announcement day.

MRR^T_{SEQ} = mean of the raw returns in the three day period at, before, and after the dividend announcement day, and in the three day period at, before, and after the earnings announcement day.

MRR^T_{SIM} = mean of the raw returns in the three day period at, before, and after the simultaneous dividend and earnings announcement day.

$MIMR^D$ = mean of the CRSP value-weighted market returns in the three day period at, before, and after the dividend announcement day.

$MIMR^E$ = mean of the CRSP value-weighted market returns in the three day period at, before, and after the earnings announcement day.

$MIMR^T_{SEQ}$ = mean of the CRSP value-weighted market returns in the three day period at, before, and after the dividend announcement day, and in the three day period at, before, and after the earnings announcement day.

$MIMR^T_{SIM}$ = mean of the CRSP value-weighted market returns in the three day period at, before, and after the simultaneous dividend and earnings announcement day.

ΔDPS = quarterly change of dividends deflated by prior quarter stock price (dividend surprises).

ΔEPS = quarterly change of earnings deflated by prior quarter stock price (earnings surprises).

The use of deflators is one of the methods to correct the heteroskedasticity problem. Prior quarter stock prices is used as the deflator (Christie 1987). The remaining heteroskedasticity is overcome using White's (1980) correction for heteroskedasticity.

Hypotheses Testing

Table 4 provides regression models to test the dilution effect hypotheses. The dilution effect only occurs for consistent evidence. Therefore, the regression models only consist of interaction dummies for consistent evidence as seen in equations (10) and (11). Models 1 and 2 in Table 4 are compared to test the dilution effect hypotheses for shorter intervals of sequential announcements. Model 1 is run using a sample where the interval between dividend and earnings announcements is 10 days or less, while model 2 is for intervals more than 10 days. A new variable called INTERVAL is added in model 3. INTERVAL contains values of intervals between dividend and earnings announcement dates, ranging from 3 to 90 days. The variable, INTERVAL, is an alternative test of the dilution effect. If the dilution effect exists for shorter intervals, the INTERVAL coefficient will be significantly positive which indicates that longer intervals have a greater effect on stock returns than shorter intervals. Model 3 is run using the full sample of sequential announcements. Model 4 is similar to model 3 but without INTERVAL variable. Model 5 is similar to model 4 but is run using the full sample of simultaneous announcements. Model 4 is compared to model 5 to test the dilution effect hypothesis of simultaneous announcement.

The dilution effect is tested by comparing two samples: the simultaneous announcement sample and the sequential announcement sample. Two groups of regressions are run: one for the simultaneous announcement sample (SIM) and another for the sequential announcement sample (SEQ). The hypothesis is tested using equations (10) and (11) Dummy variables used are X(-,-) instead of ED(-,-) and DE(-,-), and X(+,+) instead of ED(+,+) and DE(+,+). X(-,-) is the combination of ED(-,-) and DE(-,-). X(+,+) is the combination of ED(+,+) and DE(+,+).

Hypothesis H1 posits that the effect of negative dividend surprises (ΔDPS) on MRR^T for consistent negative evidence is smaller for simultaneous announcements than that for sequential announcements. This hypothesis is, therefore, supported if coefficients λ_2 in equation (10) and ψ_2 in equation (11) are not significantly negative and ψ_2 is significantly smaller than λ_2. Model 5 in Table 4 shows that ψ_2 is 0.189504 (insignificant), and model 4 shows that λ_2 is 0.032628 (insignificant). The t-test used to compare the coefficients between the (SIM) and (SEQ) samples appears in Hartono(1996) as follows:

$$t = \frac{\hat{\beta}_k^{(1)} - \hat{\beta}_k^{(2)}}{\sqrt{\dfrac{SSE^{(1)} + SSE^{(2)}}{n^{(1)} - K^{(1)} + n^{(2)} - K^{(2)}} \cdot [S_{kk}^{(1)} + S_{kk}^{(2)}]}}$$

The t-statistic that $\psi_2 < \lambda_2$ is 0.226 which is insignificant for a one-tailed test. Therefore, H5a is not supported.

Table 4. Regression Results for Sequential and Simultaneous Announcements

	Sequential					Simul-taneous	t-test[a)]
	1	2	t-test[a)] 1 vs. 2	3	4	5	5 vs 4
NTERCEPT	-0.000584 (-1.112)	-0.000937 (-2.178)**		-0.000606 (-1.402)	-0.000830 (-2.443)***	-0.000382 (-0.703)	

	(-1.132)	(-1.685)*		(-1.533)	(-1.952)**	(-0.763)	
$MIMR^T$	0.998480	0.946223		0.963627	0.962233	1.784405	
	(22.108)***	(24.702)***	(0.798)	(32.170)***	(32.177)***	(43.091)***	(10.474)***
	(19.925)***	(15.621)***	(0.665)	(22.171)***	(21.415)***	(39.504)***	(12.621)***
X(-,-)·ΔDPS	0.002551	0.042979		0.034409	0.032628	0.189504	
	(0.004)	(0.088)	(-0.048)	(0.090)	(0.086)	(0.375)	(0.167)
	(0.004)	(0.057)	(-0.041)	(0.063)	(0.058)	(0.457)	(0.226)
X(-,-)·ΔEPS	-0.011316	-0.000956		-0.002263	-0.002974	0.074847	
	(-0.150)	(-0.012)	(-0.089)	(-0.040)	(-0.052)	(0.268)	(0.159)
	(-0.286)	(-0.015)	(-0.141)	(-0.055)	(-0.071)	(1.208)	(1.022)
X(+,+)·ΔDPS	0.062683	0.756553		0.549115	0.550784	0.194534	
	(0.129)	(1.848)**	(-0.986)	(1.711)**	(1.717)**	(0.391)	(-0.391)
	(0.122)	(1.635)**	(-0.999)	(1.538)**	(1.535)*	(0.529)	(-0.691)
X(+,+)·ΔEPS	0.045320	0.026690		0.031280	0.031999	-0.041393	
	(1.670)**	(1.235)	(0.482)	(1.818)**	(1.862)**	(-1.603)*	(-1.549)*
	(2.047)**	(1.678)**	(0.683)	(2.421)***	(2.411)***	(-1.172)	(-1.947)**
INTERVAL				-0.00001			
				(-0.838)			
				(-0.587)			
Condition #	3.84587	3.63819		4.96073	3.69623	3.76077	
F-Model	102.883	124.977		177.321	212.703	381.594***	
SSE	0.00802	0.03104		0.03910	0.03912	0.00148	
R^2	0.6143	0.4555		0.4974	0.4971	0.9362	
adj-R^2	0.6083	0.4518		0.4946	0.4947	0.9338	

$$MRR^T_{SEQ} = \lambda_0 + \lambda_1 MIMR^T_{SEQ} + \lambda_2 X_{SEQ}(-,-)\cdot\Delta DPS + \lambda_3 X_{SEQ}(-,-)\cdot\Delta EPS + \lambda_4 X_{SEQ}(+,+)\cdot\Delta DPS + \lambda_5 X_{SEQ}(+,+)\cdot\Delta EPS + \varepsilon. \quad .....(10)$$

$$MRR^T_{SIM} = \psi_0 + \psi_1 MIMR^T_{SIM} + \psi_2 X_{SIM}(-,-)\cdot\Delta DPS + \psi_3 X_{SIM}(-,-)\cdot\Delta EPS + \psi_4 X_{SIM}(+,+)\cdot\Delta DPS + \psi_5 X_{SIM}(+,+)\cdot\Delta EPS + \varepsilon. \quad .....(11)$$

Models:

1 = interval between dividend and earnings announcements is 10 days or less.
2 = interval between dividend and earnings announcements is more than 10 days.
3 = full sample for sequential announcements with INTERVAL variable.
4 = full sample for sequential announcements without INTERVAL variable.
5 = full sample for simultaneous announcements.

Notes:

- t-values in the parentheses. The first t-values are the unadjusted t-statistics. The second t-values are the White's adjusted t-statistics.
- All condition numbers are less than 20 indicating multicollinearity is not a problem.
- Outliers are deleted by winsorizing based on two standard-deviations for dividend and earnings surprises and ± $5 of EPS.
- The descriptive statistics suggest that firm's size, which is defined as firm's total assets (TASSET), is different across cases. Including size variable (TASSET, TASSET per share or log of TASSET) does not change the results.

[a)] The t-test is based on the formula given in equation (A-5), see Appendix A.
* = significant at the 10% level.

** = significant at the 5% level.
*** = significant at the 1% level.

Hypothesis H2 is similar to H1, but it is applied to negative earnings surprises (ΔEPS). Hypothesis H2 is supported if coefficients ψ_3 and λ_3 are not significantly negative and ψ_3 is significantly smaller than λ_3. Coefficients ψ_3 and λ_3 are 0.074847 (insignificant) and -0.002974 (insignificant), respectively. The t-statistic test of $\psi_3 < \lambda_3$ is 1.022 which is insignificant for a one-tailed test. H2 is not supported.

Hypothesis H3 posits that the effect of positive dividend surprises (ΔDPS) on MRR^T for consistent positive evidence is smaller for simultaneous announcements than that for sequential announcements. Hypothesis H5c is supported if coefficients ψ_4 and λ_4 are not significantly negative and ψ_4 is significantly smaller than λ_4. Coefficients ψ_4 and λ_4 are 0.194534 (insignificant) and 0.550784 (significant at the 10% level for a one-tailed test), respectively. The t-statistic test of $\psi_4 < \lambda_4$ is -0.691 which is insignificant for a one-tailed test. Therefore, H3 is not supported.

Hypothesis H4 is similar to H3, but it is applied to positive earnings surprises (ΔEPS). Hypothesis H4 is supported if coefficients ψ_5 and λ_5 are not significantly negative and ψ_5 is significantly smaller than λ_5. Coefficients ψ_5 and λ_5 are -0.041393 (insignificant) and 0.031999 (significant at the 1% level for a one-tailed test), respectively. The t-statistic to test $\psi_5 < \lambda_5$ is -1.947 which is significant at the 5% level for a one-tailed test. Both coefficients are not significantly negative. Therefore, H4 is supported.

Since simultaneous and sequential announcements differ only in the intervals, the dilution effects might also occur for shorter intervals of sequential announcements. To further test whether the interval itself contributes to the dilution effect, a new variable, INTERVAL, was added in the sequential announcement regression. This variable represents the actual number of days in the interval between the dividend and earnings announcement dates. If interval matters, its effect is expected to be positive, indicating that larger intervals have more effect on stock returns than shorter intervals. The result shows that INTERVAL is negative (-0.00001) and insignificant.

To further test the dilution effect for short intervals of sequential announcements, two sample groups were formed: the short interval group for stocks with intervals between dividend and earnings surprises less than or equal to 10 days, and the long interval group, for stocks with intervals more than 10 days. The cut-off point of 10 days is chosen because prior studies found that dividend and earnings announcements that were separated by more than 10 days had interaction effects. Models 1 and 2 in Table 4 show the regression results for shorter and longer interval groups, respectively. None of the t-statistics in comparing dividend and earnings response coefficients between shorter and longer intervals are significant, indicating that the dilution effect for short intervals of sequential announcements due to the magnitude of surprises does not exist.

SUMMARY AND DISCUSSION

The following Table 5 shows the summary of the hypotheses, their tests and their results.

Table 5. Summary of Hypothesis Testing

Hypo-thesis	Direction of the evidence	Magnitude of the evidence	Order of the evidence	Test of Hypothesis	Result
Dilution Effect Hypotheses:					

H5a	Negative	ΔDPS	(-,-)	$\psi_2 < \lambda_2$	Not Supported
H5b	Negative	ΔEPS	(-,-)	$\psi_3 < \lambda_3$	Not Supported
H5c	Positive	ΔDPS	(+,+)	$\psi_4 < \lambda_4$	Not Supported
H5d	Positive	ΔEPS	(+,+)	$\psi_5 < \lambda_5$	Supported

$$MRR^T_{SEQ} = \lambda_0 + \lambda_1 \, MIMR^T_{SEQ} + \lambda_2 \, X_{SEQ}(-,-)\cdot\Delta DPS + \lambda_3 \, X_{SEQ}(-,-)\cdot\Delta EPS + \lambda_4 \, X_{SEQ}(+,+)\cdot\Delta DPS + \lambda_5 \, X_{SEQ}(+,+)\cdot\Delta EPS + \varepsilon. \quad .....(10)$$

$$MRR^T_{SIM} = \psi_0 + \psi_1 \, MIMR^T_{SIM} + \psi_2 \, X_{SIM}(-,-)\cdot\Delta DPS + \psi_3 \, X_{SIM}(-,-)\cdot\Delta EPS + \psi_4 \, X_{SIM}(+,+)\cdot\Delta DPS + \psi_5 \, X_{SIM}(+,+)\cdot\Delta EPS + \varepsilon. \quad ......(11)$$

The dilution effect hypothesis posits that consistent dividend and earnings surprises have less impact on stock returns when they occur simultaneously than when they occur sequentially. This effect is only supported for positive earnings surprises. This means that positive earnings surprises have less impact on stock returns when they are announced simultaneously with positive dividend surprises than when they are announced sequentially. The dilution effect hypotheses are not supported for negative dividend surprises, positive dividend surprises and negative earnings surprises. Apparently, timing of announcements for these surprises is not important. Surprisingly, for consistent evidence, not only timing (when two surprises should be announced), but order (how they are presented) is also unimportant (see discussion about the 'no-order' effect hypotheses above). These findings are inconsistent with results found in the Ashton and Ashton (198) experiment that support the dilution effect in simultaneous processing.

When does the behavior occur? The theory predicts that the behavior will be less likely to occur when evidence is presented simultaneous than when it is presented sequentially (dilution effect). The dissertation finds that the timing of evidence is unimportant.

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