EX-DIVIDEND STOCK PRICE BEHAVIOR:

EVIDENCE FROM A CENTURY

OF TAX LAW CHANGES

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1998

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF PHILOSOPHY
July, 2005

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ACKNOWLEDGMENTS

I wish to express my love and appreciation to my wife Shannon and my daughter Alexia for their steadfast support and patience throughout my studies. It is said that doctoral students and their families "earn" the degree together through much commitment and sacrifice, and we now know this to be true. I also express my gratitude to my father Lyndal, my mother Susie, and my grandmother Patricia, without whom I would never be what I am today. I am proud to follow in their footsteps as public servants and educators.

Moreover, I wish to express my sincere appreciation to Dr. Ramesh Rao and Dr. David Carter, who not only have provided invaluable advice during this endeavor but also have invested a great deal of time helping me develop as a research professional. I have learned much from their wisdom. I also thank my other committee members, Dr. Betty Simkins and Dr. Kevin Murphy, for their direction and their service on my committee, and Dr. Janice Jadlow for her advice and support during my many semesters teaching in the Department of Finance.

Finally, I would like to thank the faculty and staff in the Spears School of Business, along with my fellow doctoral students, for their years of support and encouragement.

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NOMENCLATURE

CRSP	Center for Research in Security Prices database
D	Dividend amount in dollars
ΔP	Ex-day price drop; denoted ΔP^* when adjusted for market return
EG	Seminal work by Elton and Gruber (1970)
EHK	Either of two papers by Eades, Hess, and Kim (1984, 1994)
HY	High-yield; refers to highest 20% of stocks ranked by D/P^{cum} each quarter
ICDE	Intercorporate dividend exclusion; also called the dividends received deduction
LY	Low-yield; refers to lowest 80% of stocks ranked by D/P^{cum} each quarter
MAR^{ex}	Ex-day market-adjusted return, calculated as $(D - \Delta P^*)/P^{cum}$
NNR	Paper by Naranjo, Nimalendran, and Ryngaert (2000)
NYSE	New York Stock Exchange
P_0	Price at which a stock was originally purchased
P^{cum}	Cum-dividend stock price; the stock price just before it goes ex-dividend
P^{ex}	Ex-dividend stock price
PDR	Price drop ratio, calculated as $\Delta P^*/D$ or (when no market adjustment is needed) simply $\Delta P/D$
SER	Standardized excess return
t_{cg}	Tax rate on capital gains
t_d	Tax rate on dividends

Chapter 1

Introduction

On a stock's ex-dividend day, we should expect to see its price drop by the amount of the dividend. If the stock were to be sold before that day, the seller would relinquish to the buyer the right to receive the dividend. After the stock goes ex-dividend, however, the right to the dividend remains with the seller and is not transferred to the buyer. Ignoring the time value of money in the short period between the ex-date and the dividend payment date (usually 2-4 weeks), the stock price must drop by the value of the dividend to prevent arbitrage.

However, much empirical research has documented that stock prices drop by significantly *less*than the dividend on the ex -day. The first explanation for this effect [Elton and Gruber (EG 1970)] cited preferential tax treatment of capital gains. Specifically, when dividends are taxed at a higher rate than capital gains, investors would not be willing to subject themselves to higher tax rates by holding a stock through the ex-dividend day *unless* they were compensated by a smaller ex-day price decline. However, there has not been unanimous agreement about whether ex-dividend stock price behavior is truly driven by differential taxation of dividends and capital gains. Other arguments [e.g., Kalay (1982)] point out that short-term traders are taxed identically on dividends and capital gains, so any deviation from a one-for-one price drop-to-dividend relationship creates an apparent arbitrage opportunity if transaction costs are low enough. However, if higher transaction costs inhibit "dividend capture" activity, the ex-day effect hypothesized by EG may still persist.

More recent explanations for the ex-day effect point to different aspects of market microstructure. One of the interesting microstructure models is that of Bali and Hite (1998). They argue that when dividends may be paid in any amount but stock prices are constrained to discrete multiples of 12.5 cents, ex-day prices should drop by the largest tick multiple less than the dividend, regardless of tax considerations. Recent events have provided an excellent opportunity to test the discreteness hypothesis, as the major exchanges converted to "decimalized" pricing in 2001, thereby removing the supposed cause for the effect. Graham, Michaely, and Roberts (2003) and Jakob and Ma (2004) find that the ex-day effect continues to exist even in the absence of large discrete price increments, thereby casting serious doubt on the explanatory power of the discreteness model.

The ex-day pricing problem has endured as a subject of interest in financial economics for several reasons. First, ex-day pricing ultimately suggests something about how stockholders value dividends versus capital gains, which has implications for corporate dividend policy (assuming managers maximize shareholder wealth). Next, with improved knowledge of the determinants of ex-day pricing, all market participants can make better decisions, either by timing transactions or by engaging in other profitable trading activities around the ex-day. Finally, the ex-day phenomenon is an anomaly with implications for market efficiency, and such anomalies naturally call for an explanation.

This study focuses almost exclusively on tax-based explanations for ex-dividend stock price behavior. Tax law changes provide an obvious opportunity to test theories about the effects of taxation, including those specifically related to ex-day pricing. Indeed, many past studies have done this to some extent. The next chapter cites at least 13 different works that examine the ex-day phenomenon before and after a U.S. tax reform. However, single-reform studies are limited to a relatively narrow time interval and are unable to consider jointly the behavior of ex-day prices under multiple tax regimes.

Tax rates on dividends and capital gains have varied considerably over the past century – certainly enough to conduct a good test of the EG model – yet few studies to date have examined the variation in ex-dividend stock price behavior over a substantial period of time. Probably the most noteworthy exception is Eades, Hess, and Kim (EHK 1994), who plot the time series of abnormal ex-day returns (scaled by a volatility estimate) from 1962-1989. In their regressions, EHK mostly fail to find a significant relationship between ex-day returns and changes in taxation. However, this may be because they attempt to measure the impact of taxes using only dummy variables for a select handful of tax reforms. Dummy variables cannot capture the broad spectrum of tax rates across multiple tax law changes; they can only indicate whether or not a given regime is in effect. Thus, the results of EHK do not necessarily imply that ex-dividend stock price behavior is unrelated to tax changes through time – only that when the *particular* tax laws studied were in effect, no significant differences in ex-day returns were detected versus when the laws were *not* in effect.

More recently, Naranjo, Nimalendran, and Ryngaert (NNR 2000) employ a slightly different methodology that relates ex-day returns to tax *rates* instead of dummy variables. Consequently, a 30 percent tax rate in one year is treated the same as a 30 percent rate in another year, even if they occur under different tax "regimes." Unlike EHK, NNR find that taxes do influence ex-day returns. However, this conclusion is based only on corporate tax rates after the elimination of fixed commissions on 1 May 1975, and it applies only to a carefully filtered sample of high dividend yield securities that are likely to be targets of corporate dividend capture.

This study contributes to the literature in several important ways. First, unlike almost every other study of ex-day pricing (except NNR), we recognize that some tax law changes are larger than others, so we use variables that are calculated from the rates themselves. Information about the *magnitude* of a tax law change is unfortunately lost in simple "before and after" comparisons or when a broad spectrum of tax rates is reduced to a binary variable that only indicates whether a given change has or has not occurred. Our approach allows for meaningful comparisons of price changes around ex-dates in multiple time periods. However, unlike NNR, we do not restrict our attention to high-yield corporate dividend capture targets. Lower-yield securities (which are by far the majority) are more likely to be held by individual investors, so a completely different set of tax rates may apply to them.

Second, we consider a longer time period incorporating more tax law changes than any prior ex-day study. While we are able to look 14 years past the end of the EHK sample period, a more interesting aspect of our study is that we also consider much *older* data. Since there is no readily available source of daily stock price data before 1962, most studies do not look at ex-day pricing in that era. While this is understandable, it is unfortunate because the 1940s and 1950s saw the highest personal tax rates (and largest differentials between dividends and capital gains) ever to occur in U.S. history. If differential taxation really is the cause of the ex-day anomaly, it should be evident in approximately the two decades preceding 1962. The first half of the twentieth century also witnessed some very large changes in tax rates. For example, the individual maximum ordinary rate was hiked from 25 to 63 percent in 1932 and from 15 to 67 percent in 1917. Regrettably, we cannot hand-collect price information around *all* dividend ex-dates before 1962. Therefore, we limit our sample to the stocks in the Dow Jones Industrial Average. The Dow sample is a convenient choice since an active market ensures that accurate price information is usually available.

Finally, we consider the effect of recent stock price performance on ex-day pricing. Elton and Gruber (1970) assume that an investor must sell either immediately before or immediately after the dividend distribution, realizing the tax consequences immediately. In reality, stockholders have at least one more choice – specifically, to receive the dividend and continue holding the stock for some time. As a rule, taxpayers prefer to postpone the recognition of income and accelerate the recognition of losses. Therefore, if the stock has appreciated significantly since the investor bought it, the tax benefits from deferring capital gains into the future may outweigh the cost of paying a higher tax rate on a relatively small dividend. Of course, if the stock's value has *declined* significantly since it was purchased, the investor may be more eager to sell it to lock in a tax deduction if he or she has not already done so. As far as we know, this aspect of taxation and its effect on ex-dividend stock price behavior has not been satisfactorily addressed in the literature.

The rest of this work proceeds as follows. The next chapter outlines the literature documenting the existence of the ex-day phenomenon, the theories that have been put forward to explain it, and the evidence supporting or refuting these ideas. Chapter 3 provides a brief narrative of important tax law changes over the past century. In Chapter 4, we make testable predictions based on several alternative models of ex-dividend stock price behavior. We begin with the classic EG model but expand it to account for the influence of recent stock price performance on ex-day trading, as well as investors' abilities to anticipate future tax law changes. Chapter 5 describes our data and the key variables used in this study, explains the methodology for each of our empirical tests, and compares the results with our *ex ante* predictions. Chapter 6 concludes.

Chapter 2

Review of the Literature

2.1 Tax-Based Dividend Clienteles and Short-Term Trading

2.1.1 Early Studies

In one of the earliest published studies on the ex-day anomaly, Campbell and Beranek (1955) observed that the ex-dividend price drop was on average slightly less than the dividend (≈ 90%) for a small sample of medium-sized to large cash distributions paid on NYSE stocks. While they do note that "a tax-paying individual will do better to sell before an ex-dividend date but to buy after it," and that "[f]or a tax-exempt institution, the rule is exactly the reverse," they do not attempt to give a formal explanation for why the price should not normally drop by the full dividend amount.

Several years later, Miller and Modigliani (1961) published their seminal piece on dividend policy, in which they first proposed the idea of dividend clienteles. They argued that while dividend policy decisions neither enhance nor destroy corporate value (thus, their famous "dividend irrelevance" proposition), it is possible that capital market imperfections could cause different investors to prefer different payout policies, so that firms with similar dividend yields would tend to attract a "clientele" favoring that particular policy.

Using a one-year sample with 4,148 dividends, Elton and Gruber (EG 1970) confirm that ex-day stock prices tend to fall by significantly less than the dividend and develop a model explaining the effect. They show that when dividends are taxed at a higher rate than capital gains, the stock price must drop by less than the dividend for investors to be indifferent between (i) selling the stock cum-dividend (i.e. before the distribution) and (ii) holding the stock, receiving the dividend, and selling ex-dividend. Specifically, the relationship is given by

$$\text{Price Drop Ratio (PDR)} = \frac{\Delta P}{D} = \frac{P^{cum} - P^{ex}}{D} = \frac{1 - t_d}{1 - t_{cg}},$$

where P^{cum} is the last cum-dividend price, P^{ex} is the first ex-dividend price, D is the dividend amount, t_d is the tax rate applied to dividend income, and t_{cg} is the tax rate applied to capital gains. (See Chapter 4 for a complete derivation.) It follows that PDR < 1 when $t_{cg} < t_d$, as the rates have frequently been for individual investors. EG sort their sample into deciles by dividend yield and compute the mean PDR for each group. Using the equation above, EG then impute investors' marginal tax rates for each dividend yield decile. They find that PDRs generally increase with dividend yield, suggesting that investors in lower tax brackets prefer stocks with higher dividend yields, while higher-bracket investors prefer lower-yield stocks. Thus, EG confirm the existence of the ex-day effect, derive a mathematical model tying the effect *and its magnitude* to tax rates, and provide economic reasoning for a specific type of "dividend clientele" as suggested generally by Miller and Modigliani (1961).

The size of the ex-day effect documented by EG is actually somewhat larger than had been previously documented by Campbell and Beranek (1955) and Durand and May

(1960). However, this is exactly what the EG tax theory would predict since both earlier studies used samples of stocks with higher dividend yields.[1]

2.1.2 Short-Term Trading and Transaction Costs

Critics of the tax theory have noted that preferential tax treatment of capital gains over dividends applies only to long-term individual investors. Corporations historically have been allowed to exclude 70 to 85 percent of dividends received from taxable income, thereby reducing their effective dividend tax rates *below* the capital gains rate. Other investors, such as short-term traders and tax-exempt funds, are taxed (or not taxed) identically on dividends and capital gains and thus should be indifferent between the two types of income. In fact, short-term arbitrageurs should exploit any difference between the dividend and the ex-day price drop until the two are approximately equal, with any remaining random discrepancies due to market imperfections. [See Brooks and Edwards (1980), Kalay (1982), Miller and Scholes (1982), and Lakonishok and Vermaelen (1986) for arguments advocating this position.] This reasoning is compelling, and it casts doubt on the validity of marginal tax rates inferred from the EG model.[2]

Kalay (1982) revisits the original EG study using a slightly different methodology for the same sample period to correct for potential biases. Interestingly, even after the adjustments, he still affirms EG's basic findings that $\Delta P/D$ is on average less than 1 and

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[1] Campbell and Beranek (1955) restrict their sample to dividends ranging from $0.375 up to $2.00 per share, in increments of $0.125. Durand and May (1960) use a sample of 43 AT&T dividends of $2.25 each and find an insignificant effect (PDR ≈ 95%). Presently most dividends are less than $0.25 per share.

[2] Interestingly, Michaely and Vila (1995) develop a theoretical model showing that investors' marginal tax rates can be inferred using ex-day price and volume information together.

positively related to the dividend yield. [For further discussion on these two studies, see Elton, Gruber, and Rentzler (1984) and Kalay (1984).[3]]

In view of the above arguments, the persistence of abnormal ex-day returns is at first puzzling. After all, it seems that anything but a one-for-one price drop creates a virtual arbitrage opportunity. On the other hand, there is little doubt that positive ex-day returns do happen, as documented by countless studies, many of which are cited later in this review. Of course, *negative* ex-day returns (where the price drops by *more* than the dividend) are well-documented, too – usually in stocks with the highest dividend yields. High-yield stocks are often attractive targets for "dividend capture" by corporations who are generally taxed much less on dividends than on capital gains. Upon further reflection, it should also be puzzling if the tax preferences of long-term investors do *not* influence stock prices around the ex-dividend date.

It might seem, then, that the EG model of tax-based dividend clienteles is in competition with the short-term trading hypothesis, and that the focus of empirical tests should be to determine which one better describes observed price behavior. It would be a mistake, however, to view the two hypotheses only as separate, opposing stories. In fact, they can be complementary, as different classes of traders may coexist, and all may influence the supply of and demand for securities around the ex-date. Boyd and Jagannathan (1994) develop a theoretical model that explicitly models the *tax heterogeneity* brought about by interaction among different types of market participants. Their model predicts a nonlinear relationship (for which they find some evidence in their

[3] Elton, Gruber, and Rentzler (1984) argue that Kalay (1982) underestimates transaction costs that would hinder short-term trading. Kalay (1984) agrees but maintains that transaction costs are not always prohibitive.

data) between the percentage price drop ($\Delta P/P$) and the dividend yield. It also shows that when the dividend yield is high enough, corporate dividend capturers have a trading advantage over tax-neutral arbitrageurs, thus explaining why PDRs are often greater than one for high-yield stocks. In the same spirit, Michaely and Vila (1995, 1996) develop a model and provide empirical evidence suggesting that abnormally high ex-day trading volume occurs precisely because of the abovementioned tax heterogeneity. They also note that "because of the risk involved [in dividend capture strategies], no traders will take an unlimited position, regardless of the price movement." Thus, ex-day abnormal returns do not necessarily imply that arbitrageurs are not at work; instead, they may have taken the largest possible positions that their tolerances for risk will allow.

The tax heterogeneity framework suggests that positive ex-day returns may exist for some stocks, but those returns are likely to vanish (or even become negative) when the dividend yield is high enough, the risk small enough, and/or transaction costs low enough to attract arbitrageurs or even corporate dividend capturers. Consistent with this view, Karpoff and Walkling (1990) find for a sample of NASDAQ stocks that ex-day returns were positively related to transaction costs as measured by bid-ask spreads, especially for high-yield stocks. Michaely and Vila (1995, 1996) find evidence that abnormal ex-day trading volume was greater for high-yield stocks, lower for riskier stocks, and higher when options could be used to hedge a risky dividend capture position. In May 1975, the New York Stock Exchange (NYSE) switched from a fixed commission system to negotiated commissions, a move that is widely agreed to have reduced transaction costs. Consistent with the integrated tax clientele/short-term trading framework, studies generally find lower ex-day returns and higher trading volume after the introduction of negotiated commissions, particularly for higher-yield stocks with lower measured transaction costs proxies. [See Lakonishok and Vermaelen (1986), Karpoff and Walkling (1988), Eades, Hess, and Kim (1984, 1994), and Naranjo, Nimalendran, and Ryngaert (2000).]

2.1.3 Other Securities and Non-Taxable Distributions

While most ex-day pricing research has focused on taxable cash dividends on common stocks, one can also make inferences about existing theories by observing the price behavior of different securities and around other distribution types. Eades, Hess, and Kim (1984) document negative excess returns for preferred dividends, as might be expected for high-yield dividend capture targets. However, Stickel (1991) obtains conflicting results. In his sample of nonconvertible preferreds, he finds positive abnormal returns and volume on the ex-day, with returns declining for more liquid stocks. So far, this is consistent with a synthesized model where both long-term investors and short-term arbitrageurs influence prices around preferred dividends. Inconsistent with this framework, however, is Stickel's finding that trading volume increases with liquidity for low-yield but not high-yield preferreds.

Preferred dividends are of course relevant to ex-day pricing theories, but it is perhaps more interesting to compare observations around non-taxable distributions against those around the usual taxable dividends. Eades, Hess, and Kim (1984) and Grinblatt, Masulis, and Titman (1984) examine ex-day price behavior around stock dividends and splits, which are non-taxable. According to both the EG model and the short-term trading hypothesis, these studies should find ex-day price drops fully reflective of the dilution caused by additional shares. In fact, neither does. Eades et al. report that "non-taxable stock dividends and splits are priced on ex-dividend days as if they are fully taxable." Oddly, Grinblatt et al. note higher positive ex-day returns for stock *dividends* than splits, possibly due to the added inconvenience investors face when dealing with odd lots.

Green and Rydqvist (1999) study a unique security – Swedish lottery bonds – to which special rules apply. Coupon payments on the bonds (distributed by lottery) are not subject to income tax, but capital gains are taxed at the ordinary rate. Furthermore, the regulatory environment is not conducive to short-term arbitrage using these securities. Consistent with the EG tax model, Green and Rydqvist find that the bond price drops by about 130 percent of the distribution on the "ex-coupon" day, and that the bonds frequently trade at *negative* pre-tax yields.

Elton, Gruber, and Blake (2005) examine two samples of closed-end funds. In one sample, distributions are not taxed (but capital gains are); in the other, distributions are taxed normally. As expected, market-adjusted price drop ratios are greater than one for the non-taxable distributions but less than one for the taxable sample. Price drop ratios for both samples also behave as predicted by the EG model following tax law changes in 1993 and 1997. Similarly, Milonas, Travlos, Xiao, and Tan (2002) examine taxable and non-taxable dividends in the Chinese stock market and find price behavior mostly consistent with the tax theory.

2.1.4 Alternative Regulatory and Tax Environments

While U.S. markets generally provide ample opportunity to test asset pricing models, international markets offer researchers the chance to reexamine theories in environments where institutional details and tax laws are sometimes very different. For example, Milonas and Travlos (2001) and Frank and Jagannathan (1998) show that the ex-day phenomenon still exists for securities traded in Athens and Hong Kong, respectively, despite the absence of both dividend and capital gains taxes in each case. Consistent with the tax heterogeneity framework, however, Kadapakkam (2000) notes that abnormal ex-day returns dropped to insignificant levels, while trading volume increased, almost *immediately* after the Hong Kong market abandoned a cumbersome physical settlement procedure that could take 21 days to complete in favor of a more efficient electronic procedure that better facilitated short-term trading. Not surprisingly, the change was most pronounced for high-yield stocks.

Japanese markets are unique in ex-day pricing research, as the dividend amount is not usually known before the ex-date, which is often very close to the end of the firm's fiscal year (usually in March). Hayashi and Jagannathan (1990) find that stock prices actually *rise* on the ex-dividend day due to "unidentified shocks." Kato and Loewenstein (1995) confirm these results and find excess returns on the ex-day large enough for even small traders to exploit. Both studies confirm that the results depend on whether the ex-day is near a fiscal year-end, and Kato and Loewenstein believe that tax effects are only of secondary importance in the case of Japan.

2.1.5 Effect of Tax Law Changes

Although a complete understanding of the determinants of ex-dividend stock price behavior still eludes us, the essence of the best-known and most enduring of all theories is that different tax rates cause investors to value dividends and capital gains unequally. The works cited previously employ a wide variety of methodologies that have furthered our understanding, but there are few better opportunities to test theories about taxes than the natural experiment created by changes in a country's tax laws. Therefore, the remainder of this subsection reviews most of the important works that have considered one or more tax law changes, whether in the U.S. or abroad. We then discuss some of their strengths and weaknesses, along with how this study advances knowledge in the area.

We begin with Barclay (1987), who documents ex-day price behavior before and after the introduction of the Federal Income Tax in 1913. Using data from the *Commercial and Financial Chronicle*, Barclay finds that $\Delta P/D$ is not only close to one but also stable across groups when stocks are sorted into quintiles by dividend yield. In a matched sample from the post-income tax era, $\Delta P/D$ is less than one and generally increases with dividend yield. These findings are clearly consistent with EG. While its uniqueness makes Barclay's study extremely interesting, it does have one notable drawback. Specifically, his post-tax matched sample is drawn from the period 1962-1985. Although the Center for Research in Security Prices (CRSP) database makes it much easier to obtain these later prices, one cannot help but wonder how ex-day prices behaved *immediately* following 1913.

Grammatikos (1989) examined ex-day price behavior before and after the Tax Reform Act (TRA) of 1984. The 1984 Act lengthened the time a corporation must hold the stock "at risk" from 16 to 46 days. If the corporation does not meet the minimum holding requirement, the dividend becomes ineligible for the intercorporate dividend exclusion and is instead taxed at the normal rate, thus eliminating the motivation for dividend capture altogether. Consistent with the added risk imposed on dividend capturers, ex-day returns rose on average after the Act, but not so much for stocks that could be hedged with options.

Of all U.S. tax law changes, none has been more thoroughly researched with respect to its effect on ex-day pricing than the 1986 Tax Reform Act (TRA). The 1986 Act lowered ordinary personal and corporate income tax rates but eliminated preferential tax treatment of long-term capital gains. According to the EG model, either of these two changes should cause $\Delta P/D$ to rise (and ex-day returns to fall), and indeed most empirical investigations [e.g. Robin (1991), Lamdin and Hiemstra (1993), Koski (1996)] support this prediction. Probably the most notable dissenter is Michaely (1991), who finds that $\Delta P/D$ is not significantly different from one in any of the years 1986-1989 around the TRA, leading him to conclude that short-term traders are much more active now than in the time period studied by EG. However, Bhardwaj and Brooks (1999) point out that Michaely's estimates may have been distorted by outliers. They are able to replicate his results, but after filtering out a small number of observations with other simultaneous distributions, excessively large positive or negative price drop ratios, and/or missing bid/ask prices on the cum- or ex-day, they find that $\Delta P/D$ in 1986 (i.e. before the TRA took effect) was on average less than one, positively correlated with the dividend yield, and negatively related to transaction costs – consistent with the integrated tax framework. Han's (1994) results are mixed, as ex-day excess returns fall post-1986 for his NASDAQ sample but not for NYSE/AMEX securities. Finally, it is also worth pointing out that the 1986 TRA decreased tax *heterogeneity*, as it caused long-term investors and would-be arbitrageurs to view dividends and capital gains similarly. Michaely and Vila (1995) and Wu and Hsu (1996) support the general consensus that ex-day returns dropped following the 1986 reform, but consistent with prior arguments, they also find a significant reduction in ex-day *volume* as decreased heterogeneity reduced the incentive to trade.

Of course, studies of tax reforms need not be confined to the U.S. Tax law changes in the United Kingdom (UK) have provided several excellent opportunities to test the basic tax clientele model, and the evidence has been mostly supportive. While Poterba and Summers (1984) do not find a notable change in ex-day returns following the introduction of a capital gains tax in 1965, they do find a substantial drop following a 1973 reduction in the effective tax rate on dividends. Lasfer (1995) finds that ex-day returns decline following the 1988 Income and Corporation Taxes Act, which reduced the differential taxation of dividends and capital gains (similar to the 1986 TRA in the U.S.). Bell and Jenkinson (2002) study ex-day returns 30 months before and after the 1997 Finance Act (FA97), which removed pension funds' preference for dividends over capital gains. Price drop ratios fell and ex-day returns rose following FA97, especially for high-yield stocks, implying not only that taxes affect valuation but also that pension funds are the likely marginal investors for the securities used in the study.

While the UK evidence has been mostly compatible with EG, results from Canadian tax reforms have been less so. In spite of a 1971 tax law change that increased the value of dividends relative to capital gains, Lakonishok and Vermaelen (1983) find lower price drop ratios for securities on the Toronto Stock Exchange, which they attribute to another provision of the tax reform that reduces short-term trader profits. A recent working paper by Bauer, Beveridge, and Sivakumar (2002) considers a 1990 change in the relative taxation of capital gains and dividends on Canadian stocks, but similarly finds no support for the tax theory. In a sample period (1970-1980) covering four different tax regimes, Booth and Johnston (1984) find that ΔP/D is consistently less than one. However, they are unable to draw conclusions in favor of the tax model because PDR does not increase with dividend yield as hypothesized.

We now turn our attention back to studies that employ U.S. data. While there is no shortage of papers covering the impact of a *single* reform, the ex-day phenomenon has rarely been examined over long periods of time with the intention of understanding how ex-dividend price behavior varies with multiple changes in taxation. The earliest example we were able to find is Skinner (1993), who considers ten personal tax law changes over a 25-year period beginning in 1963. On average, ΔP/D is found to be less than one, the notable exception being utility stocks after 1972, which have price drop ratios higher than one. This exception is not surprising because utility stocks are often suitable candidates for corporate dividend capture, and the latter part of Skinner's sample period corresponds roughly to the era following the introduction of negotiable commissions on the NYSE. Dividend capture was arguably more profitable in this era since transaction costs were lower under negotiated commissions. In separate regressions performed around each tax law change individually, ΔP/D is found to increase with a stock's dividend yield and decrease with its estimated beta, again consistent with a synthesized tax/short-term trading framework. Unfortunately, the dummy variables for each tax law change (equal to zero before the change and one afterward) are rarely significant in the predicted direction, making it difficult to draw definitive conclusions.

The most comprehensive paper to date addressing the time series of ex-dividend stock price behavior is Eades, Hess, and Kim (EHK 1994). Instead of calculating average price drop ratios, which can be distorted by very small dividends, EHK use *standardized excess returns* (SERs), defined as

$$\frac{RP_i - \mu_i}{\sigma_i} ,$$

where RP_i is the return on a portfolio of the stocks going ex-dividend on day *i*, μ_i is the return on a portfolio of "non-ex-day" stocks, and σ_i is the estimated volatility of day *i*'s ex-dividend portfolio. Consistent with prior literature, SERs are positive over the sample period (1962-1989) for all dividend-paying stocks, and especially so for the lower-yield subsample (comprised of their bottom three dividend yield quintiles). However, their highest-yield quintile exhibited mostly *negative* ex-day returns after the introduction of negotiated commissions on the NYSE in 1975. This is consistent with the idea that corporations – for whom *dividend* income receives preferential tax treatment – engage in dividend capture around the ex-date when transaction costs are not prohibitive. [Recall Boyd and Jagannathan's (1994) model which demonstrates that corporate dividend capturers, not arbitrageurs, may be the marginal price setters for the highest-yield stocks.] EHK are not able to find a consistent relationship between SERs and changes in taxation. However, some of their findings are at least consistent with tax clientele models. First, SERs are negatively related to dividend yield within the high-yield subsample. Second, for their overall and low-yield samples, EHK report negative coefficients on a dummy variable for the time period from January 1977 to June 1984, when a longer holding period requirement for personal long-term capital gains was in effect. This is to be expected since such restrictions make it more difficult for individual investors to get a lower tax rate on capital gains – the very reason for the ex-day effect according to EG.

More recently, Naranjo, Nimalendran, and Ryngaert (NNR 2000) extend EHK, focusing exclusively on high-yield stocks that are the most likely targets for corporate dividend capture. Specifically, NNR include certain high-yield utility stocks (CRSP distribution code 1239) previously missed by EHK, while restricting the sample to domestic corporations (CRSP incorporation codes 10-11) to avoid dividends that are ineligible for the intercorporate exclusion and therefore unsuitable for capture. After refining the sample selection procedure, they find mostly positive SERs before the switch to negotiated commissions (1963-1974) and *persistently* negative SERs after (1975-1994). NNR then use several weighted least squares regressions to determine what variables affect high-yield ex-day excess returns in the negotiated commission era. Notably significant in all five regressions was the "tax differential" variable

$$\frac{\theta\, t_{corp}}{1 - t_{corp}} ,$$

where θ is the intercorporate dividend exclusion percentage and t_{corp} is the ordinary corporate tax rate. Consistent with the basic tax model, the estimated tax differential coefficient was always negative, either by itself or multiplied by the dividend yield.

2.1.6 Discussion

We affirm the importance of single-tax-reform works. Researchers should continue to conduct "before and after" analyses of future tax law changes to help validate or refute tax-related theories. Considering these studies together as part of the "big picture" helps us form an understanding about the effects of taxation. However, when a long time series of data spanning multiple tax regimes is available, it makes sense to use as much information as possible in order to conduct a truly comprehensive test of the theory.

This is particularly true in the case of the ex-day phenomenon, where large stock price movements unrelated to the dividend create a high noise-to-signal ratio, making it hard to draw inferences about the effect of the dividend itself. When considering only a few years before and after a particular tax reform, there is always the danger that overall stock market performance will be very different across the two periods. To be fair, most ex-day studies we have seen attempt to control for this by adjusting for the market return on the ex-day. Nevertheless, a significant level of idiosyncratic risk remains, as evidenced by observed fluctuations in market-adjusted price drop ratios and excess returns from one year to the next.

Very little is constant when it comes to taxation in the United States. There has been considerable variation in both personal and corporate tax rates throughout the 20th century – more than enough to conduct a good test of tax-related ex-day pricing theories. As discussed in the section above, at least three studies *have* attempted this to some extent, with different approaches and mixed results. Skinner (1993) does well to consider ten different personal tax law changes. However, he runs regressions separately for each one, using a dummy variable equal to zero for the regime immediately preceding the tax law change and one immediately following. Effectively, then, this could be viewed as ten single-reform studies reported side by side. If the relative taxation of dividends versus capital gains were captured in one variable computed in all regimes, a single regression could be run for the whole sample period, thereby enabling more powerful tests. EHK (1994) include as many as three personal tax law dummies simultaneously in their regressions. However, a potential problem here is that many more tax law changes occurred during their sample period but were never considered. EHK themselves admit that this aspect of their methodology may be an oversimplification (p. 1625).

One of the problems in both of these studies is the use of dummy variables as the sole measurement of tax law changes. A dummy variable can indicate *whether* a given tax regime is in effect, but it cannot capture the *magnitude* of a given tax reform in relation to another, nor can it compare the relative tax treatment of capital gains and dividends in multiple regimes. The only study to use a "tax differential" variable comparable across all periods is NNR (2000). They make an excellent case for corporate dividend capture in high-yield stocks and present convincing evidence that ex-day returns are significantly related to corporate taxation under negotiable commissions. However, there is more work to be done. Theory suggests that individual income tax laws should affect ex-day pricing for lower-yield stocks (and perhaps even higher-yield stocks in the fixed-commission era), but as far as we can tell, no truly satisfactory, comprehensive test of this important prediction has ever been conducted.

Neither EHK nor NNR plot price drop ratios due to problems with heteroskedasticity. Given a certain price fluctuation, smaller dividends inflate the PDR, with the very smallest dividends potentially creating extreme values. For this reason, many studies exclude the smallest dividends when calculating average price drop ratios. However, EHK also contend that price changes on the same day are correlated. This should not be a problem if ex-day price changes are adjusted relative to the market, so that only firm-specific fluctuations remain. Nevertheless, they treat each *group* of stocks going ex-dividend on the same day as a single observation and then plot only average SERs for those portfolios over time. However, the SER statistic suffers from the problem that stocks are not counted equally. Specifically, a stock would be weighted more heavily if it went ex-dividend on a day by itself, rather than going ex-dividend the same day as 30 other stocks. Unfortunately, we know of no perfect test statistic, so we report the information conveyed by both PDRs and ex-day returns through time.

One other limitation with the three studies discussed above is the availability of data. Tax laws have been changing for almost 100 years now. However, CRSP daily stock price data begins in 1962, so most sample periods do not go back further. This is unfortunate because some very significant tax law changes happened before 1962, as will be outlined in Chapter 3. Hand-collecting data from the *Wall Street Journal* on all stocks going ex-dividend before 1962 would be prohibitively time-consuming; however, the task becomes feasible if we limit ourselves to the stocks in the Dow Jones Industrial Average. An advantage to this particular subset of securities is that they are generally more heavily traded, so price quotations are more meaningful. Therefore, results are reported separately for the Dow stocks back to 1910. We are also able to cover important tax law changes from 1993, 1997, 2001, and 2003 that occurred too late to be considered by NNR.

[Insert Figure 1 about here]

In summary, our study of the effects of taxation on ex-dividend stock price behavior builds upon existing research in several ways. First, we consider all changes in tax rates *simultaneously* over a broad sample period, using a tax variable that is comparable across multiple regimes. Second, we also consider important recent tax law changes that occurred after the end of NNR's sample period, and (on a limited subsample) tax regimes before 1962 that have never been examined. As illustrated in Figure 1, our sample period is much longer than that of any prior study. Next, we consider the impact of both personal and corporate tax rates on high- and low-yield stocks, whereas prior studies tend to ignore one set of securities and/or tax rates. Finally, we recognize that all ex-day price performance measures have inherent advantages and shortcomings, so we do not rely solely upon one measure.

Before we discuss relevant developments in taxation over the past century, we must mention at least briefly some important alternative explanations for the ex-day phenomenon.

2.2 Market Microstructure Effects

Over the past decade, several authors have advocated a number of microstructure-based explanations for the ex-day price effect. Maloney and Mulherin (1992) and Conrad and Conroy (1994) find that when stocks split, trades on the ex-day occur more often at the ask price than at the bid price. Thus, the average ex-day closing price would be slightly higher than the bid-ask midpoint, possibly creating the false appearance of an arbitrage opportunity. Koski (1996) explicitly considers bid-ask spreads and concludes that short-term traders are unable to profit from "dividend stripping" either before or after the 1984 and 1986 TRAs. However, Koski and Michaely (2000) find that abnormal ex-day returns still exist even if they are measured using cum-ask to ex-ask prices or cum-bid to ex-bid prices.

Frank and Jagannathan (1998) hypothesize that dividends carry a "nuisance value" and that some investors may deliberately accelerate sell orders or delay buy orders to avoid having to cash and reinvest dividend checks. Jakob and Ma (2003) note that a trader who decides on the cum-day to buy a stock can indeed delay the actual purchase until the ex-day, but an investor who decides on the ex-day to sell cannot step back in time to sell on the cum-day instead. Consistent with this reasoning, they find an excess of buy orders relative to sell orders on ex-days, but no order imbalance on cum-days.

Dubofsky (1992) proposes another explanation based on exchange rules and minimum tick sizes. NYSE Rule 118 and AMEX Rule 132 state that on a stock's ex-dividend day, open limit orders to buy must be adjusted downward by the amount of the dividend and rounded down to the next tick if necessary; open limit orders to sell, however, are not adjusted automatically. Based on this explanation, Dubofsky argues that ex-day abnormal returns will be a generally increasing function of the dividend with a "sawtooth" pattern.

Bali and Hite (1998) develop a model for ex-day trading that incorporates long-term buyers and sellers with their tax preferences, along with tax-neutral arbitrageurs. To avoid arbitrage, the price drop must be at least the dividend less one tick (D – T) but no larger than the dividend (D). The model predicts that in every case, the ex-dividend price drop must be the largest tick multiple that is strictly less than the dividend. For example, if the minimum tick size is $0.125 and the dividend is $0.30, each share would fall by $0.25. In this framework, ex-day abnormal returns would fall and $\Delta P/D$ would approach one if traders were not restricted to prices at certain discrete intervals. There has been a great deal of recent interest in the discreteness hypothesis as the minimum tick size in U.S. markets fell from $1/8 to $1/16 in mid-1997, and again from $1/16 to a penny in early 2001.[4] According to an NYSE Report to the SEC (2001), decimalization caused spreads to fall, although not usually to a penny. There were more trades, but for smaller amounts. In addition, limit orders fell as some traders were afraid of "being pennied." Consistent with Jones and Lipson (2001) on the earlier switch to sixteenths, smaller spreads do not necessarily improve market quality and could actually increase trading costs for some.

Bauer, Beveridge, and Sivakumar (2002) note that the ex-day phenomenon did not disappear after the Canadian markets converted to "decimalized" stock trading. It is now clear that decimalization did not eliminate ex-day returns in the U.S., either. Graham, Michaely, and Roberts (2003) find that ex-day returns are actually higher after decimalization, which they attribute to a reduction in the tax rate on capital gains. Jakob and Ma (2004) likewise find that the ex-day phenomenon persists post-decimalization and that, contrary to the Bali and Hite (1998) model, price drops before decimalization were just as likely to be the tick above the dividend as the tick below.[5] Nevertheless, research is still ongoing. Using a slightly longer post-decimal period, Cloyd, Li, and Weaver (2004) find that ex-day abnormal returns *did* fall after decimalization and again

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[4] NYSE/AMEX conducted a decimalization "pilot" program with a handful of securities in late 2000 before all securities switched to decimal trading on 29 January 2001. NASDAQ began its own pilot program about a month before it switched to decimals on 9 April 2001.

[5] Bali (2003) plots ex-day returns over time along with bounds showing what they would have been had prices dropped by the tick just above and below the dividend. Since actual ex-day returns generally fall within these bounds, he interprets the results as consistent with the discreteness explanation. It is noteworthy, however, that the sample period for this study ends in 1994, prior to the "tightening" of these bounds in 1997 and 2001.

(though insignificantly) after a 2003 tax law change equalizing personal tax rates on dividends and capital gains.

While it is possible that one or more microstructure-based explanations may account for some of the variation in ex-day pricing, these hypotheses are not our primary focus. This dissertation focuses instead on the effects of personal and corporate taxes as they vary through time. The next chapter reviews important developments in the taxation of dividends and capital gains in the U.S. over the past century.

Chapter 3

Income Taxes in the United States, 1909-2004[6]

3.1 Personal Income Taxation

3.1.1 General History

The Constitution of the United States grants Congress the power to "lay and collect taxes, duties, imposts, and excises" to raise revenue for national defense and other public needs. Until the twentieth century, this was accomplished through collection of tariffs, duties, and excise taxes. The first tax on income was enacted in 1861 to raise revenue for the Union during the Civil War. In its final version, all income above a $600 standard deduction was taxed at 3 percent, with any additional income over $10,000 taxed at 5 percent. After the war ended, the need for revenue greatly declined. Since excise taxes on liquor and tobacco were then sufficient for the nation's needs, the tax on income was eliminated in 1872.

[6] Our general historical narrative of taxation is based largely on "History of the U.S. Tax System," a fact sheet published by the Department of the Treasury, available online at http://www.treas.gov/education/fact-sheets/taxes/ustax.html. Ordinary income tax rates were obtained primarily from the IRS data releases "Personal Exemptions and Individual Income Tax Rates, 1913-2002" and "Corporation Income Tax Brackets and Rates, 1909-2002," along with IRS Document 6583, "Tax Rates and Tables for Prior Years." Specific histories on the tax treatment of dividends and capital gains were pieced together from the two IRS data releases above, along with Pechman (1987), Burman (1999), Barclay (1987), Michaely (1991), Eades et al. (1994), Naranjo et al. (2000), recent editions of the *U.S. Master Tax Guide*, and AICPA *Statements of Tax Policy* No. 1, "Taxation of Capital Gains," and No. 3, "Elimination of the Double Tax on Dividends."

The income tax system as it currently operates in the United States is slightly less than a century old. An 1894 income tax was quickly rejected by the Supreme Court as unconstitutional since the tax was not proportional to the states' populations. To remove the proportionality requirement, Congress later passed the Sixteenth Amendment to the U.S. Constitution in July 1909, which was ratified by the necessary 36 states (i.e. 75 percent of the 48 states) by February 1913. The first income tax under this Amendment went into effect on 3 October 1913 and was applied to income received after 1 March 1913. The original tax law exempted $4,000 for married couples ($3,000 for singles), so that less than one percent of people actually paid taxes at the time. Income above the exemption was taxed at a "normal" rate of 1 percent, with a "surtax" ranging from 1 to 6 percent assessed on higher incomes, for a maximum combined rate of 7 percent.

Figure 2 illustrates how the maximum personal income tax rate has evolved over time. From the graph, it is obvious that there has been considerable variation, with initially low rates rising to their highest levels in the middle of the twentieth century before they began to decline in the 1960s. The first such tax increase, intended to raise revenue for World War I, occurred when the 1916 Revenue Act doubled tax rates on the bottom bracket from 1 to 2 percent and increased the top combined rate to 15 percent for taxpayers with over $2 million in income. With the 1917 War Revenue Act, the top rate immediately rocketed to an unprecedented 67 percent, while the income limit for the bottom bracket fell from $20,000 to only $2,000. These changes increased the number of people paying income tax from 1 to 5 percent.

With the end of World War I in 1918 and the strong economy of the 1920s, tax rates dropped significantly from 77 percent in 1918 to only 25 percent in 1925.

Unfortunately, the strong peacetime economy with low tax rates proved to be short-lived, as the low revenues of the Great Depression prompted a reinstatement of higher tax rates, with increases to 63 percent in 1932 and to 79 percent in 1936.

[Insert Figure 2 about here]

Even after these tax hikes, the overall burden of the income tax was comparatively small – only about 1 percent of personal income in 1939 compared to 10 percent in 1988. The burden continued to be shouldered almost entirely by the highest income earners until the 1940s, when taxes were raised further to finance World War II, ushering in a 23-year period of the highest personal income tax rates in American history. By the end of World War II in 1945, the rate on the lowest income bracket was 23 percent, the top rate reached its all-time high of 94 percent, and over ten times as many people as before the war were paying taxes. A slight 1946 reduction in these rates proved to be short-lived due to the onset of the Korean Conflict in the early 1950s.

At the behest of President Johnson, Congress passed a bill in February 1964 to accelerate economic growth by cutting taxes, as the late President Kennedy had urged. The top tax rate dropped from 91 to 70 percent over the two-year period from 1963 to 1965, while the low rate similarly dropped from 20 to 14 percent. Except for a series of surcharges levied from 1968-1970 to finance the Vietnam War, rates remained stable at these levels until 1981, when President Reagan signed the Economic Recovery Tax Act, similarly designed to stimulate economic growth by cutting marginal tax rates. By 1982, the top and bottom rates had again fallen, this time to 50 and 12 percent, respectively. However, some of the provisions of the 1981 Act were reversed in 1984 due to an unforeseen recession aggravated at the time by a tight monetary policy.

The 1986 Tax Reform Act is considered by many to be the most extensive overhaul of taxation in the late twentieth century. Motivated by the principle that high marginal tax rates stifle productivity, policymakers slashed the top individual rate over a two-year period to only 28 percent, the lowest since 1931[7]. Despite the rate reduction, the 1986 Act was approximately "revenue-neutral" – neither increasing nor decreasing total tax receipts significantly – because it broadened the tax base, thereby subjecting more types of income to taxation.

The lowest tax rate never exceeded 15 percent after 1988, but continued budget deficits soon prompted tax increases in 1991 and 1993, with rates on top income earners climbing first to 31 percent under President George H.W. Bush and then to 39.6 percent under President Clinton. However, the trend toward higher rates was reversed shortly after the inauguration of President George W. Bush in 2001, as Congress passed a series of tax cuts that reduced the lowest tax rate immediately to 10 percent while ultimately reducing the top rate to 35 percent by 2003.

3.1.2 Special Tax Rules for Capital Gains

Under the original 1913 tax law, capital gains by individuals were taxed as ordinary income at the standard rates. However, they have enjoyed preferentially low tax rates almost continuously since the passage of the Revenue Act of 1921. From 1922-1933, gains on assets held at least two years were taxed at a maximum rate of 12.5 percent, even though top ordinary rates ranged from 24 to 63 percent during the period.

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[7] The benefits of the lower 15 percent bracket and the allowable personal exemptions were phased out for some high-income taxpayers. This was accomplished by the creation of a temporary 33 percent bracket. Above the phaseout level, however, the marginal rate dropped back to 28 percent.

(Short-term gains continued to be taxed at the ordinary rate.) This initial rate ceiling benefited only taxpayers in the higher brackets, with the lowest-bracket investors enjoying *ordinary* rates no higher than 4 percent. In 1934, the 12.5 percent ceiling was abolished, and taxpayers were allowed to exclude a percentage of capital gains, ranging from 20 percent for assets held from 1-2 years to 70 percent for assets held longer than ten years.

In 1938, the rules were revised again to effectively set a 15 percent ceiling rate for capital gains on assets held at least 18 months and a 20 percent ceiling for those held for two years. The maximum rate was increased to 25 percent in 1942, but the minimum holding period needed to receive this rate was shortened to six months. Limiting the tax rate on capital gains to only 25 percent provided many investors with a powerful tax break during a period where ordinary rates ranged from 70 up to 94 percent. Arguably, investors in such an environment would be especially eager to receive income in the least-taxed form when they are able to choose.

Beginning in 1970, the rate ceiling was phased out for individuals with capital gains exceeding $50,000, but investors were still allowed a 50 percent exclusion on long-term gains. Thus, by 1972, high-income individuals could face a maximum long-term capital gains rate of 35 percent (i.e. half the ordinary 70 percent rate). The exclusion was increased to 60 percent in November 1978, resulting in a lower effective 28 percent ceiling rate. Several years later, the maximum rate was lowered to 20 percent for long-term gains realized after 9 June 1981.

The minimum holding period imposed on stockholders also changed from time to time. In 1977, investors were required to hold a stock for nine months to receive the preferentially low capital gains rate. Beginning in January 1978, this requirement was increased to one year before the six-month period was later reinstated in June 1984.

As previously mentioned, the 1986 Tax Reform Act made fundamental changes in taxation, generally reducing ordinary marginal rates but also subjecting more income to tax. As part of broadening the tax base, the Act eliminated the long-standing preferential treatment of capital gains. Capital gains were to be taxed at a maximum of 28 percent during the transitional year 1987 and at ordinary rates thereafter. However, the special tax status of capital gains was soon reinstated when they were exempted from the new, higher rates over 28 percent following the 1991 and 1993 tax increases (subject to a one-year holding period). The 1997 Taxpayer Relief Act left ordinary rates unchanged but reduced to 20 percent[8] the ceiling rate for long-term capital gains realized after 6 May 1997[9]. Finally, the Jobs and Growth Tax Relief Reconciliation Act of 2003 further reduced taxes on long-term gains realized after 5 May 2003, dropping the rate to 15 percent[10].

Historically, capital losses could be deducted against capital gains, although short-term losses have not always been deductible against long-term gains (and vice-versa). However, the deductibility of capital losses against ordinary income has usually been subject to a limit (currently $3,000 per year for individuals).

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[8] 10 percent for investors in the lowest tax bracket

[9] An 18-month holding period was in effect from 29 July 1997 to 31 December 1997.

[10] 5 percent for investors in the lowest two tax brackets

3.1.3 Taxation of Dividends

Dividends received by individuals have historically been taxed at ordinary rates regardless of the investor's holding period; thus, they have generally not been granted the same tax-favored status as capital gains. There are some minor exceptions, however. Before 1936, dividends actually were exempted from the low "normal" tax rates but were subject to surtax, which Pechman (1987) calls the "progressive element of the individual income tax." Beginning in 1954, married couples filing jointly were allowed an exemption of $100 ($50 for singles) for dividends paid by most U.S. corporations. In addition, a 4 percent tax credit was generally allowed on any non-exempt dividends, thereby reducing the marginal tax rate on dividend income slightly. The exemption was raised to $200 ($100 for singles) in 1964, but the credit was reduced to 2 percent and then eliminated the next year. In 1981 only, the exemption increased to $400 ($200 for singles) for dividends *and* interest income, but the previous rules were reinstated in 1982 before the exemption was finally eliminated altogether in 1987.

Exemption amounts of $100-$400 are of only limited benefit to taxpayers and have little bearing on our analysis since the marginal investor almost certainly receives more than $400 of dividends. Clearly, individual investors have received no large tax breaks on dividend income over time. The lone exception has occurred just recently. For the first time in American income tax history, a provision of the 2003 tax relief bill allows dividends received after 2002 to be taxed at the same low rate as long-term capital gains, currently 15 percent for most taxpayers[11]. To receive this special benefit, investors must hold the stock for over 60 days around the ex-date but are not required to have held

[11] 5 percent for investors in the lowest two tax brackets

the stock for a year. This rule clearly reduces the extent of double taxation for corporate income, but it has been criticized on the grounds that it primarily benefits higher income taxpayers.

3.2 Corporate Income Taxation

3.2.1 General History

The net income of corporations has been taxed since 1909, when the Payne-Aldrich Act first established an "excise" tax for the privilege of doing business in the United States. The tax, calculated as one percent of profits in excess of $5,000, was very small indeed by today's standards. After ratification of the Sixteenth Amendment in 1913, the excise tax was repealed and a comparable income tax formally took its place. Since then, the corporate income tax system has evolved separately alongside the personal tax system. As seen in Figure 3, basic corporate tax rates have changed through time in a manner qualitatively similar to that of personal tax rates, generally increasing to their highest levels in the mid-twentieth century before starting their decline to present-day levels.

[Insert Figure 3 about here]

A cursory comparison of Figures 2 and 3 suggests that the earnings of the highest-income individuals historically have been taxed far more heavily than that of top corporations. However, the actual difference is not as great as the graphs imply because corporations were frequently assessed an additional "excess profits" tax during wartime, usually calculated as a percentage of the corporation's earnings over and above its prewar profits. Although such taxes were assessed from 1917-1922 for World War I, from 1940-

1945 for World War II, and from 1950-1953 for the Korean War, they are not reflected in Figure 3 because to do so, we would need additional information about the percentage of companies whose revenue actually increased during the war. For the Vietnam War, a tax surcharge of 10 percent was added to the normal tax in 1968-1969, with a smaller 2.5% surcharge added in 1970. These adjustments are easily accounted for and hence are reflected in Figure 3.

3.2.2 Taxation of Capital Gains

The tax treatment of capital gains and losses on corporately owned stock has varied considerably through time. While individual investors received preferential treatment on long-term gains as early as 1922, corporations did not until 1942, when a 25 percent rate ceiling was applied to gains on stock held at least six months. This ceiling remained in effect through 1969 except for the aforementioned Vietnam War surcharge and for a slight increase to 26 percent from 31 March 1951 to 31 March 1954 for the Korean War. The corporate ceiling rate on long-term capital gains was increased to 28 percent (plus the war surcharge) in 1970 and to 30 percent the following year, where it remained until being reduced back to 28 percent in 1979. As with individuals, the minimum holding period required for corporations to receive special low rates on capital gains changed from time to time, increasing to nine months in 1977 and to 12 months the following year.

The tax-favored status of corporate capital gains was finally ended by the 1986 Tax Reform Act in an effort to broaden the tax base while reducing ordinary marginal rates. Long-term gains realized in 1987 were taxed at a maximum of 34 percent, which was to become the ordinary rate the following year. By 1988, all capital gains realized by corporations were fully taxed at the ordinary rate. With the passage of the 1993 Revenue Reconciliation Act, the ordinary rate applied to capital gains increased slightly to 35 percent for corporations with net incomes over $10 million. Despite the recent changes in personal tax laws, no further changes in the corporate rates have occurred to date.

3.2.3 The Intercorporate Dividend Exclusion

One of the greatest disadvantages to the corporate form of business is the problem of double taxation. Earnings are subject to income tax once at the corporate level, and again at the individual shareholder level when dividends are paid. When corporations invest directly in stock, however, earnings can actually be taxed three or more times before they finally reach shareholders. To avoid "triple taxation," corporations have been allowed to exclude a large percentage of dividends received from taxable income – a rule we refer to as the *intercorporate dividend exclusion* (ICDE).

Under the original 1909 excise tax, the ICDE was 100 percent, so that corporations paid no taxes on dividends from other corporations. This total exclusion continued until 1935, when it was lowered to 90%. Several years later the ICDE dropped to 85 percent, where it remained until the Tax Reform Act (TRA) of 1986. Under the TRA, the exclusion was reduced to 80 percent in 1987 before falling to its current level of 70 percent in 1988.[12]

3.3 Summary and Implications for Ex-Dividend Stock Prices

The EG model predicts that observed ex-dividend price drop ratios should systematically vary through time along with fluctuations in tax rates on dividends and capital gains. Figure 4 illustrates specifically the maximum rates on dividends and capital gains for individuals since the inception of the federal income tax. In most cases, dividends are taxed at the ordinary rate while capital gains are taxed at a lower preferential rate. The lower graph in Figure 4 also illustrates how the EG-implied ex-day price drop ratio (PDR) should change with the tax rates if high-income individuals are the marginal price setters. Two things from the graphs stand out. First, consistent with most empirical research to date, the implied PDR is almost always less than one. Second, while capital gains tax rates in the mid-twentieth century were comparable to those in effect today, ordinary dividend rates were much higher, sometimes over 90 percent. As a result, EG-implied PDRs are extremely low for this period.

[Insert Figures 4 and 5 about here]

Of course, the situation is quite different if corporations are the marginal price setters. Recall that corporations have always been allowed a significant exclusion of dividend income, ranging from 70 to 100 percent. Consequently, the effective corporate tax rate on dividend income has always been *lower* than that on capital gains, even when corporations were allowed the same kind of capital gains tax breaks granted to individuals. As a result, implied PDRs derived from corporate rates have always been *greater* than one, but exactly *how much* greater depends on the strategy employed by corporate traders around the ex-day. Ordinary corporate tax rates were highest between

[12] Special rules still allow a 100 percent exclusion for distributions within "affiliated groups" mostly owned

the early 1940s and the Tax Reform Act of 1986. Panel A of Figure 5 demonstrates that since short-term capital gains are always taxed at these normal rates, corporate "dividend capturers" should be willing to accept sizeable price drops – sometimes approaching twice the dividend amount – during this period. Meanwhile, as shown by Panel B, *long-term* gains were taxed at preferentially low rates, so corporations wishing to buy the stock cum-dividend and then actually hold it as an investment would not tolerate such a large ex-dividend price drop. However, since there is very little variation in the implied PDRs shown in Panel B, we focus on corporate investors primarily in the role of dividend capturers for the remainder of this study.

The present discussion raises a number of basic questions that we hope to shed some light upon. First, is the ex-day stock price drop systematically different from the dividend (as previous research has found), and does its relative magnitude vary systematically with tax rates as predicted by EG? Second, what type of investors influence ex-day stock prices – individuals, corporations, or both? Finally, do our answers change depending on different characteristics of the stock, such as its dividend yield and/or suitability for corporate dividend capture? The next chapter discusses several tax-based models of ex-dividend stock pricing and lays out more formally the key hypotheses of this study.

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by the same entity.

Chapter 4

Tax Models and their Empirical Predictions

4.1 The "Classic" Elton-Gruber (EG) Model

Elton and Gruber (EG 1970) mathematically derive the expected ex-dividend price drop ratio $\Delta P/D$ as a function of the tax rates t_d and t_{cg} on dividends and capital gains. Consider a stock originally purchased by an investor at price P_0. At a specified future time, the stock will pay a dividend D to the shareholders. (In reality, stocks usually go ex-dividend several days before the dividend payment, but the time value of money between these two dates is generally negligible.) Assume that the investor has already decided to sell the stock at the time of the dividend payment. The only choice remaining is whether to sell before the dividend (cum-dividend) at price P^{cum} or after the dividend (ex-dividend) at price P^{ex}. If the stock is sold cum-dividend, the investor's profit is the capital gain on the stock, less the capital gains tax paid, or

$$(P^{cum} - P_0)(1 - t_{cg}).$$

If the stock is sold ex-dividend, the investor's profit is the after-tax value of the dividend, plus the after-tax value of the reduced capital gain, or

$$D(1 - t_d) + (P^{ex} - P_0)(1 - t_{cg}).$$

If the seller is to be indifferent between selling cum-dividend and selling ex-dividend, then the profits from the two strategies must be equal. Equating these two expressions and rearranging terms, we see that

$$\frac{P^{cum} - P^{ex}}{D} = \frac{1 - t_d}{1 - t_{cg}}.$$

We refer to the left-hand side of the above equation as the *price drop ratio* (PDR), denoted $\Delta P/D$.

The EG model offers a possible explanation for why the stock price typically drops by less than the dividend amount on the ex-day. If $t_{cg} < t_d$, the equation above predicts that $\Delta P/D < 1$ (or equivalently, that $\Delta P < D$). For nearly all of the last century, the Internal Revenue Code has indeed allowed for a preferentially low personal tax rate on long-term capital gains, while dividend income was taxed at the ordinary, higher tax rate. Higher-tax bracket investors are likely to sell dividend paying stocks sometime prior to the ex-day, thus putting some downward pressure on the stock price prior to the dividend. Hence, the stock price is already partially reduced before the ex-day and need not fall by the full amount of the dividend *on* the ex-day. From this "classic" EG model, we obtain the following initial prediction:

Proposition 1: *Price drop ratios should be directly related to the quotient* $\frac{1 - t_d}{1 - t_{cg}}$*, calculated using personal and/or corporate tax rates on dividends and capital gains.*

In the same framework, Eades, Hess, and Kim (EHK 1984) demonstrate that taxes affect ex-day returns. They begin by noting that

$$R_{a\text{-}t} = \frac{P^{ex} - P^{cum}}{P^{cum}}(1 - t_{cg}) + \frac{D}{P^{cum}}(1 - t_d),$$

where $R_{a\text{-}t}$ is the after-tax ex-day return for an investor who sells after the dividend. Rearranging terms, we obtain

$$\begin{aligned} R_{a\text{-}t} &= \frac{P^{ex} - P^{cum}}{P^{cum}}(1 - t_{cg}) + \frac{D}{P^{cum}}[(1 - t_{cg}) - (t_d - t_{cg})] \\ &= \frac{P^{ex} - P^{cum} + D}{P^{cum}}(1 - t_{cg}) - \frac{D}{P^{cum}}(t_d - t_{cg}) \\ &= R\,(1 - t_{cg}) - \frac{D}{P^{cum}}(t_d - t_{cg}), \end{aligned}$$

where R is the stock's before-tax ex-day return. Solving for R then produces

$$R = \frac{R_{a\text{-}t}}{1 - t_{cg}} + \frac{D}{P^{cum}} \cdot \frac{t_d - t_{cg}}{1 - t_{cg}},$$

from which we derive the following prediction:

Proposition 2: *Ex-day returns should be directly related to the quotient* $\frac{t_d - t_{cg}}{1 - t_{cg}}$, *calculated using personal and/or corporate tax rates on dividends and capital gains.*

A more basic implication of Propositions 1 and 2 together is that higher dividend tax rates reduce ΔP/D and increase ex-day returns, while higher capital gains tax rates do the opposite. However, certain provisions in the tax code (either now or in the past) have served to increase or decrease effective tax rates from their statutory levels, and these features should impact ex-dividend stock price behavior. For example, the tax code has sometimes allowed for a limited amount of dividends to be excluded from taxable income, thereby reducing t_d to zero for some investors. However, individuals have never been allowed to exclude more than $400 of dividends per year. Assuming an average annual dividend yield of 1 percent, an investor owning as little as $40,000 of stock would have already exhausted the exclusion and would receive no further tax breaks on any additional dividend income. Therefore the personal dividend exemption is very unlikely to significantly affect ex-day pricing.

The law has usually allowed for a significant tax break on capital gains. However, those wishing to receive the lower tax rate t_{cg} have always been subject to a minimum holding period in order to encourage long-term investment. Currently, a stock must be held for one year to be eligible for a lower personal tax rate on capital gains, but this rule has changed frequently over time. By making it more difficult to obtain the lower rate, a longer holding period effectively raises t_{cg} to the ordinary rate for some investors, thereby weakening the hypothesized cause of the ex-day effect. The predicted impact on ex-dividend stock price behavior is stated below:

Proposition 3: *Price drop ratios should be higher, and ex-day returns lower, when more stringent requirements (e.g. longer holding periods) must be met to obtain a lower tax rate on capital gains.*

One of the key predictions of the EG tax clientele model is that sometime before the ex-date, lower-dividend yield stocks will end up in the hands of investors for whom dividends are taxed relatively heavily, while high-yield stocks end up with investors for whom dividends are taxed at lesser rates. In fact, the highest-yield stocks are often targeted by corporations for short-term dividend capture trading, provided they meet the eligibility requirements for the intercorporate dividend exclusion (ICDE)[13]. This means that the appropriate tax rates used to calculate implied PDRs and ex-day returns may be not be the same for every security:

Proposition 4: *For ICDE-eligible stocks with the highest dividend yields, the hypothesized relationships in Propositions 1 and 2 should be strongest when* t_d *and* t_{cg} *are the corporate tax rates on dividends and short-term capital gains, respectively. For lower-yield stocks, the relationships should be strongest when* $\frac{1-t_d}{1-t_{cg}}$ *and* $\frac{t_d - t_{cg}}{1-t_{cg}}$ *are calculated using personal tax rates on dividends and long-term capital gains.*

If higher-yield stocks are held by investors with the lowest relative tax rates on dividends, then these securities should also have the highest price drop ratios according to the basic EG equation. This implies that observed values of $\Delta P/D$ should be related to the stock's dividend yield. However, this relationship may be stronger at some times than at others. Arguably, if dividends and capital gains were taxed identically, there

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[13] Most distributions by domestic corporations are eligible for the ICDE.

would be no reason for tax clienteles at all. On the other hand, high top ordinary rates along with numerous lower tax brackets give rise to tax clienteles and a spectrum of implied PDRs. These predictions are summarized below:

> **Proposition 5:** *Price drop ratios generally should be directly related to dividend yields. For ICDE-eligible stocks with the highest dividend yields, this relationship should be strongest when the differential is greatest between corporate dividend and short-term capital gains tax rates. For other stocks, the relationship between PDR and dividend yield should be strongest when the differential is greatest between personal dividend and long-term capital gains rates.*

While it is clear that $\Delta P/D$ should increase with the dividend yield (D/P), it is not so clear whether ex-day *returns* should increase or decrease with D/P. This can be understood by examining the stock return equation derived by EHK (1984),

$$R = \frac{R_{a\text{-}t}}{1 - t_{cg}} + \frac{D}{P^{cum}} \cdot \frac{t_d - t_{cg}}{1 - t_{cg}}.$$

At first glance, it appears obvious that ex-day returns should be positively related to D/P so long as dividends are taxed more heavily than capital gains. This would be true if t_d and t_{cg} were constant across all securities for every investor. However, we have already noted that higher-yield securities will attract investors with *lower* dividend tax rates. Since ex-day returns are also directly related to t_d, the net effect of an increase in D/P on the expected ex-day return is unclear.

4.2 A Tax Timing Model of Ex-Dividend Price Behavior

While affirming the basic predictions of the EG and transaction costs models above, we now develop a new "tax timing" model addressing an additional consideration in ex-day pricing – specifically, the stockholder's ability to postpone the recognition of capital gains, thereby deferring taxes until a later date. While the simple EG model implicitly assumes that the investor has already decided to sell the stock at the time of the dividend distribution (the only decision being whether to sell just before or just after), we recognize that the investor may simply choose to hold the stock and sell it much later. This may be a viable option even for those in the highest tax brackets if they currently own stock with significant unrecognized capital gains. Dividends are usually quite small relative to stock prices, and the benefits from deferring capital gains taxes to a later date may very well be worth the cost of higher dividend taxes.

Consider the following simple example. Suppose we invested $10,000 one year ago in a stock whose value has since grown by 50 percent, making our holding worth $15,000 today. Suppose further that our capital gains tax rate t_{cg} = 25%, while the dividend tax rate t_d = 40%. The stock is about to pay a 0.5 percent quarterly dividend, or $75 in our case. If we sell now to avoid paying an additional $11.25 in dividend taxes (calculated as $75 times the 15 percent difference between the two tax rates), we must recognize a $5,000 capital gain and pay $1,250 in taxes now. The additional $11.25 may very well be an acceptable "financing cost" to delay a tax payment of $1,250 even for less than one quarter. Although the preceding example is perhaps overly simplistic, it does illustrate the basic reasoning behind our model.

We now develop the tax timing model formally. Assume that an investor buys a stock today for price P_0. At time T_1, a dividend D will be paid to shareholders, at which time the stock price will drop from P_1^{cum} to P_1^{ex}. In this model, the investor may sell the stock either immediately before the dividend distribution or immediately after. However, the investor may also wait until a specified later time T_2 and sell the stock then for price P_2. We assume that the investor behaves so as to maximize end-of-period wealth at T_2.

If the stock is sold cum-dividend, the investor's wealth at time T_1 is the selling price minus taxes paid on the gain, or

$$P_1^{cum} - (P_1^{cum} - P_0)\, t_{cg} ,$$

which is equal to

$$P_1^{cum}(1 - t_{cg}) + P_0\, t_{cg} .$$

By assumption, this amount is then reinvested in a similar security, where it subsequently grows at the required rate of return $k > 0$. At time T_2, the investor's pre-tax wealth is

$$[\, P_1^{cum}(1 - t_{cg}) + P_0\, t_{cg}]\, e^{k\tau},$$

where $\tau = T_2 - T_1$, which leaves

$$[\, P_1^{cum}(1 - t_{cg}) + P_0\, t_{cg}]\, e^{k\tau}(1 - t_{cg}) + [\, P_1^{cum}(1 - t_{cg}) + P_0\, t_{cg}]\, t_{cg}, \text{ or}$$

$$[\, P_1^{cum}(1 - t_{cg}) + P_0\, t_{cg}]\, [e^{k\tau}(1 - t_{cg}) + t_{cg}]$$

remaining after capital gains taxes are paid at time T_2. It is helpful to note that the factor

$$e^{k\tau}(1 - t_{cg}) + t_{cg}$$

above, which can also be written as

$$e^{k\tau} - (e^{k\tau} - 1)\, t_{cg},$$

captures the effect of growing an initial investment at rate k for a length of time τ and subsequently taxing the gain at rate t_{cg}.

If the investor sells ex-dividend, the situation is similar, except that his after-tax wealth at time T_1 is

$$D\,(1 - t_d) + P_1^{ex}\,(1 - t_{cg}) + P_0\, t_{cg},$$

which includes the after-tax value of the dividend and the *ex*-dividend capital gain. This amount is then reinvested in a similar security until T_2, at which time taxes are levied on the capital gain, leaving the investor with end-of-period wealth

$$[D\,(1 - t_d) + P_1^{ex}\,(1 - t_{cg}) + P_0\, t_{cg}]\,[e^{k\tau}\,(1 - t_{cg}) + t_{cg}].$$

Now suppose the investor never sells the stock until time T_2. In this case, the after-tax dividend proceeds $D(1 - t_d)$ are reinvested until T_2, at which point taxes are assessed on the additional gain. The stock price grows at rate k from its ex-dividend level P_1^{ex}, but the final stock sale is taxed with respect to the *original* basis of P_0. Thus, the investor's end-of-period after-tax wealth is

$$D\,(1 - t_d)\,[e^{k\tau}\,(1 - t_{cg}) + t_{cg}] + [\,P_1^{ex}\, e^{k\tau}\,(1 - t_{cg}) + P_0\, t_{cg}].$$

Note that this is equal to the previous expression when $k = 0$ or $\tau = 0$, corresponding to the trivial case where there is either no return from future investment or no time left in which to invest.

We now derive necessary and sufficient conditions so that holding the stock is better than selling it ex-dividend and reinvesting the proceeds – that is,

$$D\,(1 - t_d)\,[e^{k\tau}\,(1 - t_{cg}) + t_{cg}] + [\,P_1^{ex}\, e^{k\tau}\,(1 - t_{cg}) + P_0\, t_{cg}] > \ldots$$

$$[D\,(1 - t_d) + P_1^{ex}\,(1 - t_{cg}) + P_0\, t_{cg}]\,[e^{k\tau}\,(1 - t_{cg}) + t_{cg}].$$

We immediately notice that the dividend term is the same on both sides of the inequality. This is no surprise since the dividend is taxed and reinvested identically in both cases. Thus, we are left with the inequality

$$P_1^{ex}\, e^{k\tau}\,(1 - t_{cg}) + P_0\, t_{cg} > [\,P_1^{ex}\,(1 - t_{cg}) + P_0\, t_{cg}]\,[e^{k\tau}\,(1 - t_{cg}) + t_{cg}].$$

Rearranging terms, we have

$$P_1^{ex}\, e^{k\tau}\,(1 - t_{cg}) - P_1^{ex}\,(1 - t_{cg})\,[e^{k\tau}\,(1 - t_{cg}) + t_{cg}] > P_0\, t_{cg}\,[e^{k\tau}\,(1 - t_{cg}) + t_{cg}] - P_0\, t_{cg},$$

which, after grouping terms and factoring, yields the inequality

$$P_1^{ex}\,(1 - t_{cg})(e^{k\tau} - 1)\, t_{cg} > P_0\, t_{cg}\,(e^{k\tau} - 1)\,(1 - t_{cg}).$$

Assuming (trivially) that $0 < t_{cg} < 1$, this simplifies easily to

$$P_1^{ex} > P_0.$$

Thus, the mathematics confirms our intuition that when the ex-dividend stock price is higher than the price originally paid for the stock, it is better to continue holding the stock if feasible and put off recognizing the capital gain for tax purposes, assuming we do not sell cum-dividend.

If the stock price at time T_1 is *lower* than the price originally paid, it is optimal to sell immediately to recognize the capital loss for a tax deduction. In this case nothing is different from the EG model. Since our third strategy (holding the stock) is suboptimal, the investor has a choice between selling cum-dividend and selling ex-dividend. If we equate end-of period wealth from these two investment strategies, we have

$$[\,P_1^{cum}\,(1–t_{cg}) + P_0\, t_{cg}]\,[e^{k\tau}\,(1–t_{cg}) + t_{cg}] = [D\,(1–t_d) + P_1^{ex}\,(1–t_{cg}) + P_0\, t_{cg}]\,[e^{k\tau}\,(1–t_{cg}) + t_{cg}],$$

which reduces to

$$P_1^{cum}\,(1 - t_{cg}) + P_0\, t_{cg} = D\,(1 - t_d) + P_1^{ex}\,(1 - t_{cg}) + P_0\, t_{cg}, \text{ and}$$

$$\frac{P^{cum} - P^{ex}}{D} = \frac{1 - t_d}{1 - t_{cg}},$$

the familiar EG equation.

Of course, stock prices actually rise more often than they fall. When $P_1^{ex} > P_0$, selling ex-dividend and reinvesting in a similar security is not rational, so the investor must choose between selling cum-dividend (avoiding the higher tax rate on dividend income) and simply continuing to hold the stock (incurring dividend taxes but delaying capital gains taxes). For an investor to be indifferent between these two strategies, end-of-period wealth must be the same for either alternative; that is,

$$[P_1^{cum}(1-t_{cg}) + P_0t_{cg}]\,[e^{k\tau}(1-t_{cg}) + t_{cg}] = D(1-t_d)\,[e^{k\tau}(1-t_{cg}) + t_{cg}] + P_1^{ex}\,e^{k\tau}(1-t_{cg}) + P_0t_{cg}.$$

Rearranging terms, we have

$$P_1^{cum}(1 - t_{cg})\,[e^{k\tau}(1 - t_{cg}) + t_{cg}] - P_1^{ex}\,e^{k\tau}(1 - t_{cg}) + P_0\,t_{cg}\,[e^{k\tau}(1 - t_{cg}) + t_{cg}] - P_0\,t_{cg}$$

$$\ldots = D\,(1 - t_d)\,[e^{k\tau}(1 - t_{cg}) + t_{cg}],$$

or

$$P_1^{cum}(1-t_{cg})[e^{k\tau}(1-t_{cg}) + t_{cg}] - P_1^{ex}\,e^{k\tau}(1-t_{cg}) + P_0t_{cg}(e^{k\tau}-1)(1-t_{cg}) = D(1-t_d)[e^{k\tau}(1-t_{cg}) + t_{cg}].$$

Unfortunately, the greater complexity of this equation does not allow us to derive a concise mathematical expression for $\Delta P/D$ as EG do. However, ex-day pricing in this modified framework can be understood qualitatively as follows. When dividends are taxed more heavily than capital gains, there would normally be an incentive for taxpaying investors to sell their stock before it goes ex-dividend. Consequently, the ex-day stock price drop ΔP is less than the dividend D. However, the incentive to sell may be weakened (or perhaps completely overshadowed) by the fact that *if the investor decides to sell an appreciated stock, capital gains taxes can be delayed no further.* By retaining the stock and receiving the dividend, he retains control over the timing of capital gains recognition. Thus, the ability to postpone capital gains taxes creates a counterincentive *not* to sell the stock – and the larger the unrealized capital gain, the stronger the counterincentive. It follows that for such stocks, the ex-day effect should be weaker; that is, ΔP/D should be higher than EG predict. In fact, in this modified framework, the expected price drop ΔP would be *greater* than the dividend D if dividends and capital gains were taxed at the same rate. We now show this formally.

Suppose $P_1^{ex} > P_0$ and $t_d = t_{cg} = t$. Beginning with the most recent equation above, we have

$$P_1^{cum}(1-t)\,[e^{k\tau}(1-t)+t] - [\,P_1^{ex}\,e^{k\tau}(1-t) - P_0\,t\,(e^{k\tau}-1)(1-t)] = D(1-t)\,[e^{k\tau}(1-t)+t],$$

which, after dividing through by $(1-t)\,[e^{k\tau}(1-t)+t]$, becomes

$$P_1^{cum} - \left[P_1^{ex}\,\frac{e^{k\tau}}{e^{k\tau}(1-t)+t} - P_0\,t\,\frac{e^{k\tau}-1}{e^{k\tau}(1-t)+t}\right] = D.$$

Since $P_1^{ex} > P_0$, we know that

$$P_1^{ex}\,\frac{e^{k\tau}}{e^{k\tau}(1-t)+t} - P_0\,t\,\frac{e^{k\tau}-1}{e^{k\tau}(1-t)+t} > P_1^{ex}\,\frac{e^{k\tau}}{e^{k\tau}(1-t)+t} - P_1^{ex}\,t\,\frac{e^{k\tau}-1}{e^{k\tau}(1-t)+t}$$

$$= P_1^{ex}\,\frac{e^{k\tau}-t\,(e^{k\tau}-1)}{e^{k\tau}(1-t)+t}$$

$$= P_1^{ex}\,\frac{e^{k\tau}(1-t)+t}{e^{k\tau}(1-t)+t}$$

$$= P_1^{ex}.$$

Combining this result with the equation above yields

$$P_1^{cum} - P_1^{ex} > D,$$

so that $\Delta P/D > 1$, as expected. Of course, this result is not usually observed *in general*. Most studies find that $\Delta P/D < 1$ on average, and some reach this conclusion even when $t_d = t_{cg}$. A failure to document average price drops greater than the dividend should not be interpreted as an outright rejection of the tax timing model. We must remember that there are two sides to every transaction. The timing model considers the ex-day pricing problem from the viewpoint of prospective security *sellers*, but the tax situation of a prospective *buyer* around the ex-date is different. Buyers are unaffected by the security's *past* performance; they need to know only the current price and expected future changes. Just as we demonstrate that the seller's equilibrium price drop ratio is higher than that implied by EG for appreciated stocks, Booth and Johnston (1984) demonstrate that the buyer's equilibrium PDR is *lower*. In continuous time, their "unrealized capital gains" model implies that

$$\frac{\Delta P}{D} = \frac{1 - t_d}{1 - e^{-k\tau} t_{cg}}.$$

Clearly both sides are relevant. The tax situation of buyers helps affects the demand for the security, while the tax situation of sellers affects the supply of the security for sale. The interaction of the two then determines the stock price. In this dissertation, however, we focus on the implications of the tax timing model that are not contradicted by their demand-side counterpart.

[Insert Figure 6 about here]

Again, the impact of recent stock price performance adds a layer of complexity to the timing model, so that it is not possible to derive an EG-style expression for the price drop ratio. Nevertheless, the expected ex-dividend price can be computed when more specific information about the security in question is known. Figure 6 illustrates the price drop ratios and ex-day returns implied by the EG and EHK equations versus those implied by the tax timing model. EG-implied PDRs are calculated for various dividend tax rates assuming a capital gains rate of 20 percent. EHK-implied returns are computed for a stock whose value is $100 before a $0.50 dividend. In calculating the timing model-implied values, we further assume that the stock was originally purchased for $80, that its expected rate of return k is 10 percent, and that the reinvestment period τ is three months (0.25 years). Confirming our prior theoretical arguments, the tax timing model predicts higher PDRs and lower ex-day returns than the classic model.

The central prediction of the tax timing model is that recent stock price performance affects ex-dividend price behavior by influencing investors' decisions about whether to sell. We formally state this prediction as follows:

> **Proposition 6:** *Price drop ratios should be directly (and ex-day returns inversely) related to the stock's recent price performance. This relationship should be stronger for low-yield stocks and for those that have recently increased rather than decreased in value.*

Figure 7 illustrates the timing model-implied price drop ratios and ex-day returns for a stock originally purchased for $80 that has since grown to a cum-dividend value of $100, assuming dividend and capital gains tax rates of 40 and 20 percent, respectively. Although the extent of the variation depends on parameters such as the dividend yield and reinvestment period, one thing is clear. In every case, the cheaper the stock was originally acquired (i.e. the greater the unrealized capital gain), the higher the implied

PDR and the lower the ex-day return. The only exception occurs when the stock was originally acquired at a higher price than its current value (i.e. when a loss has occurred), in which case the PDRs and ex-day returns assume the same values implied by the "classic" model.

[Insert Figure 7 about here]

Strictly speaking, the tax timing model implies that there is *no* covariation between $\Delta P/D$ and $(P_1^{cum} - P_0)$ for stocks that have recently declined in value. Empirically, though, we may still observe some relationship because not all investors will have purchased the security at the same time and price. In other words, one investor may have experienced a net gain while another experienced a net loss, even though both currently hold the same security.

The strength of the relationship between ex-day price behavior and recent stock price performance may also depend on the dividend yield. First, as implied by Figure 7, the relative importance of putting off capital gains taxes declines when the dividend (and its associated taxes) are greater. Second, since the highest-yield stocks are often targeted for short-term dividend capture, longer-term accrued capital gains may be little or no issue for them.

If true, Proposition 6 has important implications for the numerous "before and after" studies of how a particular event affected ex-dividend stock price behavior. Without accounting for previous stock price performance, changes in price drop ratios (or lack thereof) might erroneously be associated with the event in question, leading to incorrect conclusions.

The notion that investors may retain past "winners" and sell past "losers" for tax reasons is not entirely new. Indeed, it is a commonly cited explanation for the well-known "January effect," where stocks (particularly smaller ones) tend to perform better during the first few days of the new year. We do not deny that investors may be especially sensitive to the tax consequences of their decisions late in the year. For this reason, we also test the following proposition:

> **Proposition 7:** *For stocks that have recently appreciated (declined) in value, price drop ratios should be higher (lower), ex-day returns lower (higher), and abnormal trading volume lower (higher) for ex-dividend days that occur in the last quarter of the year than for ex-dividend days occurring in the first three quarters.*

Even if Proposition 7 proves true, investors still should not ignore the tax consequences of their trading decisions earlier in the year. For example, one should not necessarily wait until the end of the year to sell a stock whose price has declined. It may be advantageous to sell a losing stock earlier to "lock in" the tax deduction. After all, the deduction may be lost if the stock price were to rebound later in the year. (In fact, if there were no transaction costs and capital losses were always fully deductible, investors would optimally sell a stock after *every* price decline – no matter how small – whenever the current stock price is less than the basis.) In addition, even if a capital gain is realized early in the year, *it is still realized, and taxes will be paid.* Nevertheless, investors may be especially reluctant to realize capital gains before ex-dates that are in the last quarter since only a short wait is required to push the gain into the next tax year.

In any event, we affirm the basic premise of EG and subsequent tax-based models that there is tax-motivated trading around ex-dividend dates. Investors must decide whether to retain the stock and receive the dividend or to sell cum-dividend and receive a higher capital gain. The relative attractiveness of selling surely must be influenced by whether it would result in a taxable gain or a deductible loss.

4.3 Investor Anticipation of Tax Law Changes

We wish to make one further generalization. Both the EG model and our modified tax model above assume that tax rates t_d and t_{cg} are constant, or at least that traders make decisions based only on the current rates. In reality, investors *know* that politicians cannot leave the tax code alone. In many cases, investors can even anticipate the direction and extent of future changes in taxation. Candidates elected in November usually are not sworn into office until the following January, and their positions on tax policy are generally well understood prior to the election. Furthermore, when tax legislation is ultimately passed, it usually comes as no surprise, as there have been months of preparation and debate beforehand. Sometimes changes in tax rates are even scheduled explicitly by the tax code itself. For all these reasons, it is realistic to believe that investors often predict future tax rates with reasonable accuracy.

Armed with such knowledge, traders can do better still. For example, if we knew that Congress and the President were likely to reduce tax rates on capital gains next year, we would be wise to hold off on selling our stock at least until then. This creates a powerful counterincentive *not* to sell an appreciated stock cum-dividend, even though holding it would force us to pay a higher tax rate on dividends received in the meantime. This counterincentive works just as described in the previous section – i.e., to raise ΔP/D and lower ex-day returns. Suppose, however, that a different party gained control of Congress and the White House, and that capital gains tax rates were likely to rise next year. A marginal investor on the ex-day who otherwise would have been slightly better off holding the stock might now be influenced to sell it and avoid next year's higher tax rate. In this case, we would expect to see lower price drop ratios and higher ex-day returns for appreciated stock. Financial planners frequently advise their clients to employ such dynamic tax-avoidance strategies[14] and, as shown by a recent example, corporations are often happy to help their shareholders in this matter[15]. It is not unreasonable to think that such considerations may be the deciding factor for a "marginal" investor who must decide whether to sell his stock prior to the ex-day. It is also not unreasonable to think that investors may be especially aware of these tax issues late in the year. For these reasons, we make the following prediction:

> **Proposition 8:** *Price drop ratios will be higher, and ex-day returns lower, for appreciated stocks preceding a reduction in the capital gains tax rate.*

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[14] See, for example, the discussion on tax planning by Harden, Biggart, and Richmond (2003).
[15] "Microsoft to Dole Out Its Cash Hoard," 21 July 2004, *Wall Street Journal*, p. A1.

Chapter 5

Data and Empirical Tests

5.1 Sample Selection

Our largest sample for this study consists of all taxable cash dividends[16] paid to holders of NYSE- or AMEX-listed stocks identified by the Center for Research in Security Prices (CRSP) from July 1962 to December 2003. In some cases, a firm has more than one distribution with the same ex-date. When this occurs, we combine them into a single observation if they are *all* regular taxable cash dividends as defined above. Otherwise, all distributions by that firm for that ex-date are deleted from the sample. We also eliminate dividends with ex-dates occurring less than four trading days after the firm's previous ex-date, dividends smaller than $0.01, and those paid by "penny stocks" trading at less than $1 per share. To ensure that measures of ex-day price changes are meaningful, we require that the stock be actively traded (i) on the ex-day itself or one of the following five trading days, *and* (ii) on the cum-day itself or one of the preceding five trading days. There must also be no change in shares outstanding between the cum- and ex-days due to a stock split or other event. Finally, following Naranjo, Nimalendran, and Ryngaert (NNR 2000), we limit the sample to only those firms identified as domestic corporations (CRSP share type codes 10 and 11) so that all dividends are treated the same with respect to eligibility for the intercorporate dividend exclusion (ICDE). This group of dividends comprises our "CRSP" sample.

Since CRSP provides daily prices only back to 1962, most studies of ex-dividend stock price behavior do not use data from before that time. This is understandable but nonetheless unfortunate because tax rates then were often very different from those in more recent times. One of the most important contributions of this dissertation is to examine ex-dividend stock price behavior over a long period of time, including the pre-1962 era that has received almost no attention in the literature so far. Unfortunately, the only way to obtain daily stock prices from that period is to hand-collect them from old newspapers. To say the least, creating a comprehensive database of cum- and ex-dividend prices from 1962 back to the inception of the income tax would be a daunting task. Therefore, we construct a second sample consisting of dividends paid by only those stocks in the Dow Jones Industrial Average. We choose this "Dow" sample both because it is small enough to keep the task of data collection manageable and because it consists of well-known, actively traded companies for which reliable prices are usually readily available. Admittedly, the composition of our Dow sample shifts through time as firms are added to and drop out of the index. However, this is also true of the entire universe of NYSE/AMEX-listed stocks on CRSP. Furthermore, we have no reason to suspect that the sample varies in any way that would systematically bias our results.

The Dow sample is constructed as follows. From July 1962 to December 2003, ex-dividend dates, dividend amounts, and close-to-close stock price changes are obtained from CRSP. From January 1926 to June 1962, ex-dates and dividend amounts are

[16] Dividends with a CRSP distribution of the form 12N2, where N is any digit from 1 to 9

obtained from CRSP, and close-to-close stock price changes are obtained from the *Wall Street Journal*. From January 1910 to December 1925, ex-dates and stock prices are obtained from the *Wall Street Journal*, and dividend amounts are inferred from the prices and the daily change reported for the ex-day[17].

Of course, if the reported results for the CRSP and Dow samples were different, it might be unclear whether the discrepancy was due to the use of different sample firms or a different time period. To facilitate comparisons, we also create a "Post-1962 Dow" sample, which consists of observations in both samples above. Thus, differences between the CRSP and Post-1962 Dow samples are most likely due to characteristics of firms included in the two samples, while differences between the Dow and Post-1962 Dow samples are probably due to the sample period employed.

5.2 Dependent Variables

Historically, studies have used two inversely related measures to gauge the behavior of ex-dividend stock prices. The first of these – the price drop ratio (PDR), or $\Delta P/D$ – is intuitively appealing because it explicitly compares the two quantities of interest. In this study, ex-dividend price drops are calculated as

$$\Delta P^{*} = P^{cum} - \frac{P^{ex}}{1 + R^{m,ex}},$$

[17] The daily price change reported in the *Wall Street Journal* is computed as

Daily change = Today's closing price – Previous closing price + Dividend,

so the dividend amount can be inferred as

Dividend = Daily change + Cum-day closing price – Ex-day closing price.

where $R^{m,ex}$ is the return on an appropriate index of peer firms realized on the stock's ex-day. For the CRSP sample, we use the CRSP NYSE/AMEX/NASDAQ equally-weighted market index; for the two Dow samples, we use the Dow Jones Industrial Average. Note that the ex-day closing price P^{ex} is specifically market-adjusted in order to better isolate the idiosyncratic component of the price movement.[18] P^{ex} is normally the closing price on the ex-day itself. However, when there is no trading volume on the ex-day, P^{ex} is defined as the first available closing price after the ex-day, provided that at least one of the following five days has positive trading volume. Similarly, when there is no trading volume on the cum-day itself, P^{cum} is the first available closing price *before* the cum-day, so long as a trade occurs on at least once in the preceding five days. When either P^{cum} or P^{ex} must be adjusted in this manner, $R^{m,ex}$ is also adjusted to reflect the cumulative market return over the appropriate interval.

As an ex-day pricing measure, the price drop ratio is not without its statistical problems. Probably the most significant issue is that a given price fluctuation has a greater impact on the ratio $\Delta P^*/D$ for smaller dividends. Thus, parameter estimates depend heavily on what price fluctuations occur around the smallest dividends – even though these fluctuations for the most part have nothing to do with the dividends. To reduce the distortion caused by outliers, we calculate $\Delta P^*/D$ individually for each dividend and then remove observations in the upper and lower 1 percent of each sample. This reduces the influence not only of extremely small dividends but also of

[18] Theoretically, we should multiply the market return by the stock's beta as part of the adjustment. However, precise estimation of beta is difficult due to a variety of problems, including non-stationarity concerns and the necessity of price data over an estimation period (which would vastly increase the amount of data that would have to be hand-collected). In addition, if the empirically observed Security Market Line (SML) is flatter than theory implies, it is not altogether clear whether using the steeper, theoretical SML is better than no beta adjustment at all.

extraordinarily large price fluctuations due to major market disruptions (e.g. 1929 market crash, 9/11).

The second type of quantity frequently used to measure ex-dividend price behavior is the stock's ex-day *return*, including both the dividend yield and capital gain (or loss) yield. Although it is a less direct comparison of the price drop versus the dividend, the ex-day return is less prone to distortion by small dividends than the PDR. In this study, ex-dividend market-adjusted returns are computed as

$$\mathrm{MAR}^{ex} = \frac{\dfrac{\mathrm{P}^{ex}}{1+\mathrm{R}^{m,ex}} - \mathrm{P}^{cum} + \mathrm{D}}{\mathrm{P}^{cum}},$$

Where P^{ex}, P^{cum}, and $\mathrm{R}^{m,ex}$ are as defined above.

5.3 Empirical Tests

Now that we have described our samples and dependent variables, we turn our attention to testing the key predictions of the tax-based models developed in Chapter 4.

5.3.1 Testing Traditional Tax Models of Ex-Dividend Price Behavior

The classic tax model of ex-dividend price behavior implies that the expected price drop ratio (PDR) is a function of the dividend and capital gains tax rates t_d and t_{cg}. As an initial check of this theory, we test Proposition 1 on each of our three samples (i.e. CRSP, Dow, and Post-1962 Dow) by regressing[19] PDRs on the EG-implied quantity

[19] All tests of the EG tax clientele model are carried out using ordinary least squares (OLS). Qualitatively similar results were also obtained using maximum likelihood estimation (MLE) allowing for heteroskedasticity related to dividend amount.

$\left(\frac{1-t_d}{1-t_{cg}}\right)$ computed from the personal and corporate tax rates on dividends and capital gains in effect at the time of each dividend. Of course, individual investors do not all face the same marginal rate. The usual approach is to consider only the marginal rate on the highest tax bracket. However, the income level to which the top personal tax rate is applied has fluctuated considerably, ranging from $30,000 to $5 million through time. Therefore, we estimate all regressions involving personal tax rates two ways – once using rates levied on the highest income bracket, and once using the marginal rates faced by an individual with a constant inflation-adjusted[20] income of $200,000 (in real 2003 dollars). For regressions involving corporate tax rates, however, we use only the rates that would be faced by a corporate dividend capturer in the highest bracket. We do not use an alternative inflation-adjusted set of tax rates for corporate income because the threshold for maximum corporate tax brackets never exceeded $100,000 until 1984. Even after 1984, however, there was never a sizeable difference between the tax rates in any of the higher brackets. The specific equations estimated are

$$PDR_i = \alpha_0 + \alpha_1 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers max}} + \varepsilon_i ,$$

$$PDR_i = \alpha_0 + \alpha_1 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers infl-adj}} + \varepsilon_i , \text{ and}$$

$$PDR_i = \alpha_0 + \alpha_1 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ corp}} + \varepsilon_i .$$

[20] Income values were adjusted for inflation according to the Consumer Price Index (CPI).

Positive coefficients estimates $\hat{\alpha}_1$ are expected for one or more sets of implied PDRs, with their magnitudes an indication of both *how much* taxes impact the ex-day price drop and what type of investor is most influential. Our initial results in Table 1 show considerable support for the idea that personal tax rates influence the price drop-to-dividend ratio. Coefficient estimates $\hat{\alpha}_1$ are positive (and usually significant) in all samples when *either* set of personal tax rates (i.e. maximum or inflation-adjusted) is used in the classic EG formula.

Nevertheless, several questions are raised. First, we immediately notice that estimates of α_1 are similarly *negative* using corporate tax rates – implying that PDRs tend to move in the *opposite* direction from what EG would predict if corporate dividend capturers were the marginal price setters. A visual examination of Figure 4 and Panel A of Figure 5 reveals a strong negative relation between the PDRs implied by corporate dividend capture tax rates and those implied by individual rates. Collectively, these findings are consistent with individuals, and not corporations, being the marginal investors on the ex-dividend day. We also note that not all estimates of α_1 are statistically significant. The insignificance of the estimate using inflation-adjusted tax rates in the Post-1962 Dow sample ($\hat{\alpha}_1 = 0.2674$) is understandable given its unusually high standard error of 0.2240. The estimate itself is actually very comparable with others in Table 1 that are significant. However, the same cannot be said for the estimate using maximum tax rates in the Dow sample ($\hat{\alpha}_1 = 0.0426$); it is simply much smaller. The insignificance of this estimate suggests that the marginal investor on the ex-day may be better characterized as an individual with a reasonably (but not excessively) high income.

This may be particularly true during part of the earlier 20th century when only incomes in excess of $1 million were taxed at the highest rate.

[Insert Tables 1 and 2 about here]

Theory does not suggest that market-adjusted returns (MARs) depend on tax rates alone. However, Eades, Hess, and Kim (EHK 1984) show that ex-day returns should be positively related to $\frac{t_d - t_{cg}}{1 - t_{cg}}$, as stated in Proposition 2. Therefore, we similarly perform the following regressions for returns:

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \left(\frac{t_d - t_{cg}}{1 - t_{cg}} \right)_{i,\text{ pers max}} + \varepsilon_i ,$$

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \left(\frac{t_d - t_{cg}}{1 - t_{cg}} \right)_{i,\text{ pers infl-adj}} + \varepsilon_i , \text{ and}$$

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \left(\frac{t_d - t_{cg}}{1 - t_{cg}} \right)_{i,\text{ corp}} + \varepsilon_i .$$

As before, we expect γ_1 to be positive, depending on the importance of taxes in ex-day pricing and the relative market influence of different types of investors. The results for MARs (shown in Table 2) are largely consistent with our tests of Proposition 1 with PDRs. When $\left(\frac{t_d - t_{cg}}{1 - t_{cg}} \right)$ is calculated using personal tax rates, all of our estimates $\hat{\gamma}_1$ are positive, and all but one are significant. Furthermore, all estimates of γ_1 are significantly *negative* when corporate tax rates are used. As before, the estimated coefficient ($\hat{\gamma}_1$ = 0.000422) using maximum personal tax rates in the Dow sample is much smaller in magnitude than all the others and is no more than about one standard error from zero.

These findings reinforce our earlier conclusions that ex-dividend day stock price changes in general are affected by personal tax rates, that the marginal ex-day investor is not necessarily always in the highest income bracket, and that corporate dividend capturers are not the marginal price setters for our sample period as a whole.

Whenever capital gains have been taxed preferentially, the tax code has always required investors to hold a stock for a minimum length of time (ranging from 6 to 18 months) in order to qualify for a lower rate. This has the effect of encouraging long-term investing, but it also increases the effective capital gains tax rate for those who are unable or unwilling to hold the stock for the designated number of months. To test the effect of holding period requirements, our initial regressions are augmented with the variables $CGHOLD_{i,pers}$, the number of months an individual must hold a stock to qualify for the lower rate on capital gains. We do not include a holding period variable for corporations, since dividend capturers are by definition not interested in holding the stock long-term. For price drop ratios, we estimate

$$PDR_i = \alpha_0 + \alpha_1 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers max}} + \alpha_2\, CGHOLD_{i,pers} + \varepsilon_i \quad \text{and}$$

$$PDR_i = \alpha_0 + \alpha_1 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers infl-adj}} + \alpha_2\, CGHOLD_{i,pers} + \varepsilon_i \, .$$

For ex-day market-adjusted returns, the appropriate regressions are

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \left(\frac{t_d - t_{cg}}{1-t_{cg}}\right)_{i,\text{ pers max}} + \gamma_2\, CGHOLD_{i,pers} + \varepsilon_i \quad \text{and}$$

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \left(\frac{t_d - t_{cg}}{1-t_{cg}}\right)_{i,\text{ pers infl-adj}} + \gamma_2\, CGHOLD_{i,pers} + \varepsilon_i \, .$$

The capital gains tax break was not implemented until 1922 and disappeared briefly from 1988-1990 after the Tax Reform Act of 1986. Since the variable CGHOLD cannot be defined during these periods when the dividend and capital gains rates were identical, only ex-dividend dates from 1922-1987 and 1991-2003 are included in the aforementioned regressions. As suggested by Proposition 3, we expect the length of the capital gains holding period to be positively related to PDR (so that $\alpha_2 > 0$) and negatively related to MAR^{ex} (so $\gamma_2 < 0$). Our results for PDRs and MARs, reported in Tables 3 and 4, respectively, are very supportive of this prediction. All estimates $\hat{\alpha}_2$ are positive and most are significant. Similarly, all estimates $\hat{\gamma}_2$ are negative and all but one are significant. Thus, longer holding periods appear to make it more difficult to realize the tax break on capital gains (the hypothesized cause of the ex-day anomaly), thereby causing PDRs to increase toward 1 and abnormal returns to decline toward zero. Admittedly, some of the estimated coefficients $\hat{\alpha}_1$ for our tax variable $\left(\frac{1-t_d}{1-t_{cg}}\right)$ do not have the hypothesized signs and significance levels generally observed in Table 1. We suspect, however, that this is caused by multicollinearity between the tax and holding period variables. The required holding period had its lowest value (6 months) from 1942 to 1976 – a period which also saw some of the largest differentials between dividend and capital gains tax rates and the lowest EG-implied PDRs of the 20th century. Therefore, our CGHOLD estimates $\hat{\alpha}_2$ and $\hat{\gamma}_2$ may be driven by the capital gains holding period or by the tax rates themselves (or some combination of the two), but in either case, the results support the tax argument.

[Insert Tables 3 and 4 about here]

So far, we have tested the impact of both personal and corporate tax rates on all stocks in our samples. If the tax clientele model holds, though, higher-dividend yield stocks will attract different investors than lower-yield stocks. Therefore, different sets of tax variables may be appropriate for securities with different dividend yields. Following EHK (1994) and NNR (2000), we sort each of our three samples quarterly into quintiles by dividend yield (D/P^{cum}). Stocks falling into the highest quintile become part of our high-yield (HY) subsample, while those in the bottom four quintiles comprise the low-yield (LY) group. The initial set of regressions is then repeated on the newly formed subgroups. High-dividend yield stocks would most likely attract corporations, who are taxed much more heavily on capital gains, while other stocks would probably be held by individuals, who are taxed more heavily on dividends. Therefore, Proposition 4 states that the tax variables $\left(\frac{1-t_d}{1-t_{cg}}\right)_{i,corp}$ and $\left(\frac{t_d-t_{cg}}{1-t_{cg}}\right)_{i,corp}$ calculated using "corporate dividend capture" rates should have more predictive power in the HY groups[21], while personal tax rate variables should dominate in the LY subsamples. Our results for PDRs and MARs are shown in Tables 5 and 6, respectively. As expected, ex-dividend price behavior in the LY group is very similar to that in the entire sample. Using personal tax rates, all Panel B slope estimates $\hat{\alpha}_1$ and $\hat{\gamma}_1$ are positive – generally *more so* than when HY and LY stocks were combined (see Tables 1-2) – and all but one are statistically significant. Using corporate tax rates, the slopes are all significantly negative. These

[21] As implied by Proposition 4, it is also important whether a high-yield stock is eligible for the intercorporate dividend exclusion (ICDE). Some dividends paid by REITs and bond funds are ICDE-ineligible, and a different set of tax rates might be more relevant for these. However, we do not control for ICDE-eligibility at this stage because our overall sample is limited to domestic corporations, all of which should qualify for the tax break.

results support the idea that *individual* investors are the marginal price setters for LY stocks on ex-days. For HY stocks, we initially expected α_1 and γ_1 to be *positive* for the *corporate* tax variables since higher-yield equities are the most likely targets of corporate dividend capture. However, this second prediction is not borne out by the evidence in Panel A of Tables 5-6. For the CRSP HY subsample, the estimates $\hat{\alpha}_1$ and $\hat{\gamma}_1$ are similar to those in the overall sample (i.e. positive for personal tax rates and negative for corporate rates). For the Dow and Post-1962 Dow HY subsamples, all slope estimates are largely insignificant. These results suggest that for our sample period, corporate tax rates do not significantly impact the ex-dividend stock price behavior of even high-yield stocks.

[Insert Tables 5 and 6 about here]

At first, this might appear to contradict the tax clientele theory. However, it is commonly accepted that corporate dividend capture was greatly facilitated by the introduction of negotiable commissions on 1 May 1975. Before then, the high transaction costs associated with fixed commissions may have rendered corporate dividend capture infeasible. Using *only* ex-dates from the negotiable commission era, an additional regression finds that market-adjusted returns (MARs) are indeed positively related to corporate dividend capture tax rates in the CRSP HY subsample. Furthermore, MARs in the corresponding CRSP LY subsample are *negatively* related to corporate tax rates. Regressions with PDRs in the negotiable commission era yield similar results, with slope estimates $\hat{\alpha}_1$ having identical signs but falling just short of statistical significance at the 10 percent level. These results are consistent with NNR (2000), whose findings suggest that corporate dividend capture was prominent only among HY stocks and only after May 1975.

Regardless of whether corporate tax rates impact ex-dividend stock price behavior after 1975, it is clear that they did not do so for either of our sample periods (1962-2003 or 1910-2003) considered as a whole, even for high-yield stocks. Therefore, for the remainder of our empirical tests, only tax variables based on *personal* rates – which clearly *are* related to ex-day pricing – will be used.

[Insert Tables 7 and 8 about here]

In Table 7, we present results from performing the regressions

$$PDR_i = \alpha_0 + \alpha_1 HY_i + \alpha_2 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers max}} + \alpha_3 HY_i \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers max}} + \varepsilon_i \quad \text{and}$$

$$PDR_i = \alpha_0 + \alpha_1 HY_i + \alpha_2 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers infl-adj}} + \alpha_3 HY_i \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers infl-adj}} + \varepsilon_i ,$$

where HY_i is a dummy variable whose value is 1 if observation *i* is in the HY subgroup, and 0 otherwise. All estimates $\hat{\alpha}_2$ are positive and significant – with the exception of the Dow sample estimate using maximum personal tax rates, which was also insignificant in the initial test of Proposition 1. Furthermore, the fact that the estimates $\hat{\alpha}_3$ are all *negative* suggests that the strength of the relationship between PDRs and personal tax rates may decline somewhat for higher-yield stocks – again consistent with the notion that individual investors are more prone to purchase *lower-yield* stocks. However, we cannot draw this conclusion formally since none of the α_3 estimates are statistically significant. Similarly, Table 8 presents results from estimating

$$MAR_i^{ex} = \gamma_0 + \gamma_1\, HY_i + \gamma_2 \left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{i,\, pers\, max} + \gamma_3\, HY_i \left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{i,\, pers\, max} + \varepsilon_i \quad \text{and}$$

$$MAR_i^{ex} = \gamma_0 + \gamma_1\, HY_i + \gamma_2 \left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{i,\, pers\, infl\text{-}adj} + \gamma_3\, HY_i \left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{i,\, pers\, infl\text{-}adj} + \varepsilon_i \, .$$

As expected, we find that MARs also are significantly related to both maximum and inflation-adjusted personal tax rates in all three samples. However, there is mixed evidence about whether the effect strengthens or weakens with higher-yield stocks. Intuition predicts that it should weaken, but it is possible that the estimate $\hat{\gamma}_3$ may be positive since the HY dummy variable to some extent proxies for D/P^{cum}, which EHK (1984) demonstrate is positively related to the ex-day return.

If higher-yield stocks attract investors with relatively low dividend tax rates, then they should have higher PDRs, assuming the EG model is approximately correct. This prediction of Proposition 5 is consistent with our positive estimates $\hat{\alpha}_1$ for the HY dummy variable previously seen in Table 7. However, we also regress PDRs on the actual dividend yields themselves for the entirety of our three samples, as shown below:

$$\left(\frac{\Delta P^*}{D}\right)_i = \alpha_0 + \alpha_1 \left(\frac{D}{P^{cum}}\right)_i + \varepsilon_i \, .$$

When the dividend yield itself is a parametric variable in the model to be estimated, it is possible that the results might be unduly influenced by several observations with unusually large yields D/P^{cum}. Therefore, for this test only, we eliminate events where the dividend exceeds 10 percent of the cum-price. This results in the loss of very few observations from our samples, since such large dividend yields are extremely rare. Our basic results are shown in Panel A of Table 9. As expected, the relationship between PDRs and dividend yields is positive and significant in every case.

[Insert Table 9 about here]

While this evidence is certainly *consistent* with tax clienteles, a stronger case could be built if PDRs were *most* strongly related to D/P under the largest tax differentials $|t_d - t_{cg}|$. To gauge the strength of the PDR-dividend yield relationship, we perform the following regressions separately for each year in the overall sample:

$$\left(\frac{\Delta P^*}{D}\right)_i = \alpha_{0T} + \alpha_{1T}\left(\frac{D}{P^{cum}}\right)_i + \varepsilon_i \,.$$

Though relatively uncommon, there have been several historical instances of tax-rate changes that took effect in the middle of a year.[22] When this occurs in the first half of the year (i.e. January to June), we perform that year's regression with only the ex-dates occurring *after* the change. Likewise, when the rate change occurs in the latter half of the year (i.e. July to December), we use only the ex-dates *before* the change. This rule is designed to retain the maximum number of observations from each year while ensuring that the same tax rates are in effect for all dividends in each year's regression. To observe how the sensitivity of PDR to D/P depends on tax rates, we regress the previously obtained slope coefficients (which are mostly positive) on the absolute tax differential $|t_d - t_{cg}|$ using personal tax rates. Specifically, we estimate

$$\hat{\alpha}_{1T} = \phi_0 + \phi_1 |t_d - t_{cg}|_{T,\text{pers max}} + \nu_T \quad \text{and}$$

$$\hat{\alpha}_{1T} = \phi_0 + \phi_1 |t_d - t_{cg}|_{T,\text{pers infl-adj}} + \nu_T$$

[22] Mid-year tax rate changes occurred in March 1913, April 1951, November 1978, June 1981, May 1997, and May 2003.

for each of our three samples. As shown in Panel B of Table 9, estimates of ϕ_1 are all positive. The two CRSP estimates are both statistically significant, as is one of the Dow sample estimates. It should be noted, however, that the other estimates $\hat{\phi}_1$ are "insignificant" only because of high standard errors. Their magnitudes (99.0566, 57.9896, and 42.3868) are generally greater than the others (42.7606, 32.0807, and 32.9573) that *are* deemed significant. Therefore, our tests of Proposition 5 confirm that price drop ratios (PDRs) are higher for stocks with greater dividend yields, *especially* in the presence of larger differentials between dividend and capital gains tax rates. This finding is strongly supportive of the existence of tax-based dividend clienteles.

5.3.2 Testing Tax Timing Models of Ex-Dividend Price Behavior

The tax timing model developed in the previous chapter implies that ex-day price behavior depends partly on how the price of the stock has changed since the investor originally bought it. Finding the right measure of "recent" price performance for our empirical tests presents a challenge since we do not know when current shareholders originally purchased the stock. Therefore, we calculate %GAIN, the cumulative percentage change in the stock price, over (i) the past 45 trading days and (ii) the past 300 trading days. The tax treatment of capital gains is admittedly different for these two cases. If the stock has been held for only 45 trading days, selling it now would trigger a *short-term* gain or loss. If, however, the stock has been held for 300 trading days, the realized gains or losses are classified as long-term and are subject to a lower tax rate. Nevertheless, the capital gains taxes that would result from closing a "winning" position should act as a deterrent to selling in all cases – *especially* in the first, where waiting would provide the investor not only with a deferral but also with a lower rate t_{cg} when the minimum holding period requirement is met. Due to the additional data required to calculate %GAIN, all subsequent tests employ only the CRSP sample. In addition, we eliminate observations when the total number of shares outstanding changes for any reason (e.g. due to a stock dividend or split) over the relevant gain measurement period. (For example, in regressions where %GAIN is calculated over the previous 300 trading days, we eliminate observations where the number of shares changes over that interval.)

[Insert Tables 10 and 11 about here]

As an initial test of Proposition 6, we estimate the models

$$PDR_i = \alpha_0 + \alpha_1 \%GAIN_i + \alpha_2 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers max}} + \varepsilon_i \qquad \text{and}$$

$$PDR_i = \alpha_0 + \alpha_1 \%GAIN_i + \alpha_2 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers infl-adj}} + \varepsilon_i \,.$$

Our results in Table 10 support the prediction that PDRs should be directly related to accrued capital gains. All coefficient estimates $\hat{\alpha}_1$ are positive, and the ones calculated using 45-day gains are significant at the 1 percent level. Those estimated from 300-day gains lack statistical significance; however, even they are more than one standard error greater than zero. Table 11 presents our results from estimating similar models with market-adjusted returns as the dependent variable:

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \%GAIN_i + \gamma_2 \left(\frac{t_d - t_{cg}}{1-t_{cg}}\right)_{i,\text{ pers max}} + \varepsilon_i \qquad \text{and}$$

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \%GAIN_i + \gamma_2 \left(\frac{t_d - t_{cg}}{1-t_{cg}}\right)_{i,\text{ pers infl-adj}} + \varepsilon_i \,.$$

In this case, *all* coefficient estimates $\hat{\gamma}_1$ are negative and significant, consistent with the theoretical prediction that MARs should be inversely related to past capital gains. In both Tables 10 and 11, slope estimates $\hat{\alpha}_1$ and $\hat{\gamma}_1$ are clearly largest when %GAIN is calculated over the past 45 days. This suggests that very recent gains may play a larger role than longer-term gains in determining the extent of stockholders' selling prior to an ex-date. By no means does this refute the classic EG model. As was true in our tests of Propositions 1-5, there is still a significant relationship between the EG-implied tax variables and observed ex-dividend stock price behavior, as shown by the fact that all coefficient estimates $\hat{\alpha}_2$ and $\hat{\gamma}_2$ from the above models are strongly positive and significant. Therefore, ex-dividend stock price changes may be impacted both by long-term investors who come to the market having already decided to sell for reasons unrelated to the dividend (e.g. wealth consumption, portfolio rebalancing) and by other individuals – some of whom have only recently purchased the stock – that might prefer to receive the dividend and postpone selling an appreciated stock.

So far, our results are supportive of the *basic* predictions of the tax timing model stated in Proposition 6. However, a secondary prediction of the model is that the effect of recent stock price changes should be *stronger* (i) for stocks with lower dividend yields, and (ii) for stocks that have recently experience gains rather than losses. To test this, we separate the previously defined HY and LY subsamples according to whether they have recently experienced positive or negative growth, thereby giving us *four* subsamples. Henceforth, the recent performance of a subgroup of stocks will be denoted with a "+" or "–" sign after the name of the group. For example, "HY–" refers to the high-yield stocks that have recently declined in value, while "LY+" refers to the low-yield stocks that have recently increased in value. We then repeat each regression defined above on the four yield/performance groups separately.

[Insert Table 12 about here]

Table 12 presents our results from regressions with the price drop ratio (PDR) as the dependent variable. Our *ex ante* prediction is that the coefficients α_1 will be greater for low-yield (LY) stocks and for those that have recently accumulated positive capital gains. Our empirical results do not affirm this prediction. In fact, slope estimates $\hat{\alpha}_1$ are actually greatest in the "HY−" subgroup. It is not immediately clear overall whether HY or LY stocks are affected more by past stock price changes. Contrary to the theory, however, ex-dividend stock price behavior seems to be far more affected by recent *losses* than by recent gains. These results suggest that investors may actually be more inclined to sell stocks that have declined than they are to retain stocks whose values have climbed. This is not a prediction of the tax timing model derived in Chapter 4.

Our results in Table 13 for MARs complement those in Table 12 for PDRs. Consistent with Proposition 6, MARs are in most cases negatively related to prior returns. While this is consistent with theory, the fact that $\hat{\gamma}_1$ estimates are most negative in the "HY−" subgroup and only weakly so among "LY+" stocks is very difficult to reconcile with the tax timing model.

[Insert Tables 13-14 about here]

Table 14 presents our results from estimating the models

$$PDR_i = \alpha_0 + \alpha_1 HY_i + \alpha_2 \%GAIN_i + \alpha_3 HY_i \times \%GAIN_i + \alpha_4 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers max}} + \varepsilon_i \quad \text{and}$$

$$PDR_i = \alpha_0 + \alpha_1 HY_i + \alpha_2 \%GAIN_i + \alpha_3 HY_i \times \%GAIN_i$$

$$+ \alpha_4 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\, pers\, infl\text{-}adj} + \varepsilon_i \, .$$

This is a more formal test of how the sensitivity of $\frac{\Delta P^*}{D}$ to %GAIN varies by dividend yield. A non-interacting dummy variable HY is included in the regression to control for differences in the average *levels* of PDRs between high- and low-yield stocks. As in Table 10, our slope estimates for the variable %GAIN are all positive and are significant at the 1 percent level when gains are calculated over the past 45 days or over the current calendar year. All of the estimates $\hat{\alpha}_3$ for the interaction term HY × %GAIN are also positive; however, they are significant only with 45-day gains. These results indicate that PDRs are positively related to accrued capital gains for both HY and LY stocks, but (contrary to Proposition 6) *especially* so for HY stocks.

[Insert Table 15 about here]

We also estimate the equivalent models using market-adjusted returns (MARs) as the dependent variable, as given by

$$MAR_i^{ex} = \gamma_0 + \gamma_1 HY_i + \gamma_2 \%GAIN_i + \gamma_3 HY_i \times \%GAIN_i$$

$$+ \gamma_4 \left(\frac{t_d - t_{cg}}{1-t_{cg}}\right)_{i,\, pers\, max} + \varepsilon_i \qquad \text{and}$$

$$MAR_i^{ex} = \gamma_0 + \gamma_1 HY_i + \gamma_2 \%GAIN_i + \gamma_3 HY_i \times \%GAIN_i$$

$$+ \gamma_4 \left(\frac{t_d - t_{cg}}{1-t_{cg}}\right)_{i,\, pers\, infl\text{-}adj} + \varepsilon_i \, .$$

As shown in Table 15, *all* of the estimates $\hat{\gamma}_2$ and $\hat{\gamma}_3$ are negative and significant – more notably when %GAIN is calculated over the past 45 days. This confirms our findings in Table 14 that the ex-day anomaly is smaller when there has been a recent price run-up, and that the sensitivity of ex-day returns to recent gains is stronger for HY instead of LY stocks.

We have already deduced by inspecting Tables 12 and 13 that capital losses affect ex-dividend stock price behavior to a greater extent than capital gains. However, to test this conclusion formally, we estimate the following models for price drop ratios:

$$PDR_i = \alpha_0 + \alpha_1 \%GAIN_i + \alpha_2 POS_i \times \%GAIN_i + \alpha_3 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers max}} + \varepsilon_i \quad \text{and}$$

$$PDR_i = \alpha_0 + \alpha_1 \%GAIN_i + \alpha_2 POS_i \times \%GAIN_i + \alpha_3 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\text{ pers infl-adj}} + \varepsilon_i .$$

[Insert Table 16 about here]

The dummy variable POS_i equals 1 when $\%GAIN_i > 0$, and zero otherwise. As shown in Table 16, when %GAIN is calculated over 45 days, $\hat{\alpha}_1$ is again significantly positive. However, the interaction term slope α_2 is also estimated to be strongly negative, confirming that the sensitivity of PDR to %GAIN is much weaker for stocks that have experienced recent gains than for those that have suffered losses. The models for market-adjusted returns are similar:

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \%GAIN_i + \gamma_2 POS_i \times \%GAIN_i + \gamma_3 \left(\frac{t_d - t_{cg}}{1-t_{cg}}\right)_{i,\text{ pers max}} + \varepsilon_i \quad \text{and}$$

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \%GAIN_i + \gamma_2 POS_i \times \%GAIN_i + \gamma_3 \left(\frac{t_d - t_{cg}}{1-t_{cg}}\right)_{i,\text{ pers infl-adj}} + \varepsilon_i .$$

[Insert Table 17 about here]

Consistent with our earlier findings, Table 17 shows that $\hat{\gamma}_1$ is always significantly negative, while all estimates $\hat{\gamma}_2$ are significantly positive with approximately the same magnitude as their respective corresponding γ_1 estimates. Since $(\gamma_1 + \gamma_2)$ is the sensitivity of MAR to %GAIN for stocks whose prices have increased, the conclusion drawn from this particular test is that market-adjusted ex-day returns on average are negatively affected by recently accrued capital *losses* but are virtually unaffected by positive accrued gains. As discussed previously, this is contrary to the prediction of Proposition 6.

Although rational investors should be mindful of the tax consequences of their decisions at all times, it is possible that they might be more so in the last quarter of the year (and by extension, less so in the first three). To determine whether sensitivity of PDR to accrued gains is stronger in the last three months of the calendar year, we define a dummy variable LASTQTR, which equals 1 if the ex-date in question occurs in October, November, or December, and zero otherwise. Using price drop ratios (PDRs) as our dependent variable, we estimate the following regression models:

$$\text{PDR}_i = \alpha_0 + \alpha_1\,\%\text{GAIN}_i + \alpha_2\,\text{LASTQTR}_i \times \%\text{GAIN}_i + \alpha_3 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\,\text{pers max}} + \varepsilon_i \quad \text{and}$$

$$\text{PDR}_i = \alpha_0 + \alpha_1\,\%\text{GAIN}_i + \alpha_2\,\text{LASTQTR}_i \times \%\text{GAIN}_i + \alpha_3 \left(\frac{1-t_d}{1-t_{cg}}\right)_{i,\,\text{pers infl-adj}} + \varepsilon_i\,.$$

[Insert Table 18 about here]

Our results (shown in Table 18) are somewhat surprising. We expected that all estimates of α_2 would be positive if they were significant at all. Instead, we find that $\hat{\alpha}_2$ is *negative* in every case, although not statistically significant. The results from the models

$$\text{MAR}_i^{ex} = \gamma_0 + \gamma_1\ \%\text{GAIN}_i + \gamma_2\ \text{LASTQTR}_i \times \%\text{GAIN}_i + \gamma_3 \left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{i,\text{ pers max}} + \varepsilon_i \quad \text{and}$$

$$\text{MAR}_i^{ex} = \gamma_0 + \gamma_1\ \%\text{GAIN}_i + \gamma_2\ \text{LASTQTR}_i \times \%\text{GAIN}_i + \gamma_3 \left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{i,\text{ pers infl-adj}} + \varepsilon_i$$

[Insert Table 19 about here]

are no less puzzling. We expected γ_1 and γ_2 to be negative, but in fact, two of the estimates $\hat{\gamma}_2$ are positive and significant. Intuition suggests that the effect of recent capital gains should be *stronger* toward the end of the year, not only because investors are more prone to pay attention to taxes then, but also because investors' motivation to delay the sale of an appreciated stock should be strengthened by the fact that a relatively short wait (≤ 3 months) could push the capital gains completely into the next tax year. Thus, our empirical results are at odds with the spirit of the tax timing model and the behavioral arguments for Proposition 7.

[Insert Table 20 about here]

Finally, we test the implication of Proposition 8 that investors' trading decisions around ex-dates are influenced by anticipated *future* tax rate changes. To accomplish this, we estimate the models

$$\text{PDR}_i = \alpha_0 + \alpha_1\ \%\text{GAIN}_i + \alpha_2\ (\Delta t_{cg})_{i,\text{pers max}} + \varepsilon_i \quad \text{and}$$

$$\text{PDR}_i = \alpha_0 + \alpha_1\ \%\text{GAIN}_i + \alpha_2\ (\Delta t_{cg})_{i,\text{pers infl-adj}} + \varepsilon_i\ .$$

We define Δt_{cg} as the future change in the capital gains tax rate if a change occurs within the six months following the ex-date; if no change in t_{cg} occurs during this period, Δt_{cg} is set to zero. As always, regressions are estimated separately using personal tax rates on the highest bracket and rates on a constant inflation-adjusted income. The interval of six months is selected because it is an approximation of how far in advance investors may begin anticipating a rate change with reasonable accuracy. The motivation to sell prior to the ex-date to avoid higher dividend taxes (per the usual tax explanation) should be *strengthened* by an impending increase in t_{cg}, particularly if there is a large accrued capital gain. This would arguably reduce PDRs, so we expect estimates of α_2 to be negative. As shown in Table 20, this is true in every case, although the estimates are statistically significant only when %GAIN is calculated over 45 days. We also estimate the same models using MAR as the dependent variable, as shown below:

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \%GAIN_i + \gamma_2 (\Delta t_{cg})_{i,pers\ max} + \varepsilon_i \quad \text{and}$$

$$MAR_i^{ex} = \gamma_0 + \gamma_1 \%GAIN_i + \gamma_2 (\Delta t_{cg})_{i,pers\ infl\text{-}adj} + \varepsilon_i \, .$$

[Insert Table 21 about here]

Proposition 8 predicts that ex-day returns should be higher preceding an anticipated increase in t_{cg}. Consistent with this hypothesis, Table 21 shows that all estimates $\hat{\gamma}_2$ are positive. As in Table 20 where PDRs were used to quantify ex-dividend price behavior, only two of the four estimates have statistical significance. However, the others do have the theorized positive sign and are more than one standard error from zero. Therefore, the evidence is consistent with the idea that an impending increase in the capital gains rate *enhances* investors' motive to sell a stock before it goes ex-dividend, thereby magnifying the EG-implied ex-day effect.

Chapter 6

Summary and Conclusions

Since Elton and Gruber's (EG 1970) seminal work, it has been well known that stock prices do not on average drop by the full amount of the dividend on the ex-date. Although this anomaly has generated considerable interest among researchers for over three decades, there has been no clear consensus about *why* the ex-day effect exists. The oldest and best-known explanation, proposed and tested by EG themselves, is that the price cannot fall by the entire dividend amount because many investors are taxed at the full ordinary rate on dividends but enjoy a lower rate on capital gains. In such a situation, if the price drop *were* equal to the dividend, no rational investor would choose to sell the stock just *after* it goes ex-dividend when doing so would effectively convert capital gains to ordinary income dollar-for-dollar. To restore equilibrium so that investors are indifferent between selling just before and just after the ex-date, the ratio of the stock price to dividend must be given by

$$\text{Price Drop Ratio (PDR)} = \frac{\Delta P}{D} = \frac{1 - t_d}{1 - t_{cg}},$$

which is less than 1 when $t_d > t_{cg}$. Consistent with the Miller-Modigliani (1961) concept of dividend clienteles, EG go on to hypothesize that stocks with higher dividend yields will attract investors with relatively low dividend tax rates (who therefore have a comparative advantage receiving dividend income). Therefore, high-yield stocks are likely to have higher price drop ratios (PDRs) than low-yield stocks.

Like all models, the one from which the EG formula is derived is an oversimplification of reality. Not everyone is subject to the same tax rates t_d and t_{cg}. Short-term traders are taxed equally on dividends and capital gains and therefore are indifferent between the two types of income. Corporations generally receive tax breaks on dividends instead of capital gains. Depending on the relative influence of these different classes of investors, the PDR might be equal to or even greater than 1. In addition, various other constraints might impact observed ex-dividend stock price behavior. Bali and Hite (1998) note that stock prices historically have been constrained to multiples of $1/8 and derive a model showing how such discreteness restrictions can give rise to an ex-day price drop that is less than the dividend. While these alternative theories may have merit, testing them is beyond the scope of this study. The purpose of this dissertation has been to test tax-related models of ex-dividend stock price behavior.

The first half of our empirical analysis is devoted to testing whether observed ex-dividend stock price behavior is consistent with the EG model and tax-based dividend clienteles. Ours is certainly not the first paper to do so. A great number of authors have examined whether this phenomenon intensifies, weakens, or even completely vanishes around key tax law changes (both in the U.S. and abroad) as EG suggest it should. Some papers have even considered multiple tax law changes. However, this study is the first to incorporate all of the relevant tax rate changes over a long sample period and actually test whether individually observed PDRs for the whole sample vary systematically through time along with the EG-implied quantity $\frac{1-t_d}{1-t_{cg}}$. While this would be an important contribution to the literature by itself, we also employ a sample that includes ex-dividend dates for stocks in the Dow Jones Industrial Average from 1910 to 2003. All of our hypotheses are tested on the CRSP daily database, which extends back only to 1962. However, we also test the EG model on this "Dow" sample, which spans nearly an entire century. The pre-1962 period has never been examined by any prior study because it is not included in the CRSP daily database; nevertheless, it saw the largest differentials between dividend and capital gains tax rates in history and is therefore an interesting focus of potential research on ex-dividend stock pricing.

Our research finds that actual PDRs are indeed positively related to the quantity $\frac{1-t_d}{1-t_{cg}}$ when t_d and t_{cg} are the *personal* dividend and capital gains tax rates. When *corporate* tax rates are used, however, the relationship is opposite to the one hypothesized.

Price drops that are less than the dividend also cause stock returns to be higher than usual on ex-days. Eades, Hess, and Kim (EHK 1984) show that ex-day stock returns should be positively related to the quantity $\frac{t_d - t_{cg}}{1-t_{cg}}$. Our research confirms that this relationship holds in the expected direction when personal tax rates are used but in the opposite direction when corporate rates are used. We also note that the ex-day effect is weaker, as evidenced by higher PDRs and lower MARs, when a longer holding period is required to receive the capital gains tax break.

Our results do not vary greatly depending on whether a stock is high-yield (HY) or low-yield (LY). Specifically, PDRs and MARs in the HY subsample are not related to the hypothesized corporate tax variables as initially predicted. However, this is actually consistent with the argument that corporate dividend capture was much more difficult prior to the introduction of negotiable commissions in 1975 and did not exert a great influence on stock prices until then.

We also confirm another important EG prediction in all our samples – specifically, that PDRs are positively related to dividend yields. However, our tests go a step further, documenting that the *strength* of this relationship is greater when the tax differential between t_d and t_{cg} is wider.

The second half of our analysis is devoted to testing a newly derived extension of the EG model, which we call the tax timing model. In the basic EG framework, we would argue that the ex-day phenomenon exists because shareholders would have a clear incentive to sell a stock before it goes ex-dividend if ΔP were equal to D. However, the presence of a large accrued capital gain might act to *counter* that incentive since selling would force the investor to recognize and pay taxes on the capital gain that otherwise could have been delayed. Consistent with this idea, we do find that the ex-day effect is weaker (i.e. PDRs are higher and MARs are lower) when the stock has recently experienced better returns. However, we also find that the relationship between the ex-day effect and past returns is stronger in the HY subsamples and in stocks that have recently experienced negative instead of positive returns. These findings are contrary to the predictions of the tax timing model. Nevertheless, our tests show that recent capital gains do affect ex-dividend price behavior. This has potentially important implications for previously published empirical tests of the ex-day anomaly, as we know of no such study that controls for prior returns.

Finally, we relate ex-dividend price changes to *anticipated future* tax rates on capital gains. We argue that investors are able to predict with reasonable accuracy the timing, direction, and magnitude of future changes in the capital gains rate. If an ex-date were to occur in the months preceding an increase in the capital gains tax rate, and if stockholders anticipated the change, they might have an additional incentive (i.e. recognizing the gain before the tax rate hike) to sell. Our results do suggest that the ex-day effect is stronger (i.e. PDRs are lower and MARs are higher) prior to an increase in the personal capital gains tax rate.

This dissertation contributes to the literature in several important ways. Many previous works recognize that tax law changes should have an impact on ex-dividend stock price behavior if EG are correct. However, most of them have employed rather limited sample periods. This is the first study to relate observed ex-day pricing to the actual tax rates t_d and t_{cg} in effect over the entirety of a broad sample period. We also use a longer sample period than any other study in the literature – extending from the present day back to the inception of the Federal Income Tax. This is especially interesting since rather large tax differentials existed in the 1940s and 1950s, but most other studies of the ex-day anomaly examine only data subsequent to 1962.

Finally, this study contributes to the literature by recognizing another factor (i.e. recently stock price performance) that systematically influences tax-motivated trading around ex-dividend dates. Our study is the first to develop a theoretical model demonstrating why recent stock price appreciation should weaken the ex-day phenomenon and to provide empirical evidence validating this model's basic prediction.

Despite these contributions, much remains to be investigated. Our results provide strong evidence that individual tax rates impact price drop ratios and market-adjusted returns. Therefore, it follows that individual investors do have some influence at the margin over ex-dividend stock price behavior. However, we hope that future studies are able to provide more direct evidence on which investors impact prices around the ex-day and what their motivations for trading may be.

We have also developed a new model predicting that there should be a relationship between ex-dividend stock price behavior and past stock price changes. While we have confirmed the model's basic prediction, we have not been able to explain why past gains seem to matter more for high-yield stocks and for stocks that have recently suffered losses. Perhaps a more generalized tax timing model could be developed that better accounts for the relationship between the ex-day effect and past performance.

Finally, we have purposely limited the scope of this study to testing tax-related explanations for the ex-day effect. Nevertheless, there are a host of other possibilities worth considering. Previous work has established that transaction costs can impact the magnitude of ex-dividend price drops. Furthermore, there are also a number of microstructure considerations (e.g. bid-ask spreads, exchange rules for ex-day order adjustment, and price discreteness imposed by tick sizes and quote clustering) that are not yet fully understood. We therefore leave it to future research to enhance our understanding of how taxes affect ex-dividend stock price behavior and to evaluate alternative factors that may operate alongside tax effects.

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Figure 1
Sample Period of this Study Compared with Other Works on Tax Law Changes

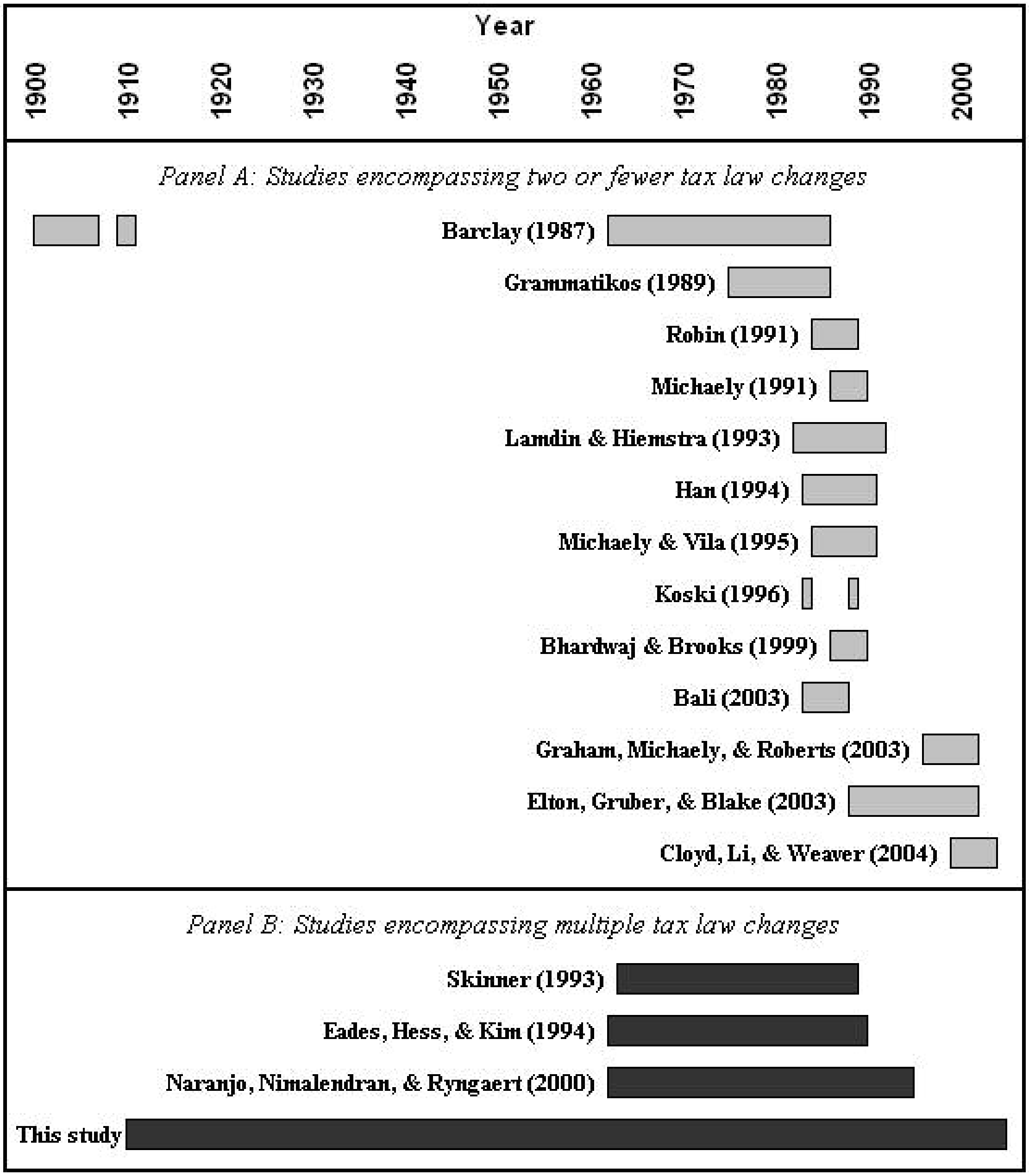


Figure 2
Top Ordinary Income Tax Rates for Individuals

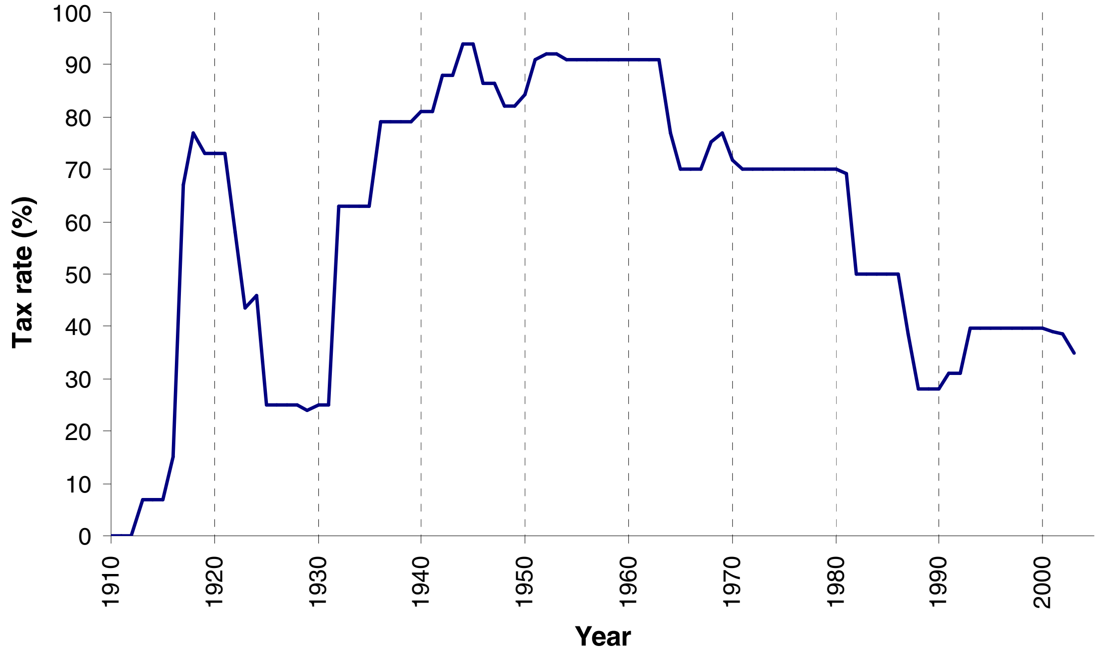


Figure 3
Top Ordinary Income Tax Rates for Corporations

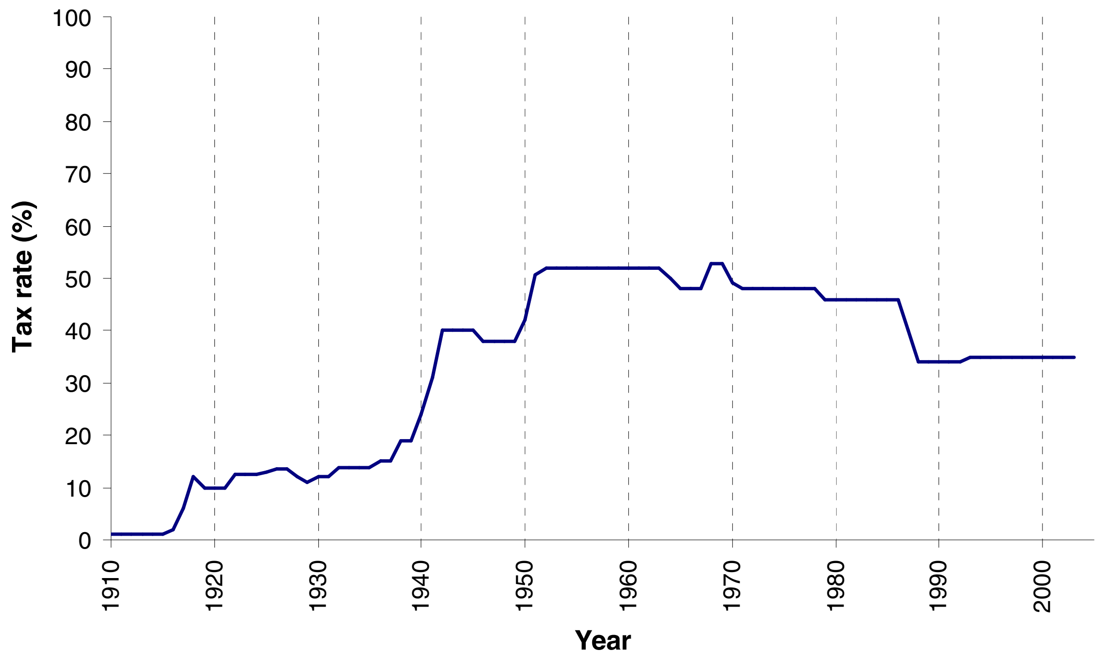


Figure 4
Price Drop Ratios Implied by Top Individual Dividend and Capital Gain Rates

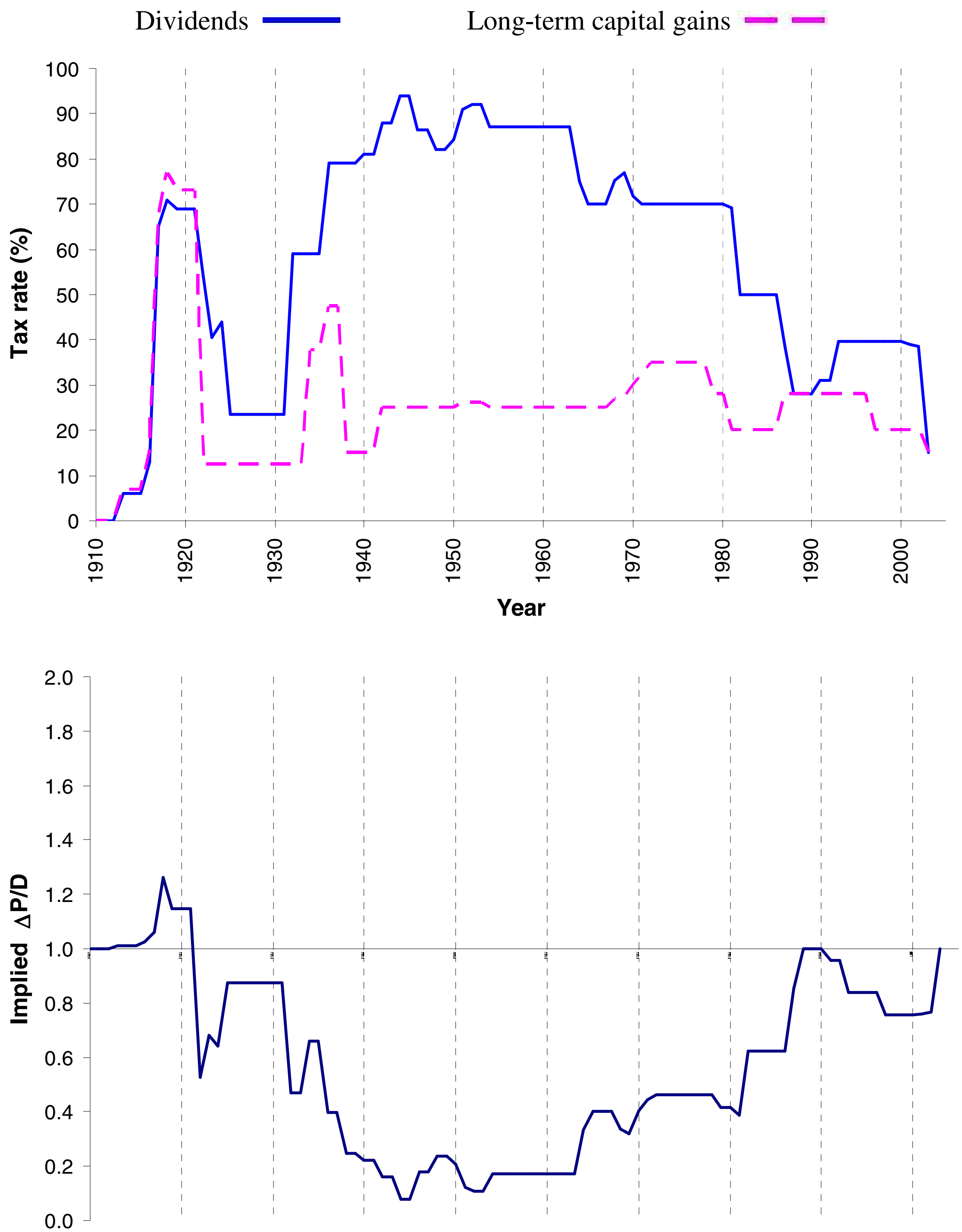
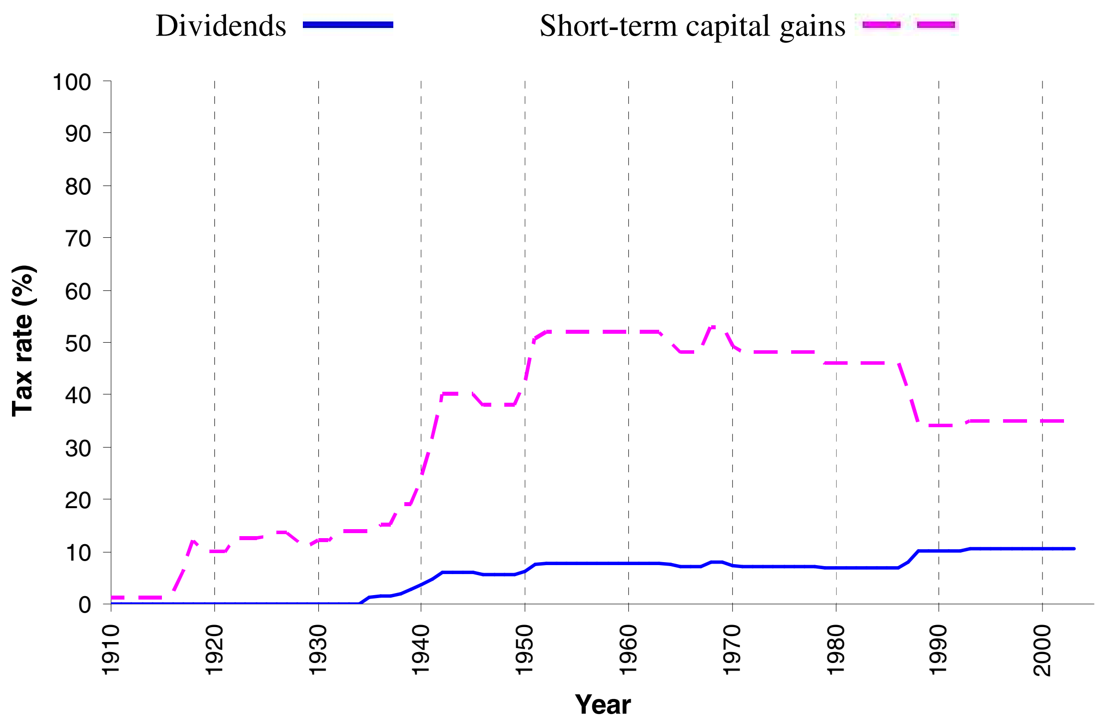


Figure 5
Price Drop Ratios Implied by Top Corporate Dividend and Capital Gain Rates

Panel A: Dividend capture strategy



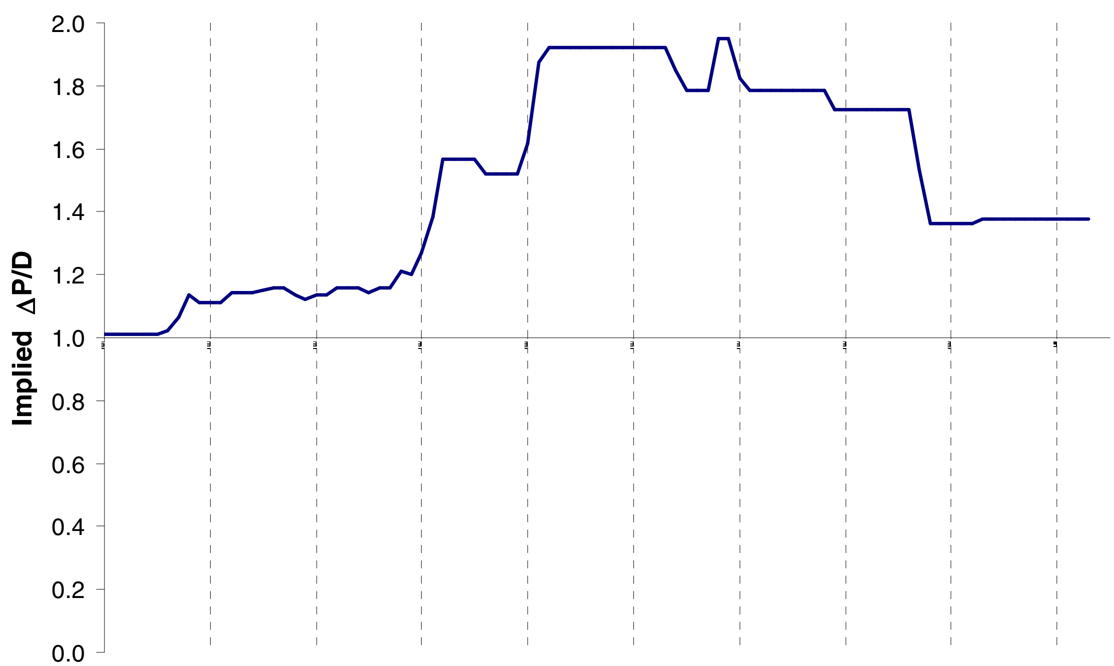
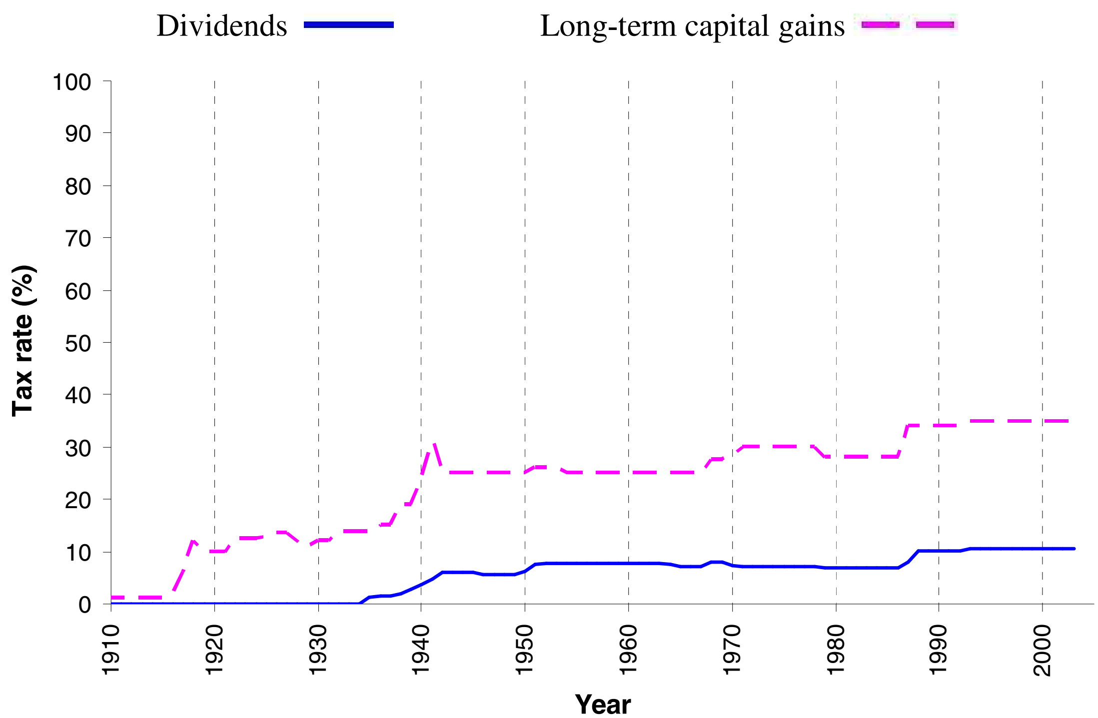


Figure 5 (continued)
Price Drop Ratios Implied by Top Corporate Dividend and Capital Gain Rates

Panel B: Long-term investment strategy



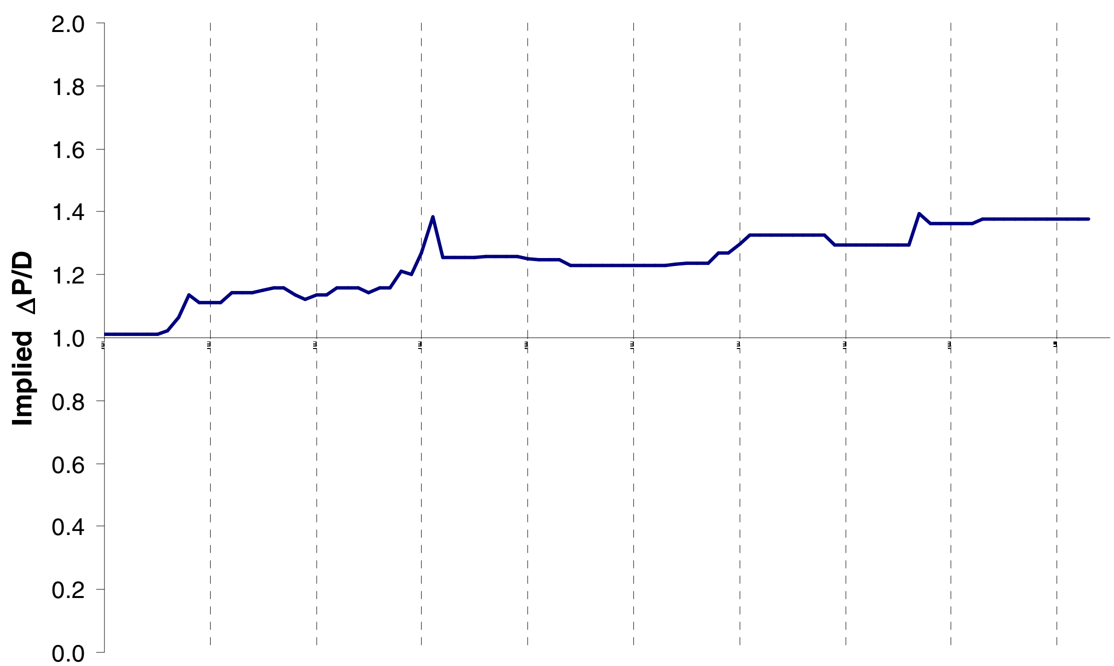


Figure 6
Price Drop Ratios and Ex-Day Returns Implied by EG and Tax Timing Models
(P_0 = \$80, P^{cum} = \$100, D/P^{cum} = 0.50%, t_{cg} = 20%, k = 10%, τ = 0.25)

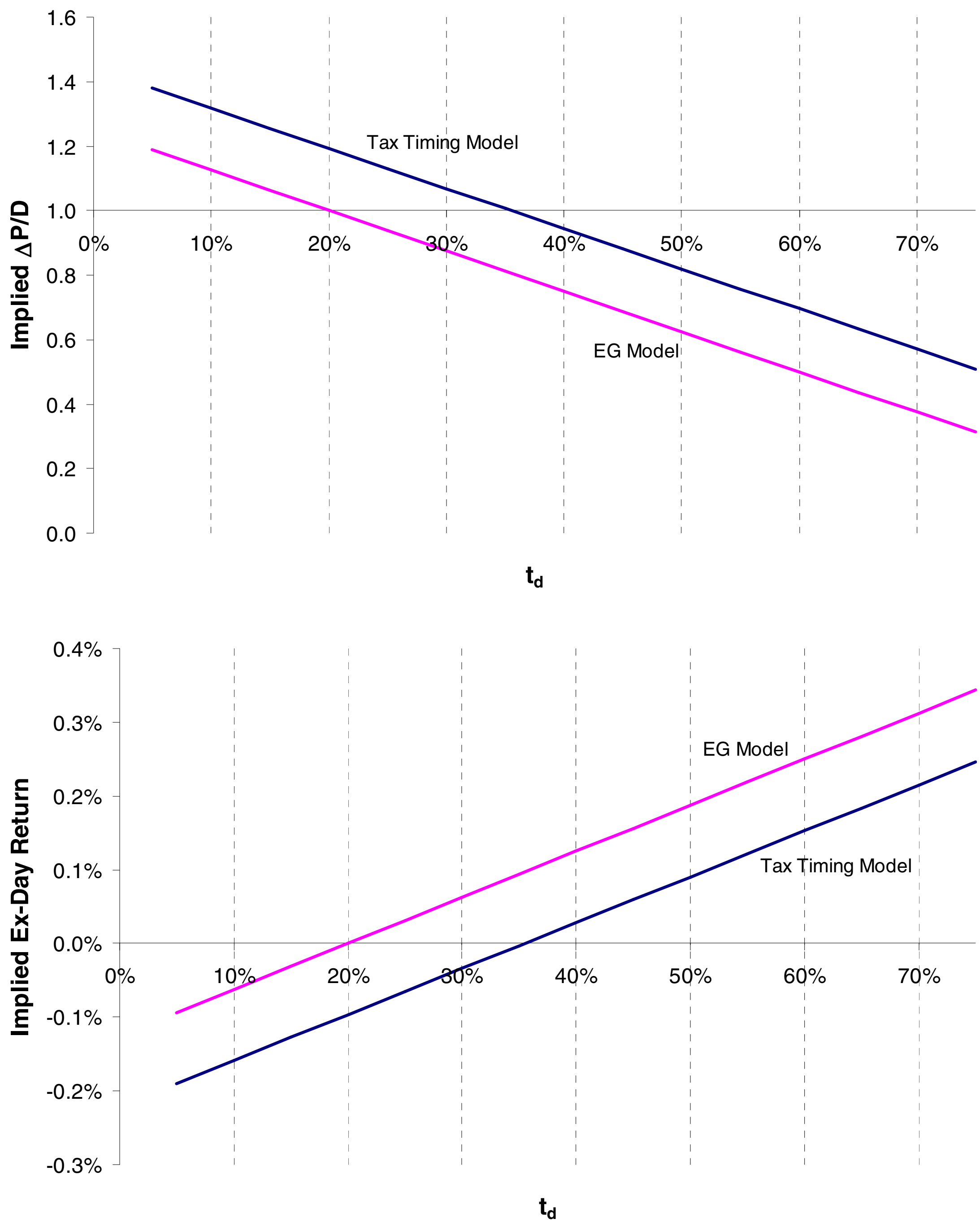
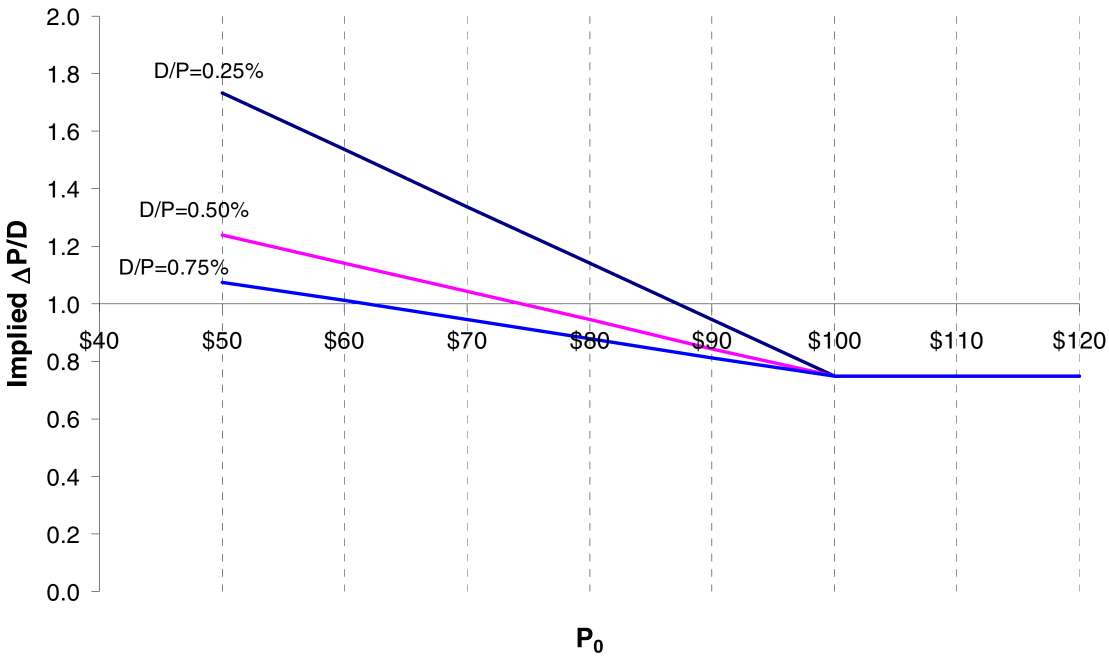


Figure 7
Tax Timing Model: Effect of Original Purchase Price (P_0) on Ex-Day Price Drop

Panel A: Different Dividend Yields (D/P^{cum})
(P^{cum} = \$100, t_d = 40%, t_{cg} = 20%, k = 10%, τ = 0.25)



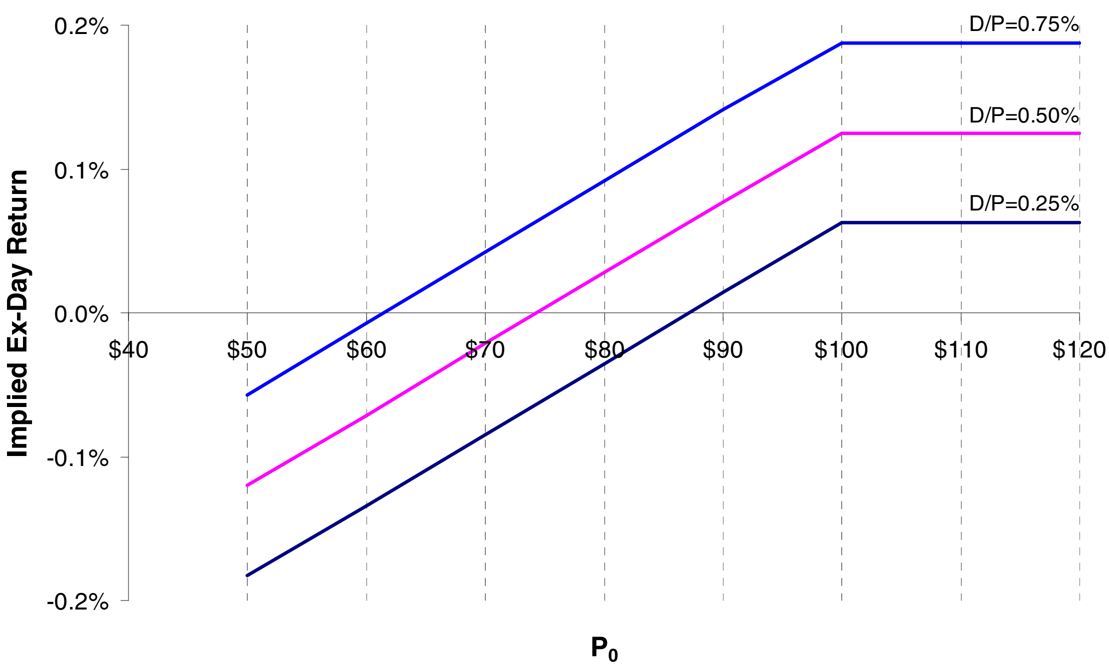
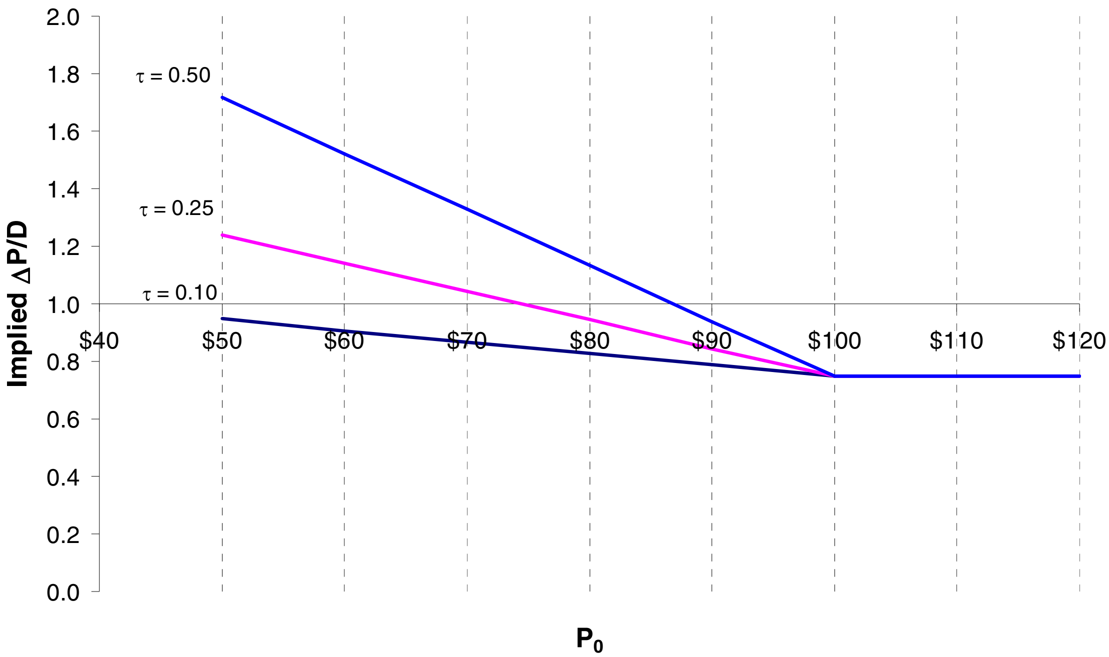


Figure 7 (continued)
Tax Timing Model: Effect of Original Purchase Price (P_0) on Ex-Day Price Drop

Panel B: Different Reinvestment Periods (τ)
(P^{cum} = \$100, D/P^{cum} = 0.50%, t_d = 40%, t_{cg} = 20%, k = 10%)



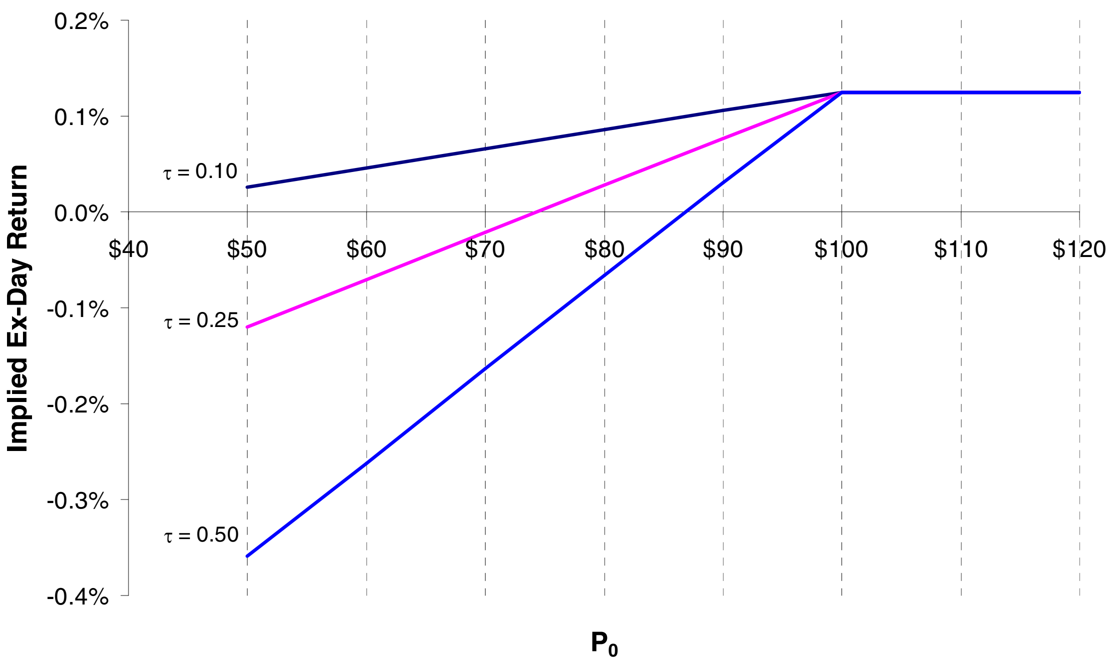


Table 1
Relationship of Observed Price Drop Ratios (PDRs) to Hypothesized Values

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than \$1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding between the cum- and ex-dates. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio (PDR), and the upper and lower 1% are trimmed. The dependent variable for all regressions is the price drop ratio (PDR), calculated as $\Delta P^*/D$.

Model Regressors	Parameter Estimates by Sample CRSP (1962-2003) *N* = 203,491	 Dow (1910-2003) *N* = 9,167	 Dow (1962-2003) *N* = 4,567
Intercept	0.7397 ***	0.8001 ***	0.6061 ***
	(0.0222)	(0.0282)	(0.0827)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{\text{pers max}}$	0.1980 ***	0.0426	0.2491 **
	(0.0349)	(0.0457)	(0.1263)
F	32.11 ***	0.87	3.89 **
R^2	0.0002	0.0001	0.0009
Intercept	0.6055 ***	0.5899 ***	0.5578 ***
	(0.0457)	(0.0749)	(0.1705)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{\text{pers infl-adj}}$	0.3414 ***	0.2910 ***	0.2674
	(0.0611)	(0.0919)	(0.2240)
F	31.19 ***	10.02 ***	1.42
R^2	0.0002	0.0011	0.0003
Intercept	1.2491 ***	0.9717 ***	1.1028 ***
	(0.0654)	(0.0791)	(0.2353)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{\text{corp}}$	–0.2381 ***	–0.0970 *	–0.2113
	(0.0394)	(0.0504)	(0.1431)
F	36.51 ***	3.70 *	2.18
R^2	0.0002	0.0004	0.0005

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 2
Relationship of Observed Market-Adjusted Returns (MARs) to Hypothesized Values

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than \$1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding between the cum- and ex-dates. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio ($\Delta P^*/D$), and the upper and lower 1% are trimmed. The dependent variable for all regressions is the market-adjusted return (MAR), calculated as $(D - \Delta P^*)/P^{cum}$.

Model Regressors	Parameter Estimates by Sample: CRSP (1962-2003) *N* = 203,491	Dow (1910-2003) *N* = 9,167	Dow (1962-2003) *N* = 4,567
Intercept	0.000666 ***	0.001322 ***	0.000760 **
	(0.000091)	(0.000229)	(0.000376)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,max}$	0.001502 ***	0.000422	0.002832 ***
	(0.000194)	(0.000396)	(0.000825)
F	59.66 ***	1.14	11.78 ***
R^2	0.0003	0.0001	0.0026
Intercept	0.000486 ***	0.000865 ***	0.000693 *
	(0.000100)	(0.000206)	(0.000416)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.003009 ***	0.003268 ***	0.004661 ***
	(0.000340)	(0.000795)	(0.001464)
F	78.24 ***	16.87 ***	10.14 ***
R^2	0.0004	0.0018	0.0022
Intercept	0.000030	0.000996 ***	–0.000369
	(0.000149)	(0.000269)	(0.000621)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{corp}$	–0.001931 ***	–0.000978 **	–0.003536 ***
	(0.000219)	(0.000437)	(0.000935)
F	77.48 ***	5.02 **	14.31 ***
R^2	0.0004	0.0005	0.0031

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 3
Impact of Personal Capital Gains Holding Periods on Observed Price Drop Ratios (PDRs)

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. CGHOLD is the number of months a stock must be held to qualify for the personal capital gains tax rate t_{cg}. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than \$1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, (vi) there is a change in total shares outstanding between the cum- and ex-dates, or (vii) CGHOLD is undefined because short-term and long-term gains are taxed identically an ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio (PDR), and the upper and lower 1% are trimmed. The dependent variable for all regressions is the price drop ratio (PDR), calculated as $\Delta P^*/D$.

Model Regressors	Parameter Estimates by Sample: CRSP (1962-2003) *N* = 190,347	Dow (1910-2003) *N* = 8,262	Dow (1962-2003) *N* = 4,233
Intercept	0.6747 ***	0.7681 ***	0.5487 ***
	(0.0283)	(0.0353)	(0.1063)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,max}$	0.2004 ***	–0.1090 *	0.0156
	(0.0495)	(0.0660)	(0.1870)
$CGHOLD_{pers}$	0.0078 **	0.0085 ***	0.0204
	(0.0035)	(0.0026)	(0.0138)
F	24.87 ***	5.35 ***	1.97
R^2	0.0003	0.0013	0.0009
Intercept	0.4545 ***	0.6814 ***	0.6139 ***
	(0.0538)	(0.1041)	(0.2005)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.4150 ***	0.0995	–0.1041
	(0.0755)	(0.1696)	(0.2858)
$CGHOLD_{pers}$	0.0117 ***	0.0049	0.0226 **
	(0.0029)	(0.0036)	(0.0114)
F	31.80 ***	4.16 **	2.03
R^2	0.0003	0.0010	0.0010

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 4
Impact of Personal Capital Gains Holding Periods on Observed Market-Adjusted Returns (MARs)

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. CGHOLD is the number of months a stock must be held to qualify for the personal capital gains tax rate t_{cg}. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than $1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, (vi) there is a change in total shares outstanding between the cum- and ex-dates, or (vii) CGHOLD is undefined because short-term and long-term gains are taxed identically an ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio ($\Delta P^*/D$), and the upper and lower 1% are trimmed. The dependent variable for all regressions is the market-adjusted return (MAR), calculated as $(D - \Delta P^*)/P^{cum}$.

Model Regressors	Parameter Estimates by Sample: CRSP (1962-2003) *N* = 190,347	Dow (1910-2003) *N* = 8,262	Dow (1962-2003) *N* = 4,233
Intercept	0.000984 ***	0.002526 ***	0.002855 **
	(0.000272)	(0.000490)	(0.001218)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,max}$	0.001509 ***	–0.000234	0.001556
	(0.000277)	(0.000560)	(0.001210)
$CGHOLD_{pers}$	–0.000039 **	–0.000078 ***	–0.000174 *
	(0.000020)	(0.000022)	(0.000089)
F	36.32 ***	7.19 ***	7.20 ***
R^2	0.0004	0.0017	0.0034
Intercept	0.000872 ***	0.000681	0.002777 ***
	(0.000220)	(0.000650)	(0.000987)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.003528 ***	0.004037 ***	0.003511 *
	(0.000422)	(0.001437)	(0.001848)
$CGHOLD_{pers}$	–0.000064 ***	–0.000008	–0.000198 ***
	(0.000016)	(0.000031)	(0.000074)
F	56.45 ***	11.06 ***	8.18 ***
R^2	0.0006	0.0027	0.0039

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 5
Relationship of Observed Price Drop Ratios (PDRs) to Hypothesized Values by Dividend Yield

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than $1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding between the cum- and ex-dates. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio (PDR), and the upper and lower 1% are trimmed. Observations are ranked quarterly by D/P^{cum} and are classified as high-yield (HY) if they fall in the top 20% or low-yield (LY) if they fall in the bottom 80%. The dependent variable for all regressions is the price drop ratio (PDR), calculated as $\Delta P^*/D$.

Panel A – High-Yield (HY) Stocks

Model Regressors	Parameter Estimates by Sample: CRSP (1962-2003) *N* = 41,496	Dow (1910-2003) *N* = 1,806	Dow (1962-2003) *N* = 952
Intercept	0.8388 ***	0.9888 ***	0.9294 ***
	(0.0172)	(0.0374)	(0.0925)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\ max}$	0.1512 ***	–0.0850	–0.0860
	(0.0271)	(0.0629)	(0.1503)
F	31.22 ***	1.83	0.33
R^2	0.0008	0.0010	0.0003
Intercept	0.7380 ***	0.8038 ***	0.9488 ***
	(0.0355)	(0.0906)	(0.1718)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\ infl\text{-}adj}$	0.2585 ***	0.1842	–0.0984
	(0.0473)	(0.1151)	(0.2403)
F	29.81 ***	2.56	0.17
R^2	0.0007	0.0014	0.0002
Intercept	1.2017 ***	0.9876 ***	0.7818 ***
	(0.0504)	(0.1066)	(0.2943)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{corp}$	–0.1660 ***	–0.0267	0.0582
	(0.0304)	(0.0666)	(0.1741)
F	29.81 ***	0.16	0.11
R^2	0.0007	0.0001	0.0001

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 5 (continued)
Relationship of Observed Price Drop Ratios (PDRs) to Hypothesized Values by Dividend Yield

Panel B – Low-Yield (LY) Stocks

Model Regressors	CRSP (1962-2003) *N* = 161,995	Dow (1910-2003) *N* = 7,361	Dow (1962-2003) *N* = 3,615
	Parameter Estimates by Sample		
Intercept	0.7149 ***	0.7534 ***	0.5167 ***
	(0.0275)	(0.0337)	(0.1009)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{\text{pers max}}$	0.2090 ***	0.0737	0.3383 **
	(0.0433)	(0.0542)	(0.1517)
F	23.26 ***	1.85	4.97 **
R^2	0.0001	0.0003	0.0014
Intercept	0.5725 ***	0.4985 ***	0.3574 *
	(0.0567)	(0.0920)	(0.2167)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{\text{pers infl-adj}}$	0.3613 ***	0.3645 ***	0.4843 *
	(0.0758)	(0.1120)	(0.2804)
F	22.71 ***	10.59 ***	2.98 *
R^2	0.0001	0.0014	0.0008
Intercept	1.2593 ***	0.9879 ***	1.2291 ***
	(0.0812)	(0.0943)	(0.2812)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{\text{corp}}$	–0.2554 ***	–0.1278 **	–0.3109 *
	(0.0489)	(0.0604)	(0.1724)
F	27.24 ***	4.47 **	3.25 *
R^2	0.0002	0.0006	0.0009

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 6
Relationship of Observed Market-Adjusted Returns (MARs) to Hypothesized Values by Dividend Yield

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than \$1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding between the cum- and ex-dates. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio ($\Delta P^*/D$), and the upper and lower 1% are trimmed. Observations are ranked quarterly by D/P^{cum} and are classified as high-yield (HY) if they fall in the top 20% or low-yield (LY) if they fall in the bottom 80%. The dependent variable for all regressions is the market-adjusted return (MAR), calculated as $(D - \Delta P^*)/P^{cum}$.

Panel A – High-Yield (HY) Stocks

Model Regressors	Parameter Estimates by Sample: CRSP (1962-2003) *N* = 41,496	Dow (1910-2003) *N* = 1,806	Dow (1962-2003) *N* = 952
Intercept	0.000210	0.001250 **	0.001985 *
	(0.000211)	(0.000602)	(0.001039)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,max}$	0.002044 ***	–0.001031	–0.000831
	(0.000453)	(0.001039)	(0.002209)
F	20.34 ***	0.99	0.14
R^2	0.0005	0.0005	0.0001
Intercept	0.000065	–0.000196	0.001365
	(0.000233)	(0.000542)	(0.001148)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.003711 ***	0.004076 **	0.000907
	(0.000793)	(0.001900)	(0.003531)
F	21.91 ***	4.60 **	0.07
R^2	0.0005	0.0025	0.0001
Intercept	–0.000340	0.000187	0.001372
	(0.000344)	(0.000707)	(0.001803)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{corp}$	–0.002140 ***	–0.000971	–0.000386
	(0.000509)	(0.001101)	(0.002558)
F	17.66 ***	0.78	0.02
R^2	0.0004	0.0004	0.0000

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 6 (continued)
Relationship of Observed Market-Adjusted Returns (MARs) to Hypothesized Values by Dividend Yield

Panel B – Low-Yield (LY) Stocks

Model Regressors	CRSP (1962-2003) $N = 161{,}995$	Dow (1910-2003) $N = 7{,}361$	Dow (1962-2003) $N = 3{,}615$
	Parameter Estimates by Sample		
Intercept	0.000785 ***	0.001357 ***	0.000547
	(0.000101)	(0.000246)	(0.000399)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{pers max}}$	0.001360 ***	0.000754 *	0.003609 ***
	(0.000215)	(0.000425)	(0.000884)
F	40.04 ***	3.15 *	16.68 ***
R^2	0.0002	0.0004	0.0046
Intercept	0.000596 ***	0.001064 ***	0.000480
	(0.000111)	(0.000221)	(0.000444)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{pers infl-adj}}$	0.002825 ***	0.003351 ***	0.006048 ***
	(0.000376)	(0.000877)	(0.001634)
F	56.45 ***	14.60 ***	13.70 ***
R^2	0.0003	0.0020	0.0038
Intercept	0.000128	0.001145 ***	–0.000722
	(0.000165)	(0.000289)	(0.000656)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{corp}}$	–0.001872 ***	–0.001072 **	–0.004281 ***
	(0.000243)	(0.000473)	(0.001004)
F	59.52 ***	5.13 **	18.19 ***
R^2	0.0004	0.0007	0.0050

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 7
Relationship of Observed Price Drop Ratios (PDRs) to Hypothesized Values with High-Yield (HY) Dummy Variable

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than \$1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding between the cum- and ex-dates. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio (PDR), and the upper and lower 1% are trimmed. HY equals 1 if the observation falls in the top 20% of dividends (ranked quarterly by D/P^{cum}) and 0 otherwise. The dependent variable for all regressions is the price drop ratio (PDR), calculated as $\Delta P^*/D$.

Model Regressors	Parameter Estimates by Sample: CRSP (1962-2003) N = 203,491	Dow (1910-2003) N = 9,167	Dow (1962-2003) N = 4,567
Intercept	0.7149 ***	0.7534 ***	0.5167 ***
	(0.0248)	(0.0312)	(0.0921)
HY	0.1239 **	0.2355 ***	0.4127 *
	(0.0552)	(0.0724)	(0.2132)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,max}$	0.2090 ***	0.0737	0.3383 **
	(0.0392)	(0.0502)	(0.1384)
$HY \times \left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,max}$	–0.0578	–0.1587	–0.4244
	(0.0868)	(0.1208)	(0.3415)
F	17.64 ***	6.45 ***	3.47 **
R^2	0.0003	0.0021	0.0023
Intercept	0.5725 ***	0.4985 ***	0.3574 *
	(0.0512)	(0.0853)	(0.1977)
HY	0.1655	0.3053 *	0.5914
	(0.1136)	(0.1798)	(0.4080)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.3613 ***	0.3645 ***	0.4843 *
	(0.0685)	(0.1038)	(0.2557)
$HY \times \left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,infl\text{-}adj}$	–0.1028	–0.1802	–0.5827
	(0.1517)	(0.2262)	(0.5610)
F	17.36 ***	9.93 ***	2.66 **
R^2	0.0003	0.0032	0.0017

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 8
Relationship of Observed Market-Adjusted Returns (MARs) to Hypothesized Values with High-Yield (HY) Dummy Variable

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than $1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding between the cum- and ex-dates. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio ($\Delta P^*/D$), and the upper and lower 1% are trimmed. HY equals 1 if the observation falls in the top 20% of dividends (ranked quarterly by D/P^{cum}) and 0 otherwise. The dependent variable for all regressions is the market-adjusted return (MAR), calculated as $(D - \Delta P^*)/P^{cum}$.

Model Regressors	Parameter Estimates by Sample: CRSP (1962-2003) *N* = 203,491	Dow (1910-2003) *N* = 9,167	Dow (1962-2003) *N* = 4,567
Intercept	0.000785 ***	0.00136 ***	0.000547
	(0.000102)	(0.00025)	(0.000408)
HY	–0.000575 **	–0.000108	0.001438
	(0.000225)	(0.000606)	(0.001043)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,max}$	0.001360 ***	0.000754 *	0.003609 ***
	(0.000218)	(0.000435)	(0.000904)
$HY \times \left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,max}$	0.000684	–0.00178 *	–0.004441 **
	(0.000483)	(0.00105)	(0.002232)
F	22.97 ***	4.35 ***	5.48 ***
R^2	0.0003	0.0014	0.0036
Intercept	0.000596 ***	0.00106 ***	0.000480
	(0.000112)	(0.00023)	(0.000455)
HY	–0.000531 **	–0.00126 **	0.000885
	(0.000248)	(0.00055)	(0.001154)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.002825 ***	0.00335 ***	0.006048 ***
	(0.000381)	(0.00090)	(0.001672)
$HY \times \left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.000886	0.00072	–0.005141
	(0.000844)	(0.00196)	(0.003667)
F	28.87 ***	9.43 ***	4.51 ***
R^2	0.0004	0.0031	0.0030

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 9
Impact of Tax Differential on Sensitivity of Price Drop Ratios to Dividend Yields

The CRSP sample includes all taxable cash dividends by NYSE/AMEX-listed domestic corporations with ex-dates from 7/2/1962 to 12/31/2003. The Dow sample includes all taxable cash dividends from 1/1/1910 to 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes Dow dividends from 7/2/1962 to 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's prior ex-date, (iii) D < \$0.01, (iv) P^{cum} or P^{ex} is less than \$1, (v) the stock is untraded over trading days [-6,-1] or [0,+5], where 0 is the ex-day, (vi) there is a change in shares outstanding between the cum- and ex-dates, or (vii) $D/P^{cum} > 0.10$. The price drop ΔP^* is the last price over [-6,-1] minus the first closing price over [0,+5] and is adjusted for the market return. Each sample is sorted by price drop ratio ($\Delta P^*/D$), and the upper and lower 1% are trimmed. In Panel A, regressions are estimated for the entire sample. In Panel B, PDR is regressed on D/P^{cum} separately for each year (excluding some of the dividends in years with mid-year tax changes), and the resulting slope estimates are regressed on $|t_d - t_{cg}|$.

Panel A – Dependent Variable: Price Drop Ratio (PDR)

Model Regressors	Parameter Estimates by Sample: CRSP (1962-2003) *N* = 203,384	Dow (1910-2003) *N* = 9,165	Dow (1962-2003) *N* = 4,567
Intercept	0.8350 ***	0.6391 ***	0.5563 ***
	(0.0151)	(0.0325)	(0.0651)
D/P^{cum}	2.3487 *	15.4891 ***	20.3774 ***
	(1.3687)	(2.4385)	(5.8321)
F	2.94 *	40.35 ***	12.21 ***
R^2	0.0000	0.0044	0.0027

Panel B – Dependent Variable: Sensitivity of PDR to Dividend Yield

Model Regressors	Parameter Estimates by Sample: CRSP (1962-2003) *N* = 42	Dow (1910-2003) *N* = 94	Dow (1962-2003) *N* = 42
Intercept	–7.0177	12.5330 *	3.9420
	(4.7564)	(7.1606)	(19.8722)
$|t_d - t_{cg}|_{pers\ max}$	32.9573 **	32.0807 *	99.0566
	(14.3540)	(17.7838)	(59.9714)
F	5.27 **	3.25 *	2.73
R^2	0.1164	0.0342	0.0639
Intercept	–5.8501	14.1872 *	23.9573
	(5.2995)	(7.3252)	(22.2761)
$|t_d - t_{cg}|_{pers\ infl\text{-}adj}$	42.7606 *	57.9896	42.3868
	(24.3546)	(39.3261)	(102.3733)
F	3.08 *	2.17	0.17
R^2	0.0716	0.0231	0.0043

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 10
Relationship of Price Drop Ratios (PDRs) to Recent Capital Gains

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than $1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio (PDR), and the upper and lower 1% are trimmed. The dependent variable for all regressions is the price drop ratio (PDR), calculated as $\Delta P^*/D$.

Model Regressors	Parameter Estimates: 45-Day Gains N = 137,754	300-Day Gains N = 31,971
Intercept	0.6782 ***	0.6781 ***
	(0.0251)	(0.0520)
%GAIN	0.5022 ***	0.0589
	(0.0625)	(0.0372)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,max}$	0.2815 ***	0.4590 ***
	(0.0422)	(0.1021)
F	54.03 ***	11.12 ***
R^2	0.0008	0.0007
Intercept	0.4635 ***	0.4836 ***
	(0.0562)	(0.1329)
%GAIN	0.5073 ***	0.0536
	(0.0626)	(0.0372)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.5122 ***	0.5966 ***
	(0.0767)	(0.1898)
F	54.08 ***	5.95 ***
R^2	0.0008	0.0004

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 11
Relationship of Market-Adjusted Returns (MARs) to Recent Capital Gains

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than \$1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio ($\Delta P^*/D$), and the upper and lower 1% are trimmed. The dependent variable for all regressions is the market-adjusted return (MAR), calculated as $(D - \Delta P^*)/P^{cum}$.

Model Regressors	Parameter Estimates: 45-Day Gains N = 137,754	Parameter Estimates: 300-Day Gains N = 31,971
Intercept	0.000717 ***	0.000077
	(0.000126)	(0.000421)
%GAIN	–0.005083 ***	–0.001275 ***
	(0.000372)	(0.000278)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,max}$	0.001858 ***	0.002472 ***
	(0.000251)	(0.000763)
F	120.22 ***	15.23 ***
R^2	0.0017	0.0010
Intercept	0.000430 ***	0.000104
	(0.000139)	(0.000455)
%GAIN	–0.005128 ***	–0.001247 ***
	(0.000372)	(0.000278)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.004032 ***	0.004127 ***
	(0.000456)	(0.001419)
F	131.92 ***	14.21 ***
R^2	0.0019	0.0009

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 12
Relationship of Price Drop Ratios (PDRs) to Recent Capital Gains by Dividend Yield and Gain/Loss Classification

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than $1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio (PDR), and the upper and lower 1% are trimmed. Observations are ranked quarterly by D/P^{cum} and are classified as high-yield (HY) if they fall in the top 20% or low-yield (LY) if they fall in the bottom 80%. Observations are also classified as having positive (+) or negative (−) recent performance depending on the sign of %GAIN. The dependent variable for all regressions is the price drop ratio (PDR), calculated as $\Delta P^*/D$.

Panel A – High-Yield Stocks with Positive Recent Performance (HY+)

Model Regressors	Parameter Estimates: 45-Day Gains $N = 14{,}785$	Parameter Estimates: 300-Day Gains $N = 4{,}193$
Intercept	0.9432 ***	0.8516 ***
	(0.0284)	(0.0546)
%GAIN	0.4151 ***	–0.0539
	(0.1108)	(0.0736)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{\text{pers max}}$	0.0397	0.2654 ***
	(0.0431)	(0.0924)
F	7.34 ***	4.50 **
R^2	0.0010	0.0021
Intercept	0.8651 ***	0.6865 ***
	(0.0597)	(0.1332)
%GAIN	0.4281 ***	–0.0488
	(0.1111)	(0.0739)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{\text{pers infl-adj}}$	0.1364 *	0.4148 **
	(0.0785)	(0.1790)
F	8.42 ***	3.07 **
R^2	0.0011	0.0015

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 12 (continued)
Relationship of Price Drop Ratios (PDRs) to Recent Capital Gains by Dividend Yield and Gain/Loss Classification

Panel B – Low-Yield Stocks with Positive Recent Performance (LY+)

Model Regressors	Parameter Estimates: 45-Day Gains $N = 60{,}818$	Parameter Estimates: 300-Day Gains $N = 13{,}451$
Intercept	0.6333 ***	0.6732 ***
	(0.0449)	(0.0964)
%GAIN	0.4438 ***	0.1131 *
	(0.1261)	(0.0639)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,max}$	0.3072 ***	0.3606 *
	(0.0700)	(0.1865)
F	15.52 ***	3.35 **
R^2	0.0005	0.0005
Intercept	0.3636 ***	0.7009 ***
	(0.0964)	(0.2535)
%GAIN	0.4841 ***	0.1130 *
	(0.1265)	(0.0641)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.6007 ***	0.2018
	(0.1279)	(0.3591)
F	16.91 ***	1.64
R^2	0.0006	0.0002

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 12 (continued)
Relationship of Price Drop Ratios (PDRs) to Recent Capital Gains by Dividend Yield and Gain/Loss Classification

Panel C – High-Yield Stocks with Negative Recent Performance (HY−)

Model Regressors	Parameter Estimates: 45-Day Gains $N = 14{,}201$	Parameter Estimates: 300-Day Gains $N = 4{,}655$
Intercept	0.7529 ***	0.9246 ***
	(0.0321)	(0.0655)
%GAIN	1.1707 ***	0.5491 ***
	(0.1454)	(0.1235)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,max}$	0.2971 ***	0.0490
	(0.0516)	(0.1180)
F	47.46 ***	9.98 ***
R^2	0.0066	0.0043
Intercept	0.5569 ***	0.7865 ***
	(0.0699)	(0.1602)
%GAIN	1.1250 ***	0.5308 ***
	(0.1453)	(0.1248)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.4926 ***	0.2260
	(0.0941)	(0.2193)
F	44.57 ***	10.43 ***
R^2	0.0062	0.0045

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 12 (continued)
Relationship of Price Drop Ratios (PDRs) to Recent Capital Gains by Dividend Yield and Gain/Loss Classification

Panel D – Low-Yield Stocks with Negative Recent Performance (LY−)

Model Regressors	Parameter Estimates: 45-Day Gains $N = 47{,}950$	Parameter Estimates: 300-Day Gains $N = 9{,}672$
Intercept	0.7171 ***	0.4320 ***
	(0.0515)	(0.1274)
%GAIN	1.0894 ***	−0.1014
	(0.2091)	(0.1979)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,max}$	0.3161 ***	0.9801 ***
	(0.0806)	(0.2344)
F	21.25 ***	8.85 ***
R^2	0.0009	0.0018
Intercept	0.5389 ***	−0.1198
	(0.1094)	(0.2967)
%GAIN	1.0529 ***	−0.1745
	(0.2094)	(0.1993)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.4838 ***	1.4663 ***
	(0.1462)	(0.4165)
F	19.04 ***	6.30 ***
R^2	0.0008	0.0013

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 13
Relationship of Market-Adjusted Returns (MARs) to Recent Capital Gains by Dividend Yield and Gain/Loss Classification

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than \$1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio ($\Delta P^*/D$), and the upper and lower 1% are trimmed. Observations are ranked quarterly by D/P^{cum} and are classified as high-yield (HY) if they fall in the top 20% or low-yield (LY) if they fall in the bottom 80%. Observations are also classified as having positive (+) or negative (−) recent performance depending on the sign of %GAIN. The dependent variable for all regressions is the market-adjusted return (MAR), calculated as $(D - \Delta P^*)/P^{cum}$.

Panel A – High-Yield Stocks with Positive Recent Performace (HY+)

Model Regressors	Parameter Estimates: 45-Day Gains $N = 14{,}785$	Parameter Estimates: 300-Day Gains $N = 4{,}193$
Intercept	0.000306	–0.001583 *
	(0.000394)	(0.000872)
%GAIN	–0.006483 ***	0.001123
	(0.001874)	(0.001242)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,max}$	–0.000024	0.003114 **
	(0.000729)	(0.001560)
F	6.00 ***	2.50 *
R^2	0.0008	0.0012
Intercept	0.000139	–0.001563 *
	(0.000421)	(0.000929)
%GAIN	–0.006557 ***	0.001041
	(0.001879)	(0.001246)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.000603	0.005470 *
	(0.001327)	(0.003019)
F	6.10 ***	2.14
R^2	0.0008	0.0010

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 13 (continued)
Relationship of Market-Adjusted Returns (MARs) to Recent Capital Gains by Dividend Yield and Gain/Loss Classification

Panel B – Low-Yield Stocks with Positive Recent Performance (LY+)

Model Regressors	Parameter Estimates 45-Day Gains $N = 60{,}818$	300-Day Gains $N = 13{,}451$
Intercept	0.000780 ***	0.000252
	(0.000196)	(0.000634)
%GAIN	–0.001389 **	–0.000732 *
	(0.000638)	(0.000376)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{pers max}}$	0.001169 ***	0.001825 *
	(0.000354)	(0.001097)
F	7.69 ***	3.20 **
R^2	0.0003	0.0005
Intercept	0.000510 **	0.001111
	(0.000208)	(0.000685)
%GAIN	–0.001601 **	–0.000722 *
	(0.000640)	(0.000377)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{pers infl-adj}}$	0.002957 ***	0.000379
	(0.000647)	(0.002111)
F	12.68 ***	1.83
R^2	0.0004	0.0003

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 13 (continued)
Relationship of Market-Adjusted Returns (MARs) to Recent Capital Gains by Dividend Yield and Gain/Loss Classification

Panel C – High-Yield Stocks with Negative Recent Performance (HY−)

Model Regressors	Parameter Estimates: 45-Day Gains $N = 14{,}201$	Parameter Estimates: 300-Day Gains $N = 4{,}655$
Intercept	−0.001412 ***	0.000191
	(0.000482)	(0.001266)
%GAIN	−0.02494 ***	−0.01308 ***
	(0.002448)	(0.002260)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{pers max}}$	0.005045 ***	−0.000010
	(0.000869)	(0.002160)
F	66.75 ***	16.75 ***
R^2	0.0093	0.0071
Intercept	−0.001662 ***	−0.000725
	(0.000514)	(0.001287)
%GAIN	−0.02413 ***	−0.01282 ***
	(0.002447)	(0.002284)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{pers infl-adj}}$	0.009298 ***	0.003200
	(0.001584)	(0.004013)
F	67.11 ***	17.07 ***
R^2	0.0094	0.0073

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 13 (continued)
Relationship of Market-Adjusted Returns (MARs) to Recent Capital Gains by Dividend Yield and Gain/Loss Classification

Panel D – Low-Yield Stocks with Negative Recent Performance (LY−)

Model Regressors	Parameter Estimates: 45-Day Gains $N = 47{,}950$	Parameter Estimates: 300-Day Gains $N = 9{,}672$
Intercept	–0.000037	–0.001077
	(0.000251)	(0.000984)
%GAIN	–0.009031 ***	–0.001699
	(0.001167)	(0.001441)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{pers max}}$	0.002387 ***	0.003822 **
	(0.000450)	(0.001707)
F	43.99 ***	3.24 ***
R^2	0.0018	0.0007
Intercept	–0.000140	–0.000963
	(0.000267)	(0.001011)
%GAIN	–0.008706 ***	–0.001387
	(0.001169)	(0.001451)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{pers infl-adj}}$	0.004319 ***	0.006188 **
	(0.000816)	(0.003032)
F	43.94 ***	2.81 *
R^2	0.0018	0.0006

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 14
Relationship of PDRs to Recent Gains with High-Yield (HY) Dummy Variable

The CRSP sample includes all taxable cash dividends paid by NYSE/AMEX-listed domestic corporations with ex-dates from 7/2/1962 to 12/31/2003. The Dow sample includes all taxable cash dividends from 1/1/1910 to 12/31/2003 for firms in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes Dow dividends from 7/2/1962 to 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D < \$0.01, (iv), P^{cum} or P^{ex} < \$1, (v) the stock is untraded over the interval [-6,-1] or [0,+5], where 0 is the ex-day, or (vi) there is a change in shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the market. Each sample is sorted by price drop ratio (PDR), and the upper and lower 1% are trimmed. HY equals 1 if the observation falls in the top 20% of dividends (ranked quarterly by D/P^{cum}) and 0 otherwise. The dependent variable for all regressions is the PDR.

Model Regressors	Parameter Estimates: 45-Day Gains N = 137,754	Parameter Estimates: 300-Day Gains N = 31,971
Intercept	0.6605 ***	0.6849 ***
	(0.0255)	(0.0528)
HY	0.0925 ***	–0.0099
	(0.0230)	(0.0395)
%GAIN	0.4616 ***	0.0368
	(0.0674)	(0.0402)
HY × %GAIN	0.4279 **	0.1708
	(0.1832)	(0.1138)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,max}$	0.2790 ***	0.4552 ***
	(0.0422)	(0.1024)
F	32.90 ***	6.13 ***
R^2	0.0010	0.0008
Intercept	0.4483 ***	0.4950 ***
	(0.0563)	(0.1332)
HY	0.0924 ***	–0.0120
	(0.0230)	(0.0396)
%GAIN	0.4671 ***	0.0311
	(0.0674)	(0.0402)
HY × %GAIN	0.4250 **	0.1711
	(0.1832)	(0.1139)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.5068 ***	0.5882 ***
	(0.0767)	(0.1911)
F	32.89 ***	3.55 ***
R^2	0.0010	0.0004

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 15
Relationship of MARs toRecent Gains with High -Yield (HY) Dummy Variable

The CRSP sample includes taxable cash dividends for NYSE/AMEX-listed domestic corporations with ex-dates 7/2/1962 to 12/31/2003. The Dow sample includes taxable cash dividends with from 1/1/1910 to 12/31/2003 for firms in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes Dow dividends from 7/2/1962 to 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's prior ex-date, (iii) D < \$0.01, (iv), P^{cum} or $P^{ex} < \$1$, (v) the stock is untraded over [-6,-1] or [0,+5], where 0 is the ex-day, or (vi) there is a change in shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45 or 300 trading days before the ex-date. The price drop ΔP^* is the last price over [-6,-1] minus the first closing price over [0,+5] and is adjusted for the market. Each sample is sorted by $\Delta P^*/D$, and the upper and lower 1% are trimmed. HY equals 1 if the observation falls in the top 20% of dividends (ranked quarterly by D/P^{cum}) and 0 otherwise. The dependent variable is the market-adjusted return (MAR).

Model Regressors	Parameter Estimates: 45-Day Gains N = 137,754	300-Day Gains N = 31,971
Intercept	0.000741 ***	–0.000091
	(0.000130)	(0.000435)
HY	–0.000189	0.000494 *
	(0.000137)	(0.000295)
%GAIN	–0.003412 ***	–0.000756 **
	(0.000400)	(0.000301)
HY × %GAIN	–0.01279 ***	–0.003724 ***
	(0.001088)	(0.000851)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{pers max}}$	0.001842 ***	0.002432 ***
	(0.000251)	(0.000765)
F	96.25 ***	12.89 ***
R^2	0.0028	0.0016
Intercept	0.000458 ***	–0.000079
	(0.000142)	(0.000473)
HY	–0.000186	0.000525 *
	(0.000137)	(0.000296)
%GAIN	–0.003459 ***	–0.000727 **
	(0.000400)	(0.000300)
HY × %GAIN	–0.01276 ***	–0.003701 ***
	(0.001088)	(0.000851)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{\text{pers infl-adj}}$	0.003989 ***	0.004078 ***
	(0.000455)	(0.001428)
F	101.93 ***	12.40 ***
R^2	0.0030	0.0015

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 16
Relationship of Price Drop Ratios (PDRs) to Recent Capital Gains with Dummy Variable for Positive Gains

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than $1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio (PDR), and the upper and lower 1% are trimmed. POS equals 1 if %GAIN > 0, and 0 otherwise. The dependent variable for all regressions is the price drop ratio (PDR), calculated as $\Delta P^*/D$.

Model Regressors	Parameter Estimates: 45-Day Gains $N = 137,754$	Parameter Estimates: 300-Day Gains $N = 31,971$
Intercept	0.7120 ***	0.6693 ***
	(0.0270)	(0.0551)
%GAIN	0.9238 ***	0.0072
	(0.1402)	(0.1135)
POS × %GAIN	−0.6531 ***	0.0663
	(0.1944)	(0.1376)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,max}$	0.2801 ***	0.4601 ***
	(0.0422)	(0.1022)
F	39.79 ***	7.49 ***
R^2	0.0009	0.0007
Intercept	0.5041 ***	0.4568 ***
	(0.0578)	(0.1372)
%GAIN	0.8822 ***	−0.0313
	(0.1404)	(0.1143)
POS × %GAIN	−0.5811 ***	0.1090
	(0.1948)	(0.1387)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.4967 ***	0.6154 ***
	(0.0769)	(0.1913)
F	39.02 ***	4.17 ***
R^2	0.0008	0.0004

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 17
Relationship of Market-Adjusted Returns (MARs) to Recent Capital Gains with Dummy Variable for Positive Gains

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than \$1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio ($\Delta P^*/D$), and the upper and lower 1% are trimmed. POS equals 1 if %GAIN > 0, and 0 otherwise. The dependent variable for all regressions is the market-adjusted return (MAR), calculated as $(D - \Delta P^*)/P^{cum}$.

Model Regressors	Parameter Estimates: 45-Day Gains N = 137,754	Parameter Estimates: 300-Day Gains N = 31,971
Intercept	0.000202	–0.000386
	(0.000138)	(0.000438)
%GAIN	–0.01179 ***	–0.004329 ***
	(0.000833)	(0.000848)
POS × %GAIN	0.01039 ***	0.003920 ***
	(0.001154)	(0.001028)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,max}$	0.001835 ***	0.002411 ***
	(0.000251)	(0.000763)
F	107.18 ***	15.00 ***
R^2	0.0023	0.0014
Intercept	0.000006	–0.000166
	(0.000147)	(0.000461)
%GAIN	–0.01147 ***	–0.004108 ***
	(0.000834)	(0.000854)
POS × %GAIN	0.009827 ***	0.003672 ***
	(0.001157)	(0.001036)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.003770 ***	0.003494 **
	(0.000457)	(0.001430)
F	112.05 ***	13.66 ***
R^2	0.0024	0.0013

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 18
Relationship of Price Drop Ratios (PDRs) to Recent Capital Gains with Last Quarter Dummy Variable

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than $1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio (PDR), and the upper and lower 1% are trimmed. LASTQTR equals 1 if the ex-day occurs between October 1 and December 31, and 0 otherwise. The dependent variable for all regressions is the price drop ratio (PDR), calculated as $\Delta P^*/D$.

Model Regressors	Parameter Estimates: 45-Day Gains *N* = 137,754	Parameter Estimates: 300-Day Gains *N* = 31,971
Intercept	0.6782 ***	0.6796 ***
	(0.0251)	(0.0520)
%GAIN	0.5130 ***	0.0764 *
	(0.0724)	(0.0430)
LASTQTR × %GAIN	−0.0419	−0.0672
	(0.1414)	(0.0825)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,max}$	0.2813 ***	0.4561 ***
	(0.0422)	(0.1022)
F	36.05 ***	7.63 ***
R^2	0.0008	0.0007
Intercept	0.4635 ***	0.4816 ***
	(0.0562)	(0.1329)
%GAIN	0.5212 ***	0.0755 *
	(0.0724)	(0.0430)
LASTQTR × %GAIN	−0.0536	−0.0841
	(0.1413)	(0.0825)
$\left(\frac{1-t_d}{1-t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.5121 ***	0.5995 ***
	(0.0767)	(0.1899)
F	36.10 ***	4.31 ***
R^2	0.0008	0.0004

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 19
Relationship of Market-Adjusted Returns (MARs) to Recent Capital Gains with Last Quarter Dummy Variable

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than $1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio ($\Delta P^*/D$) and the upper and lower 1% are trimmed. LASTQTR equals 1 if the ex-day occurs between October 1 and December 31, and 0 otherwise. The dependent variable for all regressions is the market-adjusted return (MAR), calculated as $(D - \Delta P^*)/P^{cum}$.

Model Regressors	Parameter Estimates: 45-Day Gains N = 137,754	Parameter Estimates: 300-Day Gains N = 31,971
Intercept	0.000715 ***	0.000106
	(0.000126)	(0.000421)
%GAIN	–0.004985 ***	–0.001623 ***
	(0.000430)	(0.000321)
LASTQTR × %GAIN	–0.000381	0.001339 **
	(0.000840)	(0.000617)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,max}$	0.001860 ***	0.002414 ***
	(0.000251)	(0.000764)
F	80.21 ***	11.73 ***
R^2	0.0017	0.0011
Intercept	0.000429 ***	0.000087
	(0.000139)	(0.000455)
%GAIN	–0.005048 ***	–0.001621 ***
	(0.000430)	(0.000321)
LASTQTR × %GAIN	–0.000310	0.001435 **
	(0.000840)	(0.000616)
$\left(\frac{t_d - t_{cg}}{1 - t_{cg}}\right)_{pers\,infl\text{-}adj}$	0.004033 ***	0.004177 ***
	(0.000456)	(0.001419)
F	87.99 ***	11.29 ***
R^2	0.0019	0.0011

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 20
Relationship of Price Drop Ratios (PDRs) to Future Changes in the Capital Gains Tax Rate

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than \$1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. Δt_{cg} is defined as the difference between t_{cg} six months after the ex-date and the current value of t_{cg}. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio (PDR), and the upper and lower 1% are trimmed. The dependent variable for all regressions is the price drop ratio (PDR), calculated as $\Delta P^*/D$.

Model Regressors	Parameter Estimates: 45-Day Gains N = 137,754	300-Day Gains N = 31,971
Intercept	0.8324 ***	0.8987 ***
	(0.0095)	(0.0180)
%GAIN	0.4803 ***	0.0518
	(0.0627)	(0.0372)
$(\Delta t_{cg})_{pers\ max}$	−2.5027 ***	−1.3424
	(0.5022)	(1.2012)
F	44.20 ***	1.64
R^2	0.0006	0.0001
Intercept	0.8328 ***	0.8972 ***
	(0.0095)	(0.0179)
%GAIN	0.4854 ***	0.0523
	(0.0627)	(0.0373)
$(\Delta t_{cg})_{pers\ infl\text{-}adj}$	−1.9458 ***	−0.6818
	(0.5522)	(1.3198)
F	37.99 ***	1.15
R^2	0.0006	0.0001

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

Table 21
Relationship of Market-Adjusted Returns (MARs) to Future Changes in the Capital Gains Tax Rate

The CRSP sample includes all taxable cash dividends (code 12N2) paid by NYSE/AMEX-listed domestic corporations (share type codes 10-11) with ex-dates between 7/2/1962 and 12/31/2003. The Dow sample includes all taxable cash dividends with ex-dates between 1/1/1910 and 12/31/2003 for companies in the Dow Jones Industrial Average on the ex-date. The Post-1962 Dow sample includes dividends in the Dow sample for ex-dates between 7/2/1962 and 12/31/2003. Observations are deleted if (i) any other type of distribution by the same firm has the same ex-date, (ii) the ex-date is less than 4 trading days after the firm's previous ex-date, (iii) D is less than 1 cent, (iv), P^{cum} or P^{ex} is less than $1, (v) the stock is untraded over the interval of trading days [-6,-1] or [0,+5], where day 0 is the ex-day, or (vi) there is a change in total shares outstanding during the period over which %GAIN is calculated. %GAIN is the cumulative percentage increase in the stock price over the 45-day or 300-day continuous period preceding the ex-date. Δt_{cg} is defined as the difference between t_{cg} six months after the ex-date and the current value of t_{cg}. The price drop ΔP^* is the last price over the interval [-6,-1] minus the first closing price over [0,+5] and is adjusted for the realized market return over the corresponding day(s). Each sample is sorted by price drop ratio ($\Delta P^*/D$), and the upper and lower 1% are trimmed. The dependent variable for all regressions is the market-adjusted return (MAR), calculated as $(D - \Delta P^*)/P^{cum}$.

Model Regressors	Parameter Estimates: 45-Day Gains *N* = 137,754	Parameter Estimates: 300-Day Gains *N* = 31,971
Intercept	0.001557 ***	0.001355 ***
	(0.000056)	(0.000134)
%GAIN	–0.004961 ***	–0.001231 ***
	(0.000372)	(0.000278)
$(\Delta t_{cg})_{pers\ max}$	0.01348 ***	0.01475
	(0.002984)	(0.008978)
F	102.93 ***	11.33 ***
R^2	0.0015	0.0007
Intercept	0.001554 ***	0.001373 ***
	(0.000056)	(0.000134)
%GAIN	–0.005008 ***	–0.001233 ***
	(0.000372)	(0.000278)
$(\Delta t_{cg})_{pers\ infl\text{-}adj}$	0.007556 **	0.0105
	(0.003281)	(0.009865)
F	95.36 ***	10.55 ***
R^2	0.0014	0.0007

*, **, or *** indicates statistical significance at the 10%, 5%, or 1% level, respectively. Parameters and their associated standard errors (shown in parentheses) are estimated using Ordinary Least Squares (OLS).

VITA

Jeffrey Lynn Whitworth

Candidate for the Degree of

Doctor of Philosophy

Thesis: EX-DIVIDEND STOCK PRICE BEHAVIOR: EVIDENCE FROM A CENTURY OF TAX LAW CHANGES

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Education: Graduated from Vanoss High School, Ada, Oklahoma in May 1994; received Bachelor of Science degree in Mathematics from Oklahoma State University, Stillwater, Oklahoma in May 1998. Completed the requirements for the degree of Doctor of Philosophy with a major in Finance at Oklahoma State University in July, 2005.

Experience: Served as National Parliamentarian and Oklahoma State President for the Future Business Leaders of America in high school; employed as a tutor by the Oklahoma State University Department of Mathematics as an undergraduate; employed as a lecturer by the Oklahoma State University Department of mathematics as a graduate student; employed as a summer intern at Rural Enterprises of Oklahoma; employed as a graduate teaching and research associate and as a faculty adjunct by the Oklahoma State University Department of Finance, 1999 to present.

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Name: Jeffrey Lynn Whitworth Date of Degree: July, 2005

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: EX-DIVIDEND STOCK PRICE BEHAVIOR: EVIDENCE FROM A CENTURY OF TAX LAW CHANGES

Pages in Study: 130 Candidate for the Degree of Doctor of Philosophy

Major Field: Finance

Scope and Method of Study: This study tests the tax clientele model of ex-dividend stock price behavior developed by Elton and Gruber (1970). Ordinary least squares (OLS) estimation is used to determine whether actual ex-dividend price drop ratios (PDRs) and market-adjusted returns (MARs) are related to dividend and capital gains tax rates in the theorized manner. The relationship between PDR and dividend yield is examined to determine whether it strengthens with wider tax differentials $|t_d - t_{cg}|$. The Center for Research in Security Prices (CRSP) daily database is employed along with a sample of dividends paid by firms in the Dow Jones Industrial Average dating back to 1910. This study also develops a tax timing model showing that accumulated capital gains on a stock can weaken the ex-day effect. OLS regressions are used on the CRSP sample to test whether PDRs and MARs are related to recent changes in the stock price and to future changes in the capital gains tax rate t_{cg}.

Findings and Conclusions: Regression results confirm that PDRs are related to $\frac{1 - t_d}{1 - t_{cg}}$ and MARs are related to $\frac{t_d - t_{cg}}{1 - t_{cg}}$ as expected when t_d and t_{cg} are the tax rates faced by individuals. Regressions also show that PDRs are positively related to the dividend yield and that the strength of this relationship increases with the differential $|t_d - t_{cg}|$. We conclude, therefore, that tax clienteles exist and that they influence ex-dividend stock price behavior. Regression results do confirm that PDRs and MARs are related to recent stock price changes. However, the relationship is unexpectedly stronger for high-yield stocks and for those with accrued losses. Therefore, we conclude that the tax timing model does not adequately describe the relationship between the ex-day effect and past returns. Finally, the results confirm that PDRs and MARs are related to future changes in t_{cg} as hypothesized.

ADVISER'S APPROVAL: Ramesh P. Rao