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Asymmetry in the Dividend Behavior of US and Japanese Firms

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INTRODUCTION

Firm's decisions on changes in dividend payouts have always been an important factor for investors and portfolio managers when they make their investment decisions. Hagin (1979, p. 63), for example, summarizes their view as follows:

> ... Firms do not make dividend changes without thorough assessment of the future. Decreases take place largely because firms have little choice other than cut the payout. Increases, in addition to reflecting high current earnings, reflect management's optimism that the new dividend level can be sustained. It follows, then that if dividend changes reflect management's opinion about the future, and if the managers can correctly assess the future, dividend changes should serve as barometers of a firm's future prosperity.

Japanese firms' reluctance to change dividend payouts is noted by Wallich and Wallich (1976, p. 302): 'One aspect of rights issues ... has been the policy of paying a dividend that is stable in amount per share over considerable periods ...'

With respect to firms' attitudes towards increasing versus decreasing dividends, Lintner (1956, p. 106) argues that the constant term in his partial adjustment model of the dividend behavior of a firm is expected to be non-negative and should be present in his dividend equation 'to reflect the greater reluctance to reduce than to raise dividends which was commonly observed as well as the influence of the specific desire for a gradual growth in dividend payments found in about a third of the companies visited'. Recent studies on using the signalling approach by Spence (1974) to explain the firms' financial structure and dividend payouts in equilibrium (Ross, 1977, 1978, and Battacharya, 1979, for example) also note explicitly the asymmetry that exists in firms' behavior when they face favorably and unfavorably changing economic conditions. Ross (1977, 1978) emphasizes the moral hazard confronting managers when they try to signal the true prospect of the firms' earnings to investors using finance (financial structure and dividends, for example). Asymmetry in managerial behavior arises when managers do not perceive the moral hazard the same way when they face favorable and unfavorable economic conditions. Bhattacharya (1979) assumes for his dividend-signalling equilibrium that the cost of making up a cash-flow deficit resulting from an overcommitment of dividend payout is more than the benefit of a cash-flow surplus of the same size and hence that frictionless access to extra external financing is unavailable. In this case, too, asymmetry in firms' dividend behavior follows.

Despite the general recognition of this possible asymmetry in firms' dividend paying behavior for a variety of theoretical reasons there is little empirical work to ascertain such asymmetry. The purpose of this paper is to investigate empirically the validity of a widely used econometric specification of firms' dividend behavior in the light of such asymmetry. Our results show that a serious misspecification may result if such asymmetry is ignored. The implications of such a misspecification on practical applications of dividend equations in investment and portfolio decisions will be a topic of another study. The plan of the paper is as follows. In the next section some stylized facts are first presented regarding changes in dividend payouts for both US and Japanese firms. Then firms' decisions to change dividends are modeled as a problem of a dummy dependent variable in the third section. In the fourth section asymmetry in firms' dividend behavior is analyzed using the Lintner equation. The paper ends with some conclusions.

ASYMMETRY IN DIVIDEND PAYING BEHAVIOR OF US AND JAPANESE FIRMS

It is often argued that firms are often more reluctant to reduce than raise dividends. (See, for example, Lintner, 1956, and Levy and Sarnat, 1986, p. 577.) This implies that firms are more likely to increase than decrease dividends. The opposite empirical implication seems to follow Bhattacharya's (1979) assumption for dividend-signalling equilibrium that the cost of making up a cash-flow deficit resulting from an overcommitment of dividend payout is more than the benefit of a cash-flow surplus of the same size. None of these and other

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arguments, however, have much to say about the magnitudes of dividend increases or decreases. It is then an empirical matter to determine how firms' managers implement asymmetry in terms of magnitudes of dividend changes.

In Table 1 basic statistics are presented on dividend increases and decreases for US and Japanese firms calculated using databases created from the Compustat tape for US firms (1964–82) and the Japan Development Bank financial tape for Japanese ones (1960–81). By comparing the numbers of observations under the headings of $\Delta D = D_t - D_{t-1} > 0$ (dividend increase) and $\Delta D = D_t - D_{t-1} < 0$ (dividend decrease) for US firms we see that these firms increased dividends much more often than they decreased them in all twelve industries. On the other hand, Japanese firms increased dividends about as many times as they decreased them.[1] Under the heading of 'Difference' in Table 1 the mean differences in percentage changes ($\Delta D_t/D_{t-1}$) and changes (ΔD_t) between the two subsamples corresponding to $\Delta D_t > 0$ and $\Delta D_t < 0$ are presented. To control for firm-specific effects, only those firms which experienced both dividend increases and decreases during the sample period are used to calculate these mean differences. For the USA the differences are generally statistically different from zero for all industries except Service, indicating that the magnitudes of dividend reductions are considerably higher than those of dividend increases. At least for the USA the stylized fact is that firms are much more reluctant to reduce than increase dividends, but when they do reduce them, the amounts of dividend reductions are much higher than those of the increases. For Japan, also, the magnitudes of dividend reductions are generally larger than those of dividend increases and the differences in mean magnitudes are generally statistically significant. The fact that managers are willing to cut dividends in larger quantities than to

Table 1. Percentage Changes in Dividend Payouts of US and Japanese Firms[a]

	$\Delta D>0$[b]	USA $\Delta D<0$	Difference	No. of firms (no. of pooled obs.)		$\Delta D>0$[b]	Japan $\Delta D<0$	Difference	No. of firms (no. of pooled obs.)
Food					*Food*				
Change (%)[c]	0.176	0.356	−0.141[e]		Change (%)[c]	0.225	0.219	0.047[d]	
	(0.020)	(0.018)	(0.067)			(0.019)	(0.014)	(0.027)	
Change[c]	0.140	0.438	−0.424[e]		Change[c]	1.274	1.785	−0.515[d]	
	(0.006)	(0.035)	(0.062)			(0.101)	(0.276)	(0.333)	
No. of obs.	552	176		54	No. of obs.	287	315		47
				(1026)					(987)
Chemicals					*Chemicals*				
Change (%)	0.176	0.360	−0.199[f]		Change (%)	0.238	0.296[d]	−0.057[e]	
	(0.012)	(0.016)	(0.028)			(0.016)	(0.015)	(0.022)	
Change	0.132	0.447	−0.363[f]		Change	1.259[d]	1.617	−0.304[e]	
	(0.004)	(0.036)	(0.036)			(0.073)	(0.171)	(0.100)	
No. of obs.	870	196		79	No. of obs.	499	502		77
				(1501)					(1617)
Petroleum Refining					*Petroleum Refining*				
Change (%)	0.203	0.345	−0.128[f]		Change (%)	0.271	0.366	−0.035	
	(0.026)	(0.028)	(0.037)			(0.037)	(0.046)	(0.060)	
Change	0.200	0.625	−0.528[f]		Change	1.473	1.855	−0.337[d]	
	(0.011)	(0.064)	(0.088)			(0.177)	(0.204)	(0.194)	
No. of obs.	336	87		30	No. of obs.	55	52		9
				(570)					(189)
Cement					*Cement*				
Change (%)	0.209	0.472	−0.220[f]		Change (%)	0.222	0.269	−0.037[d]	
	(0.041)	(0.047)	(0.071)			(0.021)	(0.020)	(0.029)	
Change	0.148	0.414	−0.367[f]		Change	1.443	1.720	−0.303[d]	
	(0.012)	(0.051)	(0.082)			(0.115)	(0.186)	(0.202)	
No. of obs.	96	45		15	Nos. of obs.	179	236		32
				(285)					(672)
Machinery and Precision					*Machinery and Precision*				
Change (%)	0.213	0.366	−0.098[f]		Change (%)	0.243	0.257	−0.027[d]	
	(0.009)	(0.011)	(0.025)			(0.015)	(0.010)	(0.016)	
Change	0.139	0.350	−0.239[f]		Change	1.879	2.528	−0.678[f]	
	(0.004)	(0.020)	(0.024)			(0.151)	(0.245)	(0.237)	
No. of obs.	1602	551		191	No. of obs.	967	931		2793
				(3629)					(133)
All Machinery					*All Machinery*				
Change (%)	0.215	0.370	−0.110[f]		Change (%)	0.230	0.251	−0.032[f]	
	(0.008)	(0.010)	(0.021)			(0.011)	(0.008)	(0.012)	
Change	0.152	0.383	−0.247[f]		Change	1.697	2.336	−0.763[f]	
	(0.004)	(0.019)	(0.021)			(0.113)	(0.196)	(0.246)	
No. of obs.	2019	745		241	No. of obs.	1326	1244		3864
				(4579)					(184)

Table 1. *Continued.*

	USA $\Delta D>0^{b}$	USA $\Delta D<0$	Difference	No. of firms (no. of pooled obs.)		Japan $\Delta D>0^{b}$	Japan $\Delta D<0$	Difference	No. of firms (no. of pooled obs.)
Utilities					*Utilities*				
Change (%)	0.076	0.281	-0.226^{f}		Change (%)	0.182	0.147	0.037^{e}	
	(0.003)	(0.024)	(0.031)			(0.015)	(0.012)	(0.017)	
Change	0.101	0.467	-0.397^{f}		Change	4.447	4.471	0.275^{d}	
	(0.003)	(0.048)	(0.055)			(0.453)	(0.461)	(0.208)	
No. of obs.	801	71		56	No. of obs.	124	123		315
				(1064)					(15)
Wholesale/retail					*Wholesale/retail*				
Change (%)	0.228	0.395	-0.143^{f}		Change (%)	0.191	0.217	-0.029	
	(0.017)	(0.018)	(0.026)			(0.017)	(0.016)	(0.028)	
Change	0.117	0.305	-0.237^{f}		Change	1.206	1.576	-0.491^{d}	
	(0.004)	(0.021)	(0.033)			(0.088)	(0.184)	(0.294)	
No. of obs.	785	245		83	No. of obs.	245	266		882
				(1577)					(42)
Service					*Service*				
Change (%)	0.361	0.395	0.138		Change (%)	0.242	0.231	0.060	
	(0.048)	(0.035)	(0.134)			(0.033)	(0.024)	(0.076)	
Change	0.221	0.564	-0.902		Change	2.469	2.736	0.293	
	(0.049)	(0.0276)	(0.765)			(0.501)	(0.556)	(0.533)	
No. of obs.	202	57		23	No. of obs.	136	127		546
				(437)					(26)
Computing machinery					*Transportation Machinery*				
Change (%)	0.222	0.380	-0.133^{e}		Change (%)	0.195	0.234	-0.049^{e}	
	(0.024)	(0.036)	(0.064)			(0.013)	(0.016)	(0.022)	
Change	0.250	0.628	-0.340^{e}		Change	1.206	1.764	-0.984^{d}	
	(0.034)	(0.233)	(0.168)			(0.093)	(0.279)	(0.593)	
No. of obs.	105	34		14	No. of obs.	359	313		1071
				(266)					(51)
Motor vehicles					*Mining*				
Change (%)	0.208	0.376	-0.177^{f}		Change (%)	0.274	0.421	-0.113^{d}	
	(0.024)	(0.030)	(0.043)			(0.071)	(0.070)	(0.074)	
Change	0.229	0.603	-0.327^{f}		Change	6.551	4.509	0.062	
	(0.029)	(0.081)	(0.0656)			(2.492)	(1.551)	(0.374)	
No. of obs.	192	98		22	No. of obs.	21	26		126
				(418)					(6)
Aircraft					*Construction*				
Change (%)	0.231	0.389	-0.130^{f}		Change (%)	0.201	0.190	0.005	
	(0.027)	(0.030)	(0.044)			(0.016)	(0.013)	(0.021)	
Change	0.179	0.349	-0.230^{f}		Change	1.312	1.906	-0.769^{d}	
	(0.012)	(0.034)	(0.055)			(0.091)	(0.322)	(0.451)	
No. of obs.	225	97		28	No. of obs.	175	221		630
				(532)					(30)

[a]The Compustat tape (1964–82) was used to create a database for US firms. The financial database developed by the Japan Development Bank (1960–81), which includes all firms listed on the Tokyo and Osaka Stock Exchanges, was used to create a database for Japanese firms. Those firms which do not have relevant variables were eliminated. The dividends and earnings were both measured on a per share basis. There are 19 observations per US firm and 21 observations per Japanese firm.
[b]Pooled observations are divided into those for which dividends went up ($\Delta D = D_t - D_{t-1} > 0$) and those for which dividends went down ($\Delta D_t < 0$). The observations which do not belong to either subsample correspond to no changes in dividends, i.e. $D_t = D_{t-1}$.
[c]The means for percentage changes (Change %)) in dividends, ($\Delta D_t/D_{t-1}$), and changes (Change) in dividends, ΔD_t, are both given in absolute values. Numbers in parentheses are estimated standard errors. The mean differences in dividend changes between the two subsamples corresponding to $\Delta D>0$ and $\Delta D<0$ are calculated using only those observations of the firms which experienced both dividend increases and decreases during the sample period. This way we control for the firm-specific fixed effects in dividend behavior.
[d–f]These superscripts imply that the differences in the means of the subsamples are significant at at least 80%, 95% and 99% levels, respectively.

increase dividends is quite opposite to existing expectations (Lintner, 1956; Levy and Sarnat, 1986; Hagin, 1979, for example).

DETERMINANTS OF PROBABILITIES OF DIVIDEND CHANGES

The probabilities of firms' decisions to change dividends are characterized by the underlying equation which describes the dividend behavior of a firm. In this paper we use the partial adjustment model (1) of Lintner (1956), which fits US and Japanese data (at both aggregate and disaggregate levels) quite well:

$$\Delta D_{it} = a_{i0} + c_i(D^*_{it} - D_{i,t-1}) + u_{i,t};\ t = 1, 2, \ldots, T \tag{1}$$

where $\Delta D_{i,t} = D_{i,t} - D_{i,t-1}$ denotes the change in dividends for firm i, $D_{i,t}$ is the dividends firm i paid out in time period (year) t, $D^*_{i,t}$ is the unobserved target dividend payout, c_i is the speed of adjustment to the difference between the target divided payout and last year's payout, a_{i0} is a firm-specific constant and $u_{i,t}$ is an error term which is assumed to be normally and independently distributed with zero mean and variance σ_u^2 over firms as well as over time periods. In the Lintner model the target payout is related to the current earnings $y_{i,t}$ by

$$D^*_{i,t} = r_i y_{i,t} \tag{2}$$

where r_i is the desired dividend payout ratio. Although for the sake of simplicity, only current earnings are used in Eqn (2) in the present analysis, it is also possible to relate $D^*_{i,t}$ to expected future earnings. (See Nakamura and Nakamura, 1985, for such an extension of the Lintner model.) Combining Eqns (1) and (2), the Lintner model for firm i is given by

$$\Delta D_{i,t} = a_{i,0} + c_i r_i y_{i,t} - c_i D_{i,t-1} + u_{i,t} \tag{3}$$

In the following the subscript i will be omitted for brevity of notation.

When firms make decisions on dividend changes it is possible that firm-specific variables such as firm size (S_t) and lagged debt ratio (DR_{t-1}) affect their decisions.[2] Therefore we depart somewhat from the Lintner model here and introduce these firm-specific variables as follows:

$$a_0 = b_0 + b_1 S_t + b_2 DR_{t-1} + v_t \tag{4}$$

where v_t is normally and independently distributed over all time periods and firms with mean zero and variance σ_v^2. Substituting Eqn (4) into Eqn (3), we obtain

$$\Delta D_t = b_0 + cry_t - cD_{t-1} + b_1 S_t + b_2 DR_{t-1} + u'_t \tag{5}$$

where $u'_t = u_t + v_t$ is a normal variable such that $E(u'_t) = 0$ and $V(u'_t) = \sigma^2_{u'} = \sigma_u^2 + \sigma_v^2$.

The probability that the firm increases its dividends is then given by

$$\begin{aligned} P(\Delta D_t > 0) &= P(u'_t > -b_0 - cry_t + cD_{t-1} - b_1 S_t \\ &\quad - b_2 DR_{t-1}) \\ &= P\{-(u'_t/\sigma_{u'}) < (b_0/\sigma_{u'}) + (cr/\sigma_{u'})y_t \\ &\quad - (c/\sigma_{u'})D_{t-1} + (b_1/\sigma_{u'})S_t \\ &\quad + (b_2/\sigma_{u'})DR_{t-1}\} \\ &= F(\phi_{1t}) \end{aligned} \tag{6}$$

where $\phi_{1t} = (b_0/\sigma_{u'}) + (cr/\sigma_{u'})y_t - (c/\sigma_{u'})D_{t-1} + (b_1/\sigma_{u'}) S_t + (b_2/\sigma_{u'})DR_{t-1}$ and F is the distribution function of the standard normal variable. It is also easily seen that $P(\Delta D_t > 0) = P(\Delta D_t > 0,\ D_t > 0)$.

The probability that the firm decreases its dividends is given by

$$\begin{aligned} P(\Delta D_t < 0) &= P(b_0 + cry_t - cD_{t-1} + b_1 S_t + b_2 DR_{t-1} \\ &\quad + u'_t < 0) \\ &= P\{u'_t < -b_0 - cry_t + cD_{t-1} - b_1 S_t \\ &\quad - b_2 DR_{t-1}\} \\ &= P\{(u'_t/\sigma_{u'}) < \xi_{1t}\} \\ &= F(\xi_{1t}) \end{aligned} \tag{7}$$

where

$$\begin{aligned} \xi_{1t} = &-(b_0/\sigma_{u'}) - (cr/\sigma_{u'})y_t + (c/\sigma_{u'})D_{t-1} \\ &- (b_1/\sigma_{u'})S_t - (b_2/\sigma_{u'})DR_{t-1} \end{aligned}$$

Finally, the probability that the firm pays dividends is given by

$$\begin{aligned} P(D_t > 0) &= P(b_0 + cry_t - cD_{t-1} + D_{t-1} + b_1 S_t \\ &\quad + b_2 DR_{t-1} + u'_t > 0) \\ &= P\{u'_t > -b_0 - cry_t + (c-1)D_{t-1} - b_1 S_t \\ &\quad - b_2 DR_{t-1}\} \\ &= P[-(u'_t/\sigma_{u'}) < (1/\sigma_{u'})\{b_0 + cry_t \\ &\quad - (c-1)D_{t-1} + b_1 S_t + b_2 DR_{t-1}\}] \\ &= F(\xi_{2t}) \end{aligned} \tag{8}$$

where

$$\begin{aligned} \xi_{2t} = &(b_0/\sigma_{u'}) + (cr/\sigma_{u'})y_t - \{(c-1)/\sigma_{u'}\}D_{t-1} \\ &+ (b_1/\sigma_{u'})S_t + (b_2/\sigma_{u'})DR_{t-1} \end{aligned}$$

Using probit analysis, we can derive maximum likelihood estimates of unknown parameters involved in our probability models (6)–(8): $(b_0/\sigma_{u'})$, $(b_1/\sigma_{u'})$, $(b_2/\sigma_{u'})$, $(cr/\sigma_{u'})$ and $-(c/\sigma_{u'})$ for ϕ_{1t}, $-(b_0/\sigma_{u'})$, $-(b_1/\sigma_{u'})$, $-(b_2/\sigma_{u'})$, $-cr/\sigma_{u'})$ and $(c/\sigma_{u'})$ *for* ξ_{1t}, and $(b_0/\sigma_{u'})$, $(b_1/\sigma_{u'})$, $(b_2/\sigma_{u'})$, $(cr/\sigma_{u'})$ and $-(c-1)/\sigma_{u'}$ for ξ_{2t}. By estimating three separate equations for the probabilities $P(\Delta D_t > 0)$, $P(\Delta D_t < 0)$ and $P(D_t > 0)$, we can analyze the hypothesis that firms' dividend behavior is symmetric with respect to decisions on changing dividends. In particular, we are interested in seeing if the parameter estimates for $(b_0/\sigma_{u'})$, $(b_1/\sigma_{u'})$, $(b_2/\sigma_{u'})$, $(cr/\sigma_{u'})$ and $(c/\sigma_{u'})$ derived from three probit analyses are similar to each other.

Using annual data for US firms from the Compustat tape (1964–82) and for Japanese firms from the Japan Development Bank financial data tape (1960–81), the three probability Eqns (6)–(8) were estimated. Maximum likelihood estimates are presented in Tables 2(a) and 2(b) for US and Japanese firms, respectively. In the data sets used, both the dividend and earnings variables (D and Y) are measured on a per share basis, the size variable (S) is the firm's net sales deflated by CPI (1960 = 100) and the lagged debt ratio (DR_{-1}) is the long-term debt (at book value) divided by the sum of the long-term debt and common equity. (The lagged, rather than current, debt ratio is used here to avoid the potential problem of endogeneity in the probit estimation.)

The coefficients of D_{-1} in Tables 2(a) and 2(b) represent $(-c/\sigma_{u'})$ for $P(\Delta D > 0)$, $(c/\sigma_{u'})$ for $P(\Delta D < 0)$ and $(1-c)/\sigma_{u'}$ for $P(D > 0)$, where c is the speed of adjustment. (Note also that under the hypothesis of symmetric dividend behavior it is possible to identify $\sigma_{u'}$ using estimates of $(c/\sigma_{u'})$ and $(1-c)/\sigma_{u'}$.) Comparing the two estimates for $(c/\sigma_{u'})$ found in the rows for $\Delta D > 0$ and $\Delta D < 0$, respectively, it is seen that these are quite different for US firms in all industries except in Food, Chemicals, Utilities and Motor Vehicles, and for Japanese firms in all industries except in Machinery

Table 2(a). Determinants of Probabilities of Dividend Increases, Decreases and Payouts for US Firms[a]

Industry	Constant	Y	D_{-1}	S	DR_{-1}	Chi-squared	r (Payout ratio)[e]
Food							
($\Delta D>0$)	−0.161	0.0483[d]	−0.731[d]	0.047[d]	−2.030[d]	296.6	0.66
	(1.5)	(15.6)	(10.3)	(6.8)	(8.0)		
($\Delta D<0$)	−1.059[d]	−0.255[d]	0.642[d]	−0.011[c]	0.336[b]	80.4	0.40
	(11.8)	(10.9)	(10.1)	(2.1)	(1.4)		
($D>0$)	−0.548[d]	0.285[d]	6.573[d]	0.067[d]	−1.726[d]	464.9	
	(2.6)	(6.1)	(9.0)	(3.5)	(4.0)		
Chemicals							
($\Delta D>0$)	0.023	0.540[d]	−0.813[d]	0.021[d]	−1.905[d]	350.3	0.66
	(0.3)	(15.8)	(11.8)	(2.8)	(8.9)		
($\Delta D<0$)	−1.192[d]	−0.351[c]	0.882[d]	−0.024[d]	0.287[b]	142.2	0.40
	(19.0)	(2.5)	(14.5)	(4.8)	(1.6)		
($D>0$)	−0.098	0.457[d]	4.411[d]	−0.068	−1.902[d]	581.0	
	(0.7)	(5.8)	(9.3)	(1.2)	(4.9)		
Petroleum Refining							
($\Delta D>0$)	0.192	0.211[d]	−0.203[c]	−0.001	−1.654[d]	92.0	1.04
	(1.1)	(6.3)	(2.1)	(0.4)	(4.4)		
($\Delta D<0$)	−1.320[d]	−0.125[d]	0.532[d]	−0.004[c]	0.392	31.8	0.23
	(9.0)	(5.9)	(7.0)	(2.9)	(1.2)		
($D>0$)	−0.643[c]	0.327[d]	4.539[d]	0.11	−1.156[c]	266.6	
	(2.3)	(3.5)	(6.2)	(0.4)	(2.0)		
Cement							
($\Delta D>0$)	−1.045[d]	0.299[d]	−0.238[b]	0.083[c]	−0.076	55.7	1.26
	(5.3)	(8.8)	(1.7)	(1.9)	(0.2)		
($\Delta D<0$)	−1.113[d]	−0.142[d]	0.520[d]	−0.164[d]	0.663[b]	23.5	0.27
	(5.9)	(4.3)	(4.1)	(4.2)	(1.5)		
($D>0$)	−2.045[d]	0.163[d]	4.254[d]	0.231	1.416[c]	183.1	
	(6.2)	(3.8)	(8.5)	(1.1)	(1.8)		
Machinery and Precision							
($\Delta D>0$)	−0.326[d]	0.254[d]	−0.209[d]	0.008[d]	−1.193[d]	556.4	1.21
	(7.1)	(19.9)	(5.4)	(2.7)	(9.6)		
($\Delta D<0$)	−1.152[d]	−0.221[d]	0.787[d]	−0.024[d]	0.025	306.6	0.28
	(28.0)	(19.3)	(21.7)	(10.8)	(0.2)		
($D>0$)	−0.448[d]	0.114[d]	8.303[d]	−0.009	−2.177[d]	2679.8	
	(6.8)	(5.7)	(21.7)	(0.7)	(13.2)		
All Machinery							
($\Delta D>0$)	−0.317[d]	0.252[d]	−0.208[d]	−0.001	−1.073[d]	684.1	1.21
	(7.9)	(28.8)	(7.0)	(0.7)	(10.2)		
($\Delta D<0$)	−1.072[d]	−0.208[d]	0.659[d]	−0.006[d]	−0.105	398.1	0.31
	(29.4)	(22.3)	(21.9)	(5.9)	(1.1)		
($D>0$)	−0.281	0.155[d]	5.587[d]	−0.037[d]	−1.854[d]	3024.1	
	(4.8)	(11.9)	(25.2)	(7.2)	(13.0)		
Utilities							
($\Delta D>0$)	0.407	0.814[d]	−1.119[d]	−0.018[b]	0.103	112.2	0.73
	(0.8)	(9.0)	(7.7)	(1.4)	(0.1)		
($\Delta D<0$)	0.446[b]	−0.594[d]	0.941[d]	0.017[c]	−3.522[d]	46.0	0.63
	(1.3)	(12.1)	(9.8)	(2.2)	(7.0)		
($D>0$)	3.215	17.972[d]	1.810[b]	−2.114[d]	1.470	40.9	
	(0.2)	(5.0)	(1.7)	(4.7)	(0.0)		
Wholesale/Retail							
($\Delta D>0$)	−0.392[d]	0.413[d]	−0.566[d]	0.014[d]	−0.542[d]	279.4	0.73
	(4.8)	(15.6)	(7.4)	(3.9)	(3.3)		
($\Delta D<0$)	−1.112[d]	−0.281[d]	0.943[d]	−0.020[d]	0.207[b]	132.5	0.30
	(14.7)	(12.4)	(13.1)	(7.8)	(1.3)		
($D>0$)	−0.661[d]	0.339[d]	6.886[d]	−0.002	−0.442[b]	831.9	
	(5.2)	(7.3)	(12.2)	(0.1)	(1.8)		
Service							
($\Delta D>0$)	−0.356[d]	0.196[d]	−0.065	0.176[d]	−1.272[d]	81.0	3.01
	(3.0)	(6.5)	(1.1)	(3.3)	(4.5)		
($\Delta D<0$)	−1.259[d]	−0.134[d]	0.452[d]	0.025	0.303	21.3	0.30
	(11.2)	(4.2)	(4.8)	(0.6)	(1.2)		
($D>0$)	−0.783[d]	0.118[d]	7.484[d]	0.210[d]	−1.048[d]	338.2	
	(4.5)	(3.0)	(8.9)	(2.7)	(2.5)		

Table 2(a). *Continued.*

Industry	Constant	Y	D_{-1}	S	DR_{-1}	Chi-squared	r (Payout ratio)[e]
Computing Machinery							
($\Delta D>0$)	−0.778[d]	0.522[d]	−0.280[d]	−0.038[d]	−1.953[d]	105.0	1.86
	(4.6)	(10.5)	(2.6)	(4.8)	(4.8)		
($\Delta D<0$)	−0.923[d]	−0.226[d]	0.626[d]	−0.010[b]	−0.715[b]	21.2	0.36
	(6.4)	(6.1)	(5.3)	(1.4)	(1.8)		
($D>0$)	−1.069[d]	0.274[d]	14.9[d]	0.103	−4.004[d]	264.8	
	(3.6)	(3.0)	(3.6)	(1.2)	(6.6)		
Motor Vehicles							
($\Delta D>0$)	0.015	0.233[d]	−0.435[d]	0.001	−0.881[d]	89.2	0.53
	(0.1)	(16.8)	(7.2)	(0.4)	(2.5)		
($\Delta D<0$)	−0.913[d]	−0.150[d]	0.487[d]	−0.003[b]	−0.356	70.1	0.31
	(7.0)	(7.2)	(6.3)	(1.8)	(1.1)		
($D>0$)	0.533[c]	0.204[d]	1.646[d]	−0.011[b]	−1.248[d]	146.8	
	(2.4)	(10.8)	(5.9)	(1.7)	(2.7)		
Aircraft							
($\Delta D>0$)	−0.485[d]	0.283[d]	−0.057	−0.021[d]	−0.963[d]	82.1	4.96[f]
	(3.7)	(9.7)	(0.6)	(2.9)	(3.4)		
($\Delta D<0$)	−0.751[d]	−0.216[d]	0.484[d]	−0.002	−0.229	40.4	0.45
	(6.1)	(7.8)	(5.9)	(0.3)	(0.9)		
($D>0$)	−0.176	0.250[d]	4.292[d]	−0.055[d]	−1.809[d]	283.9	
	(0.8)	(5.0)	(9.0)	(3.6)	(4.1)		

Table 2(b). Determinants of Probabilities of Dividend Increases, Decreases and Payouts for Japanese Firms[a]

Industry	Constant	Y	D_{-1}	S	DR_{-1}	Chi-squared	r (Payout ratio)[e]
Food							
($\Delta D>0$)	−0.337[d]	0.019[d]	−0.051[d]	0.002[b]	−1.259[d]	53.3	0.37
	(3.8)	(8.5)	(6.3)	(1.3)	(4.2)		
($\Delta D<0$)	−0.833[d]	−0.024[d]	0.112[d]	0.005[d]	−0.713[c]	104.6	0.21
	(7.1)	(9.8)	(7.3)	(2.8)	(2.3)		
($D>0$)	−0.807[d]	0.018[d]	0.565[d]	0.013[b]	−1.093[c]	457.5	
	(4.5)	(6.4)	(13.4)	(1.7)	(2.4)		
Chemicals							
($\Delta D>0$)	−0.146[b]	0.022[d]	−0.085[d]	0.005[d]	−1.08[d]	126.0	0.26
	(1.8)	(9.4)	(11.3)	(4.2)	(5.9)		
($\Delta D<0$)	−0.641[d]	−0.033[d]	0.128[d]	0.004[d]	−0.828[d]	194.68	0.26
	(6.1)	(14.4)	(9.6)	(3.7)	(4.1)		
($D>0$)	−0.430[d]	0.079[d]	0.572[d]	0.007[d]	−2.194[d]	1121.8	
	(2.8)	(20.3)	(20.1)	(3.0)	(7.5)		
Petroleum Refining							
($\Delta D>0$)	−0.343	0.025[d]	−0.065[d]	0.000	−0.557	22.5	0.38
	(0.8)	(8.6)	(4.7)	(0.3)	(0.9)		
($\Delta D<0$)	−1.593[d]	−0.024[d]	0.231[d]	−0.003[d]	0.605	43.9	0.10
	(3.5)	(5.7)	(5.5)	(3.1)	(1.0)		
($D>0$)	0.749	0.051[d]	0.762[d]	−0.001	−3.301[d]	152.8	
	(0.9)	(11.7)	(7.5)	(0.8)	(2.6)		
Cement							
($\Delta D>0$)	−0.482[d]	0.011[d]	−0.033[d]	0.007[d]	−0.781[d]	32.0	0.33
	(4.8)	(5.4)	(4.4)	(2.6)	(3.1)		
($\Delta D<0$)	−0.365[d]	−0.026[d]	0.085[d]	0.005[c]	−1.065[d]	87.5	0.30
	(3.1)	(12.2)	(7.1)	(1.9)	(4.0)		
($D>0$)	−0.782)[d]	0.042[d]	0.574[d]	0.018[d]	−1.369[d]	387.6	
	(3.2)	(10.0)	(12.3)	(2.5)	(2.7)		
Machinery and Precision							
($\Delta D>0$)	−0.092[c]	0.019[d]	−0.061[d]	0.002[d]	−1.701[d]	325.5	0.31
	(2.1)	(17.6)	(24.1)	(4.1)	(10.5)		
($\Delta D<0$)	−0.385[d]	−0.021[d]	0.065[d]	0.002[d]	−1.081[d]	308.8	0.32
	(8.3)	(20.3)	(13.6)	(4.3)	(6.7)		
($D>0$)	0.065	0.030[d]	0.286[d]	0.026[d]	−2.613[d]	1381.0	
	(0.6)	(15.2)	(15.5)	(5.0)	(11.2)		

Table 2(b). *Continued.*

Industry	Constant	Y	D_{-1}	S	DR_{-1}	Chi-squared	r (Payout ratio)[e]
All Machinery							
($\Delta D>0$)	-0.144^d	0.018^d	-0.060^d	0.001^d	-1.310^d	403.8	0.30
	(4.0)	(20.4)	(26.4)	(5.4)	(11.5)		
($\Delta D<0$)	-0.380^d	-0.019^d	0.055^d	0.001^d	-0.942^d	346.0	0.34
	(10.3)	(20.7)	(14.8)	(4.2)	(8.4)		
($D>0$)	-0.061	0.030^d	0.355^d	0.006^d	-2.008^d	1893.1	
	(0.8)	(20.0)	(23.2)	(4.8)	(12.3)		
Utilities							
($\Delta D>0$)	-0.275	0.043^d	-0.062^d	0.001	0.247	75.8	0.69
	(0.9)	(12.5)	(10.5)	(1.1)	(0.3)		
($\Delta D<0$)	-0.613^d	-0.047^d	0.059^d	0.001^b	0.370^d	75.3	0.80
	(2.1)	(13.1)	(11.5)	(1.5)	(0.49)		
($D>0$)	—	—	—	—	—	—	
Wholesale/Retail							
($\Delta D>0$)	-0.442^d	0.017^d	-0.052^d	0.0004^d	-1.035^d	67.7	0.33
	(4.3)	(13.6)	(4.90)	(5.7)	(4.9)		
($\Delta D<0$)	-1.119^d	-0.020^d	0.137^d	0.0002^d	-0.246	100.0	0.14
	(9.3)	(8.5)	(8.5)	(3.0)	(1.1)		
($D>0$)	-0.919^d	0.025^d	0.601^d	0.001^c	-1.080^d	499.6	
	(4.9)	(7.2)	(13.2)	(2.0)	(3.3)		
Service							
($\Delta D>0$)	-0.467^d	0.003^d	-0.017^d	0.021^b	-1.08^d	19.3	0.11
	(5.0)	(3.5)	(4.7)	(1.7)	(3.4)		
($\Delta D<0$)	-0.849^d	-0.002^c	0.010^d	0.017^b	0.020	6.7	0.20
	(9.2)	(2.0)	(2.5)	(1.5)	(0.1)		
($D>0$)	-0.619^d	0.048^d	0.742^d	-0.032	-0.800^b	341.0	
	(3.5)	(3.8)	(9.0)	(0.9)	(1.6)		
Transportation Machinery							
($\Delta D>0$)	-0.197^d	0.017^d	-0.059^d	0.001^d	-0.875^d	87.2	0.29
	(2.9)	(9.6)	(11.4)	(3.4)	(5.1)		
($\Delta D<0$)	-0.442^d	-0.013^d	0.033^d	0.0004	-0.527^d	45.0	0.39
	(6.4)	(6.1)	(5.1)	(1.2)	(3.1)		
($D>0$)	-0.373^c	0.029^d	0.546^d	0.003^c	-1.701^d	449.7	
	(2.4)	(12.4)	(14.9)	(2.2)	(7.0)		
Mining							
($\Delta D>0$)	-0.838^d	0.030^d	-0.047^d	0.005	-1.219^d	20.0	0.64
	(3.6)	(5.7)	(4.9)	(0.9)	(2.6)		
($\Delta D<0$)	-0.164	-0.030^d	0.033^d	0.003	-1.832^d	20.8	0.91
	(0.7)	(5.4)	(3.5)	(0.7)	(3.8)		
($D>0$)	-0.865^d	0.067^d	0.951^d	0.028	-2.661^d	139.4	
	(2.7)	(6.9)	(5.6)	(1.1)	(4.4)		
Construction							
($\Delta D>0$)	-0.021	0.019^d	-0.114^d	0.003^c	-1.4^d	45.0	0.17
	(0.2)	(8.9)	(10.3)	(2.4)	(3.1)		
($\Delta D<0$)	-1.085^d	-0.028^d	0.161^d	0.0002	0.025	76.5	0.17
	(9.4)	(9.8)	(9.5)	(0.2)	(0.0)		
($D>0$)	-1.263^d	0.090^d	0.817^d	0.048^c	-3.795^c	197.3	
	(2.7)	(10.2)	(7.7)	(2.1)	(2.2)		

[a]These results are based on three probit analyses in which dummy dependent variables are set equal to one if (1) $\Delta D_t>0$, (2) $\Delta D_t<0$ and (3) $D_t>0$, respectively. Numbers in parentheses are (asymptotic) t-statistics. See Table 1 for numbers of observations. Variables S and DR_{-1} denote, respectively, net sales (in thousand dollars) and debt ratio defined to be the ratio between the long-term debt and the sum of the long-term debt and common equity, lagged one year.
[b–d]*These superscripts imply that the coefficients are significant at at least 80%, 95% and 99% levels, respectively.*
[e]*Estimates of r are calculated as |coefficient estimate of y/Coefficient estimate of D_{-1}| $\simeq (cr/\sigma)/(c/\sigma) = r$.*
[f]The coefficient estimate of D_{-1} is not significant.

and Precision, All Machinery and Utilities. It is also possible to derive an estimate of the desired payout ratio r from each set of the probit estimates by computing the absolute value of the ratio between the estimated coefficients of Y and D_{-1}. These estimates for r are given in the last columns of Tables 2(a) and 2(b). Since probit analysis ignores the magnitudes of dividends and their changes, one cannot put much confidence in these estimates of structural parameters of interest such as r. We will look at estimation of r in detail in the next section.

As for the impacts of current earnings Y and lagged dividends D_{-1} on the probabilities $P(\Delta D>0)$, $P(\Delta D<0)$ and $P(D>0)$, their estimated coefficients are statistically significant and have the signs fully consistent with the underlying Lintner equation for both

US and Japanese firms. For example, higher current earnings and lower dividends in the previous year increase $P(\Delta D>0)$ and decrease $P(\Delta D<0)$.

The two variables, S and DR_{-1}, included to control for firm-specific effects in these probabilities, have fairly systematic but different impacts on Japanese and US firms. The coefficients of the size variable are positive in $P(\Delta D>0)$ and negative in $P(\Delta D<0)$, whenever they are statistically significant at at least a 95% level for all US industries except Utilities, Computing Machinery and Aircraft. The positive (negative) sign of the coefficient of S in $P(\Delta D>0)$ ($P(\Delta D<0)$) means that larger firms are more (less) likely to increase (decrease) dividends. Such dividend behavior of large firms is consistent with certain traditional views (Lintner, 1956). The estimated coefficients of S are positive and of similar magnitudes for both $P(\Delta D>0)$ and $P(\Delta D<0)$ for Japanese firms in eight out of twelve industries. This implies that larger firms are more likely to both increase and decrease dividends than smaller ones. This symmetric behavior of large Japanese firms in decisions on dividend changes is interesting compared to the asymmetric behavior found for US firms.

The coefficients of the lagged debt ratio, DR_{-1}, for US firms are negative in $P(\Delta D>0)$ and positive in $P(\Delta D<0)$, indicating that firms' financial structure matters in decisions on dividend changes and that higher (lower) debt ratio imply lower (higher) probabilities of dividend increases (decreases). The only exception is Utilities, for which firms' higher debt ratios decrease the probability of dividend reduction at a 99% level. The estimated coefficients of DR_{-1} for both $P(\Delta D>0)$ and $P(\Delta D<0)$ for Japanese firms are often negative, indicating that firms with higher debt ratios are less likely to increase or decrease dividends than those with lower ones. This aspect of dividend behavior of Japanese firms is quite different from US firm's behavior.

ESTIMATING THE LINTNER EQUATION WITH SELECTIVITY

Results from Tables 1 and 2 indicate that firms' decisions to increase and decrease dividends are not necessarily made in a symmetric way. It is then possible that estimating Lintner's (or any other) dividend equation for a firm for the entire sample period without regard to the direction of a change in dividends may lead to a serious specification error. In order to estimate the dividend Eqn (3) separately for the subsamples corresponding to $\Delta D>0$ and $\Delta D<0$ it is necessary to take into account the fact that the expected value of the error term u_t in Eqn (3) conditional on $\Delta D>0$ or $\Delta D<0$ is likely to be nonzero, implying that the standard application of ordinary least squares to Eqn (3) using such subsamples provides inconsistent estimates.

Taking the expectation of both sides of Eqn (3), conditional on the firm's decision $\Delta D>0$, where the firm's decision on dividend changes is assumed to be based on Eqn (5), we obtain

$$E(\Delta D_t|\Delta D_t>0) = a_0+cry_t-cD_{t-1}+E(u_t|\Delta D_t>0) \quad (9)$$

where

$$\begin{aligned} E(u_t|\Delta D_t>0) &= E(u_t|b_0+cry_t-cD_{t-1} \\ &\quad +b_1S_t+b_2DR_{t-1}+u'_t>0) \\ &= E\{u_t|-(u'_t/\sigma_{u'})<\phi_{1t}\} \\ &= -(\sigma_{uu'}/\sigma^2_{u'})\lambda_t \quad (10) \end{aligned}$$

$$\lambda_{1t}=f(\phi_{1t})/F(\phi_{1t}) \quad (11)$$

and $\sigma_{uu'}$ is the covariance between u and u'. For $\Delta D>0$, $U_{1t}=u_t-E(u_t/\Delta D_t>0)$ is truncated normal with zero mean and heteroscedastic variance $\sigma^2_u(1-\rho^2)+\sigma^2_u\rho^2M_1$, $\rho^2=\sigma^2_{uu'}/(\sigma^2_u\sigma^2_{u'})$ and $M_1=1+\phi_{1t}\lambda_{1t}-\lambda^2_t$. λ_{1t} is the selection bias term representing the mean of the truncated normal random variable (see, for example, Johnson and Kotz, 1970, 1972; Madalla, 1983, p. 367; Nakamura and Nakamura, 1981, 1983), and can be estimated consistently using probit estimates for ϕ_{1t} from Eqn (6). By substituting Eqn (10) into Eqn (9), the Lintner equation to estimate using the subsample for $\Delta D>0$ becomes

$$\Delta D_t=a_0+cry_t-cD_{t-1}+e_1\lambda_{1t}+U_{1t} \quad (12)$$

where $e_1=-(\sigma_{uu'}/\sigma^2_u)$. Unknown parameters in Eqn (12) can be estimated consistently by ordinary least squares using the predicted value of λ_{1t}. Since U_{1t} is heteroscedastic, consistent estimates of standard errors are derived by using the White (1980) variance–covariance matrix.

The Lintner equation for the subsample for $\Delta D<0$ is similarly derived by taking the conditional expectation of the error term of Eqn (3) as follows:

$$\begin{aligned} E(u_t|\Delta D_t<0,\ D_t\geqslant 0) &= E(u_t|b_0+cry_t-cD_{t-1} \\ &\quad +b_1S_t+b_2DR_{t-1}+u'_t<0, \\ &\quad b_0+cry_t-cD_{t-1}+D_{t-1} \\ &\quad +b_1S_t+b_2DR_{t-1}+u'_t\geqslant 0) \\ &= E(u_t|-\xi_{2t}\leqslant(u'_t/\sigma_{u'})<\xi_{1t}) \\ &= (\sigma_{uu'}/\sigma^2_{u'})\lambda_{2t} \quad (13) \end{aligned}$$

where the selection bias term $\lambda_{2t}=\{f(\xi_{1t})-f(-\xi_{2t})\}/\{F(-\xi_{2t})-F(\xi_{1t})\}$ is the nonzero mean of the doubly truncated normal variable (see, for example, Nakamura and Nakamura, 1983, pp. 252–3) and can be estimated consistently using probit estimates for ξ_{1t} and ξ_{2t} from Eqns (7) and (8), respectively. For $\Delta D_t<0$ and $D_t\geqslant 0$, $U_{2t}=u_t-E(u_t/\Delta D_t<0,\ D_t\geqslant 0)$ is truncated normal with mean zero and hetroscedastic variance $\sigma^2_u(1-\rho^2)+\sigma^2_u\rho^2M_2$, where

$$M_2=1+G_2-\lambda^2_2$$

and

$$G_2=\{-\xi_{2t}f(-\xi_{2t})-\xi_{1t}f(\xi_{1t})\}/\{F(\xi_{1t})-F(-\xi_{2t})\}$$

Table 3(a). Lintner Dividend Equations with Selectivity for US Firms[a]

Industry	Constant	Y (c, adj. speed)	D_{-1}	Selection bias	R^2	No. of obs.	r (Payout ratio)[b]
Food							
(All)	−0.013	0.095[e]	−0.218[e]	—	0.265	1026	0.43
	(0.7)	(8.5)	(5.8)				
($\Delta D>0$)	−0.014	0.058[e]	−0.029	—	0.418	552	2.0
	(0.9)	(4.0)	(0.9)				
	−0.101[c]	0.072[e]	−0.040	0.090[d]	0.436	552	1.8
	(1.8)	(3.5)	(1.2)	(1.9)			
($\Delta D<0$)	−0.067[e]	0.093[e]	−0.444[e]	—	0.612	176	0.21
	(1.2)	(4.8)	(8.4)				
	0.878[c]	0.213[e]	−0.720[e]	−0.624[e]	0.620	176	0.29
	(1.8)	(3.1)	(5.0)	(1.9)			
Chemicals							
(All)	−0.017	0.101[e]	−0.216[e]	—	0.267	1501	0.47
	(1.2)	(8.3)	(5.4)				
($\Delta D>0$)	0.024[e]	0.036[e]	−0.001	—	0.329	870	—
	(1.9)	(7.1)	(0.1)				
	0.024	0.036[e]	−0.001	−0.000	0.329	870	—
	(0.7)	(4.1)	(0.1)	(0.0)			
($\Delta D<0$)	−0.266[e]	0.171[e]	−0.406[e]	—	0.478	196	0.42
	(4.4)	(4.6)	(5.0)				
	−0.922[e]	0.260[e]	−0.352[e]	0.631[e]	0.598	196	0.74
	(5.3)	(7.3)	(3.9)	(5.0)			
Petroleum Refining							
(All)	0.005	0.082[e]	−0.224[e]	—	0.238	570	0.37
	(0.2)	(6.0)	(5.2)				
($\Delta D>0$)	0.026	0.049[e]	−0.040[d]	—	0.327	336	1.2
	(1.0)	(6.2)	(2.0)				
	−0.103	0.061[e]	−0.043[d]	0.139[c]	0.335	336	1.4
	(1.1)	(4.7)	(2.1)	(1.7)			
($\Delta D<0$)	0.075[c]	0.035[d]	−0.500[e]	—	0.785	87	0.07
	(1.6)	(1.9)	(13.1)				
	−0.364	0.005	−0.418[e]	0.279	0.788	87	—
	(0.8)	(0.2)	(5.5)	(1.0)			
Cement							
(All)	0.004	0.038[e]	−0.099[e]	—	0.152	285	0.38
	(0.2)	(3.6)	(3.1)				
($\Delta D>0$)	0.149[e]	0.014[d]	−0.046[e]	—	0.097	96	0.30
	(4.1)	(2.1)	(2.8)				
	−0.028	0.036[d]	−0.047[e]	0.119[c]	0.117	96	0.76
	(0.2)	(2.2)	(2.9)	(1.2)			
($\Delta D<0$)	−0.086	0.032[d]	−0.346[e]	—	0.450	45	0.09
	(0.9)	(2.1)	(3.1)				
	0.252	0.060[d]	−0.390[e]	−0.230[c]	0.468	45	0.15
	(0.9)	(2.2)	(3.8)	(1.2)			
Machinery and Precision							
(All)	−0.000	0.061[e]	−0.161[e]	—	0.191	3629	0.38
	(0.0)	(5.6)	(3.1)				
($\Delta D>0$)	0.002	0.039[e]	0.24[c]	—	0.347	1602	—
	(0.2)	(11.2)	(1.7)				
	−0.043	0.044[e]	0.020[c]	0.041	0.348	1602	—
	(0.7)	(5.7)	(1.7)	(0.8)			
($D<0$)	0.075[c]	0.042[e]	−0.490[e]	—	0.738	551	0.08
All Machinery							
(All)	0.003	0.062[e]	−0.168[e]	—	0.227	4579	0.37
	(0.2)	(7.7)	(4.9)				
($\Delta D>0$)	−0.011	0.049[e]	0.009	—	0.348	2019	—
	(0.7)	(6.9)	(0.6)				
	−0.183[d]	0.070[e]	−0.009	0.159[d]	0.358	2019	—
	(2.0)	(4.9)	(0.5)	(2.1)			
($\Delta D<0$)	0.001	0.035[e]	−0.392[e]	—	0.602	746	0.09
	(0.2)	(3.7)	(6.5)				
	−0.236	0.022	−0.348[e]	0.152	0.604	746	0.06
	(0.5)	(0.8)	(2.7)	(0.6)			
Utilities							
(All)	0.069[e]	0.102[e]	−0.189[e]	—	0.166	1064	0.54
	(2.7)	(7.5)	(5.3)				

Table 3(a). *Continued.*

Industry	Constant	*Y (c, adj. speed)*	D_{-1}	Selection bias	R^2	No. of obs.	*r* (Payout ratio)[b]
($\Delta D>0$)	0.028[e]	0.047[e]	−0.032[e]	—	0.207	802	1.5
	(3.1)	(10.8)	(3.0)				
	0.027[c]	0.047[e]	−0.032[d]	0.001	0.207	802	1.5
	(1.3)	(6.1)	(2.3)	(0.0)			
($\Delta D<0$)	0.068	0.171[e]	−0.579[e]	—	0.577	71	0.29
	(0.6)	(3.3)	(12.1)				
	−0.475[c]	0.079[c]	−0.392[e]	0.255[d]	0.599	71	0.20
	(1.6)	(1.5)	(4.1)	(2.3)			
Wholesale/Retail							
(All)	0.004	0.066[e]	−0.191[e]	—	0.210	1577	0.34
	(0.4)	(9.1)	(6.3)				
($\Delta D>0$)	0.049[e]	0.030[e]	−0.016	—	0.139	785	1.9
	(4.5)	(5.9)	(0.9)				
	−0.033	0.045[e]	−0.030[d]	0.074[d]	0.147	785	1.5
	(0.8)	(6.2)	(1.9)	(2.1)			
($\Delta D<0$)	0.045[d]	0.051[e]	−0.516[e]	—	0.732	245	0.10
	(1.9)	(4.8)	(13.1)				
	−0.026	0.041[c]	−0.490[e]	0.046	0.732	245	0.08
	(0.1)	(1.7)	(6.4)	(0.4)			
Service							
(All)	0.018	0.144[d]	−0.477[c]	—	0.302	437	0.30
	(0.1)	(2.2)	(1.4)				
($\Delta D>0$)	−0.213[c]	0.022	0.512[c]	—	0.409	202	—
	(1.6)	(0.8)	(1.7)				
	−0.837[c]	0.081[e]	0.544[c]	0.604[d]	0.528	202	—
	(1.9)	(4.2)	(1.8)	(2.0)			
($\Delta D<0$)	0.369[e]	0.045[c]	−0.944[e]	—	0.958	57	0.05
	(5.2)	(1.7)	(16.7)				
	3.633[e]	0.185[e]	−1.193[e]	−2.1[e]	0.980	57	0.15
	(9.4)	(5.7)	(32.3)	(8.9)			
Computing Machinery							
(All)	−0.123[e]	0.174[e]	−0.381[d]	—	0.421	266	0.46
	(2.8)	(2.8)	(2.0)				
($\Delta D>0$)	−0.028	0.025[e]	0.113[e]	—	0.672	105	0.22
	(1.2)	(3.0)	(3.7)				
	−0.054	0.029[c]	0.107[e]	0.021	0.672	105	0.27
	(0.5)	(1.5)	(3.2)	(0.2)			
($\Delta D<0$)	−0.050	0.196[e]	−0.716[e]	—	0.932	34	0.27
	(0.5)	(3.6)	(9.8)				
	1.801[e]	0.318[e]	−0.978[e]	−1.206[e]	0.964	34	0.32
	(5.3)	(7.4)	(18.5)	(5.9)			
Motor Vehicle							
(All)	0.071[c]	0.067[e]	−0.205[e]	—	0.301	418	0.33
	(1.4)	(4.0)	(3.8)				
($\Delta D>0$)	−0.053[c]	0.058[e]	0.040	—	0.393	192	—
	(1.3)	(3.1)	(1.0)				
	−0.382[d]	0.102[e]	−0.047	0.3370[d]	0.420	192	2.2
	(2.5)	(3.9)	(1.0)	(2.4)			
($\Delta D<0$)	−0.083	0.032[d]	−0.292[e]	—	0.415	98	0.11
	(0.9)	(2.3)	(3.8)				
	−2.189[e]	−0.044[d]	0.019	1.430[e]	0.500	98	—
	(4.2)	(2.1)	(0.2)	(3.9)			
Aircraft							
(All)	−0.018	0.059[e]	−0.143[e]	—	0.227	532	0.41
	(1.0)	(6.4)	(5.0)				
($\Delta D>0$)	0.053[d]	0.067[e]	−0.110[e]	—	0.317	225	0.61
	(2.2)	(4.5)	(3.2)				
	0.220[d]	0.048[d]	−0.100[e]	−0.136[d]	0.325	225	0.48
	(2.2)	(2.3)	(2.7)	(1.9)			
($\Delta D<0$)	−0.024	0.040[e]	−0.397[e]	—	0.622	97	0.10
	(0.8)	(2.6)	(8.4)				
	0.678	0.107[c]	−0.553[e]	−0.497[c]	0.635	97	0.19
	(1.2)	(1.7)	(4.0)	(1.3)			

Table 3(b). Lintner Dividend Equations with Selectivity for Japanese Firms[a]

Industry	Constant	Y (c, adj. speed)	D_{-1}	Selection bias	R^2	No. of obs.	r (payout ratio)[b]
Food							
(All)	1.845[d]	0.056[e]	−0.462[e]	—	0.451	987	0.12
	(2.3)	(3.0)	(2.8)				
($\Delta D>0$)	0.718[d]	0.053[e]	−0.072[e]	—	0.172	287	0.74
	(1.9)	(2.2)	(3.4)				
	−0.021	0.061[e]	−0.091[e]	0.634	0.173	287	0.67
	(0.0)	(2.8)	(3.4)	(1.0)			
($\Delta D<0$)	3.446[e]	0.070[e]	−0.798[e]	—	0.852	315	0.09
	(5.2)	(2.8)	(7.4)				
	9.879[e]	0.104[e]	−0.949[e]	−5.600[e]	0.879	315	0.11
	(4.6)	(3.7)	(8.1)	(3.6)			
Chemicals							
(All)	0.903[c]	0.078[e]	−0.392[e]	—	0.352	1617	0.20
	(1.7)	(4.0)	(2.5)				
($\Delta D>0$)	0.872[c]	0.015[c]	0.034	—	0.040	499	—
	(1.8)	(1.7)	(0.3)				
	−2.452[c]	0.061[e]	−0.121[c]	3.137[e]	0.112	499	0.50
	(1.7)	(3.2)	(1.7)	(3.0)			
($\Delta D<0$)	2.371[e]	0.115[e]	−0.821[e]	—	0.823	502	0.14
	(4.8)	(8.2)	(8.8)				
	9.590[e]	0.206[e]	−1.029[e]	−6.594[e]	0.900	502	0.20
	(13.4)	(15.9)	(28.7)	(9.5)			
Petroleum Refining							
(All)	0.401[d]	0.032[e]	−0.155[e]	—	0.353	189	0.21
	(2.1)	(4.9)	(3.6)				
($\Delta D>0$)	1.233[e]	0.040[e]	−0.115[c]	—	0.293	55	0.34
	(3.2)	(4.1)	(1.5)				
	9.329[e]	−0.056[d]	0.024	−6.263[e]	0.366	55	—
	(4.3)	(2.2)	(0.3)	(4.1)			
($\Delta D<0$)	−0.420	0.028[e]	−0.211[e]	—	0.563	52	0.13
	(1.2)	(4.8)	(3.9)				
	−0.768	0.026[d]	−0.189[c]	0.217	0.563	52	0.14
	(0.4)	(2.4)	(1.5)	(0.2)			
Cement							
(All)	0.341	0.033[e]	−0.166[d]	—	0.210	672	0.20
	(1.1)	(3.8)	(2.4)				
($\Delta D>0$)	0.984[e]	0.037[e]	−0.051	—	0.149	179	0.72
	(3.5)	(4.9)	(1.1)				
	−1.942[c]	0.055[e]	−0.104[e]	−2.470[e]	0.195	179	0.53
	(1.7)	(5.3)	(2.7)	(3.1)			
($\Delta D<0$)	0.445	0.024[c]	−0.320[d]	—	0.410	236	0.07
	(0.6)	(1.2)	(2.4)				
	−1.733	0.005	−0.281[d]	2.166[c]	0.435	236	0.02
	(0.9)	(0.2)	(2.2)	(1.2)			
Machinery and Precision							
(All)	0.686[e]	0.109[e]	−0.402[e]	—	0.409	2794	0.27
	(4.0)	(8.9)	(7.8)				
($\Delta D>0$)	0.419[d]	0.059[e]	−0.012	—	0.197	967	—
	(2.0)	(2.9)	(0.1)				
	−0.897	0.072[d]	−0.056	1.344	0.200	967	—
	(0.6)	(2.4)	(0.5)	(1.0)			
($\Delta D<0$)	0.652[c]	0.144[e]	−561[e]	—	0.697	931	0.26
All Machinery							
(All)	0.617[e]	0.098[e]	−0.365[e]	—	0.369	3865	0.27
	(4.3)	(8.2)	(7.8)				
($\Delta D>0$)	0.373[d]	0.054[e]	−0.001	—	0.186	1326	—
	(2.1)	(3.2)	(0.0)				
	−1.901[c]	0.077[e]	−0.081	2.222[c]	0.193	1326	0.95
	(1.3)	(2.7)	(0.9)	(1.7)			
($\Delta D<0$)	0.700[d]	0.137[e]	−0.560[e]	—	0.688	1244	0.24
	(2.1)	(8.3)	(9.3)				
	9.685[e]	0.209[e]	−0.730[e]	−8.190[e]	0.790	1244	0.29
	(4.0)	(6.9)	(8.4)	(3.9)			
Utilities							
(All)	0.427[d]	0.178[e]	−0.236[e]	—	0.596	315	0.75
	(1.9)	(15.0)	(14.3)				
($\Delta D>0$)	0.329[c]	0.128[e]	−0.065	—	0.643	124	1.97
	(1.3)	(7.9)	(2.3)				
	−3.288[d]	0.178[e]	−0.136[e]	4.045[e]	0.668	124	1.31
	(2.5)	(6.2)	(2.8)	(2.5)			

Table 3(b). *Continued*

Industry	Constant	Y (c, adj. speed) adj. speed)	D_{-1}	Selection bias	R^2	No. of obs.	r (payout ratio)[b]
($\Delta D<0$)	0.291	0.133[e]	−0.261[e]	—	0.685	123	0.51
	(1.2)	(8.4)	(17.3)				
	2.100[c]	0.156[e]	−0.295[e]	−1.677[c]	0.690	123	0.53
	(1.6)	(7.0)	(10.7)	(1.4)			
Wholesale/Retail							
(All)	1.120[d]	0.045[e]	−0.311[e]	—	0.327	882	0.14
	(2.3)	(3.8)	(2.8)				
($\Delta D>0$)	1.129[e]	0.041[e]	−0.120[c]	—	0.247	245	0.34
	(3.2)	(4.1)	(1.8)				
	−0.827	0.060[e]	−0.170[e]	1.669[e]	0.291	245	0.35
	(1.2)	(5.7)	(3.1)	(4.0)			
($\Delta D<0$)	1.788[d]	0.060[e]	−0.545[e]	—	0.589	266	0.11
	(1.5)	(3.0)	(2.7)				
	5.720	0.086[d]	−0.672[d]	−3.165	0.608	266	0.13
	(1.2)	(2.1)	(2.1)	(1.1)			
Service							
(All)	0.405	0.022[d]	−0.104[d]	—	0.092	546	0.21
	(2.3)	(2.1)	(2.4)				
($\Delta D>0$)	0.873[c]	0.019	0.094	—	0.318	136	—
	(1.5)	(0.7)	(0.7)				
	−1.606	0.024	0.068	2.052[c]	0.320	136	—
	(0.8)	(0.9)	(0.5)	(1.5)			
($\Delta D<0$)	−0.059	0.020[c]	−0.245[e]	—	0.557	127	0.08
	(0.3)	(1.3)	(3.5)				
	−9.324	0.010	−0.196[e]	6.861	0.561	127	0.05
	(0.8)	(0.9)	(4.4)	(0.8)			
Transportation Machinery							
(All)	0.333[c]	0.053[d]	−0.206[d]	—	0.196	1071	0.26
	(1.6)	(2.3)	(2.4)				
($\Delta D>0$)	0.658[e]	0.009[c]	0.065[c]	—	0.083	359	—
	(3.0)	(1.5)	(1.6)				
	−3.266[e]	0.062[e]	−0.094	3.634[e]	0.149	359	0.66
	(4.3)	(5.2)	(2.6)	(5.2)			
($\Delta D<0$)	1.357[c]	0.104[e]	−0.612[e]	—	0.663	313	0.17
	(1.4)	(4.4)	(3.5)				
	4.885[c]	0.126[e]	−0.670[e]	−3.0	0.665	313	0.19
	(1.3)	(3.7)	(3.3)	(1.1)			
Mining							
(All)	−0.193	0.198[e]	−0.296[e]	—	0.378	126	0.67
	(0.5)	(4.0)	(3.9)				
($\Delta D>0$)	−0.531	0.345[c]	−0.438[c]	—	0.417	21	0.79
	(0.4)	(1.8)	(1.2)				
	−20.017	0.625[c]	−0.825	11.5	0.436	21	0.76
	(1.0)	(1.4)	(1.1)	(1.0)			
($\Delta D<0$)	−0.684[c]	0.114[c]	−0.322[e]	—	0.669	26	0.35
	(1.5)	(1.8)	(4.1)				
	1.617	0.141[c]	−0.364[e]	−1.694	0.671	26	0.39
	(0.3)	(1.2)	(2.9)	(0.4)			
Construction							
(All)	2.346[e]	0.098[e]	−0.598[e]	—	0.576	630	0.16
	(18.2)	(25.2)	(29.1)				
($\Delta D>0$)	1.392[e]	0.014[c]	−0.061	—	0.036	175	0.23
	(5.0)	(1.8)	(1.1)				
	2.654[d]	−0.005	0.051	−1.425[c]	0.053	175	—
	(2.5)	(0.3)	(0.5)	(1.3)			
($\Delta D<0$)	2.888[e]	0.126[e]	−0.790	—	0.803	221	0.16
	(3.1)	(4.1)	(4.7)				
	12.5[e]	0.203[e]	−1.164[e]	−8.192[e]	0.948	221	0.17
	(27.3)	(22.8)	(53.2)	(18.2)			

[a]These are least squares estimation results for Lintner's dividend equations estimated using the entire sample and the two subsamples corresponding to $\Delta D>0$ and $\Delta D<0$. The equations for the subsample are estimated with and without the selection bias term. Numbers in parentheses are relevant t-statistics.
[b]The value for r is calculated only when the t-statistics for the estimated coefficients for Y and D_{-1} are both at least equal to 0.9 and the coefficients are of the right signs.
[c–e]These superscripts imply that the coefficients are significant at at least 80%, 95% and 99% levels, respectively.

Using Eqns (3) and (13), the equation to estimate for the subsample for $\Delta D<0$ is

$$\Delta D_t = a_0 + cry_t - cD_{t-1} + e_2\lambda_{2t} + U_{2t} \tag{14}$$

where $e_2 = (\sigma_{uu'}/\sigma_u^2)$. Equation (14) can be estimated consistently using ordinary least squares.

Estimation results for Eqns (12) and (14) using subsamples of data and for Eqn (3) using the entire data (standard Lintner equation) are presented in Table 3(a) for US firms and in Table 3(b) for Japanese firms. Two parameters of interest are the speed of adjustment c and the desired payout ratio r. Estimates for c and r are given in the columns for the estimated coefficients of Y and in the last columns, respectively, of Tables 3(a) and 3(b). Selection bias terms (λ_1 and λ_2) are often significant, indicating that there is a correlation between the decision on whether or not to increase or decrease dividends and actual amounts of dividend payouts. The speed of adjustment estimates are larger in the periods of decreases than in the periods of dividend increases for eight out of twelve industries for the USA and for nine out of twelve industries for Japan. A more striking finding is that the desired payout ratio r is quite different between the two subsamples: estimates for r are almost always much larger in the periods of dividend increases than in the periods of dividend decreases for both the USA and Japan.

Results in Tables 3(a) and 3(b) show that firms behave in an asymmetric manner with respect to dividend changes and that estimating Lintner or any other dividend equations using the entire sample of observations pooled over the periods of both firms' dividend increases and decreases is likely to suffer from a specification error. Our empirical results also suggest that for modeling the firm's dividend behavior for, for example, the purpose of predicting dividends, it might be useful to divide the firm's dividend decisions into two stages: first, the firm decides whether dividends should be increased, decreased or kept unchanged, and second, it decides by how much dividends should be changed, if they are to be changed at all.

For models where dividends are viewed as signals about the state of the firm's earnings prospect sent by the firm's managers to investors, our results indicate that information content of dividend signals is quite different, depending on whether dividends are increased or decreased, and that a single-dividend equation which treats negative and positive changes in dividends in a symmetric way may lead to incorrect inferences of managerial and investors' behavior. In such signalling models one research topic of interest is perhaps to explain why managers behave asymmetrically about the payout ratio, i.e. why they would want to pay out much larger fractions of earnings in the periods of dividend increases than in those of dividend decreases.

CONCLUSIONS

It is generally recognized that an increase in dividends is associated with information which is different from that associated with a reduction in dividends. In this paper various arguments in the literature explaining why firms' managers may not behave in a symmetric way regarding their decisions on dividend changes are first summarized. Certain stylized facts about dividend changes are presented for both US and Japanese firms. Then determinants of probabilities of dividend changes and Lintner equations with sample selection bias are estimated. Some of the observed differences in the dividend behavior of US and Japanese firms may be due to different institutional settings in the two countries which are not controlled for in this study.[3] (For example, the corporate income tax rate on the dividends paid out is lower than the tax rate on the retained income in Japan.) How to incorporate such institutional settings into econometric models of firms' dividend behavior for intercountry comparisons will be an interesting topic of research.

One of the main findings of this paper is that for both US and Japanese firms, estimating Lintner (or any other) dividend equations using the entire sample of observations pooled over the periods of both firms' dividend increases and decreases is likely to lead to a specification error. In particular, one of the (structural) parameters of the Lintner model, the desired payout ratio r, is much larger in the periods of dividend increases than in those of dividend decreases. The approach presented in this paper can be generalized to the case where the target dividend payout depends on expected future earnings within a rational expectations framework. (For example, Nakamura and Nakamura, 1985, give a rational expectations model of dividend behavior which provides an economic interpretation and an econometric restriction to the Fama–Babiak, 1968, model. However, it is quite possible that basic results of this paper hold, regardless of particular dividend models used.) It may also be worth considering a structural model in which the desired payout ratio r is not fixed. Finally, the joint asymmetric determination of firms' dividends and financial structure may be another topic for future research.

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NOTES

1. The dividends and earnings used for this study were measured on a per share basis. The dividends per share represent the cash dividends including any extra dividend per share, adjusted for all stock splits and stock dividends that occurred during the reporting period, but do not include payments in preferred stock in lieu of cash, spin-offs and stock of other corporations. (See Compustat manuals for details.) Empirical findings presented in this paper are derived using (undeflated) per share data on dividends and earnings since these are the most commonly used type of data for estimating firms' dividend equations in the literature, and hence our results are relevant for this class of literature. This does not mean that the effect of inflation on the per share dividends should be ignored. However, since the occurrences of stock splits are correlated with inflation, simply deflating per share dividends as defined in this paper may not separate out the impact of inflation. (In a way per share data are at least partly deflated.) Perhaps the total dividends the firm pays out might be a more relevant quantity to consider in analyzing the impact of inflation. This issue is currently under investigation.
2. Firms' decisions on dividends are assumed to consist of two stages: first, firms decide whether or not dividends should be changed at all, and second, if dividends are to be changed, firms must decide by how much dividends should be changed. We include the size (or the stage in the life cycle) and the financial status of a firm in the first stage since they often play a significant role in determining whether or not dividends should be paid out and are not included in the Lintner equation. This two-stage approach to modeling firms' dividend behavior allows us to empirically investigate what factors other than those included in the second-stage regression equation (Lintner equation in our case) should be included in the first-stage probabilistic decisions.
3. One interesting observation here is that despite certain differences in institutional settings between the USA and Japan, the Lintner (and other) dividend equations fit data from both countries reasonably well, and yet estimating such equations may result in a serious specification error for both countries if the asymmetry of the kind discussed here is ignored.

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