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Dividends and Capital Asset Prices

I. G. MORGAN*

ABSTRACT

Tax based dividend models of capital asset pricing assume that dividends are known at the time prices are set. Dividends which are announced and paid in the same month, and dividends which were expected but cancelled in the month constitute surprises which interfere with many empirical tests of the effects of expected dividend yield on returns. This paper avoids these problems by relating returns to forecasts of dividend yield obtained from past data.

THREE DISTINCT VIEWS OF the importance of dividends to investors have received support at one time or another. According to the two most important views, dividends have a neutral and a negative effect on security prices respectively. Miller and Modigliani [1] and Miller and Scholes [12, 13] favor complete substitutability of dividends and capital gain. Brennan [6] and Litzenberger and Ramaswamy [9] have developed models which incorporate differential taxation of income and capital gain. In these models, the tax disadvantage of income changes the investor's portfolio problem from one of optimization of mean and variance of portfolio before-tax return to optimization in after-tax terms. Stocks with relatively large dividend yields should provide high expected returns (and so sell for low prices) to compensate the investor for the tax.

Much of the empirical evidence seems to favor the view that tax disadvantages of dividend income do not escape investors' attention and that returns are higher when they include dividend income to compensate the investor for the tax liability. However, interpretation of the available evidence is difficult and it is significant that most of these researchers remain unconvinced that their own findings can be satisfactorily explained by tax effects. Ball, Brown, Finn, and Officer [1] interpret their estimates as being far too strong to be explained in terms of differential taxation. Blume [3] reaches a similar conclusion, but Litzenberger and Ramaswamy attribute their results to the tax disadvantage of dividend income.

Other evidence by Black and Scholes [2] and Miller and Scholes [13] is more consistent with complete substitutability of dividends and capital gain. Miller and Scholes show how very sensitive the estimates of a dividend factor are to the definition of the dividend yield variable. Dividends which are announced and

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paid in the same month constitute surprises which interfere with tests of the effects of expected dividend yield on returns.

In this paper, portfolios are formed month by month to have dividend yields which are reasonably well predicted by Box-Jenkins models fitted to past data. Abnormal returns on these portfolios are related to the forecasted dividend yields with the use of pooled cross sectional and time series estimates. Some evidence supports the existence of a linear relationship between individual yield and return, as in the after-tax models of capital asset pricing, but other evidence does not.

I. A Summary of the Relevant Theory

Let R_j be the return on asset j and R_m the return on the value-weighted market portfolio. Let ER_j and ER_m be their expected values. Define $\beta_j = \mathrm{cov}(R_j, R_m)/\sigma_m^2$ and define δ_j, the dividend yield, to be the dividend to be paid at the end of the period divided by initial price per share of asset j. The dividend is assumed to be announced at the beginning of the period. Define δ_m, the dividend yield on the market portfolio, in a similar way.

In Brennan's after-tax version of the capital asset pricing model, expected return is a function of the weighted average of investors' marginal tax rates on dividends, T_d, and on capital gains, T_g. Letting $T = (T_d - T_g)/(1 - T_g)$ and assuming that a riskless asset with return r exists, Brennan derives the equilibrium relationship for expected returns on asset j,

$$ER_j - r = [ER_m - r - T(\delta_m - r)]\beta_j + T(\delta_j - r) \tag{1}$$

Miller and Scholes [12] argue that dividends should have no effect on expected return because taxes on dividend income can be avoided in one or more ways. One of these ways relies on the deductibility of interest payments in the computation of personal tax. Litzenberger and Ramaswamy [9] incorporate this in their generalization of Brennan's model, which accommodates many different sets of assumptions. For example, assume that borrowers eliminate taxes on dividends by their interest payments and that lenders eliminate taxes on interest earned by short sales of dividend paying stocks. Let ϕ be the weighted sum, over all investors, of the ratio of the tax elimination constraint multiplier to the marginal utility of expected return. Aggregation of individual demands leads to the following expression for equilibrium expected returns,

$$ER_j - r = [ER_m - r - \phi(\delta_m - r)]\beta_j + \phi(\delta_j - r) \tag{2}$$

Equation (2) is a special case of Expression (15) of Litzenberger and Ramaswamy with marginal tax rate of zero and no margin constraint.[1]

Equations (1) and (2) collectively will be called after-tax versions of the capital asset pricing model (CAPM). Since the empirical work that follows does not

[1] Let μ_i be expected return on the portfolio of investor i and σ_i^2 the variance of return. Let U_i be the utility function to be maximized. As Bruno Verdon has shown me, the multiplier associated with the tax elimination constraint is

$$\lambda_2^i = [(r - \mu_i)\partial U_i/\partial\mu_i - 2\sigma_i^2\partial U_i/\partial\sigma_i^2]/r$$

and, since $\mu_i \geq r$, neither its sign nor that of ϕ can be determined.

distinguish between the two, it will be convenient to define a parameter γ_1 to represent either ϕ or T as the coefficient for dividend yield.

II. Portfolio Formation

Suppose that one of the tax-based models (1) or (2) is the true model. Also suppose that, in spite of this, a before-tax version of the CAPM is used as the yardstick for the data. Residuals from an estimate of such a model will not be independent of dividend yield if T is non-zero in (1) or ϕ is non-zero in (2). Consequently, before- and after-tax versions of the CAPM can be evaluated by examination of the residuals from the before-tax version.

Residuals or abnormal returns are to be calculated from portfolios rather than from individual securities. It is hard to forecast dividend yield for a given security in a given month from a short history of data. It is possible to construct portfolios with a longer history and use this to forecast their dividend yields. The portfolio formation rules developed here are designed to exploit quarterly payment patterns and to obtain a wide range of dividend yields to maintain reasonable statistical efficiency. The portfolio formation rules allow forecasting of dividend yield with data available to the investor ex ante.

Ultimately, three portfolios are formed in each calendar month t. Portfolio H has a high dividend yield at t, portfolio L has a low dividend yield at t, and portfolio Z has a zero dividend yield at t. Portfolio Z contains all stocks which paid no dividend at t, but which did pay a dividend at either $t - 5$ or $t - 4$ (or both) and are therefore likely to pay a dividend at $t + 1$ or $t + 2$. These stocks are unlikely to pay a dividend at $t + 3$. Portfolio Z should have zero dividend yield at t, medium to high dividend yield at $t + 1$ and $t + 2$, and low dividend yield at $t + 3$.

Portfolios H, L, and Z are constructed to have unit beta by applying suitable weightings to intermediate portfolios, and so may be called control portfolios. The purpose is to facilitate computation of abnormal returns in order to eliminate the effect of beta on returns in the estimation of γ_1. The steps required in the case of portfolio Z have been described by Watts [15].

In the construction of portfolio Z, two intermediate portfolios, a and b, are formed from the group of stocks which paid no dividend at t but which paid a dividend at either $t - 5$ or $t - 4$. Portfolio a consists of stocks with estimated beta less than the median estimate for the group. Portfolio b consists of stocks with estimated beta greater than or equal to the median. The two portfolios are then weighted to produce the composite portfolio Z with a unit beta by determining the value c such that

$$c\hat{\beta}_{at} + (1 - c)\hat{\beta}_{bt} = 1 \tag{3}$$

Portfolios a and b and weight c differ from month to month.

Portfolio returns are then given by

$$R_{pt} = cR_{at} + (1 - c)R_{bt} \tag{4}$$

and, since the portfolio beta is now 1.0, the variable $R_{pt} - R_{mt}$ should satisfy

$$E(R_{pt} - R_{mt}) = 0 \tag{5}$$

The other two portfolios, H and L, are both constructed from the remaining stocks which consist of those which paid a dividend at t and all those which did not pay one at $t-5$ or $t-4$. Relative to portfolio Z, these two portfolios have high dividend yield at t and at $t+3$, but low dividend yield at $t+1$ and $t+2$. Relative to portfolio L, portfolio H is constructed to have higher dividend yield at t and this tends to lead to higher dividend yield at $t+3$. Dividend yield on a given stock is measured by actual dividend paid at the end of the month divided by price at the end of the previous month.

To construct portfolios H and L, the first step is to form four intermediate portfolios from the group of stocks which either paid dividends at t or which did not pay a dividend at $t-5$ or $t-4$. These four portfolios consist of stocks with low beta and low yield, high beta and low yield, low beta and high yield, and high beta and high yield. Low and high for a given characteristic are terms which are again defined by reference to the median of the characteristic for all stocks in this group. The aim is to construct, from the four intermediate portfolios, a low dividend yield portfolio and a high dividend yield portfolio both of which have a beta of 1.0.

Let 1 and 2 be subscripts representing, respectively, low and high beta intermediate portfolios for the low yield subgroup, and let 3 and 4 be subscripts representing low and high beta intermediate portfolios for the high yield subgroup. Weights $c_1 \ldots . c_4$ are found for the system of equations

$$c_1\hat{\beta}_1 + c_2\hat{\beta}_2 + c_3\hat{\beta}_3 + c_4\hat{\beta}_4 = 1$$

$$c_1 + c_2 + c_3 + c_4 = 1 \tag{6}$$

by arbitrarily choosing $c_1 = 5c_3$ and $c_2 = 5c_4$ to obtain positive dividend yields for the low dividend yield portfolio. Similarly, by setting $5c_1 = c_3$ and $5c_2 = c_4$, larger dividend yields are obtained for the high dividend yield portfolio. Portfolio returns are given by

$$R_{pt} = c_1R_{1t} + c_2R_{2t} + c_3R_{3t} + c_4R_{4t} \tag{7}$$

and the variable $R_{pt} - R_{mt}$ should again satisfy condition (5) since portfolio beta is 1.0. Portfolio yield is

$$\delta_{pt} = c_1\delta_{1t} + c_2\delta_{2t} + c_3\delta_{3t} + c_4\delta_{4t} \tag{8}$$

The returns and dividend yields of each of the four intermediate portfolios on the right-hand side of Equations (7) and (8) are simple averages of the returns and dividend yields of the component stocks.

III. Data

The data consist of monthly returns and distribution classifications for common stocks listed on the New York Stock Exchange (NYSE) between January 1931 and December 1977. The source files are the returns and master files of the Center for Research in Security Prices (CRSP) of the University of Chicago.

The market proxies to be used are the CRSP equal-weight and value-weighted proxies for the unobservable market portfolio. Most of the analysis is made with the value-weighted proxy. The equal-weight proxy is included for two reasons. First, Roll [14] has stressed the consequences of drawing inferences from tests with an inappropriate proxy and even the value-weighted proxy must be considered to be suspect. Second, Brown and Warner [7] have illustrated the difficulties arising from the practice of constructing control portfolios with equal weighting when the market proxy is value weighted.

Since the focus of this paper is on tax-based dividend factors in capital asset pricing, a strict definition of dividend is used. For a distribution to be counted as a dividend, it must have been classified by CRSP to be a cash dividend taxable in the normal way or as ordinary income. Dividend yield is then taken to be the difference between returns with and without distributions. All other distributions are treated as though they are capital gain, which is implicitly nontaxable. When such distributions occur it is assumed, for classification purposes and for computation of dividend yield, that no dividend is paid. Return, of course, includes the distribution.

The dividend yield on the market index is calculated, in the case of the equal-weight proxy, using the definition of dividend already described, by averaging the dividend yield figures for all individual stocks. For the value-weighted market index, the dividend yield was taken to be the difference between the CRSP value-weighted market returns with and without distributions.

The criterion for including a security in the sample is that return data for months $t - 60$ through t are available. For stock j, the estimates of β_j used in the formation of the intermediate portfolios which lead to the construction of Portfolios H, L, and Z are made by ordinary least squares regression of R_{js} on R_{ms} for months $s = t - 60$ through $s = t - 1$.

IV. A Description of the Portfolio Returns

This section describes the behavior of Portfolios H, L, and Z in the ex-dividend month t and in the following three months.

Table I summarizes the results for the period January 1936 to December 1977 using the CRSP value-weighted index return as market proxy. The focus of Table I is the behavior of the abnormal return variables $R_{p,t+k} - R_{m,t+k}$, $k = 1, 2, 3$, for portfolios $p = H$, L, and Z. These portfolios, with high, low, and zero dividend yields at t are formed at month t and then examined at $t + 1$, $t + 2$, and $t + 3$.

Table I shows the mean and standard error of abnormal return by portfolio and by month. Also shown is the abnormal return beta and the portfolio dividend yield. A glance at the mean dividend yields in Table I shows that a reasonably wide spread between the dividend yields of the three portfolios has been achieved in every month. Portfolio Z has the highest dividend yield at $t + 1$ and $t + 2$, while Portfolio H has the highest dividend yield at $t + 3$.

The mean abnormal returns are consistently positive. As Brown and Warner [7] describe, given that the market portfolio proxy is value weighted, the consistently positive mean abnormal returns in Table I can be attributed to the equal weighting within control portfolios giving too much importance to high beta but small market value securities. Even though a weighted average beta would be 1.0, the simple average beta is greater.

Table I

Abnormal Returns,[a] Relative to the Value-weighted Market Proxy, from NYSE Portfolios formed at Month t for January 1936 to December 1977

Month	t	$t+1$	$t+2$	$t+3$
Number of months	504	503	502	501
Analysis of variance				
between portfolios	0.00178	0.00116	0.00051	0.00153
within portfolios	0.00041	0.00041	0.00038	0.00042
variance ratio[b]	4.4	2.9	1.3	3.7
Kruskal-Wallis statistic[c]	19.2	19.5	6.2	6.2
High yield portfolio H				
mean abnormal return	0.00466	0.00031	0.00354	0.00334
standard error	0.00071	0.00076	0.00071	0.00070
t-ratio	6.61	0.41	4.98	4.76
abnormal return beta	0.02	0.04	0.03	0.00
standard error	0.016	0.017	0.016	0.012
mean yield	0.0122	0.0005	0.0011	0.0101
standard error	0.00017	0.00003	0.00005	0.00013
Low yield portfolio L				
mean abnormal return	0.00332	0.00252	0.00277	0.00440
standard error	0.00126	0.00123	0.00120	0.00129
t-ratio	2.63	2.04	2.31	3.42
abnormal return beta	0.15	0.16	0.14	0.14
standard error	0.027	0.026	0.026	0.028
mean yield	0.0031	0.0018	0.0017	0.0045
standard error	0.00006	0.00008	0.00009	0.00011
Zero yield portfolio Z				
mean abnormal return	0.00095	0.00322	0.00153	0.00173
standard error	0.00058	0.00056	0.00060	0.00078
t-ratio	1.63	5.78	2.58	2.24
abnormal return beta	0.01	0.00	−0.01	0.00
standard error	0.013	0.012	0.013	0.013
mean yield	0.	0.0066	0.0052	0.0011
standard error	0.	0.00014	0.00011	0.00005

[a] Abnormal returns: $R_{p,t+k} - R_{m,t+k}$

[b] $F_{2,1500}(0.05) = 3.00$, $F_{2,1500}(0.01) = 4.62$ The number of degrees of freedom in the denominator varies between 1509 at t and 1500 at $t + 3$.

[c] $\chi^2_2(0.05) = 5.99$, $\chi^2_2(0.01) = 9.21$.

Much of the information given in Table I is summarized by one-way analyses of variance of abnormal return. For example, the one-way analysis of variance at t shows that there are significant differences in the means of $R_{pt} - R_{mt}$ for the three portfolios. The variance ratio of 4.4 is significant at the 5% level and the Kruskal-Wallis statistic (see Lehmann [8], pp. 204–207]) of 19.2 is significant at the 1% level. This result includes the effects of a selection bias due to the fact that not all dividends paid at t have been announced at or before $t - 1$. The analyses of variance for subsequent months are therefore much more interesting than that for t in the detection of possible differences between portfolios. The Kruskal-Wallis statistics are significant at $t + 1$, $t + 2$, and $t + 3$, suggesting that there are differences between the three portfolios in all months. The analyses of variance give less decisive results, the variance ratio being significant only at $t + 3$. The before-tax versions of the CAPM predict insignificant variance ratios and Kruskal-Wallis statistics.

A small but apparently systematically positive departure from zero is found in the beta estimates for $R_{p,t+k} - R_{m,t+k}$ in the case of Portfolio L. In other words, the past estimates of beta used in the formation of Portfolio L may differ from current beta values. It is also possible that the use of the control portfolio procedure with the value-weighted index introduces a difference between the simple average beta and the weighted average of 1.0 in the formation of Portfolio L. The composition of Portfolio L differs from that of H and Z in at least one way. It mostly consists of the lower yielding half of the group of stocks which paid dividends at t plus those stocks which paid no dividend at $t - 5$ or $t - 4$. Accordingly, it will include all stocks which do not pay dividends at all and those that are currently nonpayers. Portfolio L is on average the lowest yielding of the three portfolios. When the dividend yields are summed from $t + 1$ to $t + 3$, the cumulative yields obtained are 0.0117, 0.0080, and 0.0134 for Portfolios H, L and Z respectively.

Table II is the equivalent of Table I for the equal weight market proxy. In general, the conclusions which may be drawn from Table II are similar to those of Table I but the patterns in the data are clearer than they are with the value-weighted market proxy. This is particularly obvious in the analyses of variance, where significant Kruskal-Wallis statistic values are obtained in all months and the variance ratios are significantly large in every month except $t + 2$. The denominator of the variance ratio, the within-portfolio variance, is much smaller with the equal-weight proxy than it is with the value-weighted proxy.

Given that there are significant differences between the means of the estimated abnormal returns $R_{p,t+k} - R_{m,t+k}$ across portfolios, the individual means and their t-ratios should be examined in more detail. The means for Portfolio H are approximately −0.15, 0.15, and 0.10 percent for $t + 1$ through $t + 3$ respectively. All of these values are significantly different from zero. Portfolio L has neutral results at $t + 1$ and $t + 2$, but its mean of 0.18 percent at $t + 3$ is significantly different from zero. The mean for Portfolio Z at $t + 3$ is −0.11 percent. From the general pattern of dividend yields on these portfolios, there appears to be a weak positive association between dividend yield and return.

The inference that the mean abnormal returns of the portfolios differ is weakened somewhat by the finding that the variables $R_{p,t+k} - R_{m,t+k}$ do not always have zero beta values. In this respect, it is interesting to see that the departure from zero beta is positive in the case of Portfolio L again, just as it was in Table I using the value-weighted market proxy. The Brown and Warner criticism of the control portfolio procedure does not apply in Table II, in which the market proxy is the equal-weight proxy. Presumably, the departures from zero beta values exist for some other reason such as nonstationarity. This problem is to be discussed in the next phase of the analysis.

V. Regressions of Abnormal Returns on Dividend Yield

A. Elimination of Selection Bias

The theory that leads to the after-tax versions of the CAPM assumes that dividends to be paid at t, and therefore dividend yields, are known at $t - 1$. Since some of the dividends paid at t have not been announced by $t - 1$, data from

Table II

Abnormal Returns,[a] Relative to the Equal-weight Market Proxy, from NYSE Portfolios formed at Month t for January 1936 to December 1977

Month	t	$t+1$	$t+2$	$t+3$
Number of months	504	503	502	501
Analysis of variance				
between portfolios	0.00229	0.00080	0.00064	0.00118
within portfolios	0.00013	0.00012	0.00012	0.00013
variance ratio[b]	17.9	6.9	5.3	9.3
Kruskal-Wallis statistic[c]	84.5	57.1	51.1	23.7
High yield portfolio H				
mean abnormal return	0.00303	−0.00156	0.00150	0.00105
standard error	0.00048	0.00044	0.00047	0.00046
t-ratio	6.37	−3.52	3.21	2.30
abnormal return beta	−0.07	−0.04	−0.07	−0.07
standard error	0.007	0.007	0.007	0.007
mean yield	0.0127	0.0005	0.0011	0.0098
standard error	0.00021	0.00003	0.00006	0.00015
Low yield portfolio L				
mean abnormal return	0.00070	−0.00015	0.00038	0.00185
standard error	0.00046	0.00044	0.00043	0.00049
t-ratio	1.54	−0.34	0.39	3.80
abnormal return beta	0.07	0.07	0.06	0.07
standard error	0.007	0.006	0.006	0.007
mean yield	0.0032	0.0017	0.0015	0.0042
standard error	0.00006	0.00007	0.00007	0.00010
Zero yield portfolio Z				
mean abnormal return	−0.00122	0.00095	−0.00076	−0.00112
standard error	0.00057	0.00055	0.00057	0.00056
t-ratio	−2.15	1.74	−1.34	−2.00
abnormal return beta	−0.07	−0.08	−0.08	−0.08
standard error	0.008	0.008	0.008	0.008
mean yield	0.	0.0065	0.0063	0.0007
standard error	0.	0.00017	0.00015	0.00004

[a] See Footnote[a], Table I
[b] See Footnote[b], Table I
[c] See Footnote[c], Table I

period t are subject to selection bias. Therefore, these data must be discarded and tests restricted to data for months following the portfolio formation month t. Consequently, the analysis is centered on the variables $R_{p,t+k} - R_{m,t+k}$, $k = 1, 2, 3$.

B. Estimation of the Dividend Yield Effect

Either version of the after-tax CAPM predicts that there will be differences between the means of $R_{p,t+k} - R_{m,t+k}$ across Portfolios $p = H, L$, and Z. Furthermore, the abnormal returns should be related to dividend yield. Let s represent a calendar month and let $\gamma_0 = E(\gamma_{0s})$ and $\gamma_1 = E(\gamma_{1s})$ be coefficients. Let u_{ps} be an error term with zero mean. Then in

$$R_{ps} - R_{ms} = \gamma_{0s} + \gamma_{1s}(\delta_{ps} - \delta_{ms}) + u_{ps} \tag{9}$$

both of the after-tax models specify $E(\gamma_{0s}) = 0$. In (1) $\gamma_1 = T$ and in (2) $\gamma_1 = \phi$, so that $E(\gamma_{1s}) \neq 0$ in either case.

Equation (9) is inadequate as a means of testing the before-tax capital asset pricing hypothesis that $E(\gamma_{1s}) = 0$. Although the portfolios *H*, *L*, and *Z* are constructed to have beta of 1.0, the estimates of beta are based on past data and small departures from the desired result at *s* occur. Specifically, $R_{ps} - R_{ms}$ is not independent of R_{ms}. To get zero beta residual returns, $R_{ps} - R_{ms}$ is regressed on R_{ms} and the intercept estimates $\hat{\alpha}_p$ plus the residuals $\hat{e}_{ps}$ from this simple regression are substituted for the left-hand side of (9),

$$\hat{\alpha}_p + \hat{e}_{ps} = \gamma_{0s} + \gamma_{1s}(\delta_{ps} - \delta_{ms}) + u_{ps} \tag{10}$$

This procedure is similar to that of Black and Scholes ([2], p. 17).

In the sample period April 1936 is the first month for which observations of zero beta residual returns and dividend yields are available for nine portfolios. Three are for portfolios *H*, *L*, and *Z* formed in January, three from those formed in February, and three from those formed in March. Cross-sectional estimates of γ_{0s} and γ_{1s} in Equation (10) are obtained by ordinary least squares methods with the nine sets of observations each month from April 1936 onwards. Estimates of γ_0 and γ_1, and their standard errors are obtained from simple averaging of the individual estimates for each month in the case of ordinary least squares (OLS) or from weighted averages in the case of generalized least squares (GLS). In the latter case, the weights are proportional to the reciprocals of the variance of the estimates, as in expressions (27) through (31) of Litzenberger and Ramaswamy.

C. A Reproduction of the Litzenberger-Ramaswamy Result

Estimates of γ_0 and γ_1 are shown for the value-weighted market proxy in Table III and for the equal-weight market proxy in Table IV. Since the after-tax capital asset pricing models assume that dividends are announced at the beginning of the period, most of the results in Tables III and IV are obtained with Box-Jenkins estimates of expected dividend yield rather than realized dividend yield in Equation (10). The Box-Jenkins estimates are the values fitted to the complete time series of the realized dividend yield variable corresponding to $\delta_{ps} - \delta_{ms}$ of Equation (10) for a given portfolio. The actual Box-Jenkins models fitted are shown in Table V.

In Table III, the first four sets of estimates are for the whole period from April 1936 to December 1977. The results are given first for realized values of $\delta_{ps} - \delta_{ms}$, then for estimated values of the dividend yield variable. In both cases the values of $\hat{\gamma}_1$ are significantly positive, whether the time series aggregation is OLS or GLS. The corresponding Litzenberger and Ramaswamy estimates are shown in the final column of Table III.

Table III also shows details of estimates of γ_0 and γ_1 for each of six subperiods. The main point of interest in these subperiods is that the estimates of γ_1 in Equation (10) are generally quite similar to those found by Litzenberger and Ramaswamy. The largest discrepancy between the two sets of estimates is found in the subperiod 1962–68.

Table IV repeats the analyses of Table III with the equal-weight market proxy

Table III

Regression of Abnormal Returns on the Difference in Dividend Yield between the Portfolio and the Value-weighted Market Proxy[a]

$$\hat{\alpha}_p + \hat{e}_{ps} = \gamma_{0s} + \gamma_{1s}(\delta_{ps} - \delta_{ms}) + u_{ps}$$

Period	Dividend Yield	Estimation Method	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_1$: LR[b]
4/36–12/77	Realized	GLS	0.00013	0.200	
			(0.00006)	(0.018)	
		OLS	0.00257	0.205	
			(0.00077)	(0.045)	
	Box-Jenkins	GLS	−0.00005	0.194	0.234
	Estimates		(0.00006)	(0.018)	(0.028)
		OLS	0.00259	0.197	0.227
			(0.00078)	(0.043)	(0.036)
4/36–12/40	Box-Jenkins	GLS	0.00190	0.388	0.335
	Estimates		(0.00025)	(0.079)	(0.127)
1/41–12/47			0.00430	0.237	0.408
			(0.00016)	(0.042)	(0.056)
1/48–12/54			−0.00349	0.237	0.158
			(0.00015)	(0.033)	(0.036)
1/55–12/61			−0.00135	0.054	0.018
			(0.00014)	(0.040)	(0.056)
1/62–12/68			−0.00008	−0.024	0.171
			(0.00014)	(0.051)	(0.073)
1/69–12/77			0.00047	0.345	0.329
			(0.00014)	(0.045)	(0.055)

[a] Figures in the table are the coefficient estimates and standard errors.
[b] LR = Litzenberger-Ramaswamy estimates of the dividend yield coefficient.

and it shows that the results of the cross-sectional analyses of Equation (10) are not very sensitive to the choice of market proxy. In particular, the estimates of γ_1 are generally similar in Tables III and IV, except that in 1962–68 the coefficient estimate for the equal-weight market proxy is significantly positive while that for the value-weighted market proxy is not.

Tables III and IV seem to support the after-tax capital asset pricing models (1) and (2) in that $\hat{\gamma}_1$ is significantly different from zero, but they also contain evidence which is not consistent with the existence of a simple linear relationship between expected return and dividend yield. Specifically, $\hat{\gamma}_0$ is significantly different from zero. There is, however, a potentially serious bias in this analysis and this problem must now be addressed.

D. Use of Forecast Dividend Yield

Tables III and IV show that realized returns are positively related to estimated dividend yield. A potential source of bias is that the estimates of dividend yield in Tables III and IV are values fitted to the entire time series of $\delta_{ps} - \delta_{ms}$ for each portfolio. At any given calendar month, an investor knows only past values of dividend yields and must forecast future dividend yield from the information available at the time.

It is a straightforward matter to ensure that tests use data which were available at the time market prices are set. The Box-Jenkins models of Table V are re-estimated using data for month $t = s - 120$ through $t = s - 1$ to produce a forecast of $\delta_{ps} - \delta_{ms}$. Then each model is estimated for $t = s - 119$ to $t = s$ to forecast $\delta_{p,s+1} - \delta_{m,s+1}$ and so on. The first 120 months of observations have to be discarded, but genuine forecasts are available for the 381 months from April 1946 onwards.

As well as the Box-Jenkins forecasts, some simpler forecasts can be examined. The first of these simple forecasts is the realized dividend yield three months earlier, $\delta_{p,s-3} - \delta_{m,s-3}$. The second simple forecast is the realized dividend yield twelve months earlier, $\delta_{p,s-12} - \delta_{m,s-12}$. Finally, for purposes of comparison, Table VI also shows results for realized dividend yields as perfect forecasts. The estimation procedures are OLS and GLS (as in expressions (27) through (31) of Litzenberger and Ramaswamy).

In Panel A of Table VI, the estimates of γ_1 are remarkably similar for nearly all the forecasts examined. Not much is changed, for example, by substituting forecasts of the dividend yield variable for realized values. There are some differences between the slope estimates for the three estimation procedures, but none of them are important enough to change the basic conclusion that there is a positive relationship between abnormal return and forecast dividend yield.

Panel B of Table VI repeats the analyses of Panel B with an alternative method

Table IV

Regression of Abnormal Returns on the Difference in Dividend Yield between the Portfolio and the Equal-weighted Market Proxy[a]

$$\hat{\alpha}_p + \hat{e}_{ps} = \gamma_{0s} + \gamma_{1s}(\delta_{ps} - \delta_{ms}) + u_{ps}$$

Period	Dividend Yield	Estimation Method	$\hat{\gamma}_0$	$\hat{\gamma}_1$
4/36–12/77	Realized	GLS	0.00028	0.253
			(0.00006)	(0.017)
		OLS	0.00022	0.176
			(0.00025)	(0.050)
	Box-Jenkins	GLS	0.00028	0.245
	Estimates		(0.00006)	(0.017)
		OLS	0.00023	0.174
			(0.00024)	(0.053)
4/36–12/40	Box-Jenkins	GLS	−0.00032	0.361
	Estimates		(0.00038)	(0.112)
1/41–12/47			−0.00008	0.338
			(0.00015)	(0.042)
1/48–12/54			−0.00018	0.251
			(0.00012)	(0.029)
1/55–12/61			−0.00025	0.076
			(0.00013)	(0.038)
1/62–12/68			0.00075	0.180
			(0.00013)	(0.048)
1/69–12/77			0.00109	0.388
			(0.00013)	(0.044)

[a] Figures in the table are the coefficient estimates and standard errors.

Table V

Box-Jenkins Estimates of the Time Series of Differences between Portfolio and Market Dividend Yields

Market Proxy	Portfolio	Month	Estimated Model[a]	Box-Pierce Statistic[b]
Value-weighted	H	$t+1$	$(1-0.63B^3)(1-B^{12})y_s = (1-0.66B^{12})u_s$	61.8
		$t+2$	$(1-0.50B^3)(1-B^{12})y_s = (1-0.55B^{12})u_3$	75.6
		$t+3$	$(1-0.40B-0.60B^3)(1-B^{12})y_s = (1-0.63B^3)u_3$	65.6
	L	$t+1$	$(1-0.30B^3)(1-B^{12})y_s = (1-0.53B^{12})u_s$	53.7
		$t+2$	$(1-0.32B^3)(1-B^{12})y_s = (1-0.52B^{12})u_s$	38.9
		$t+3$	$(1-0.12B^3)(1-B^{12})y_s = (1+0.25B^6-0.46B^{12})u_s$	41.8
	Z	$t+1$	$(1-0.65B^3)(1-B^{12})y_s = (1-0.62B^{12})u_s$	53.5
		$t+2$	$(1-0.17B-0.65B^3)(1-B^{12})y_s = (1-0.75B^{12})u_s$	65.8
		$t+3$	$(1-0.14B-0.61B^3)(1-B^{12})y_s = (1-0.58B^{12})u_s$	67.5
Equal-weight	H	$t+1$	$(1-0.28B-0.30B^6-0.61B^{12})(y_s+0.0033) = (1+0.35B^3)u_s$	89.7
		$t+2$	$(1-0.11B-0.37B^6-0.46B^{12})(y_s+0.0026) = (1+0.43B^3)u_s$	55.7
		$t+3$	$(1-0.29B-0.19B^6-0.42B^{12})(y_s-0.0063) = (1+0.10B^3)u_s$	99.8
	L	$t+1$	$(1-0.15B-0.30B^6-0.52B^{12})(y_s+0.0019) = (1+0.31B^3)u_s$	37.6
		$t+2$	$(1-0.13B-0.17B^6-0.63B^{12})(y_s+0.0021) = (1+0.32B^3)u_s$	76.7
		$t+3$	$(1-0.13B-0.68B^{12})(y_s-0.0072) = u_s$	38.4
	Z	$t+1$	$(1-0.33B-0.18B^6-0.76B^{12})(y_s-0.0025) = (1+0.29B^3)u_s$	75.6
		$t+2$	$(1-0.21B-0.38B^6-0.51B^{12})(y_s-0.0026) = (1+0.53B^3)u_s$	50.5
		$t+3$	$(1-0.38B-0.38B^6-0.55B^{12})(y_s+0.0031) = (1+0.47B^3)u_s$	85.7

[a] $y_s = \delta_{ps} - \delta_{ms}$ and $B^t y_s = y_{s-t}$

[b] For 24 lags; $\chi^2_{19}(0.05) = 30.1$. It is unlikely that the autocorrelation in the residuals can be exploited without the use of an excessively large number of parameters.

Table VI

Estimation of Equations (10) and (11) with Forecasts of Dividend Yield[a,b,c]

A. $\hat{\alpha}_p + \hat{e}_{ps} = \gamma_{0s} + \gamma_{1s}(\delta_{ps} - \delta_{ms}) + u_{ps}$ (10)

	OLS		GLS	
Estimation Method	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_0$	$\hat{\gamma}_1$
Forecast				
Box-Jenkins	0.00125	0.207	−0.00022	0.209
	(0.00086)	(0.039)	(0.00007)	(0.019)
Realized yield at $s - 3$	0.00125	0.228	−0.00032	0.217
	(0.00086)	(0.041)	(0.00007)	(0.019)
Realized yield at $s - 12$	0.00126	0.201	−0.00022	0.205
	(0.00086)	(0.040)	(0.00007)	(0.019)
Perfect: Realized yield at s	0.00127	0.201	−0.00029	0.216
	(0.00087)	(0.040)	(0.00007)	(0.019)

B. $R_{ps} - R_{ms} = \gamma_{0s} + \gamma_{1s}(\delta_{ps} - \delta_{ms}) + \gamma_{2s}\hat{\beta}_p + u_{ps}$ (11)

	GLS		
Estimation Method	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$
Forecast			
Box-Jenkins	−0.00049	0.194	0.002
	(0.00006)	(0.014)	(0.001)
Realized yield at $s - 3$	−0.00050	0.157	−0.000
	(0.00006)	(0.014)	(0.001)
Realized yield at $s - 12$	−0.00050	0.204	0.003
	(0.00006)	(0.014)	(0.001)
Perfect: Realized yield at s	−0.00050	0.165	0.000
	(0.00006)	(0.014)	(0.001)

[a] Number of observations is 381, from 4/46 to 12/77.

[b] Standard errors are shown below the coefficient estimates.

[c] The market proxy is value weighted.

of removing the slight dependence of $R_{ps} - R_{ms}$ on R_{ms}. The equation used in Panel B is, for $\hat{\beta}_p$ an estimate of the beta of $R_{ps} - R_{ms}$ obtained from the whole sample of 381 months,

$$R_{ps} - R_{ms} = \gamma_{0s} + \gamma_{1s}(\delta_{ps} - \delta_{ms}) + \gamma_{2s}\hat{\beta}_p + u_{ps} \tag{11}$$

The results are not affected very much by this alternative procedure.

The similarity between the estimates of γ_1 obtained with the ex ante forecasts of dividend yield and those obtained with realized dividend yield is surprising. Would the estimate of γ_1 be sensitive to the inclusion of an unexpected component of dividend yield? Table VII extends the analysis by estimating the apparent effects of forecast dividend yield and error in forecast. Let $y_{ps} = \delta_{ps} - \delta_{ms}$ and let $\hat{y}_{ps}$ be the forecasted value of y_{ps}. Table VII shows the results of estimation of a multiple regression similar to Equation (10),

$$\hat{\alpha}_p + \hat{e}_{ps} = \gamma_{0s} + \gamma_{1s}\hat{y}_{ps} + \gamma_{2s}(y_{ps} - \hat{y}_{ps}) + u_{ps} \tag{12}$$

The figures in Table VII are weighted average estimates of γ_0, γ_1, and γ_2, obtained by generalized least squares from the time series of ordinary least squares estimates of γ_{0s}, γ_{1s}, and γ_{2s}. The final column of the table shows the mean

Table VII

Estimation of Equation (12): Expected and Unexpected Dividend Yield[a,b,c]

$$\hat{\alpha}_p + \hat{e}_{ps} = \gamma_{0s} + \gamma_{1s}\hat{y}_{ps} + \gamma_{2s}(y_{ps} - \hat{y}_{ps}) + u_{ps} \quad (12)$$

Forecast	γ_0	γ_1	γ_2	MSE[d]
Box-Jenkins	0.00020	0.230	0.315	0.55×10^{-6}
	(0.00008)	(0.021)	(0.135)	
Realized yield at $s - 3$	−0.00045	0.223	−0.091	1.20×10^{-6}
	(0.00007)	(0.020)	(0.089)	
Realized yield at $s - 12$	−0.00026	0.156	0.817	0.84×10^{-6}
	(0.00007)	(0.022)	(0.121)	

[a] Number of observations is 381, from 4/46 to 12/77.

[b] Market proxy is value weighted.

[c] Estimates are generalized least squares. Standard errors are shown below the coefficient estimates.

[d] MSE is the mean squared error of the forecast, in other words the estimated second moment of $y_{ps} - \hat{y}_{ps}$, $p = 1, 2 \ldots 9$, $s = 1, 2 \ldots 381$.

squared error of the forecast; in other words, the estimated second moment of $y_{ps} - \hat{y}_{ps}$, $p = 1, 2, \ldots 9$, $s = 1, 2, \ldots . 381$. As expected, the Box-Jenkins forecasts are more accurate than the simpler forecasts.

Although some of the forecasts lead to large positive estimates of the coefficient for unexpected dividend yield, as is consistent with the existence of information content in unexpected dividend payments, the important result is that the coefficient for expected dividend yield remains strongly positive.

E. Evidence from residuals

Perhaps even more striking than Table VI in its representation of the lack of variation of results from forecast to forecast is Table VIII. In the first seven columns of this table, the OLS residuals from the cross-sectional regressions (10) and (12) are standardized by dividing by their estimated standard deviation for each month and then averaged over time for each portfolio separately. Differences between portfolios for a given forecast of dividend yield are much more noticeable than differences between dividend yield forecasts for a given portfolio, the figures along any given row being very similar to each other. Since there are 381 observations on the standardized residuals for each portfolio, the standard error of the mean is $(381)^{-1/2}$ or 0.051. For many of the portfolios the mean standardized residual is several times this value. Strongly negative and strongly positive mean standardized residuals in certain portfolios constitute systematic departures from the simple linear relationship between the expected return and dividend yield implied by the after-tax version of the model.

The final column of this table shows the means of the time series realized values of $\delta_{ps} - \delta_{ms}$ for each portfolio. There does not seem to be an obvious relationship between these values and the mean standardized residuals. Means of the time series of the forecasts of $\delta_{ps} - \delta_{ms}$ are not shown, but are almost without exception identical to the realized values to two significant digits.

Table VIII

Average Standardized OLS Residuals in Equations (10) and (12) and mean $\delta_{ps} - \delta_{ms}$, by Portfolio[a,b,c]

$$u_{ps} = \hat{\alpha}_p + \hat{e}_{ps} - \gamma_{0s} - \gamma_{1s}(\delta_{ps} - \delta_{ms}) \quad (10)$$

$$u_{ps} = \hat{\alpha}_p + \hat{e}_{ps} - \gamma_{0s} - \gamma_{1s}\hat{y}_{ps} - \gamma_{2s}(y_{ps} - \hat{y}_{ps}) \quad (12)$$

Equation		Box-Jenkins (10)	Box-Jenkins (12)	Forecast: Realized yield $s-3$ (10)	Forecast: Realized yield $s-3$ (12)	Forecast: Realized yield $s-12$ (10)	Forecast: Realized yield $s-12$ (12)	Perfect	Mean $\delta_{ps} - \delta_{ms}$
Portfolio									
H	$t+1$	−0.23	−0.21	−0.22	−0.21	−0.23	−0.22	−0.23	−0.0030
	$t+2$	0.42	0.37	0.43	0.41	0.42	0.34	0.42	−0.0025
	$t+3$	−0.04	−0.00	−0.06	−0.03	−0.04	−0.03	−0.05	0.0063
L	$t+1$	−0.19	−0.15	−0.19	−0.12	−0.19	−0.13	−0.19	−0.0019
	$t+2$	−0.14	−0.13	−0.14	−0.17	−0.15	−0.10	−0.14	−0.0020
	$t+3$	0.07	0.05	0.05	−0.02	0.07	0.03	0.07	0.0009
Z	$t+1$	0.20	0.15	0.20	0.20	0.21	0.17	0.20	0.0027
	$t+2$	−0.13	−0.13	−0.14	−0.10	−0.13	−0.10	−0.13	0.0025
	$t+3$	0.05	0.05	0.06	0.06	0.05	0.04	0.05	−0.0030
Kurtosis[d]		2.5	2.6	2.5	2.6	2.5	2.6	2.5	

[a] Number of observations is 381, from 4/46 to 12/77. Standard error is 0.051.
[b] Market proxy is value weighted.
[c] Average standardized residual $\bar{u}_p$, given standard error of regression $\hat{\sigma}_s$, is

$$u_p = [\textstyle\sum_{s=1}^{381} u_{ps}/\hat{\sigma}_s]/381$$

[d] Sample kurtosis is for the overall sample, pooling standardized observations from 9 portfolios and 381 months. Normally distributed data would have kurtosis of 3.

VI. Discussion of Results and Conclusion

The abnormal returns on portfolios constructed to have equivalent market risk but widely different dividend yields have been evaluated. Preliminary evidence, in Tables I and II, suggested anomalies in the behavior of the abnormal returns of a given portfolio observed at three consecutive months after its formation. Abnormal return was then related to dividend yield. Evidence for this relationship in Table III is reasonably consistent with that obtained by Litzenberger and Ramaswamy. The results were found to be remarkably robust to the choice of method of analysis and of market proxy.

The main inference from Table VI is that abnormal return is positively related to dividend yield, realized or forecast, as the after-tax version of the CAPM requires. This inference is not consistent with those of Miller and Scholes, whose results suggest that information effects are of overriding importance. Since the methods of my paper and of theirs are so dissimilar, it is difficult to relate the two sets of results. One direct comparison is possible. In their Table I, the coefficient for dividend yield forecasted by the realized yield of the stock 12 months earlier is 0.038 with a standard error of 0.029. In Table VI of my paper, the OLS coefficient estimate is 0.201 with a standard error of 0.040 and the GLS estimate is 0.205 with a standard error of 0.019, the forecasts being for the difference between portfolio dividend yield and market portfolio dividend yield. The difference is easier to forecast than the dividend yield itself, the latter being subject to the full impact of the variation in price over time without a compensating control in the form of the similar and related variation for the market portfolio. Table VII shows that the mean squared error of the forecast of the difference is 0.84×10^{-6}. If portfolio dividend yield itself is forecasted by the lagged yield the mean squared error increases to 1.62×10^{-6}. The gain from forecasting the difference should offset some of the loss of information due to aggregation in portfolio formation. Aggregation has some benefit, too, in the form of more satisfactory behavior with respect to the distributional assumptions about regression residuals.

Some of the evidence in Table VI and much of the evidence in Table VIII is not consistent with the simple linear relationship between return and dividend yield implied by the after-tax model. Litzenberger and Ramaswamy show evidence of clientele effects which are also inconsistent with the linear relationship. My methods do not allow further examination of such effects.

The overall conclusion to be drawn from the work is that abnormal return is related to forecast dividend yield, but not in the precise way specified by the simple after-tax versions of the capital asset pricing model.

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