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Dividend payout ratio, tax rates, and share repurchase *

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Abstract This paper examines whether the legalization of share repurchase in 1982 by the U.S. Securities and Exchange Commission had a significant impact on the relationship between dividend payout and dividend tax preference, which measures tax rates on dividends relative to tax rates on capital gains. A bi-variate time series model of dividend and dividend tax preference is employed in which the dividend payout ratio relates to the mean of dividend tax preference, which follows a three-state Markov regime switching process, and depends upon the legitimacy of share repurchase. For the period covering 1929-2011, which covers multiple large changes in tax rates, we find that stock buybacks have a significant impact on the relationship in the high mean regime of dividend tax preference. This result suggests that share repurchases are a close substitute for cash dividends.

Keywords share repurchase, dividend payout ratio, tax rates, Markov switching model

JEL Classification G35

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1. INTRODUCTION

The relationship between the relative size of dividend income tax rates to capital gains tax rates (hereafter, relative dividend tax rates) and dividend payment has been one of the most interesting issues for corporate finance researchers. A large body of literature examines how the propensity to pay cash dividends changes in response to large changes in the relative dividend tax rates. Brittain (1964) and Miller (1986) analyze the influence of the undistributed profit tax introduced in 1936 and discontinued in 1939[1]; Lamdin (1993), Michaely (1991), Poterba (1987), and Smith and Watts (1992) examine how the 1986 Tax Reform Act influenced firms' dividend payout ratios[2]; and Poterba (2004) studies the influence of the Bush administration's Job Growth and Tax Relief Reconciliation Act of 2003 on the propensity to pay dividends.[3] Rather than look at a single change in the relative dividend tax rate, Bae and Ji (2010) examine how the dividend payout ratio is related to the relative dividend tax rate for multiple changes in the relative dividend tax rate over the period of 1929-2003.

Firms' propensity to pay dividends may also be affected by share repurchase, an activity in which a company buys back its own shares from the marketplace. The practice of share repurchase could compensate shareholders by reducing the number of outstanding shares. If share repurchase replaces the traditional means of compensation, which is paying a cash dividend, it lowers the dividend payout ratio, as documented in Grullon and Michaley (2009). In the meantime, stock buyback was legalized in 1982 by the U.S. Securities and Exchange Commission before the practice increased massively in scale. Prior to legalization, share repurchases were not widely employed due to concerns of artificial stock price manipulation. Hence, it is strongly suggested that the relationship between the dividend payout ratio and relative dividend tax rate is dependent on whether a stock buyback is legal. To understand this point better, suppose that the practice of share repurchase is illegal and the relative dividend tax rate is θ with a level of dividend payout ratio denoted by γ. Now suppose that stock buyback is legal, while the relative dividend tax rate remains unchanged at θ. We then have an-

[1]The undistributed profit tax, which was imposed on accumulated earnings, aimed to restrict managers discretionary power over accumulated earnings.

[2]The main features of the act were a simplification of tax brackets for ordinary income and a lowering of income tax rates for all brackets. In addition, capital gains tax rates were raised while tax rates on dividends were lowered, which made dividends more attractive than before.

[3]Pursuant to the act, also called the Bush tax cuts, the dividend tax rate was made equal to the capital gains tax rate, as a result of which dividends became relatively more favorable than capital gains. For example, the ratio of the after-tax value of one dollar of dividend to the after-tax value of one dollar of capital gain increased from 0.769 to 1.00 in the highest bracket.

other level of dividend payout ratio, denoted by $\gamma\prime$. Since the relative dividend tax rate remains the same at θ, the legalization of buyback lowers the dividend payout ratio, meaning $\gamma\prime < \gamma$. Hence, the relation between γ and θ changes due to the legitimacy of share repurchase.

Some authors, however, argue that the relation between the dividend payout ratio and relative dividend tax rate is unaffected by the legitimacy of stock buyback. Guay and Harford (2000), and Weston and Siu (2003) document that managers do not use share repurchase to compensate shareholders as an alternative to paying a dividend.[4] This implies that share repurchases and cash dividends are not close substitutes. Another more important implication is that the dividend payout ratio is unaffected by the legalization of share repurchase. As a result, at a given relative dividend tax rate θ, the payout ratio γ when stock buyback is illegal is equal to the payout ratio when stock buyback is legal. Hence, the legitimacy of share repurchase has no impact on the relation between γ and θ.

This study aims to analyze whether stock buybacks impact the relationship between the dividend payout ratio and relative dividend tax rate.[5] Due to the unavailability of data, relative dividend tax rates are proxied by Poterba's (2004) dividend tax preference.[6] The model used is a bi-variate time series model of dividend and dividend tax preference. The dynamics of the dividend are specified by Linter's (1956) partial adjustment model in which managers determine the actual payout ratio such that the difference between the dividend paid in the previous period and the current period's target payout is adjusted. The dynamics of dividend tax preference are assumed to follow a Markov regime-switching process in which the mean is subject to recurrent shifts, as in Bae and Ji (2010). The dividend payout ratio, defined as a coefficient in the dividend dynamics, depends on the dividend tax preference regime. As the dividend tax preference switches to a regime with a higher mean, the payout ratio becomes larger. This regime dependency may be affected by the legitimacy of share repurchase. When dividend tax preference shifts to a new regime, the change in the payout ratio differs depending on whether the shift takes place before or after legalization. To analyze this, we allow the relation to vary before and after 1982, the year in which stock buyback was legalized in the United States.

[4]Guay and Harford (2000) claim that CEOs change dividend sizes in response to permanent shocks to cash flow, but repurchase shares in response to temporary shocks. Weston and Siu (2003) argue that share repurchase is mainly used as an incentive for CEOs and to prevent hostile takeovers.

[5]As far as the author is aware, this is the first attempt to analyze the effect that stock buybacks had on the relationship between the dividend payout ratio and relative dividend tax rate.

[6]In Poterba (2004), data are available up to 2003, but this study collects data up to 2011.

The paper is organized as follows. Section 2 introduces the model. Section 3 reports the empirical results, and section 4 concludes the paper.

2. MODEL

This section introduces a bi-variate time series model for dividend and dividend tax preference to examine whether the legalization of stock buyback affects the relationship between the dividend payout ratio and relative dividend tax rates. The dividend tax preference, a variable developed by Poterba (2004), is used as a proxy for relative dividend tax rates, for which data are unavailable.

1) DIVIDEND DYNAMICS

Linter's (1956) partial adjustment model is used to specify the dynamics of the dividend. Following Bae and Ji (2010), this model is modified to account for heteroskedasticity in the dividend growth rate. The model is as follows:

$$\Delta d_t = \alpha_{D_t} + \beta_{D_t}(d_t^* - d_{t-1}) + u_t, \qquad u_t \sim i.i.d.N(0, \sigma^2_{u,D_t}), \tag{1}$$

$$d_t^* = \gamma_t \, E_t, \tag{2}$$

$$q_{00} = Pr(D_t = 0 | D_{t-1} = 0), \qquad q_{11} = Pr(D_t = 1 | D_{t-1} = 1) \tag{3}$$

where d_t is the logarithm of the real dividend that managers choose in period t, Δd_t is the dividend growth rate, and d_t^* is the long-term target dividend. $(d_t^* - d_{t-1}$ is the difference between the long-term target dividend of period t and the actual dividend in the previous period. Managers adjust a β portion of the difference in the current period. The long-term target dividend is a γ portion of the logarithm of real earnings E_t, as in equation (2). The parameter γ refers to the propensity to pay a dividend, also known as the dividend payout ratio.

Observing that the volatility of dividend growth after the early 1950s has remained at a relatively lower level than in previous years, Bae and Ji (2010) model volatility as a regime-switching process alternating between a high variance regime and a low variance regime. In this paper, we also takes this form of heteroskedasticity into account. D_t is the state variable that indicates the regime

of variance, taking a value of zero or one. In the high volatility regime, $D_t = 0$ and the variance is σ_0^2. In the low volatility regime, $D_t = 1$ and the variance is σ_1^2. D_t follows a first-order Markov chain process governed by the transition probabilities in equation (3). q_{00} is the probability that regime 0 in the previous period is maintained in the current period, and q_{11} is the probability that regime 1 in the previous period is maintained in the current period. Parameters α and β are allowed to be regime-dependent since the dynamics of dividend growth rates may depend on which regime contains the variance:[7] α_0 and β_0 in the high volatility regime, and α_1 and β_1 in the low volatility regime.

2) DIVIDEND TAX PREFERENCE AND ITS DYNAMICS

Because data for relative dividend tax rates are not available, Poterba (2004) suggests using dividend tax preference as a proxy. Dividend tax preference, the degree to which shareholders prefer dividends over capital gains, is defined as follows:

$$\theta_t = \sum_h \omega_{h,t} \frac{(1-\tau_{div,h,t})}{(1-\tau_{cg,h,t})}, \tag{4}$$

where h is a household, ω_h is the portion of the entire stock owned by household h, and $\tau_{div,h}$ and $\tau_{cg,h}$ are the marginal tax rates on dividend and capital gains for household h respectively. $(1-\tau_{div,h})$ is the after-tax dividend when household h receives one dollar of dividend, and $(1-\tau_{cg,h})$ is the after-tax value of one dollar of capital gain. θ_t, defined as the after-tax value of a dividend relative to capital gains, grows as dividend tax rates get lower and/or capital gains tax rates get higher. This shows that dividend tax preference is a valid measure of relative dividend tax rates.

By nature, tax rates exhibit large changes infrequently. Once changed, however, tax rates are maintained at their new level for a while. This implies that several regimes are contained in the dynamics of relative dividend tax rate. This feature is very likely to be evident in dividend tax preference as well. Thus, following Bae and Ji (2010), the dynamics of dividend tax preference are assumed to follow a Markov regime-switching process in which the mean is subject to recurrent shifts. The model is as follows:

$$\theta_t = \mu_{S_t} + \varepsilon_t, \qquad \varepsilon_t \sim i.i.d.N(0, \sigma^2_{\varepsilon,S_t}), \tag{5}$$

[7] If the constant term α, speed of dividend adjustment β, and dividend payout ratio γ are fixed, the model is reduced to the Linter (1956) model.

$$\mu_{S_t} = \mu_1 S_{1t} + \mu_2 S_{2t} + \cdots + \mu_J S_{Jt}, \tag{6}$$

$$S_{jt} = \begin{cases} 1 & if \;\; S_t = j \\ 0 & o.w. \end{cases} \quad , \quad j = 1, \cdots, J, \tag{7}$$

where μ_{S_t}, the mean of dividend tax preference, is not fixed but has J different values depending on the regime of the mean, which is indicated by S_t. If the regime in period t is j, $\mu_{S_t} = \mu_j$ because when $S_t = j$, $S_{jt} = 1$, $S_{1t} = \cdots = S_{j-1t} = S_{j+1t} = \cdots = S_{Jt} = 0$. If the regime in period t is i, μ_{S_t} takes μ_i. The state variable S_t follows a first-order Markov process governed by the following transition probabilities:

$$P = \begin{bmatrix} p_{11} & \cdots & p_{J1} \\ \vdots & \ddots & \vdots \\ p_{1J} & \cdots & p_{JJ} \end{bmatrix}, p_{ij} = Pr(S_t = j | S_{t-1} = i), i = 1, \cdots, J, j = 1, \cdots, J, \tag{8}$$

$$\sum_{j=1}^{J} p_{ij} = 1, \tag{9}$$

where p_{ij} is the probability of regime i in period $t-1$ shifting to regime j in period t. The probability of staying in the same regime in period t is p_{ii}. The matrix P is a collection of the probabilities of all possible regime switches. All elements in each column add up to one. For example, the sum of the i-th column is one. This is because regime i in period $t-1$ can shift to any regime in the next period.

3) THE DEPENDENCE OF DIVIDEND PAYOUT RATIO ON DIVIDEND TAX PREFERENCE AND SHARE REPURCHASE

The equations given below describe the dependence of dividend payout ratio γ on dividend tax preference and share repurchase.

$$\gamma_t = \gamma_{S_t} + \delta_{S_t} R_t, \tag{10}$$

$$R_t = \begin{cases} 0 & for\ \ t \leq 1981 \\ 1 & o.w. \end{cases} , \tag{11}$$

where R_t is a dummy variable that takes a value of zero or one, depending on whether the practice of stock buyback is legal. Up until 1981, stock buyback was not officially legal even though some firms engaged in the practice. For the period over which share repurchase is inactive, R_t is assigned the value zero. Stock buyback was legalized in 1982 by the U.S. Securities and Exchange Commission. With legal concerns lifted, the size of share repurchases grew at an enormous rate. For the period over which stock buyback is active, R_t takes the value of one.

Equation (10) shows that γ_t relies on R_t. This implies that the amount to pay as a dividend depends on the regime of the average of dividend tax preference. This dependency changes in relation to the value of R_t. If $R_t = 0$ (i.e., stock buyback is illegal), $\gamma_t = \gamma_{S_t}$, and if $R_t = 1$ (i.e., stock buyback is legal), $\gamma_t = \gamma_{S_t} + \delta_{S_t}$.[8] Suppose that share repurchase is illegal. If the regime of dividend tax preference is j (i.e., $S_t = j$), the dividend payout ratio γ_t takes γ_j. Now suppose that share repurchase is legalized. If the dividend tax preference regime is j (i.e., $S_t = j$), the dividend payout ratio γ_t is $\gamma_j + \delta_j$. Hence, the value of δ_{S_t} is the key to determining whether the legitimacy of share repurchase has any influence on the relationship between the dividend payout ratio and dividend tax preference. If $\delta_{S_t} \neq 0$, the legitimacy of stock buyback affects the relationship, and if $\delta_{S_t} = 0$, the relationship is unaffected by the legitimacy of stock buyback.

3. EMPIRICAL RESULTS

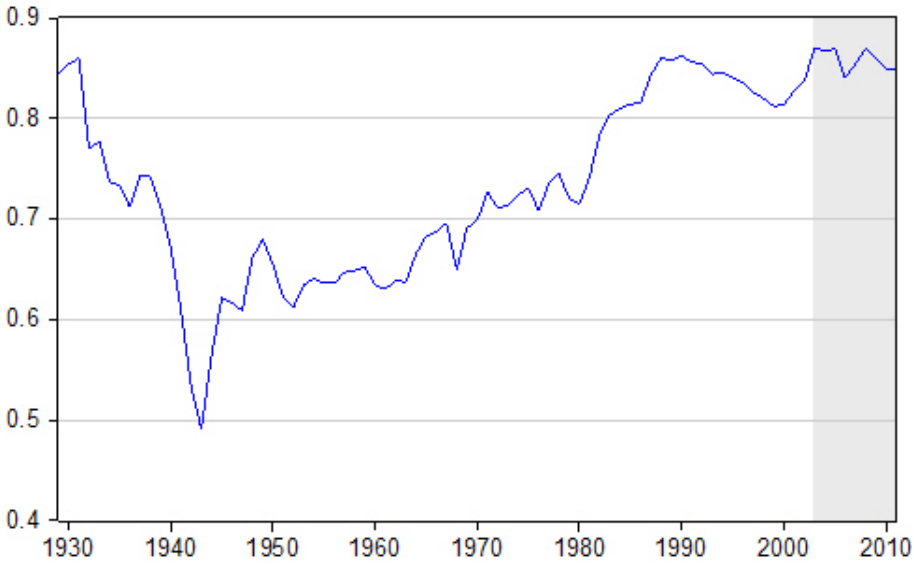
The data used in this study are dividend, dividend tax preference, and earnings. The sample period is 1929-2011, and the data frequency is annual. Dividends and earnings are in the S&P 500 index, and are divided by the Consumer Price Index to transform them into real variables.[9] Dividend tax preference is constructed using the method developed by Poterba (2004). Poterba (2004) collects and makes available this data up till 2003. Hence, this study extends the

[8] In Bae and Ji (2010), γ depends not only on S_t, but also on D_t, the regime of variance of dividend growth. In this paper, the dependency of γ on D_t is not considered for two reasons. First, a theoretical justification of the dependency is not found. Second, if γ depends on D_t as well as S_t and R_t, the model faces an over-specification problem since too many γ's must be considered.

[9] The data source is professor Robert Shiller's homepage, (url: http://aida.econ.yale.edu/ shiller/data.htm). I thank professor Shiller for sharing the data.

series to the year 2011.[10] The period between 2003 and 2011 was when extensive tax reduction policies were enacted in the United States. The dividend tax preference data is depicted in <Figure 1>.

< Figure 1 > Time series of dividend tax preference



Note: The shaded area indicates the period of 2003-2011 during which the Bush administration's Job Growth and Tax elief Reconciliation Act of 2003 was implemented.

<Table 1> shows the descriptive statistics of the logarithm of real dividend, the logarithm of real earnings, and dividend tax preference.

[10]The dividend tax preference series and other data series used to construct it are available upon request.

<Table 1> Descriptive Statistics

	Log real dividend	Log real earings	Dividend tax preference
Mean	2.7923	3.4210	0.7398
Median	2.8449	3.4879	0.7330
Maximum	3.4831	4.5709	0.8700
Minimum	2.0669	2.0136	0.4910
Std. dev.	0.3606	0.5892	0.0955
Skewness	-0.4291	-0.2845	-0.2468
Kurtosis	2.5561	2.7361	2.0461
Jarque-Bera	3.2670	1.3768	3.9896

Before the model is estimated, the number of regimes in the mean of dividend tax preference must be obtained. The number, denoted by J, is set to three following Bae and Ji (2010).[11] With $J = 3$, the parameters to be estimated in equations (5)-(9) are the means of each regime $[\mu_1, \mu_2, \mu_3]$, variances of each regime $[\sigma^2_{\varepsilon,1}, \sigma^2_{\varepsilon,2}, \sigma^2_{\varepsilon,3}]$, and transition probabilities $[p_{11}, p_{12}, p_{13}, p_{21}, p_{22}, p_{23}, p_{31}, p_{32}, p_{33}]$.[12] Because $J = 3$, the dividend payout ratio coefficients depending on the dividend tax preference regime are $[\gamma_1, \gamma_2, \gamma_3, \delta_1, \delta_2, \delta_3]$. The estimation results for the model composed of equations (1)-(3) and (5)-(11) with $J = 3$ are given in <Table 2>. The maximum likelihood estimation based on the Hamilton (1989) filter is employed.

[11] Bae and Ji (2010) find three regimes in the mean of dividend tax preference based on the sequential multiple structural breaks test developed by Bai and Perron (1998). This study also considered the case of $J = 4$, but the main results were only slightly different from the case of $J = 3$. The results for the case of $J = 4$ are available upon request.

[12] p_{i3} $(i = 1, 2, 3)$ is not directly estimated but is obtained from the restriction $\sum_{j=1}^{3} p_{ij} = 1$. For example, if $i = 1$, p_{13} is obtained from the restriction $p_{11} + p_{12} + p_{13} = 1$ where p_{11} and p_{12} are estimated. Parameters $\alpha, \beta, \sigma^2_u, q_{00}$ and q_{11} in equations (1)-(3) are not affected by J.

<Table 2> Parameter estimates

Parameter	Estimate	Parameter	Estimate
	a. Dividend dynamics		c. Dividend tax preference dynamics
α_0	0.1768 (0.2589)	μ_1	0.6350 (0.0083)
α_1	0.0168 (0.0108)	μ_2	0.7316 (0.0055)
β_0	0.6184 (0.0888)	μ_3	0.8422 (0.0038)
β_1	0.0015 (0.0271)	$\sigma_{\varepsilon,1}$	0.0437 (0.0057)
$\sigma_{u,0}$	0.0757 (0.0107)	$\sigma_{\varepsilon,2}$	0.0226 (0.0043)
$\sigma_{u,1}$	0.0407 (0.0039)	$\sigma_{\varepsilon,3}$	0.0201 (0.0029)
q_{00}	0.9727 (0.0330)	p_{11}	0.9601 (0.0344)
q_{11}	0.9708 (0.0233)	p_{12}	0.0399 (-)
		p_{21}	0.0388 (0.0402)
	b. Dividend payout	p_{22}	0.8957 (0.0651)
γ_1	0.7130 (0.1353)	p_{31}	0.0000 (-)
γ_2	0.7921 (0.1578)	p_{32}	0.0207 (0.0229)
γ_3	0.9439 (0.1586)		
δ_1	0.0000 (-)		
δ_2	-3.6984 (68.183)		
δ_3	-0.2649 (0.0795)		
Log likelihood 284.659			

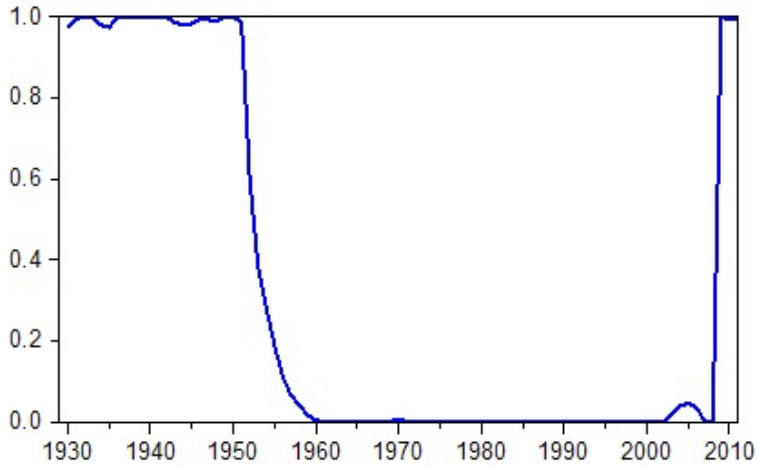
Note: This table reports the parameter estimates of the model consisting of equations (1)-(3) and (5)-(11) with the number of dividend tax preference regimes, J, set to three. Panel a is for parameters governing the dividend dynamics in equations (1)-(3), panel c for those governing the dynamics of dividend tax preference in equations (5)-(9), and panel b for dividend payout coefficients defined in equations (10)-(11). p_{13} and p_{31} converge to the boundary (zero), and δ_1 is not estimable due to the limited prevalence of the low dividend preference regime after the share repurchase legalization. Accordingly, we re-estimate the model with a zero restriction imposed on them. A standard error is not obtained for them, but otherwise reported in parentheses.

1) DIVIDEND DYNAMICS

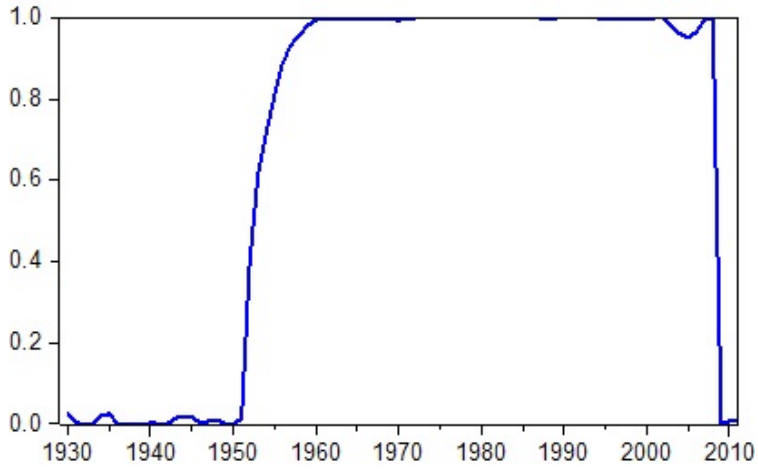
Panel a in <Table 2> shows the estimates of coefficients governing the dividend dynamics. $\sigma_{u,0}$, the variability of dividend growth when the state variable D_t is zero, is estimated to be 0.0757, and $\sigma_{u,1}$ is estimated to be 0.0407 for $D_t = 1$. As $\sigma_{u,0}$ is approximately two times greater than $\sigma_{u,1}$, $D_t = 0$ and $D_t = 1$

are regarded as the high volatility regime and low volatility regime respectively. <Figure 2> shows the smoothed probability of the state variable D_t.

< Figure 2 > Smoothed probabilities of dividend growth regime $Pr(D_t \mid I_T)$



a. $Pr(D_t = 0 \mid I_T)$ [High volatility regime]



b. $Pr(D_t = 1 \mid I_T)$ [Low volatility regime]

Smoothed probability is defined as the probability inferred using all available

information. With all available information denoted as I_T, the smoothed probability of time t being in regime l can be expressed as $Pr(D_t = l|I_T)$, where l is zero or one.

The top panel shows the smoothed probability of period t being in the high volatility regime, denoted by $Pr(D_t = 0|I_T)$, for $t = 1$ to $t = T$. $Pr(D_t = 0|I_T)$ is close to one throughout the periods of 1929-1952 and 2009-2011, but almost zero at other times. Hence, the periods 1929-1952 and 2009-2011 could be in the high volatility regime.[13] A characteristic of the high volatility regime is that it persists for a long time. This is confirmed by the estimate of q_{00}. $q_{00} = 0.9727$ means that the chance of having the same regime in the next period is 97.27%, when this period is in the high volatility regime. This also means that a transition into the low volatility regime barely occurs, as is verified by the estimate of q_{01}, which is only 0.0273.[14] This is consistent with the fact that there was only one regime shift from the high volatility regime to the low volatility regime in 1953.

The bottom panel presents the smoothed probability of period t being in the low volatility regime. It is worth noting that as the sum of the smoothed probabilities of both regimes for a given period is always one, $Pr(D_t = 1|I_T) = 1 - Pr(D_t = 0|I_T)$. $Pr(D_t = 1|I_T)$ is close to one throughout the period of 1953-2008, and thus the period could be in the low volatility regime. Like the high volatility regime, the low volatility regime exhibits strong persistency. This is confirmed by the estimate of q_{11} being 0.9708, which means that the probability of the next period being in the low volatility regime if the current period is in the low volatility regime is 97.08%. Meanwhile, the chance of a shift to the high volatility regime from the low volatility regime is merely 2.92%. This shift seems to have taken place only once in 2009.

The estimation results for the dividend dynamics are like those in Bae and Ji (2010). The novel contribution of this study is that the period of 2009-2011, which is after the 2008 financial crisis, is estimated to be the high volatility regime. It is worth noting that the volatility of the dividend growth rate has increased recently.

Meanwhile, coefficient β, the speed of adjusting the real dividend to the target dividend, is estimated to be 0.6184 in the high volatility regime and 0.0015 in the low volatility regime. It is natural that the adjustment speed in the high volatility regime is greater than that in the low volatility regime. This is because volatility increases as the adjustment gets faster.

[13] It is a convention in the literature that when the probability of a period being in regime l is higher than 0.5, the period is considered to be in regime l.

[14] q_{01} is equal to $1 - q_{00}$, and $q_{01} = 0.0273$ as $q_{00} = 0.9727$.

2) DIVIDEND TAX PREFERENCE AND ITS DYNAMICS

Panel c in <Table 2> shows the estimate of coefficients governing the dividend tax preference dynamics. μ_1 is estimated to be 0.6530. This means that when $S_t = 1$, (i.e., in regime 1), the mean of dividend tax preference is 0.6530. The estimate of μ_2 is 0.7316, which means that in regime 2, dividend tax preference is, on average, 0.7316. In regime 3, μ_3 is estimated to be 0.8422. As $\mu_1 < \mu_2 < \mu_3$, regime 1 can be classified as the low dividend tax preference regime, regime 2 as the medium dividend tax preference regime, and regime 3 as the high dividend tax preference regime. <Figure 3> shows the smoothed probability of the state variable S_t.

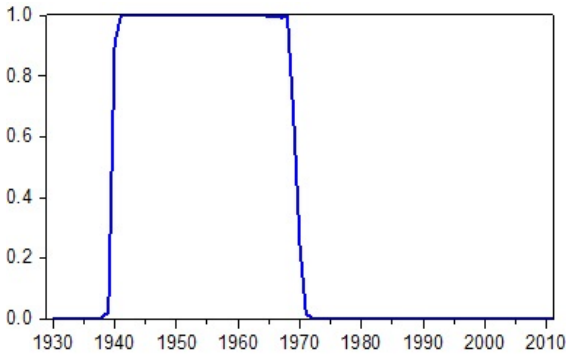
Smoothed probabilities of low, medium, and high dividend tax preference regimes, denoted by $Pr(S_t = 1|I_T)$, $Pr(S_t = 2|I_T)$, and $Pr(S_t = 3|I_T)$ respectively, are plotted for $t = 1$ to $t = T$ in the top, middle, and low panels.[15]

(1) Low dividend tax preference regime $[S_t = 1]$

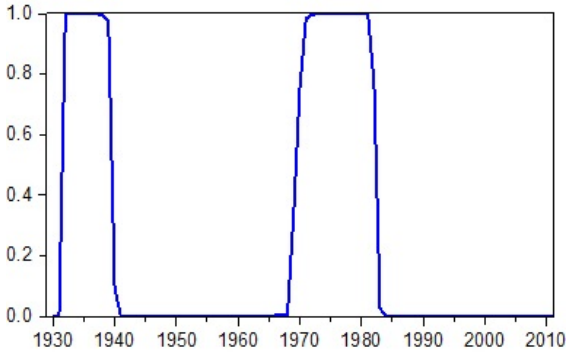
The low dividend tax preference regime, when the degree to which dividends are preferred over capital gains is least, seems to have started in 1940 and ended in 1969. This is because $Pr(S_t = 1|I_T)$ is close to one throughout the period of 1940-1969. The fact that the low dividend tax preference regime lasts for 30 years reflects its strong persistence, and the estimate of p_{11} confirms this. The estimate of p_{11} being 0.9601 means that if the current regime is the low dividend tax preference regime, the chance for remaining in the same regime in the next period is 96.01%. This indicates that there is a slight possibility of a shift to the medium or high dividend tax preference regime. p_{12}, the probability of a shift from the low to medium dividend tax preference regime, is estimated to be 3.99%. A shift from regime 1 to regime 2 took place once in 1970. This is because while $Pr(S_t = 1|I_T)$ was close to one in 1969, $Pr(S_t = 2|I_T)$ was close to one in 1970. p_{13}, the probability of a shift from regime 1 to regime 3, the high dividend tax preference regime, is estimated to be zero. This is because $p_{11} + p_{12} + p_{13} = 1$ and $p_{11} + p_{12}$ is estimated to be one.

[15] The results regarding the dividend tax preference regime confirm Bae and Ji (2010).

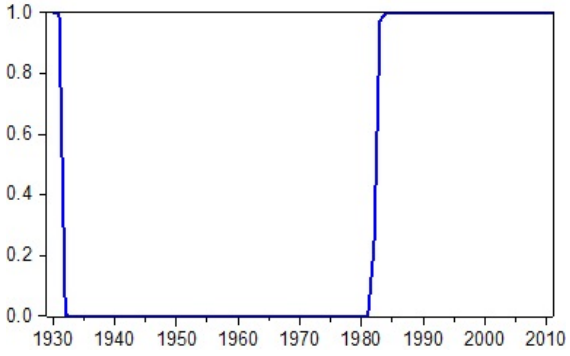
< Figure 3 > Smoothed probabilities of dividend tax preference regime$Pr(S_t \mid I_t)$



a. $Pr(S_t = 1 \mid I_t)$ [Low preference regime]



b. $Pr(S_t = 2 \mid I_t)$ [Medium preference regime]



c. $Pr(S_t = 3 \mid I_t)$ [High preference regime]

(2) Medium dividend tax preference regime $[S_t = 2]$

$Pr(S_t = 2|I_T)$ is close to one throughout the periods of 1932-1939 and 1970-1982. Thus, the two periods can be considered to have the medium dividend tax preference regime. The first period of the medium dividend tax preference regime lasts for eight years (1932-1939), and the second lasts for 13 years (1970-1982). Hence, the medium dividend tax preference regime shows moderate persistence, which is lower persistence than the low dividend tax preference regime. p_{22}, the probability of regime 2 in this period remaining unchanged in the next period, is estimated to be 0.8957.[16] On the other hand, the chance of a shift from regime 2 to one of the other regimes is very low. As indicated by the estimate of p_{21}, the probability of a shift from regime 2 to regime 1 is 0.0388 (=3.88%). This shift took place once in 1940. This is because while $Pr(S_t = 2|I_T)$ is close to one in 1939, $Pr(S_t = 1|I_T)$ is close to one in 1940. By the relation $p_{23} = 1 - p_{21} - p_{22}$, the probability of shift from regime 2 to regime 3 is 0.0655(=6.55%). This switch happens once in 1983 as $Pr(S_t = 2|I_T)$ is close to one in 1982 and $Pr(S_t = 3|I_T)$ is close to one in 1983.

(3) High dividend tax preference regime $[S_t = 3]$

As $Pr(S_t = 3|I_T)$ is close to one throughout 1929-1931 and 1983-2011, these periods are in the high dividend tax preference regime. Even though the period of 1929-1931 is short, the 1983-2011 period lasts longer than other regimes. Thus, the high dividend tax preference regime has the highest persistence. p_{33}, the probability of regime 3 in the current period and the same regime in the next period, is 0.9793, which supports this contention.[17] Thus, once we are in the high dividend tax preference regime, switching to other regimes rarely occurs. The probability of a switch to the medium dividend tax preference regime is 2.07% because $p_{32} = 0.0207$. This switch happens once in 1932, as $Pr(S_t = 3|I_T)$ is close to one in 1931 and $Pr(S_t = 2|I_T)$ is close to one in 1932. There are no changes from the high dividend tax preference regime to the low dividend tax preference regime as p_{31} is estimated to be zero.

[16] Because p_{22} is smaller than p_{11}, the medium dividend tax preference regime is less persistent than the low dividend tax preference regime.

[17] Because $p_{31} = 0.0000$ and $p_{32} = 0.0207$, $p_{33} = 0.9793$ by the relation $p_{33} = 1 - p_{31} - p_{32}$.

3) THE DEPENDENCE OF DIVIDEND PAYOUT RATIO ON DIVIDEND TAX PREFERENCE AND SHARE REPURCHASE

This subsection discusses how the dividend payout ratio changes in response to changes in the dividend tax preference regime, and how the relationship alters after the legalization of share repurchase.

(1) Before legalization of share repurchase

The manner in which the dividend payout ratio changes due to the dividend tax preference before legalization of share repurchase (i.e., before 1982) can be seen from γ_1, γ_2, and γ_3. The γ_1 parameter is the dividend payout ratio in the low dividend tax preference regime. It is estimated to be 0.7130 with a standard error of 0.1353. As shown above, the low dividend tax preference regime is 1940-1969, which is before the legalization of share repurchase. Therefore, the estimate suggests that before the legalization of stock buyback, firms paid out, on average, 71.30 cents per one dollar of profit as a dividend in the low dividend tax preference regime.

The dividend payout ratio in the medium dividend tax preference regime can be measured by γ_2. The estimate for this parameter is 0.7921 with a standard error of 0.1578. The periods for the medium dividend tax preference regime before 1982 are 1932-1939 and 1970-1981. Hence, before legalization, 79.21 cents were paid out as a dividend for every dollar of profit on average in the medium dividend tax preference regime.

The dividend payout ratio in the high dividend tax preference regime γ_3 is estimated to be 0.9439, and its standard error is 0.1586. The period of the high regime before the legalization of share repurchase is 1929-1931. During this period, 94.39 cents were paid to shareholders as dividend for every dollar of profit on average.

The fact that $\gamma_3 > \gamma_2 > \gamma_1$ indicates that the dividend payout ratio is positively related to dividend tax preference, implying that more dividends tend to be paid out as relative dividend tax rates get smaller.

(2) After legalization of share repurchase

The dividend payout ratio in each dividend tax preference regime after the legalization of share repurchase is measured by $\gamma_1 + \delta_1$, $\gamma_2 + \delta_2$, and $\gamma_3 + \delta_3$, respectively. Furthermore, the size of δ_1, δ_2, and δ_3 determines whether the legalization of stock buyback affects the relationship between the dividend payout

ratio and dividend tax preference regime. Below are explanations for the result of each regime.

First, the legalization of share repurchase in the high dividend tax preference regime decreases the dividend payout ratio. The key parameter is δ_3. If $\delta_3 = 0$, the dividend payout ratio would be unaffected by the legalization, and if $\delta_3 \neq 0$, the dividend payout ratio would be affected. The estimate of δ_3 is -0.2649 with a standard error of 0.0795. This means that the estimate is statistically significant at the 5% significance level and thus the null hypothesis $\delta_3 = 0$ is rejected in favor of the alternative hypothesis $\delta_3 < 0$. Hence, in the high dividend tax preference regime, the dividend payout ratio is smaller when share repurchase is legal than when it is illegal. The period in which share repurchase is legal and simultaneously in the high dividend tax preference regime is 1983-2011. The dividend payout ratio for this period is estimated by $\gamma_3 + \delta_3$, with the estimate being 0.6790. For 1929-1931, the period under the high dividend tax preference regime before the legalization of share repurchase, γ_3 is estimated to be 0.9439, as discussed above. Therefore, due to the legalization of share repurchase in the high dividend tax preference regime, firms, on average, pay out 26.49 cents less as dividends per dollar profit.[18]

Second, it cannot be determined whether the legalization of stock buyback influences the dividend payout ratio in the medium dividend tax preference regime. The coefficient δ_2 is the key. The estimate of δ_2 is -3.6984 and its standard error is 68.153, meaning that the estimate is statistically insignificant even at the 10% significance level. Hence, it seems that the legalization of share repurchase does not affect the propensity to pay a dividend. Nonetheless, it should be noted that there is little information for estimating δ_2. The data used for estimating δ_2 are observations falling in the medium dividend tax preference regime after the legalization of stock buyback. Those are the observations in 1982, 1983, and 1984. There is a non-zero probability of being in the medium dividend tax preference regime after legalization only for three years: 77.24% in 1982, 2.67% in 1983, and 0.02% in 1984.[19] Thus, the data used to measure δ_2 are only 77.24% of the observation of 1982, 2.67% of that of 1983, and 0.02% of that of 1984. Because so little data are used, the parameter δ_2 is incorrectly estimated. Accordingly, whether the legalization of stock buyback influences the dividend payout ratio in the medium dividend tax preference regime is indeterminate.

Third, it is impossible to determine whether the legalization of share repur-

[18]No qualitative differences are found when the starting point of the period of active share repurchase is set to 1981, 1983, or 1984.

[19]Because the number is infinitesimal, it is hard to identify it in the middle panel in <Figure 3>.

chase affects the dividend payout ratio in the low dividend tax preference regime. The probability of being in the low dividend tax preference regime after the legalization of stock buyback is zero. Hence, no data are available to estimate the key parameter δ_1. For this reason, the estimate of δ_1 is 0.0000 and its standard error cannot be calculated.

To summarize, even though the influence of share repurchase legalization on dividend payout ratio in the low and medium dividend tax preference regime cannot be determined, legalization diminishes the dividend payout ratio in the high dividend tax preference regime. This result shows that the relationship between the dividend payout ratio and dividend tax preference is affected by share repurchase legalization. Furthermore, it is implied that share repurchases have been used by firms to replace dividend payments. This is because if there were no substitutions, or the degree of substitution were weak, there would not have been a significant drop in the propensity to pay dividends.

4. CONCLUSIONS

This study examines whether the relationship between dividend payout ratio and relative dividend tax rate has been influenced by the legalization of stock buyback. The effect is verified by testing whether the mentioned relationship shows any differences before and after 1982, the year in which the U.S. Securities and Exchange Commission legalized stock buyback. Relative dividend tax rate is measured by the dividend tax preference developed by Poterba (2004). The existing data of dividend tax preference are available until 2003, and this study extends through 2011.

The relationship between dividend payout ratio and dividend tax preference is one in which dividend payout ratio depends on the regime of dividend tax preference mean. There are three regimes, which are assumed to follow a Markov-switching process. The result obtained from the long-term time series of 1929-2011, which includes several major tax rate changes, is that the legalization of share repurchase in the high dividend tax preference regime lowers the dividend payout ratio. This signifies that the legalization of stock buyback has a meaningful influence on the relationship between dividend payout ratio and dividend tax preference. What can be inferred from the result is that, after legalization, firms started to reduce dividends and use share repurchase to compensate shareholders. This also means that the effectiveness of the Job Growth and Tax Relief Reconciliation Act of 2003 may be limited. One of the purposes of this policy was to encourage firms to pay more dividends, enabling households to consume

more by equalizing the dividend tax rate and capital gains tax rate, thereby giving dividends a relative advantage. However, the degree to which share repurchases replaced dividends is substantial, leading firms to adopt share repurchases over dividends while leaving small dividend increases, contrary to legislator's intent.

REFERENCES

Bae, J. and Ji, P. I., 2010, "Dividend Payouts React to Changes in Tax Rates? Evidence from Time-Series Models", Journal of Economic Studies, Vol. 28, pp. 51-73.

Bai, J. and Perron, P., 1998, "Estimating and Testing Linear Models with Multiple Structural Changes", Econometrica, Vol. 66, pp. 47-78.

Brittain, J. A., 1964, "The Tax Structure and Corporate Dividend Policy", American Economic Review, Vol. 54, pp. 272-287.

Grullon, G. and Michaely, R., 2009, "Dividends, Share Repurchases, and the Substitution Hypothesis", Journal of Finance, Vol. 57, pp. 1649-1684.

Guay, W. and Harford, J., 2000, "The Cash-Flow Permanence and Information Content of Dividend Increases vs. Repurchases", Journal of Financial Economics, Vol. 57, pp. 385-415.

Hamilton, J. D., 1989, "A New Approach to the Economic Analysis of Nonstationary Time Series Models", Journal of Econometrics, Vol. 70, pp. 127-157.

Lamdin, D. J., 1993, "Shareholder Taxation and Aggregate Dividend Payout: Evidence from the Tax Reform Act of 1986", Review of Quantitative Finance and Accounting, Vol. 3, pp. 459-468.

Lintner, J., 1956, "Distribution of Incomes of Corporations among Dividends, Retained Earnings, and Taxes", American Economic Review, Vol. 46, pp. 97-113.

Michaely, R., 1991, "Ex-dividend Stock Price Behavior: The Case of the 1986 Tax Reform Act", Journal of Finance, Vol. 46, pp. 845-860.

Miller, M. H., "Behavioral Rationality in Finance: The Case of Dividends", Journal of Business, Vol. 59, 1986, pp. 451-468.

Poterba, J., 1987, "Tax Policy and Corporate Saving", Brookings Papers on Economic Activity, Vol. 2, pp. 455-515.

Poterba, J., 2004, "Taxation and Corporate Payout Policy", American Economic Review, Vol. 94, pp. 171-175.

Smith, C. W. and Watts, R. L., 1992, "The Investment Opportunity Set and Corporate Financing Dividend, and Compensation Policies", Journal of Financial Economics, Vol. 32, pp. 263-292.

Weston, J. F. and Siu, J. A., 2003, "Changing Motives for Share Repurchases", Working paper, Anderson Graduate School of Management, UCLA.