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EX-DAY BEHAVIOR OF JAPANESE STOCK PRICES:
NEW INSIGHTS FROM NEW METHODOLOGY

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ABSTRACT

We study the ex-dividend day behavior of Japanese stock prices for the

period 1983-87. We find that, contrary to previous findings, prices of ex-

day stocks drop by nearly the <u>full amount</u> of the dividend. However, ex-day

stocks shows an abnormal return. Also, for the many ex-dividend day stocks

that also go ex-rights on the same ex-day, we find that the return is on

average higher than that for stocks without rights issues. We thus conclude

that the ex-day behavior of Japanese stocks are qualitatively similar to that

of U.S. stocks.

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1. Introduction and Summary

In this paper we study the ex-dividend day behavior of prices of common stocks of firms traded in the Tokyo Stock Exchange. The motivation for our study is similar to that of studies that have been conducted using stock prices in the U.S.A. If dividends and capital gains are taxed differently at the hands of investors, then the relation between the ex-dividend day price drop and the amount of the dividend will provide information about the trans- actions costs and the differential tax rate on dividends over capital gains of the marginal investor.[1] As Campbell and Beranek (1955) note, such informa- tion will be useful to the portfolio decisions of investors. For example, if prices fall by the full amount of the dividends, then it will be optimal for an investor who pays taxes on dividend income but not on capital gains to accelerate any sale (and delay any purchase) in order to avoid getting the dividends.

Earlier studies on the ex-dividend day behavior of U.S. stocks include Elton and Gruber (1970), who find that the ratio of the ex-day price drop to the amount of the dividend is on average 0.778 during the period April 1966 to March 1967. Kalay (1982) reports an average ratio of 0.881 for the same period for a different sample for U.S.A stocks. The corresponding numbers for high dividend yield stocks are 1.18 and 1.29 respectively, suggesting that the clientele for high dividend yield stocks are those who prefer dividend income to capital gains.

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[1] Poterba and Summers (198) provide evidence from the British stock market supporting the view that ex-dividend day price behavior is related to the tax differential between dividend income and capital gains of individual investors.

There are reasons to believe that Japanese institutional investors,
under the regulatory constraint of being barred from distributing capital
gains to policyholders, prefer dividend income.[2] It is surprising, then,
that the ratio of the price drop to the amount of dividends is much smaller
than one for Japan.[3] Maru, Kon-ya and Yonezawa (1979), which to our knowl-
edge is the only existing study on the ex-day behavior of Japanese stock
prices, report that the ratio is on average 0.176 during the ten year period
of 1968-77, a figure much too low to be justified by the differential tax
rates on dividends and capital gains.

In evaluating this anomalous result, it is important to bear in mind the
institutional peculiarity of Japan that ex-dividend days are highly concen-
trated on just several days of the year. The price drop due to dividends for
stocks going ex-dividend on the same day could be obscured by news to the
stock market. It is possible that Maru _et. al._'s figure, which is an average
over just twenty ex-days, is contaminated by the effect of good news for a few
ex-days in the sample. However, in Maru _et. al._'s study, the ratio of the

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[2] For example, The Wall Street Journal dated May 28, 1988 carried the
article titled "Japanese Players Grab Big Dividend Income in Latest Market
Ploy". The article reported that while the total trading volume on that day in
the New York Stock Exchange was 155 million shares, trading in GTE shares ac-
counted for 48 million. The article claimed that most of the volume in GTE was
due to dividend-capture trading by Japanese life insurance companies. See also
the article, "Tax Maneuver by Japanese" in the New York Times dated August 26,
1987. It is therefore not unreasonable to conjecture that Japanese institutions
which find dividend capture activity in the U.S.A attractive will also find such
activity even more attractive in Japan.

[3] The popular view that the dividend yield for Japanese stocks is too low
in order for dividend capture to be worthwhile. This view is unwarranted.
Since most Japanese stocks pay dividends only once a year, an annual dividend
yield of 1% for Japanese stocks corresponds to 4% for U.S. stocks which typical-
ly pay quarterly dividends.

price drop to the dividend is well below one for every ex–day in their sample, so the anomaly cannot be explained by the scarcity of ex–days.

To resolve the anomaly about the ex–day behavior of Japanese stock prices, we employ a different methodology that does not require data on many ex–days. Scarcity of ex–days implies that many stocks go ex–dividend on the same day, providing a large cross–section of ex–day price changes. Instead of calculating the ratio of the price drop to the dividend (which equals the negative of the ratio of the rate of price change to the dividend yield), we regress the rate of price change on the dividend yield on the cross–section of stocks. For the bench– mark case of equal preference for dividend income and capital gains, the dividend yield coefficient should be minus one. The difference is that we do not constrain the regression intercept to be zero. This seemingly innocuous difference is important because the intercept can capture the effect of news affecting the cross–section of stocks on the same day.

We apply our regression technique to the cross–section of Japanese stocks for five ex–dividend days (March ex–days for 1983–1987). We focus on the March ex–day because that is when the majority of stocks go ex–dividend. We find that Japanese stock prices drop by nearly the full amount of the dividend once the general effect of news on the ex–day is taken into account. That is, the dividend yield coefficient in the cross–section regression is almost minus one. This, however, produces a new anomaly that the average rate of price change for ex–day stocks paying no dividends, which is the regression intercept, is positive and significantly higher than that for for non ex–day stocks that by definition pay no dividend on the same ex–day. This explains

why the ratio of the price drop to the dividend is less than one even though the price drop reflects nearly the full amount of the dividend. We also find another anomaly that stocks that go ex-rights earn abnormally high returns on the ex-day when compared to other stocks. This is similar to the positive abnormal return on ex-days for stock splits and stock dividends reported in Eades, Hess and Kim (1984) and Grinblatt, Masulis and Titman (1984).

The rest of the paper is organized as follows. Section 2 describes our model. Section 3 addresses the econometric issues involved in estimating the model parameters. Section 4 contains the empirical results. Section 5 contains the conclusions.

2 Modelling ex-dividend day behavior of stock prices

In this study we focus attention on the ex-day for the regular dividends for stocks listed in the Tokyo Stock Exchange (TSE). These stocks go ex-dividend by end of March. Most firms follow a 12 month financial reporting period, whereas, some follow a 6 month financial period. The former firms pay regular dividends once a year and the latter pay regular dividends twice a year. In addition, the former firms may also pay an interim dividend. This is unlike in the U.S.A where firms, in general, pay dividends every quarter. Since the fiscal reporting period for most firms traded on the TSE end in March, we chose to limit attention to those stocks that go ex-dividend by end of March.

While studying the behavior of stock prices around the ex-dividend day, it is important to take into account the fact that several stocks also go ex-rights on the ex-dividend day. Let the following diagram represent the

occurrence of events in calendar time:

t_0———————t_{rt}———————————t————t'————————————t_{div}

t_0 - some arbitrary date on which the investor purchased the stock of the firm under consideration, at a price p_0, where p_0 may include transactions costs that are required under tax laws to be capitalized.

t_{rt} - date on which rights issue of shares is announced by the firm. Each existing share is allocated x new shares at a subscription price of s. On this date the firm may also announce a free rights issue of y shares per existing share. The date of announcement of the dividends by the board of directors is not shown in the time line.

t - last trading date on which the stock trades with dividend and with rights (at a price p).

t' - first ex-dividend as well as ex-rights trading day for the stock, on which the stock trades (at a price p').

t_{div}= date of approval of dividend in the general meeting of the shareholders (div yen per ex-share) which may be received in the mail by the investor with a few more days of postal delay). On this day the shareholders may also approve a stock dividend of g per old share (i.e., the rights issues are not eligible for the stock dividend).

Rights issue (at a subscription price of s) and free rights issue are decided at the board of director's meeting and do not require stock holders' approval. Although cash and stock dividends require approval at the general meeting of

the ex–day. Free rights issue can be only used for capitalizing certain legal reserves, and unlike a stock split does not result in a change in the par value of the stock. Split of a par value stock requires amending the articles of association and requires approval by shareholders by means of a special resolution.

In modelling the relation between cum–dividend and ex–dividend day stock prices, we will first assume that prices are such that some investor is indifferent at the margin between trading and not trading an additional unit. We will refer to this investor as the marginal investor. We will then examine the effect of relaxing this assumption. There are three important cases to consider. (A) The marginal investor has already decided to sell the shares and is indifferent between selling cum–dividend and selling ex–dividend. (B) The marginal investor is indifferent to engaging in any additional tax–induced dividend capture activity, where, we use the term "dividend capture" to describe the activity of buying the stock cum–dividend, collecting the divi- dend and selling the stock ex–dividend. (C) The marginal investor has decided to buy the share and is indifferent between buying it cum–dividend and buying it ex–dividend.

Let us first consider case (A). Let c, T_c and T_d respectively denote the one way proportional transactions cost, marginal tax rate on capital gains and marginal tax rate on dividends for the marginal investor. Note that the marginal transaction cost need not be the same proportion across all stocks. In what follows we will assume that transactions costs have to capitalized for income tax purposes.

With these notations, the cashflow from selling the share cum–dividend

is given by:

$$p(1-c) - [p(1-c)-p_0]T_c = p(1-T_c)(1-c) + T_c p_0$$

The after tax cashflow if sold ex-dividend is given by:

$$(1+g+x+y)p'(1-c) - xs - [(1+g+x+y)p'(1-c) - p_0 - xs]T_c + (1-T_d)(1+g+x+y)\text{div}.$$

For the sake of generality of the model we allow g to be non-zero, even though it is zero in our sample. Notice that we are making the simplifying assumption that the investor who sells ex-dividend will have, in addition to the one share he owned, g shares from stock dividend/split, y free rights shares and x rights shares which he will purchase at the subscription price s. This can not be strictly true since g has to be approved in the general meeting of the shareholders to be held in the future, and the rights shares would not be on hand on the ex-day for sale. This is the same as assuming that investors can costlessly shortsell (x+g+y) shares at a ex-dividend price of p' and cover the short position with the rights and stock dividend.

If the investor were to be indifferent between selling cum-dividend and selling ex-dividend, then the value of the expected proceeds from the two should be the same. Let Value(.) denote the valuation operator, i.e., Value(z) denotes the market value of a future cashflow z. Equating the value of the two expressions, we get:

$$\text{Value}[p(1-T_c)(1-c)] =$$

$$\text{Value}[(1+g+x+y)p'(1-T_c)(1-c) - xs(1-T_c) + (1-T_d)(1+g+x+y)\text{div}]$$

Let D_c be the discount rate for $E(p')$ and D_d be the discount rate for $E(\text{div})$, where $E(.)$ denotes the conditional expectations operator based on information

set I of the marginal investor.[4] Let

$$r = (1+g+x+y)p'/(p+xs/(1-c)) - 1 \qquad (1)$$

denote the overnight capital gains part of the rate of return on the stock
(i.e., the evernight rate of return exclusive of dividends) and

$$d = (1+g+x+y)\text{div}/(p+xs/(1-c)) \qquad (2)$$

denote the "dividend yield". Notice that the transactions cost c appears in
the overnight rate of return term r and the dividend yield term d whenever the
number of rights shares issued, x, is not zero. In our empirical study we
will assume that the approximation error introduced by setting c = 0 in r and
d is negligible.

By rearranging the terms, we get:

$$E(r) = (1/D_c - 1) - (D_d/D_c)(1-T_d)/(1-T_c)(1/(1-c)) E(d) \qquad (3)$$

Equation (3) can be rewritten as:

$$r = \alpha + \beta E(d) + \epsilon \qquad (4)$$

where, $\alpha = 1/D_c - 1$; $\beta = -(D_d/D_c)(1-T_d)/(1-T_c)(1/(1-c))$, $\epsilon = r-E(r)$. We are
suppressing the time subscript t and the firm subscript j in variables r, α,
β, E(d), and ϵ, in order to simplify notations.

Now suppose that the marginal investor is one who engages in dividend
capture as in (B). Institutional investors are the ones most likely to engage
in dividend capture. The after tax cashflow from incremental dividend capture
activity is:

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[4] Note that we do not assume investors to be risk-neutral. Hence our
modelling strategy does not suffer from the shortcomings pointed out by Heath
and Jarrow (1988).

$$[p'(1+g+x+y)(1-c) - \{p+xs/(1+c)\}(1+c)](1-T_c) + div(1+g+x+y)(1-T_d).$$

At the margin, the value of the cashflow to the investor engaging in dividend capture should be zero. As before, let D_d and D_c be the discount rates for dividends and capital gains, respectively. We therefore get:

$$D_cE[p'(1+g+x+y)(1-c)(1-T_c)] - \{p+xs/(1+c)\}(1+c)(1-T_c)$$
$$+ D_dE[div(1+g+x+y)(1-T_d)] = 0.$$

Rearranging terms, we get:

$$E[\{p'(1+g+x+y)\}/\{p+xs/(1+c)\}]$$

$$= (1+c)/[(1-c)D_c] - (D_d/D_c)[(1-T_d)/\{(1-c)(1-T_c)\}]E[div(1+g+x+y)/(p+xs/(1+c))].$$

In the case where x is zero, this expression can be simplified to:

$$E(r) = [(1+c)/\{(1-c)D_c\} - 1] - (D_d/D_c)[(1-T_d)/(1-T_c)][1/(1-c)]E(d) \qquad (3')$$

The above equation is a minor variant of equation (3). Hence in this case too equation (4) would hold, with α suitably redefined. When x is different from zero, we approximate the term $p+xs/(1+c)$ by $p+xs$ as before in measuring r and d.

Now suppose that the marginal investor is as described in (C), i.e., one who has already decided to buy the stock and is indifferent between buying it cum-dividend and ex-dividend. For such an investor the after tax value of the cash outflow in both cases must be the same, i.e.,

$$Value[(-(p+xs/(1+c))(1+c)(1-kT_c) + div(1+g+x+y)(1-T_d)]$$

should equal

$$Value[-p'(1+c)(1+g+x+y)(1-kT_c)].$$

In computing after tax cashflows, the purchase price is multiplied by $(1-kT_c)$ to allow for the fact that the purchase price forms the basis in computing any taxes that may be payable when the stock is sold in the future, using some trading strategy. This is only an approximation. For example, if the investor plans to own the stock for ever, then k would be zero. Using the discount factors D_d for E(div) and D_c for E(p') to compute Value(.) and rearranging the terms, we get,

$$E[p'(1+g+x+c)/(p+xs/(1+c))]$$

$$- 1/D_c - (D_d/D_c) \ (1-T_d)/(1-kT_c)(1/(1+c))E[div(1+g+x+y)/(p+xs/(1+c))].$$

When $x - 0$, we get:

$$E(r) - (1/D_c - 1) - [(D_d/D_c)/(1+c)](1-T_d)/(1-kT_c)E(d) \qquad (3'').$$

Equation (3") is similar to equation (3) and it too leads to equation (4) with suitable redefinition of the parameter β. When x is not zero, once again we approximate p+xs/(1+c) by p+xs.

In general A and C would be individual investors for whom T_c is zero and T_d could be as large as 48.2%[5]. Hence in these two cases β will be less than -0.5. Corporations are most likely to engage in dividend capture activity described in B. If, at the margin, dividend capture is what determines prices, then β could even be less than -1 (greater than 1 in absolute value) since corporate tax rate on dividends is less than that on capital gains (see

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[5] If the individual opts to separate the dividend income the maximum income tax (to be withheld) will be 35%. No dividend tax credit is available on this. In addition the individual will have to pay Municipal taxes (at most 11%) and Prefectural taxes (at most 4%). A dividend tax credit of at least 0.4% on Municipal taxes and 1.4% on Prefectural taxes can be claimed.

Appendix 1 for a brief description of personal and corporate taxes in Japan).

The brokerage commission part of c is about 0.0055 (about 0.0018 for institu-

tional investors). This is small relative to the tax rate terms and hence can

be ignored in determining the magnitude of β.[6] Also, the term D_d/D_c will be

close to unity and its impact can be ignored in interpreting empirical esti-

mates of β. To see this consider the extreme case where the riskless interest

rate is 4 percent per year, the expected return on stocks is 20 percent per

year and dividends are known on the ex-date bu received 3 months after the ex-

date. Even in this case D_d/D_c will be 0.99.

If every investor is interested in engaging in any one of the activities

described in (A), (B) or (C) but is prevented from doing so due to any con-

straint (financial or otherwise) then the parameters in equation (4) will be

harder to interpret. In such cases, the implicit cost of transactions will be

higher for every investor. Prices will then be determined by the investor

with the least transactions cost.

The model in this section has the following empirical implications. To

the extent relative (explicit and implicit) transactions costs are smaller for

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[6]   Since investors who trade for tax reasons alone possess no special
information about the stock they are trading in, the implicit bid-ask spread
(that arises from traders using limit orders to protect themselves from
investors with superior information) will impose an additional cost on their
transactions. We do not have information about the magnitude of the implicit
bid-ask spread in the Japanese stock market.
    Unlike the New York Stock Exchange (NYSE) there are no specialists in
the Tokyo Stock Exchange (TSE).   The opening price is determined as in the
NYSE.   Under the Zaraba method used in determining transaction prices after
the opening, order positions are maintained in the order-book of the concerned
Saitori member. Price priority and time priority is used to clear trades, and
the transaction is posted on the official quotation board of the exchange.
Market orders get priority over limit orders.   The lowest price in the book
for a limit sale order will be the implicit "ask" price. The highest price in
the book for a limit buy order will be the implicit "bid".

stocks which (a) have a relatively higher volume and (b) relatively higher
dividend yield, such stocks will be relatively more attractive as vehicles for
dividend capture. Hence we may expect β to be relatively small (i.e., rela-
tively larg in absolute value) for such stocks. To the extent tax rates on
dividends and capital gains are the same for the marginal investor engaging in
dividend capture, β will be close to -1. We may also expect such stocks to
exhibit relatively more pronounced increase in trading volume around ex-days.
Prices of other stocks are likely to be determined more by investors who are
indifferent at the margin to buying (selling) with or without dividend. The
only implication for such stocks is that β should be greater than -1 (less
than 1 in absolute value).

3. Econometric Issues

In estimating parameters of equation (4) we have to address three
econometric problems. First, as explained above, dividends are not declared
until several weeks after the ex-day or at an earlier date. Hence the equa-
tion involves the expected dividend yield $E(d)$. Fortunately, the stock prices
file prepared by Nikkei (Japan Economic Daily) contains Nikkei's forecast of
dividends. It is not clear that the forecast was formed on the ex-day or
earlier, but we nevertheless used this forecast for $E(d)$. Since dividends are
highly forecastable (a cross-section regression of this forecast on declared
dividends produced an R^2 of more than 0.95), it is not important that the
forecast may not have been formed on the ex-day. For the rest of the paper,
we will use the same symbol d for expected dividend yield.

Second, since for a given stock the marginal investor could be of any

one of the three types discussed above, the parameters α and β can depend on the stock. Provided that attitudes toward risk is similar across investors with different tax rates, they do so exclusively because of the difference in tax rates T_d and T_c, which in turn depend only on the (expected) dividend yield d. It follows that equation (4) is a nonlinear function of d but that once the nonlinearity is allowed for the equation should be applicable to all stocks with different dividend yields. In our empirical implementation we employ the piece-wise linear equation with a kink at $d = 0.01$:

$$r = \alpha + \beta_1 \min(d, 0.01) + \beta_2 \max(d-0.01, 0) + \epsilon. \tag{4'}$$

Third, there is the problem about forecast error first pointed out by Chamberlain (1984). While it is true that the _time_ _average_ of the forecast error is zero, the rational expectations hypothesis does _not_ imply that the _cross-section_ average of the forecast error is zero. If a favorable shock hits the stock market that moves prices of all stocks up, then the forecast error ϵ can be positive for all stocks at a point in time. The shock can be industry specific, so that ϵ is the same for all stocks within the industry but different between industries. To allow for this possibility, we include ten industry dummies (denoted by IND) in the equation. Thus, if j is the stock index and t is the year index, the equation we estimate is

$$r_{jt} = \alpha_t' IND_j + \beta_1 \min(d_{jt}, 0.01) + \beta_2 \max(d_{jt}-0.01, 0) + \epsilon_{jt}. \tag{4''}$$

The coefficients vector α_t of industry dummies can depend on the year because the sign and magnitude of industry specific shocks are year-specific. We assume that, after controlling for the industry effect, the forecast error ϵ_{jt} is uncorrelated in cross-section with the (expected) dividend yield d_{jt}. Put

differently, there is no unexpected events hitting the stock market on the ex-
day that affect only higher dividend stocks one way or another. This is an
identifying assumption. If one allows for unrestricted cross—section cor-
relation between the forecast error and the dividend yield (or, for that
matter, any other variable known at date t), then nothing can be leaned from
data.

4. Empirical Analysis

4.1. Description of Data

For about 60% of companies listed on the Tokyo Stock Exchange, the
fiscal year ends in March and their stocks go ex—dividend on the same day
toward the end of March (March 28 for 1983 and 1984, and March 27 for 1985,
1986 and 1987). We thereafter call those stocks March stocks. If a March
stock also involves rights issues, the stock goes ex—rights on the same day.
We obtained from the Nikkei stock prices file data on daily prices of all
stocks traded on the TSE for 41 working days around the March ex—day (20 days
before the ex—day, the ex—day, and 20 days after the ex—day) for each of the
five years 1983—87.[7] From the file we deleted September stocks (companies
whose fiscal year is end of September) that pay an interim dividend or involve
rights issues in March (which are very few). This is because, as far as we
can tell, no information on expected interim dividends is available from the

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[7] All the calculation was done at Osaka University when the first author
was affiliated there. The stock prices tape provided to Osaka University by
Nikkei had no information for April 1985 and therefore daily prices in April
1985 were given a missing value. Also, the file had quite a few duplicate
records which we excluded from our calculation.

stock prices file. We also deleted (very few) companies whose fiscal year ends on March 20, not March 31. Thus for the 41 days around the March ex-day, there are no non-March stocks in our sample that go ex-dividends or ex-rights, and all the March stocks go ex-dividend and/or ex-rights on the same single March ex-day of the year.

This resulted in a sample of 7,106 cases (stock-year combinations pooled across years) over the five years. For some stocks for some years, no trade takes place on the ex-day or the day before, and for such stocks the difference between the cum-dividend price (p) and the ex-dividend price (p') is not observable. Table 1a displays the frequency of those missing cases by year. Table 1b displays the frequency by the March ex-day status. As the row and column percents indicate, missing cases are not concentrated in any particular category; the occurrence of no trade on the ex-day and the day before does not seem related to the ex-day status of the stock.

Regarding the price changes over 41 days around the ex-day, Figure 1 graphs the daily rate of change of prices from close to close. The rate of change is an average over all cases (year-stock combinations) for which the price change is observable.[8] Figure 1a is for the first two categories of the ex-day status: non-March stocks and March stocks without rights issues. Figure 1b is for March stocks with rights issues. The price change on the ex-day for stocks with rights issues is negative, reflecting the capital change resulting from rights issues. Our first anomaly about the ex-dividend day behavior of Japanese stock prices, to be elaborated below in Table 4, can be

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[8] Since the April 1985 file was missing from the Nikkei stock prices file, the average excludes April 1985 daily price changes.

read off from Figure 1a, where the price change for March stocks without rights issues is higher than that for non-March stocks. This is true before the dividend yield is added to the rate of change for March stocks. Figure 2 displays daily nominal trading volume (the stock price times the number of shares traded) for the three categories of the ex-day status. For March stocks, volume picks up on the ex-day but otherwise it looks stationary, so there is no evidence in Japan for increased trading volume around ex-days. This is in contrast to the finding by Lakonishok and Vermaelen (1986) for the U.S.

4.2 The Ex-Day Behavior

We now focus on the price change from the close of the day before the ex-day (p) and the opening price on the ex-day (p') for the 5,882 cases for which the price change is observable. Table 2 reports averages for p (cum-dividend price), p'(ex-dividend price), div (expected dividend per share), d (expected dividend yield, ratio of div to p), s (amount to be paid in to receive x issues per share), x, and y (free rights issues per share) for cells defined by the ex-day status and the range for the dividend yield. There is no case of stock dividends in our sample, so statistics for g (stock dividends per share) are not reported here.

For March stocks, the dividend yield is 0.7%, which seems extremely low. The definition of this number requires some elaboration. First, as mentioned in section 2.1., for most stocks (including March stocks), dividends are paid only once a year. This is in contrast to the U.S. where dividends are paid quarterly. Thus for those investors interested in dividend capture, a Japanese dividend yield of, say, 1% is equivalent to 4% for the U.S. Second, for

companies which pay dividends twice a year (either because there is an interim dividend or because the financial period is 6 months), our definition of div (dividend per share) is the amount associated with the March ex-day. The annual dividend yield as usually defined (the ratio of annual dividend to price) for our sample of 5,882 cases is about 1.1%, which is still very low, though.

The next table, Table 3, reports results of our calculation on the ex-day price drop (for dividend-paying March stocks without rights issues) similar to the one performed in the previous study by Maru, Kon-ya and Yonez-awa (1979). To summarize the central result in their study, which is for the ten-year period 1968-77 that includes 20 ex-days (March and September for each year), the overall average of the ratio of the price drop on the ex-day to the amount of dividends is 0.176, which is much smaller than estimates found in the U.S. studies cited in section 1, although the ratio is relatively large for high dividend stocks (it is 0.688 for the highest yielding stocks). Results from our sample, displayed in Table 3, confirm this anomaly, for low-volume stocks. The average ratio of 0.232 for low-volume stocks is close to Maru et. al.'s overall average. The anomaly is stronger in our sample because the average ratio is negative for high-volume stocks, stocks to which our standard model is more likely to be applicable.

To interpret the results on the price drop in Tables 2 and 3, however, we should bear in mind the fact that in our Japanese sample the ex-days are concentrated on just five calendar days. If good news hits the stock market, there will be a general rise in stock prices. If that happens on some of the five ex-days in our sample, the average price drop over the five ex-days may

well be negative. There are two ways to remove the components of price changes that are not related to dividends. The first is to obtain more data on different ex-days, which for Japan amounts to a longer time period. The second approach, which was outlined in section 3 and which we take up in the next section, is to look at stocks with different dividend yields for the same time period. If the news that moved the stock price is unrelated to the dividend yield of the stock, then the difference in price changes on the ex-day between stocks with different dividend yields should be related to the dividend yield. In other words, we would estimate the rate of return equation (4") by the regression technique and see if the dividend yield coefficient is close to −1.

Before embarking on the regression analysis, we look at the mean rate of return (exclusive of dividend yield) by (expected) dividend yield class and the ex-day status of the stock. The capital gains part of the rate of return on the ex-day, r, is calculated by formula (1), which reflects capital changes due to rights issues but does <u>not</u> include dividends.[9] We can read three basic facts from Table 4. First, comparing March stocks that are expected to pay no dividend with non-March stocks, the rate of return for March stocks is higher. It is an anomaly because it is known before the ex-day that the stock offers no rights issues (x and y are known to be zero) and because there is no reason to believe that the market receives new information about dividends (to be declared several weeks after the ex-day). Second, for all dividend yield classes, March stocks with rights issues have higher rates of return than March stocks without rights issues. This is another anomaly for the same

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[9] For all cases in our sample, $g = 0$.

reason. Third, consistent with the standard model, there is negative associa-
tion between the rate of return and the dividend yield. In fact the negative
association is nearly one for one. For example, take the column for March
stocks without rights issues. We note that the rate of return declines by
0.006 as we move from the first row (for zero dividends) to the second row
(for the dividend yield between 0 and 0.01). We know from Table 2 that the
average dividend yield for the second row is 0.006.

4.3. Econometric Analysis

We now proceed to estimate the rate of return regression (4"). The two
anomalies found in Table 4 forces us to add two additional dummies to the
equation:

$$r_{jt} = \alpha_t' IND_j + \beta_1 \min(d_{jt}, 0.01) + \beta_2 \max(d_{jt} - 0.01, 0)$$

$$+ \delta_1 MARCH_{jt} + \delta_2 RIGHTS_{jt} + \epsilon_{jt}, \qquad (t = 1983, 1984, .., 1987) \qquad (5)$$

where r_{jt} is the ex-day rate of return exclusive of dividends defined by
formula (1), IND_j is a vector of ten industry dummies, $MARCH_{jt}$ is a dummy
variable that equals one if stock j in year t is a March stock, and $RIGHTS_{jt}$
is a dummy for stocks with rights issues. The parameter β_1 is the dividend
yield coefficient for d less than 0.01 and β_2 is the coefficient for d greater
than 0.01.

Since not every stock in our sample is traded on all the five ex-days,
data on the rate of return is missing for some years. Let n_j be the number of
ex-days for which the rate of return is observable for stock j. There are
1,452 different stocks in our sample for which the rate of return is obser-
vable for at least one ex-day. Our sample is an unbalanced panel because n_j

is not equal to 5 for all j. As already mentioned, our sample has 5,882 cases (stock–year combinations), that is, $\Sigma_j n_j = 5882$. Estimation and inference of equation (5) on the unbalanced panel is not trivial, but it can be shown that the optimal estimator that places no restriction on the serial correlation of ϵ_{jt} and no restriction on conditional heteroskedasticity is simply the OLS (ordinary least squares) on the pooled sample of 5,882 cases[10]. The calculation of correct standard error is not trivial and is described in Appendix 2.[11]

We first estimated equation (5) allowing β_1 and β_2 and MARCH and RIGHTS coefficients to vary over time. The Wald test for the stability of those coefficients over time produced a p–value of 9%, so in what follows we impose the restriction, already embodied in equation (5).

Table 5 reports our parameter estimates on the unbalanced panel. As we have anticipated from the look at Table 4, the dividend yield coefficient is close to −1 and does not depend on the level of the dividend yield. In fact the p value for the equality of the two dividend coefficients is more than 90%. The positive and highly significant MARCH coefficient corresponds to the first anomaly noted for Table 4 that March stocks have higher rate of return than non–March stocks. The RIGHTS coefficient is also positive and signifi-cant, confirming the second anomaly that rights issues appear to add extra premium to the rate of return even though the capital changes associated with

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[10]   Of course, if we have _a priori_ information about the conditional variance of the error term, then the OLS is no longer optimal, and a GLS–type estimator will be more efficient. Here, we do not impose any such _a priori_ restrictions on the error term.

[11] This estimation technique has been employed in, e.g., Altonji, Hayashi and Kotlikoff (1989).

rights issues are taken into account in the calculation of the rate of return. To illustrate the importance of the MARCH dummy in the regression, the second regression in Panel A drops the MARCH dummy. The dividend yield coefficient dramatically declines.

The lower panel of Table 5 estimates the same equation (5) for the sub-sample of high-volume cases. As we might have expected, the dividend yield coefficient is closer to -1, and again, there is no evidence of nonlinearlity between returns and dividend yields.

4.4. Putting Results on the Ex-Day Together

We are now ready to explain in a consistent manner the results on the ex-day returns presented in Tables 2–5. Suppose the relation between the return (exclusive of dividends but inclusive of capital changes) and the dividend yield for March stocks that go ex-dividend on the same day, around which actual observations are randomly scattered, is given by

$$r = r_0 - d \qquad (6)$$

Thus, controlling for the intercept, the ex-day price drop on average equals the amount of the dividend. The intercept r_0 denotes the ex-post overnight return on a zero dividend stock. Even when the expected overnight return is close to zero, r_0 could be large, because news on the ex-day can raise the ex-post return for all March stocks. This is in fact the relation uncovered by the regression results in Table 5.

For stocks without rights issues, $r = -(p-p')/p$ and $d = div/p$, so from (6) the ratio of the ex-day price drop $(p'-p)$ to the amount of dividend (div) is given by

$$(p'-p)/\text{div} = -r/d = 1 - r_0/d,$$

which increases with the dividend yield d. In fact, for low dividend yield stocks whose d is less than r_0, the ratio can be negative. This simple observation explains the apparent anomalies found in Tables 2 and 3 that the ratio of the ex-day price drop to the amount of the dividend is far less than one, and even negative, for low yielding stocks, and that the ratio increases with the dividend yield.

We are therefore left with the following two anomalies: (a) the overnight return for March stocks that pay no dividends is different from that for non-March stocks, and (b) the overnight return for March stocks that go ex-rights are different from that for otherwise similar March stocks that do not go ex-rights.[12] To see if March stocks are qualitatively different from non-March stocks, we looked at the frequency distribution of the total rate of return r+d (capital gains plus dividends) by the ex-day status of the stock, which is reported in Table 6. As the row and column percents indicate, extraordinarily high returns are over-represented by ex-day stocks, particularly by stocks with rights issues.[13] Thus our two anomalies about the ex-day price behavior are mostly due to unusually high returns for a few stocks.

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[12] Since we controlled for the industry effect by including industry dummies in the regression, the return differential cannot be due to the possibility that ex-day stocks happened to be in the industries that experienced a string of positive shocks over the five year period. Anyway, it is not the case in our data that some industries are over-represented by ex-day stocks, so even if we did not control for the industry effect, there is no possibility of the industry effect proxying the ex-day effect.

[13] We checked every single case of extraordinary returns and found no apparent errors in our data construction. The stock split for Kyocera for 1984 is incorporated in our calculation.

5. Conclusions

In this study we examined the ex–dividend day behavior of Japanese stock prices. We find that on average the stock price falls by full the amount of the dividend on the ex–day. The implications for an investor who pays taxes on dividend income but not on capital gains is that it will be optimal to accelerate any trade (and delay any purchases) in order to avoid getting the dividends.

Since most Japanese stocks go ex–dividend on the same calendar date, methods used to analyze the ex–dividend day behavior of stock prices in the U.S.A are inappropriate for studying the ex–day behavior of Japanese stock prices. We therefore used a regression technique in our empirical study. Our empirical analysis reveals two anomalies. First, March stocks that pay no dividend earn a significantly different (higher) overnight return on the ex–day than non–March stocks, even though there are no systematic industry differences between March and non–March stocks. Second, stocks that go ex–rights show a positive abnormal overnight return on the ex–day. These anomalies are similar to the positive ex–day abnormal return for stock–splits and stock–dividends reported by Eades, Hess and Kim (1984) and Grinblatt, Masulis and Titman (1984).

By including industry dummies in our regression, we acknowledged the existence of shocks that affect all stocks in the same industry. One could argue that the abnormal ex–day returns are due to some other shocks that affect all ex–day stocks but not no ex–day stocks. What we have documented is that there was a string of ex–day shocks whose realizations for the five ex–days happened to be significantly positive. It does not follow from this that

the (time averaged) expectation of the ex–day shock is zero or that the ex–day shock is guaranteed to be positive in the future. This argument is valid, provided there is such a thing as the ex–day shock. It is hard to imagine that investors have been surprised that ex–day stocks go ex–dividend on the ex–day.

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APPENDIX 1

Brief Description of Japanese Income Tax Laws
Applicable to Income from Stocks

I. Before 1988: (Taken from Japan Security Research Institute (1989))

A. CORPORATIONS

Capital gains from security transactions are treated as ordinary income, with
some exceptions. Retained earning is taxed at 42% and earnings paid as
dividends is taxed at 32%. Corporations with a capital of 100 million yen or
less are taxed at the following lower rates on the first 8 million yen of
income per year: retained earnings is taxed at 30% and earnings paid as
dividends is taxed at 24%.

Dividend income received from another corporation is completely exempt from
income tax. However, if dividend received exceed the dividend paid, 25% of
the excess is taxable at the corporate tax rate.

B. INDIVIDUALS:

There was a 20% withholding tax on dividends when paid. Tax credit on
dividends received was 10% in case the overall taxable income was less than 10
million yen and 5% otherwise. Annual dividends of 100,000 yen or less from a
single issue were exempt from taxes, except for the 20% withholding tax which
is applicable on all dividends paid to individuals — in this case no tax
credit was available, and were exempted from resident tax. If an individual
held less than 5% of the number of outstanding shares of a corporation and if
the annual dividend from a corporation was between 100,000 yen and 500,000
yen, the individual could choose to separate the dividend income on which a
35% withholding tax was applicable. No dividend tax credit would be applica-
ble in such a case.

II. 1989-90: (Taken from Yuji Gomi (1990))

   A. CORPORATIONS:

   1. Capital Gains:

No tax concessions are granted on capital gains derived by a corporation, with
some exceptions.

   2. Dividends:

Dividend includes interim dividends. Dividends received by domestic cor-

porations from other domestinc corporations, less the interest chargeable to
the shares on which those dividends were paid, are fully excluded from gross
income in computing the amount of ordinary income. However, if a domestic
corporation owns less than 25% of the shares of another domestic corporation
which pays dividends, a percentage of those dividends received, less the
interest chargeable to the shares on which those dividends were paid, is
exempt. The percentage is 80%, it is 90% with respect to business years
beginning during the period from April 1, 1989 to March 31, 1990.

If dividends are received on shares which were acquired within one month prior
to the end of the business year of the issuing corporation and sold within two
months after the end of the same business year, those dividends are not
excluded from gross income.

If a corporation receives distribution of profits from a securities investment
trust, the above-mentioned principle is applied to one-half of that distribu-
tion. If the dividends excluded from gross income by the treatment mentioned
above exceed dividends paid out by the corporation, 12.5% of the excess should
be included in gross income. This is the interim measure applicable to
business years beginning during the period from April.1, 1989 to March. 31,
1990 corresponding to the interim measure on abolition of the "reduction-rate
on dividends-paid".

3. Corporate tax rate

For corporations whose capital exceeds 100 million yen, the tax rate on income
(excluding dividends received) distributed as dividends is 35%. On the
remainder, the tax rate is 40%. For corporations with a smaller capital, a
lower tax rate is applied on the first 8 million yen of income per year. For
this purpose, the first 8 million yen of income is decomposed into that is
distributed as dividends and that which is retained. On the first part, i.e.,
on [(8 million yen)/(total taxable income)] fraction of the income distributed
as dividend, the tax rate is 26%. On the retained earnings component of the
first 8 million yen of income, the tax rate is 29%. On the rest of the income
the tax rate is 35% on that part that is distributed as dividends and 40% on
that part that is retained.

B. PERSONAL TAXES

1. Capital Gains

Capital gains with respect to stocks or shares (5-260): Since 1953, an
individual taxpayer has not as a rule been taxed on capital gains from stocks
but from 1989 such gains are taxable if: the sale is after April 1989, then
the gain is taxable at 20% (26% including local inhabitant tax).

Capital losses can only be adjusted against capital gains.

2. Dividends

Personal tax credit for dividend income received is 10% up to 10 million yen
and 5% on dividend income in excess of 10 million yen. Distributions from
securities investment trusts are eligible for half the above mentioned
amounts.

Tax rates:

Note: Income is in million yen and tax rates are in percentages.

Income	Income Tax	Prefecture	Municipal	Total
Under 1.2	10	2	3	15
1.2 to 3.0	10	2	8	20
3.0 to 5.0	20	2	8	30
5.0 to 6.0	20	2	11	33
6.0 to 10.0	30	4	11	35
10.0 to 20.0	40	4	11	45
Over 20.0	50	4	11	65
Dividend tax credit[1]	10 (5)	2.8 (1.4)	0.8 (0.4)	2.0 (1.0)

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[1] Figures are for the case when dividend income belongs to the bracket not
exceeding 10 million yens. Otherwise, figures in parenthesis apply. Dividends
paid to shareholders are treated as the top layer of income, and distribution of
securities investment trusts paid to beneficiaries is treated as the next lower
layer of income.

Appendix 1-3

APPENDIX 2

Estimation of Equation (4) on Unbalanced Panel

Let N_j be the set of years for which the return is observable for stock j and n_j be the number of observations for stock j (i.e., the number of elements in N_j). For example, $N_j = \{83,85,87\}$ and $n_j = 3$. It ranges from 1 to T where T is the length of the period covered by the data. Let N be the number of stocks for which n_j is at least one. In our sample, $T = 5$ and $N = 1456$. We use k for the number of industry dummies. It is ten in our study. The estimation equation (4) can be written compactly as

$$r_{jt} = z_{jt}\theta + \epsilon_{jt} \qquad (t \in N_j; \ j = 1,..,N) \qquad (A1),$$

where

$\theta' = (\alpha_1',\ldots,\alpha_T',\beta_1,\beta_2,\delta_1,\delta_2),$

$\alpha_t =$ column vector of k industry dummy coefficients for year t,

$z_{jt} = (e_t \otimes IND_j', \ \min(d_{jt},0.01), \ \max(d_{jt}-0.01,0), \ MARCH_{jt}, \ RIGHTS_{jt}),$

$IND_j =$ column vector of k industry dummies,

$e_t = $ T dimensional row vector with one in the t-th element and zero elsewhere.

The dimension of θ and z_{jt} is kT+4. Let r_j be the vector of observable returns r_{jt}. Its dimension is n_j. Similarly define ϵ_j. Also, let z_j be a matrix whose rows are z_{jt}. The size of z_j is n_j by (kT+4). Thus the number of columns of z_j is constant across j. With this notation the estimation equation can be written compactly as

$$r_j = z_j\theta + \epsilon_j \qquad (j = 1,\ldots,N). \qquad (A2)$$

The OLS estimate of θ is

$$\hat{\theta} = \left(\frac{1}{N}\sum_{j=1}^{N}z_j'z_j\right)^{-1}\left(\frac{1}{N}\sum_{j=1}^{N}z_j'r_j\right). \tag{A3}$$

Now consider the expression $\sqrt{N}(\hat{\theta} - \theta)$. From (A2) and (A3) it can be written as

$$\sqrt{N}(\hat{\theta} - \theta) = A_N^{-1}B_N, \tag{A4}$$

where

$$A_N = \frac{1}{N}\sum_{j=1}^{N}z_j'z_j, \tag{A5}$$

$$B_N = \frac{1}{\sqrt{N}}\sum_{j=1}^{N}z_j'\epsilon_j. \tag{A6}$$

In B_N, $\{z_j'\epsilon_j\}$ is a sequence of independent, but not identically distributed random vectors. Under a set of regularity conditions presented in White (1980), B_n converges in distribution to a multivariate zero-mean normal distribution with the (kT+4) by (kT+4) variance matrix given by

$$\Omega = \plim_{N\to\infty} V_N \tag{A7}$$

where

$$V_N = \sum_{j=1}^{N}z_j'\epsilon_j\epsilon_j'z_j. \tag{A8}$$

It follows that $\sqrt{N}(\hat{\theta} - \theta)$ converges to a multivariate zero-mean normal distribution whose variance matrix is consistently estimated by $A_N^{-1}V_NA_N^{-1}$. Thus the correct (asymptotic) standard errors for the OLS estimate $\hat{\theta}$ is the square root of the diagonal elements of $A_N^{-1}V_NA_N^{-1}/N$.

Table 1a

Frequency of Missing Cases by Year

	1983	1984	1985	1986	1987	Total
price change observed	986	1155	1177	1274	1290	5882
price change missing	403	245	236	163	177	1224
Total	1389	1400	1413	1437	1467	7106

Table 1b

Frequency of Missing Cases by the Ex-Day Status

frequency percent row percent column pct.	March ex-day status of the stock			
	non-March	March stocks		
	stocks	w/o rights issues	with rights issues	Total
price change observed	2442 34.37 41.52 83.89	2997 42.18 50.95 82.45	443 6.23 7.53 79.11	5882 82.78
price change not observed	469 6.60 38.32 16.11	638 8.98 52.12 17.55	117 1.65 9.56 20.89	1224 17.22
Total	2911 40.97	3635 51.15	560 7.88	7106 100.00

Note: "Price change" is the difference between the closing price on the working day of the ex-day and the opening price on the ex-day. If the stock is not traded on either day, the price change is not observed.

Table 2

Sample Means for Selected Variables

dividend yield		non-March		March stocks										
				without rights issues				with rights issues						
		p	p'	p	p'	div	d	p	p'	div	d	s	x	y
d = 0	MEAN	816.1	816.5	368.1	371.4	0.0	0.0	282.0	272.2	0.0	0.0	0.0	0.0	0.042
	N	2442		589				5						
0 < d ≤ .01	MEAN	.	.	1054.7	1060.1	4.7	0.006	1800.7	1636.0	5.2	0.005	3.6	0.003	0.102
	N	.		1631				347						
0.01 < d	MEAN	.	.	412.1	410.2	6.4	0.016	526.8	479.2	7.0	0.015	0.0	0.0	0.097
	N	.		777				91						
Total	MEAN	816.1	816.5	753.8	756.9	4.2	0.007	1521.9	1383.0	5.5	0.007	2.8	0.002	0.100
	N	2442		2997				443						

Key: p = closing price on the day before the ex-day, p' = opening price on the ex-day, div = (expected) dividend per share in yen, d = dividend yield, div/p, s = subscription price in yen per share for rights issues, x = number of shares for a subscription price of s, y = free rights issues per share.

Table 3

Ratio of Price Change to Dividend for March Stocks without Rights Issues

ratio = (p - p')/div

dividend yield	statistic	volume		Total
		low	high	
0 < d ≤ 0.01	mean std. dev. N	0.195 3.333 644	-1.829 7.759 990	-1.031 6.466 1634
0.01 < d	mean std. dev. N	0.279 1.262 512	-0.025 2.190 262	0.176 1.641 774
Total	mean std. dev. N	0.232 2.625 1156	-1.452 7.009 1252	-0.643 5.436 2408

Note: The high volume cases are those in which the nominal trading volume averaged over the 21 day period preceding and including the ex-day of the year for the stock is greater than 50 million yen.

Table 4

Rate of Return on the Ex-Day

dividend yield	statistic	March ex-day status		
			March stocks	
		non March stocks	w/o rights issues	with rights issues
d = 0	mean std. dev. N	0.00160 0.01600 2442	0.00943 0.02742 589	0.02089 0.02534 5
0 < d ≤ 0.01	mean std. dev. N	. . .	0.00328 0.02047 1631	0.01309 0.03571 347
0.01 < d	mean std. dev. N	. . .	−0.00378 0.02256 777	0.00356 0.03453 91
Total	mean std. dev. N	0.00160 0.01600 2442	0.00267 0.02296 2997	0.01169 0.03556 443

Note: The rate of return, defined by formula (3), is after adjustment of capital changes due to rights issues but is exclusive of dividend yield. For the definition of volume, see note to Table 3.

Table 5

Regression Results

PANEL A: ENTIRE SAMPLE

number of cases – 5882, number of stocks – 1456
mean of the dependent variable (r) – 0.00290
its standard deviation – 0.02202
standard error of the regression – 0.02100
stadard error of the regression without March dummy – 0.02112

	range for dividend yield		dummy for March stocks	dummy for rights issues
	0 < d ≤ 0.01	0.01 < d		
point estimate (standard error)	−0.79 (0.14)	−0.77 (0.097)	0.0069 (0.0010)	0.0086 (0.0018)
point estimate (standard error)	−0.16 (0.088)	−0.87 (0.096)	_____	0.0099 (0.0018)

PANEL B: HIGH VOLUME CASES

number of cases – 2858, number of stocks – 980
mean of the dependent variable (r) – 0.00591
its standard deviation – 0.02469
standard error of the regression – 0.02279

	range for dividend yield		dummy for March stocks	dummy for rights issues
	0 < d ≤ 0.01	0.01 < d		
point estimate (standard error)	−0.96 (0.24)	−0.92 (0.24)	0.0096 (0.0015)	0.0097 (0.0023)

Note to Panel B: For the definition of high–volume cases, see note to Table 3.

Table 6

Distribution of Total Return by the Ex-Day Status

frequency percent row percent column percent	March ex-day status			
		March stocks		
range for return	non March stocks	w/o rights issues	with rights issues	Total
r+d < -0.025	49 0.84 31.01 2.01	88 1.50 55.70 2.95	21 0.36 13.29 4.77	158 2.70
-0.025 ≤ r+d < 0.0	539 9.21 37.04 22.14	806 13.77 55.40 27.05	110 1.88 7.56 25.00	1455 24.85
0.0 ≤ r+d < 0.025	1415 24.17 45.25 58.11	1555 26.56 49.73 52.18	157 2.68 5.02 35.68	3127 53.41
0.025 ≤ r+d < 0.05	375 6.40 43.81 15.40	399 6.81 46.61 13.39	82 1.40 9.58 18.64	856 14.62
0.05 ≤ r+d < 0.1	54 0.92 23.48 2.22	120 2.05 52.17 4.03	56 0.96 24.35 12.73	230 3.93
0.1 ≤ r+d < 0.15	3 0.05 13.64 0.12	8 0.14 36.36 0.27	11 0.19 50.00 2.50	22 0.38
0.15 ≤ r+d	0 0.00 0.00 0.00	4 0.07 57.14 0.13	3 0.05 42.86 0.68	7 0.12
Total	2435 41.59	2980 50.90	440 7.51	5855 100.00

Note: Here the return r+d includes dividend yield.