The Dividend Disconnect *

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Abstract

Many individual investors, mutual funds and institutions trade as if dividends and capital gains are disconnected attributes, not fully appreciating that dividends result in price decreases. Behavioral trading patterns (e.g. the disposition effect) are driven by price changes instead of total returns. Investors rarely reinvest dividends, and trade as if dividends are a separate, stable income stream. Analysts fail to account for the effect of dividends on price, leading to optimistic price forecasts for dividend-paying stocks. Demand for dividends is systematically higher in periods of low interest rates and poor market performance, leading to lower returns for dividend-paying stocks.

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> "The humble dividend is reclaiming its rightful place as the arbiter of stock-market value... To investors desperate for income, the argument for buying equities is, well, duh. Who wouldn't want a higher income? Shares might swing around, but corporate managers go out of their way to preserve the dividend."
> - James MacKintosh, *The Wall Street Journal* May 9, 2016

At the heart of the dividend irrelevance result from Miller and Modigliani (1961) is the idea that money is fungible, implying that a value-maximizing investor should treat money equally regardless of its source. Because of this, academic finance typically assumes that an investor in a frictionless world will be indifferent between receiving $1 worth of dividends (with the price declining by $1) and selling $1 worth of that position. Adding real-world frictions such as taxes and trading costs to the model can influence whether an investor prefers to receive a dividend or sell a given amount of stock. However, even with these frictions, investors are assumed to simply maximize the value of their position after subtracting costs, and otherwise treat the two sources of profits equally. This assumption (implicitly) underlies the vast majority of asset pricing research, as it justifies why a return that combines capital gains and dividends is the central variable of analysis.

While the idea in Miller and Modigliani (1961) is intuitive when explicitly laid out, some of its implications (e.g. the price declining to offset dividend payment) may not be salient to many investors. Dividend irrelevance runs counter to intuitions from other areas of life, whereby harvesting the fruit from a tree is viewed as fundamentally different to harvesting the tree itself. One often reads statements like the quote with which we began, which may at first glance seem reasonable, but on reflection are difficult to reconcile with the Miller and Modigliani (1961) framework.

To value a stock for its income stream, like our initial quote claims, may speak to a sophisticated understanding of taxes and transaction costs, but the phrase "duh" does not immediately suggest such nuance. The last sentence of the quote implies that dividends are viewed as a safe hedge against uncertain fluctuations in price, thereby ignoring that dividends come directly at the expense of the price level. We term this mistake the free dividends fallacy - unless the tradeoff between price changes and dividends is salient, dividends are apt to appear as a desirable, free source of income. We examine whether evidence of such a mistake is present in the trading and pricing of securities.

We find that the disconnect between price changes and dividends appears to be of considerable practical importance, affecting outcomes as varied as trading relating to gains and losses, prices of dividend-paying stocks, analysts' forecasts, and dividend reinvestment.

We begin by presenting evidence that investors separately track price changes and dividends, rather than combining them into returns. This behavior is consistent with investors utilizing separate mental accounts (Thaler 1980, Thaler 1999, Frydman et al. 2015) for price changes and dividends, an idea first proposed by Shefrin and Statman (1984). If investors track each variable separately, price changes are likely to be more salient as a measure of stock performance, as prices have larger and more frequent moves than dividends. We examine various trading behaviors where the decision to sell an asset is based on some function of past stock performance, and show that the trading is driven primarily by past price changes rather than past returns. We examine the disposition effect (the tendency to sell winners more often than losers, as in Shefrin and Statman 1985), the rank effect (the tendency to sell extreme-ranked positions, as in Hartzmark 2015), and the rolled disposition effect (the tendency to sell a new position once its value exceeds the initial investment in a previously sold position, as in Frydman et al. 2015). Each behavior is a response to a different aspect of past stock performance (e.g. performance relative to purchase price, or performance relative to other holdings in a portfolio), so together they provide a sense of how investors consider "performance." Given that these patterns are behavioral, the economic content of dividends, such as taxes or signaling, is unlikely to account for the results.

For these effects, we decompose the drivers of performance into a price change component and a dividend component. In each case, there is significantly less selling response to the dividend component, and in a number of cases dividends do not appear to be part of the performance evaluation at all. When examining the disposition effect, the perception of gains and losses for individual investors, mutual funds and institutions seem to be largely driven by price changes, without regard to the effect of dividends on the price. When selling extreme-ranked positions, each investor type increases their selling propensity in response to the ranks of stocks based on price changes, but shows little response to ranks that include dividends. When computing the combined

gain and loss on a reinvested position, individual investors (the data on whom allow an examination of this question) trade as if the gain/loss status does not include dividends.

By evaluating stock performance in this manner, investors do not appear to correct for the impact of a dividend on the price level. In other words, if two stocks have increased in price from \$5 to \$6, but one of them first rose to \$7 then paid \$1 of dividends, investors who only focus on price changes treat the two stocks as having equivalent performance. But the fact that investors appear to give dividends less weight when trading based on past performance does not mean that dividends are ignored in the decision-making process. Rather, if price changes and dividends are viewed as disconnected attributes, investors focusing separately on dividends will view the \$1 as a small positive gain, distinct from the price level. Such an investor suffers from the free dividends fallacy, as dividends appear to be a small consistent gain with no apparent offsetting cost in price.

Investors focusing on the dividends, presumably for the perceived attractiveness of the income stream, are likely to pay less attention to the capital gains component of returns. Consistent with this, we show that investors (individuals, mutual funds and institutions) are less likely to sell stocks that pay more dividends. Dividends also make investors less sensitive to past price changes when selling stocks. This supports the prediction that investors do not view dividends and capital gains as part of a combined returns measure, but focus on one variable or the other.

If investors view dividend payments as being separate from the value of their position, they may not reinvest dividends into the stocks from which they came. This has been shown for individuals in Baker et al. (2007) who argued that dividends were financing consumption. We document that dividend reinvestment is also rare among mutual funds and institutions, who lack an obvious consumption motive.[1] We examine how often dividend-paying holdings increase by approximately the number of shares that could be purchased with the dividend on the payment date and compare this to another passive investing benchmark - holding exactly the same number of shares. We show that dividend reinvestment is only about 2.3% as common as zero holdings changes for the case of mutual funds, and 9.6% as common for institutional investors. This lack of reinvestment leads to

[1]Similar to Kaustia and Rantapuska (2012) using Finnish data.

dividend-induced portfolio drift, whereby portfolio weights in dividend-paying positions drift downward over time compared to non-dividend-paying positions. If revealed preference is to be believed, the low level of dividend reinvestment implies that these investors desire to marginally reduce their portfolio weights by the amount of the dividend on the ex-dividend date. It seems more likely that these investors are behaving as if stock prices and dividends are disconnected attributes.

If the free dividends fallacy is widespread, it should be evident in the actions of other market participants. We examine analysts' forecasts of future stock prices to see if they neglect that dividend-paying firms, all else equal, will have lower prices by the amount of the dividend. Consistent with the free dividends fallacy, we find that the price forecast error is significantly more negative for firms with a higher dividend yield. Analysts are professionals following stocks and their forecasts are not impacted by consumption motives, tax considerations or other likely reasons for trading. This is further evidence that the dividend disconnect has a psychological basis, not an economic one.

Next we turn to the marketwide implications of the free dividends fallacy, namely that the desirability of each attribute of performance will shift according to how the separate payoffs are viewed at that time. To proxy for investors' demand for dividend income, we examine the abnormal return in the interim period after dividend announcement and before the ex-date. Hartzmark and Solomon (2013) show that the positive returns in this short period (which lacks dividend-related news, uncertainty, or tax consequences) are linked to price pressure from dividend-seeking investors.

If investors are subject to the free dividends fallacy and view dividends as a distinct source of income, they will place a higher value on that income stream when other options for income are less attractive. Perhaps the closest substitute for dividend income is from bonds. We find that dividend demand is higher when interest rates are low and bond interest payments provide less income. In the cross-section, demand is higher for stocks whose dividends are more stable, and whose dividends have increased in the recent past. Demand for dividends is also lower when recent past market returns have been higher. In these times, the smaller predictable stream of payments from dividends appears less attractive compared with the large recent capital gains, if the two

components are evaluated as separate alternative ways to make money on a stock.

Our results are consistent with investors evaluating their portfolio performance in a more naive way than academic finance has generally assumed. We provide evidence that investors do not treat dividends and capital gains in the same manner, consistent with considering them in separate mental accounts. A disconnect between price changes and dividends would explain why the popular discourse on dividends diverges so sharply from the academic literature. When US Airways called its frequent flier program "Dividend Miles," they presumably had in mind a definition of "paying dividends" similar to that of the Macmillan Dictionary - "to bring you a lot of benefits."[2] It seems unlikely they were trying to convey messages like "tax-disadvantaged miles," "irrelevant miles" or "signaling miles." If investors do not accurately perceive the tradeoff between dividends and price changes, dividend payments will seem like an unambiguously positive aspect of stocks. The fact that this confusion exists even in the financial press is consistent with the effects we document.

The disconnect between price changes and dividends helps to unify a number of results that are puzzling under normal assumptions about returns. Individuals like to consume out of their dividends relative to capital gains (Baker et al. 2007, Di Maggio et al. 2018) consistent with mental accounting distinctions between the two variables. Baker and Wurgler (2004b) argue for a catering theory whereby investors have a general demand for dividends due to psychological or institutional reasons, though the psychology behind this is not discussed at length. The free dividends fallacy not only explains psychologically why dividends may be desirable, but also why the shifting attractiveness of capital gains and dividends can generate time-varying demand for dividends which firms respond to (Baker and Wurgler 2004a). Valuing dividends as an income stream can help to explain the observed preference of older investors for dividends (Graham and Kumar 2006, Becker et al. 2011), and investors failing to perceive the risk-reward tradeoff inherent in the leverage change associated with a dividend (Welch 2016). An overall demand for dividends is consistent with Hartzmark and Solomon (2013), who document abnormally positive returns during dividend months linked to price pressure from dividend-demanding investors. In order to appeal to dividend-demanding investors,

[2]http://www.macmillandictionary.com/us/dictionary/american/pay-dividends

some mutual funds "juice" their dividend yield by trading in and out of dividend-paying stocks to increase the fund's dividend yield even though it results in higher taxes and trading costs (Harris et al. 2015). These results all point to a general time-varying demand for dividends, but do not explain why dividends are desirable.[3]

Our research highlights how decision framing and reference point choice can impact behavior and market outcomes in large, liquid financial markets. Viewing prices and dividends as separate attributes is related to how investors frame a position's performance (Read et al. 1999, Tversky and Kahneman 1985). By splitting attention between price changes (as large, dramatic changes in performance) and dividends (as small stable gains), investors are focusing on salient aspects of equities, similar to the models of Bordalo et al. (2012) and Bordalo et al. (2015). The framing of salient attributes is an important aspect of why certain firms cater to investors in ways that are difficult to understand within simple value-maximizing frameworks (e.g. Celerier and Vallée 2016; Ellison and Ellison 2009 and Harris et al. 2015).

The free dividends fallacy is also costly to investors because of the systematic nature of time-varying dividend demand. In addition to the direct costs and benefits of dividends (such as taxes and trading costs of reinvestment), dividend-seeking investors are likely to buy dividend-paying stocks at the same time as each other. If this demand causes over-pricing in these periods, investors will earn predictably lower returns. We estimate that investors buying dividend-paying stocks during times of high demand earn roughly 2-4% less per year in expectation. Thus, an investor whose preferences for dividends cause him to shift into and out of dividend-paying stocks at the same time as other investors would lose a significant portion of the equity premium by doing so.

[3]The idea that capital gains and dividends might be considered in separate mental accounts was first proposed by Shefrin and Statman (1984). In their model, segregating the two parts into different mental accounts create a preference for dividends for reasons such as solving self-control problems, increasing prospect theory values by combining or separating gains and losses, and lowering regret by not consuming from stock sales. Importantly, these effects all operate regardless of whether or not investors understand the tradeoff between price changes and dividends.

1 Data Sources and Summary Statistics

Information about prices, returns, dividends and market-wide indices are all from CRSP. The individual trader data is the same as used in Barber and Odean (2000) and is processed for analysis as described in Hartzmark (2015) and Frydman et al. (2015). The sample includes trades from January 1991 through November 1996. Each observation is a position that could have been sold, on a day that an investor sells at least one position in their portfolio (a sell day).[4] Positions held before the beginning of the sample are dropped as the initial purchase price is unknown. Short positions are excluded from the analysis, as are all positions that ever have a negative commission. Returns and percentage price changes are calculated from the purchase price to the closing price the day before the sell day. All returns are calculated using the cumulative dividend received over a period, assuming no reinvestment. If a position is purchased multiple times the value weighted average of the multiple purchase prices is used to calculate returns.

In Panel A, we present summary statistics for the individual investor sample. The data covers 54,176 accounts over 313,625 days that included the sale of an equity position. There are 1,506,274 equity positions in total held on those days, with the median investor holding 3 stocks on a day when he sells a position. Out of these positions, 696,138 are stocks that paid a dividend while the investor was holding them.

Information about institutional holdings (13-F filings) and mutual funds holding (s12 filings) are taken from Thomson Reuters. Data cover 1980 to 2015 and the filters from Frazzini (2006) are used to remove observations that appear to be errors. The reinvestment analysis looks at changes in holdings from one report date to the next. We examine reports that occur between 60 and 120 calendar days from each other to focus on quarterly reports. For the selling analysis the data is treated similar to the individual investor analysis, with report dates treated equivalently to a sell date. If a fund reports a holding on a given report date and does not report it in the subsequent filing then the position is considered to be liquidated (change of shares of -100%).

In Panel B, we present summary statistics for the mutual funds and institutions. We have

[4]The internet appendix explores alternative sampling frequencies and finds similar results.

21,743 mutual funds with 279,018 report dates (over which we consider sales, which are a decrease in holding between consecutive report dates). This results in 24,570,258 holdings observations, of which 11,521,670 paid a dividend over the prior quarter. Similarly for institutions, we have observations for 6,761 institutions over 229,528 report dates, covering 57,040,527 holdings observations, of which 28,359,091 paid dividends over the prior quarter.

Because part of our tests involve the question of whether investors perceive dividends as resulting in price decreases (as opposed to being free income), we examine summary statistics about how apparent this tradeoff might be. It bears emphasizing that we do not claim that investors never perceive such a tradeoff. Rather, we seek to evaluate whether an investor would find the tradeoff in price decreases so readily apparent that he would be forced to notice it from casual observation.

Summary statistics of various measures of performance over various horizons are presented in Table 1 Panel C. Examining the daily correlation between return and dividend yield for individual stocks, conditional on a positive dividend yield, we see a positive correlation of about 0.09 (the ex-date price drop is slightly less than the dividend, as documented in Elton and Gruber 1970).

For our purposes, the more important correlation is between price change and dividend yield, particularly given that many investors are likely observing price changes and not returns.[5] At the daily level, we see a robust negative correlation between daily price changes and dividend yields of -0.50 for individual stocks. The negative correlation is unsurprising as it is predicted by Miller and Modigliani (1961). However, even at the daily frequency this number is far away from -1. Even though on average the price drops by roughly the value of the dividend, market movements and idiosyncratic price changes are a large portion of the daily stock return on dividend ex-dates.

The second and third columns examine the monthly and annual frequency. As the time increases (to a level that is probably closer to what most investors use to evaluate their portfolio), the correlation between price change and dividend yield moves closer to 0. While this decrease is a mechanical effect due to greater price volatility over longer horizons, this is still what an investor would observe. The correlation with monthly price changes is -0.103 and at the annual level the

[5]See Hartzmark and Solomon (2017) for an overview of how performance is displayed to investors, including the difficulty of finding actual return measures in most public data sources.

correlation is -0.067. Correlations around -0.1 are sufficiently low that the tradeoff between price changes and dividends is not likely to be salient to a casual observer without access to large datasets. In other words, an investor suffering from the free dividends fallacy who only observed the prices of stocks periodically in his portfolio would be unlikely to be quickly disabused of his mistake.

2 Trading Behavior Based on Capital Gains and Dividends

The main hypothesis we explore is that investors treat price changes and dividends separately, consistent with placing each in a separate mental account (Thaler 1999 and Shefrin and Statman 1984). This hypothesis is based on an implication of mental accounting not previously emphasized - if decisions about capital gains and dividends are made piecemeal, rather than combined together, then the two aspects of performance are likely to be considered separately, rather than combined into a single returns variable.[6]

The first prediction we examine is that investors will view capital gains and dividends as distinct, desirable attributes. If investors view price changes and dividends as separate attributes of a stock, then they will make different trading decisions when focusing on one or the other. While the dividend income stream is likely to appear as a relatively stable source of small gains, it will not offer the opportunity for large gains (or the risk of large losses) that price changes do. As a result, price changes are likely to receive greater attention as a measure of a stock's recent performance. Thus, when trading based on a stock's recent past performance we expect price changes rather than total returns to be a more important determinant of trading decisions. In addition, if price changes and dividends are viewed as independent ways to profit from a stock, then investors in dividend-paying assets are likely to be less sensitive to the price change component, as they will perceive that they have already made a profit through the dividend component.

[6]This aspect also differs from the behavioral model of dividends in Baker et al. (2016) where investors in a signaling model are loss averse over dividend cuts. This leads managers to be reluctant to cut dividends. Their model focuses on the predictions for managers, and finds support for their predictions. However, their model of investor preferences is quite different, because investors care only about the dividend stream over multiple periods. Because their model does not include price changes as part of investors' evaluation of stocks, it does not speak to the question of how investors evaluate price changes versus dividends for trading purposes.

The literature has documented a number of patterns in how the propensity of investors to sell stocks is related to their past performance. In the papers describing these effects, performance was either measured using price changes or returns including dividends, but the role of dividends has been discussed mostly in terms of showing that similar results are ascertained using performance measures with or without dividends.[7]

However, this does not answer the question we are interested in - do investors respond to the return including dividends, or just the price change component of performance? In this section, we decompose the impact of returns into price changes and dividend yields for these behavioral patterns, and find that investors respond mostly, and in some cases entirely, to the price change component.

2.1 Dividends and the Evaluation of Gains and Losses: The Disposition Effect

The disposition effect describes the tendency of investors to be more likely to sell a position at a gain than at a loss (Shefrin and Statman 1985).[8] For many positions, either price changes or returns including dividends will yield the same category of gain or loss. However, some positions are at a gain when dividends are included, but at a loss when excluded. How do investors treat such positions when deciding whether to sell the position? This is equivalent to asking whether investors adjust for the mechanical decrease in share price that results from dividend payments.

We examine three distinct cases of being at a gain or loss: a position at a loss regardless of whether dividends are included (which we term an "unambiguous loss"), a position at a gain when dividends are included but at a loss when they are excluded (a "gain only with dividends"), and a position at a gain regardless of whether dividends are included (an "unambiguous gain"). In our sample of individual investors, 40,866 positions are in the ambiguous category of a gain only after

[7] For example, Odean (1998) does not include dividends in the calculation of returns. He notes that "The primary finding of the paper... is unaffected by the inclusion or exclusion of commissions or dividends."

[8] The effect has been documented for stocks (Odean 1998), stock options (Heath et al. 1999), real estate (Genesove and Mayer 2001), futures (Locke and Mann 2005), and online betting (Hartzmark and Solomon 2012). It has been documented for different levels of investor sophistication, including futures traders (Locke and Mann 2005), mutual fund managers (Frazzini 2006), and individual investors (in the US Odean 1998; Finland, Grinblatt and Keloharju 2001; China, Feng and Seasholes 2005). The exception is delegated assets, where investors display a reverse disposition effect (Chang et al. 2016) as delegation resolves the cognitive dissonance of losing positions.

dividends are included, compared to 437,805 unambiguous gains and 217,467 unambiguous losses.

In Table 2 we examine how the disposition effect varies across these three cases. The dependent variable is a *Sell* dummy variable, equal to one if the position was sold that day. As independent variables, we consider the different categories of gains. We include the dummy variable *Unambiguous Gain*, which equals one if the stock is at a gain using price changes alone. We also include *Gain Only With Dividends,* which is equal to one for the intermediate case where the stock is at a gain when dividends are included, but at a loss when dividends are excluded. The omitted category is thus the unambiguous loss case. In particular, we wish to know whether the category of gain only with dividends is traded as if it were a gain (as would be the case if investors are considering a standard returns variable that includes dividends), or traded as if it were a loss (as would be the case if investors only evaluated price changes and ignored dividends).

The main variable of interest is *Gain Only With Dividends.* Regardless of whether investors are examining returns with dividends or just price changes, the coefficient on *Unambiguous Gain* should be positive and significant. This is consistent with the disposition effect, as regardless of measure these positions are at a gain. If investors are examining returns including dividends, then the coefficient on *Gain Only With Dividends* should be positive, significant, and of a similar magnitude to *Unambiguous Gain.* This would indicate that such stocks are sold more than the unambiguous loss case and similar to the unambiguous gain case. By contrast, if investors are only examining price changes and are ignoring dividends for this calculation, then *Gain Only With Dividends* is not expected to be significantly positive, as stocks in this category will be treated like the omitted category of losses. Further, the coefficient on *Gain Only With Dividends* will be significantly lower than the coefficient on *Unambiguous Gain*, as only the unambiguous gain stocks will be viewed as being at a gain for investors who are examining price changes.

We examine these questions for three groups of investors - individual investors, mutual funds and institutions. The cleanest prediction is for investors who display the disposition effect, so we begin by focusing on the subset that themselves have a positive a disposition effect.[9] For these investors,

[9]Individuals on average display the disposition effect (Odean 1998). For mutual funds, the average behavior is subject to more debate - Cici (2012) documents a reverse disposition effect on average, whereas Frazzini (2006)

we know that they are exhibiting a tendency to sell at a gain (in a manner frequently ascribed to behavioral biases), so the relevant question is what performance metric counts as a gain. For each investor (individual, mutual fund or institution) at each date, we estimate their disposition effect using the methodology of Odean (1998) for trades on all dates prior to the one being evaluated.[10] We observe a disposition effect for 62% of individual investor observations, 44% of mutual fund observations and 41% of institutional investor observations.

Panel A of Table 2 focuses on the subset of each investor group that displays a positive disposition effect (measured over dates before the present date). We examine how selling propensities of these positive disposition effect investors are related to the gain status with and without dividends. We use a linear probability model, and regress the *Sell* dummy on our various gain measures. In Column 1 we examine individual investors and find a coefficient on *Unambiguous Gain* of 0.125 with a t-statistic of 33.57 (with standard errors clustered by account and date). This means that investors are 12.5% more likely to sell unambiguous gains than the omitted category of unambiguous losses. The coefficient on *Gain Only With Dividends* is much smaller, at 0.0240 with a t-statistic of 5.78. The *Gain Only With Dividends* coefficient is also significantly smaller than the coefficient on *Unambiguous Gain* (p-value less than 0.001), confirming that the gain only with dividends case is sold at a significantly lower rate than the unambiguous gain case. These results are consistent with investors evaluating gains and losses primarily using price changes - stocks which are at a loss when dividends are excluded but at a gain when dividends are included are treated more like other losses than like other gains.

One possible concern with the basic specification is that we may be capturing correlations with other variables known to be associated with selling behavior, such as level of past returns. Stocks

and An and Argyle (2015) find a positive average disposition effect. In the internet appendix, we document that institutional investors and mutual funds display a reverse disposition effect, consistent with Cici (2012), and that the difference determining whether a positive or reverse result is obtained is the inclusion of liquidated positions. Depending on the question being examined it may or not make sense to include such positions (e.g. Frazzini (2006) focuses on current holdings to examine the price impact of positions in a fund's portfolio), but for basic calculations of the disposition effect liquidated positions should be included in the analysis. We thank Andrea Frazzini for helpful conversations related to his methodology and in replicating the base findings.

[10] For all observations prior to the current date, we compute the proportion of gains realized (PGR) as the number of gains sold divided by the number of gains that could have been sold, and analogously the proportion of losses realized (PLR). The disposition effect is measured as PGR-PLR.

that are at a gain only with dividends are likely to have different overall levels of returns than those which are unambiguous gains, as the former are likely to be closer to zero. We control for this in several ways. In column 2 we control for price changes in the positive domain, price changes in the negative domain, the volatility over the previous year interacted with gain and loss, following Ben-David and Hirshleifer (2012). We also include account fixed effects to control for different average selling propensities across investors and a portfolio size fixed effect. Ivković et al. (2005) show that investor-specific variation in selling propensity based on holding period can be a significant determinant of selling behavior. To control for this important heterogeneity we include interactions of the account fixed effect with the square root of the holding period of the stock to allow each investor to have their own account-specific loading on holding period.

With these additional controls in Column 2, the *Unambiguous Gain* coefficient indicates that individual investors are about 13.9% more likely to sell an unambiguous gain than an unambiguous loss. The coefficient on *Gain Only With Dividends* is similar to before (0.0212, with a t-statistic of 6.91), and the two coefficients are different from each other ($p<0.001$). This means that after controlling for additional permutations of return levels, holding periods and variances, the gain only with dividends category is sold at a significantly lower rate than the unambiguous gains case.

In columns 3 and 4, we run the same tests for the positive disposition effect mutual fund sample. Without controls, the coefficient on *Unambiguous Gain* is 0.0466 with a t-statistic of 9.12, meaning these funds are 4.66% more likely to sell unambiguous gains than unambiguous losses. This coefficient is significantly higher ($p<0.001$) than the coefficient on *Gain Only With Dividends*, (0.0113 with a t-statistic of 2.74). Adding extra controls shrinks the difference somewhat, but the two coefficients are again significantly different from each other. Comparing these coefficients with column 1 indicates that mutual funds display a smaller disposition effect than individual investors.

In columns 5 and 6, the institutional investor sample has results similar to the mutual fund sample. In column 5, without controls, the coefficient on *Unambiguous Gain* is 0.0306 with a t-statistic of 7.05. This significantly exceeds ($p<0.001$) the *Gain Only With Dividends* coefficient of

0.0146 with a t-statistic of 4.33, and this difference survives the extra controls.[11]

In Panel B we examine investors that have a reverse disposition effect. For this sample, there are various reasons why investors may sell losers more than winners, so the predictions for how they should treat dividends are less clear. Nonetheless, we examine the broad prediction of the dividend disconnect - that gains with and without dividends will be evaluated differently. The specifications are otherwise the same as those in Panel A.

The results in Panel B suggest that investors with a reverse disposition effect also treat gains with and without dividends differently. In each instance the point estimate of gain only with dividends is less negative than the unambiguous gain case, though the difference is not significant for individual investors. Investors react more to price changes regardless of whether they have a disposition effect or a reverse disposition effect. In other words, when investors want to sell gains, they primarily evaluate this using price changes, and when investors *don't* want to sell gains, they still primarily evaluate this using price changes.

The controls in Table 2 include measures of the total return and price changes for the position, split into gains and losses. Nonetheless, it is possible that this particular choice of return specification is not fully capturing differences in selling propensity related to the fact that unambiguous gains and gains only with dividends will tend to have different total returns. To ensure this is not driving the results, we examine selling propensities in a non-parametric manner in Figure 1. We limit the sample to investors displaying a disposition effect and run a regression of a *Sell* dummy on the controls from Table 2 not related to the level of returns or price change, namely volatility, portfolio size, account fixed effects and investor-specific holding period controls. We take the residuals from this regression and plot them across two dimensions - the return since purchase on the x-axis, and the dividend yield since purchase on the y-axis. Selling propensity is given by color, with red indicating a high probability of sale and blue indicating a relatively lower level.

These are presented in Figure 1. Panels A, B and C graph the selling propensities of individual

[11] For mutual funds and institutions, there is a potential concern that the different behavior from individuals stems from examining a different time period. In the internet appendix, we re-run the mutual fund and institutional trading tests limiting the sample to the same 1991-1996 time period, and find similar results. This indicates that the different behavior is more related to differences in investor types, not different time periods.

investors, mutual funds and institutions, respectively. If investors respond to total returns and do not respond to the level of the dividend after controlling for the level of returns, vertical sections of the graph would be the same color. This is because positions with the same return level would have the same selling propensity regardless of the level of the dividend yield. In each panel we do not see evidence of such an effect. For a given return level, colors tend to move from red to blue as the dividend yield increases. This indicates that investors are less likely to sell positions as their dividend yield increases, controlling for the level of returns. We explore this formally in section 2.4. These investors are not solely making selling decisions based on past returns, but are responding to the dividend component of returns separately.

Investors may also be responding to the price change component of performance. If investors were looking only at price changes then in the graphs colors would follow a 45 degree line. For example, to examine the selling propensity of positions with a price change of 0, begin at the bottom center of the graph, which has zero return and zero dividend, and move to the top right corner, which has a 5% return with a 5% dividend. There is noisy evidence of such a pattern. The noise is to be expected as selling propensities vary both with the level of price change and the level of dividends, and it is unclear precisely how these should interact visually in this figure.

Taken as a whole, the table suggests investors view the gain or loss status of a positions based on their price changes. We also see no evidence of investors examining total returns by combining price changes and dividends together. Investors display a strong tendency to sell stocks that are at a gain using price changes. However, stocks that are at a gain when dividends are included, but at a loss if dividends are excluded, are sold at a rate similar to positions at an unambiguous loss. This is consistent with a general disconnect between price changes and dividends.

One possible concern is that this evidence is not capturing an investor's perception of performance based on gains and losses, but rather some other attribute consistent with rational trading behavior under the null hypothesis. The pattern in selling is not suggested by the simplest dividend irrelevance framework, but it could be that he selling patterns are capturing variation in beliefs about stocks based on their past performance. It is not clear why zero (corresponding to the gain

versus loss distinction) should be a particularly relevant point for generating different beliefs, as this is not a prediction under models like Miller and Rock (1985), and the updating of beliefs appears similar across the different groups of investors with likely different skill levels. Nonetheless, a more general form of beliefs-based explanation is hard to rule out directly in the preceding tests. To address this possibility, we turn next to another behavioral trading pattern where the perception of performance is based on a different margin which is highly investor-specific and non-linear, making it even less likely to be capturing rational belief-based behavior.

2.2 Dividends and Ranks of Stock Performance: The Rank Effect

In addition to trading based on the returns of each stock on its own, Hartzmark (2015) documents that investors engage in relative evaluation within their portfolio to judge performance. They exhibit the rank effect, being more likely to sell the best- and worst-performing positions in their portfolio based on performance since each position was purchased. This presents another way to gauge how investors are assessing the performance of positions. When deciding which are the best- and worst-ranked stocks to sell, do investors include dividends in their evaluation of performance?

We examine this question in Table 3. We run similar linear probability regressions to before, but as independent variables we include dummy variables for the best-ranked, second-best-ranked, worst-ranked and second-worst-ranked positions in the portfolio. We construct two versions of each of these ranking variables - one set constructed based on price changes, and another based on return including dividends. For example, *Best (Price Only)* is equal to one if the position has the highest capital gain in the portfolio, and *Best (Including Dividends)* is equal to one if the position has the highest total return. The omitted category is thus middle ranked positions. By including both versions of the rank variables in the same regression, we examine which ranking has a larger effect on selling propensities. We also add fixed effects for the total number of stocks in the portfolio, to control for mechanical effects based on correlations between portfolio size and selling propensity.

Column 1 of Table 3 includes only the rank variables. All of the four price change rank variables are associated with significantly higher selling probabilities, while the returns including dividends

measures are generally smaller. For instance, the best-ranked position by price change is 14.6% more likely to be sold (with a t-statistic of 23.72), compared with the best-ranked position by returns including dividends which is 0.7% more likely to be sold (with a t-statistic of 1.13).

These base effects may pick up the influence of other correlated variables. Investors may differ along a variety of dimensions, so in column 2 we add account fixed effects. Rank-based measures will also be correlated with the level of returns, as in Ben-David and Hirshleifer (2012). Thus, we also include the additional controls from Table 2. Adding these somewhat strengthens the results, with all four price-change rank variables now being positive and statistically significant, with effects ranging from 1.05% for the second-worst ranked to 10.5% for the best ranked. By contrast, return-based measures are small, ranging from 0.5% to 2.04%.

Next we examine the rank effect for mutual funds and institutions and find similar results. In the fourth column (with the full set of controls), mutual funds show positive and significant responses to price-based ranks, but not to ranks that include dividends. Mutual fund are 4.8% more likely to sell their best position sorted by price change, while they are an insignificant 0.1% more likely to sell their best position ranked by total returns. For worst-ranked stocks, the worst-price-change position is 7.9% more likely to be sold, whereas the worst-return position has an effect of 1.3%. For second-best and second-worst the price-based measure is significantly larger than the corresponding measure including dividends. Examining institutional investors in column six, we find a similar result - price-based extreme ranks are significantly more likely to be sold, but ranks that include dividends show effects that are either zero or negative. Institutions are 5.0% more likely to sell their best-ranked position based on price change, but 2.1% less likely to sell their best-ranked position including dividends. Worst-ranked positions based on price are 2.2% more likely to be sold while the worst-ranked return measure is 1.3% more likely to be sold.

As with the disposition effect, selling decisions based on ranks of past performance are made primarily using price-based measures rather than returns including dividends. The two effects use very different transformations of performance, but show a consistent tendency to evaluate performance using price changes. To explain the results using an economic attribute of dividends would

require that the attribute not only makes investors treat gains and losses differently, but also treat extreme winners and losers differently (where extremity is not measured in the level of performance, but rather the rank order in the investor's particular portfolio). The more parsimonious explanation is that price changes and dividends are being considered separately.

2.3 Gains and Losses Across Positions: The Rolled Disposition Effect

Next, we test how investors account for profits across multiple positions. The typical assumption in studies of investor behavior is that each position is considered in a separate mental account. However, Frydman et al. (2015) show that on days when investors sell a position and buy another position (reinvestment days), they do not close the mental account in the sold asset, but roll the account into the new position. As a result, when investors trade the new position they evaluate whether they are at a gain or a loss relative to the amount initially invested in the old position that is no longer in their portfolio. Consistent with this, investors have a rolled disposition effect, being more likely to sell a reinvested position when it is at a gain relative to the amount originally invested in the old position no longer in the portfolio. This provides another test of how dividends are evaluated - when evaluating rolled gains and losses, are dividends included in the calculation or not? This test is perhaps the most difficult to explain using economic attributes of dividends (such as beliefs about stock returns), as a considerable fraction of past performance in the calculation comes from the *old* position, which is not even held in the portfolio at the time of the sale decision.

Table 4 examines individual investors, and shows that the rolled disposition effect is driven by the capital gains across the two positions, not the total return. We consider only positions that were purchased on a reinvestment day when only one stock was purchased and one stock was sold. We take observations for these stocks on all future sell days. Given the lack of daily trading data for funds and institutions, this analysis is limited to the individual investor sample. We again use a linear probability model where the dependent variable is a dummy for if the stock was sold that day. As the independent variables, we consider two versions of *Original Gain*. These are both dummy variables that equal one if the value of the position exceeds the amount initially invested in the old

position. One version, labeled *Price Only*, calculates the cumulative value using only capital gains on both positions, ignoring any dividends. The other, labeled *Including Dividends*, calculates the current value including dividends paid on both positions. The first two columns show that there are significantly positive effects for measures using both capital gains and returns, when only one or the other variable is controlled for (although the effect without dividends of a 3.95% increase is more than double the effect with dividends of 1.67%).

Column 3 includes both measures together and finds that the dividend-excluding measure has a positive and significant effect of 3.8%, while the dividend-including measure is an insignificant 0.7%. Columns 4 and 5 add further controls for being at a gain or loss on the current position (both with and without dividends) as well as the additional controls for performance of the current position. In all specifications, the point estimate on *Original Gain (Price Only)* is between 0.019 and 0.029, meaning that investors display a strong rolled disposition effect across reinvested positions using prices to calculate combined value. However, the *Original Gain (Including Dividends)* coefficient is either zero or negative once the price-based measure is controlled for, implying that dividends are not being included in the calculation of combined gains and losses across positions.

2.4 Dividends and the Reaction to Price Changes

The above analysis suggests that trading based on past performance is typically based on price changes. This does not mean that dividends have no role in trading decisions, but that they are not considered in the same category of performance as price changes. If investors do not consider price changes and dividends as part of a single evaluation, they will be less likely to appreciate that dividend payment results in a decrease in the price of the security. Without this apparent tradeoff, dividends are apt to appear as free. This will make dividends an unambiguously positive aspect of stocks, making investors less likely to sell them (to receive the ongoing dividend stream).

We test this possibility in Table 5. As before, the dependent variable is a dummy variable for whether the stock was sold. The main independent variable is *Dividend Yield in Prior Year*, the total amount of dividends paid over the prior 12 months divided by the previous day's price. This

variable is measured at the stock level, rather than being an investor-specific measure. Thus, it may capture investors using not just the free dividend fallacy, but also using the dividend yield in a trading strategy such as a measure of safety or value. To attempt to control for some of these alternative possibilities, we add a number of stock-specific controls including company age, market capitalization, book-to-market ratio, and volatility of return on assets over the prior five years.

In Panel A, regardless of the specification or investor type, the propensity to sell a stock decreases with the level of the dividend yield. This result holds even relative to the investor's own average turnover level among all stocks in his portfolio. Recall that the regressions also control for attributes such as the book-to-market ratio, meaning that the dividend yield is not just measuring price declines regardless of dividend status. The lower propensity to sell dividend-paying stocks is consistent with individuals viewing dividend streams as a source of income that represents a distinct and independent aspect of performance from price appreciation. Similar results are observed when the level of dividend yield is measured with dummy variables rather than levels.

If investors directly value a stock's dividend yield, they may be less sensitive to price changes, as price changes and dividends are viewed as separate desirable ways to make money. In Table 5 Panel B, we examine whether dividends reduce an investor's propensity to sell gains (measured using price changes). As in Table 2 Panel A, because the interest is in the disposition effect, we examine investors with a disposition effect. The dependent variable is again a *Sell* dummy, while the independent variables are a *Gain (Price Only)* dummy, a *Received Dividend* dummy, and the interaction of the two. The main variable of interest is the *Gain (Price Only)*Received Dividend* interaction, the difference in the effect of gains between dividend-paying and non-dividend-paying stocks. This is large and significantly negative. In column 1, the *Gain (Price Only)* coefficient of 0.16 means that non-dividend-paying stocks have a disposition effect of 16%. Meanwhile, the *Gain (Price Only)*Received Dividend* coefficient is -0.0844, with a t-statistic of -19.79. This means that dividend-paying stocks have a significantly lower disposition effect of 7.56% (0.16 - 0.0844). Adding account fixed effects and other controls reduces the *Gain (Price Only)*Received Dividend* coefficient to -0.041, but the effect is still large and statistically significant. When evaluating dividend-paying

stocks, investors pay less attention to whether the stock is at a gain or a loss.[12]

Mutual funds and institutions also respond less to the price changes of dividend-paying stocks. Mutual funds display a disposition effect 1.1% lower for dividend-paying positions, roughly 30% less than the base rate of 3.8% for non-dividend-paying positions. Institutions display a disposition effect that is 0.7% lower than non-dividend-paying positions, roughly 26% of the 2.6% disposition effect for non-dividend-paying positions. In other words, not only do these investors fail to add dividends to capital gains when evaluating stock performance, but dividends actually appear to result in less attention being paid to capital gains.

Overall, the results from this section indicate that the disconnect between price changes and dividends is evident across a wide variety of investor groups. Mutual funds and institutional investors show smaller magnitudes in a number of the base effects, consistent with them being a less homogeneous group with more sophisticated investors. Nonetheless, there is considerable evidence that price changes and dividends are not treated as equivalent measures of performance or determinants of trading decisions, consistent with the importance of mental accounting.[13]

In order to explain the results using a general beliefs framework, investors must react differently to dividend-paying stocks at a gain based on prices rather than returns, to portfolio-specific rankings of stocks based on prices rather than returns, to the combined performance across stocks no longer in a portfolio based on prices, and be less sensitive to price changes for dividend-paying stocks. This set of findings is very difficult to parsimoniously explain using standard economic attributes of dividends such as taxes, trading costs, or the economic circumstances of dividend-paying firms.

[12] One potential concern with the individual investor analysis is whether the differential treatment of dividends could be driven by tax considerations. In the internet appendix we replicate all of the tables using individual investor data for the sub-sample of tax exempt accounts and find materially similar results.

[13] As with many questions involving mutual fund data, it is difficult to know whether the behavior is driven by the preferences of mutual fund managers or by how they perceive their public disclosures will be interpreted. Regardless of the cause of the behavior, these investors exhibit similar patterns to individual investors trading on their own accounts.

3 Reinvestment of Dividends

3.1 Frequency of Dividend Reinvestment by Institutions and Mutual Funds

Another prediction of capital gains and dividends being evaluated in different mental accounts is that investors may use the proceeds of each differently. For example, individuals exhibit the house money effect (Thaler and Johnson 1990) whereby including gains in a separate mental account induces different risk taking with these gains. A key part of the dividend irrelevance theorem of Miller and Modigliani (1961) is dividend reinvestment - an investor who receives a dividend from a share and prefers to maintain the size of his existing portfolio weight simply reinvests the dividend. Baker et al. (2007) show that individual investors rarely reinvest dividends and appear to consume out of dividend income, and Di Maggio et al. (2018) show that there is a higher marginal propensity to consume out of dividends compared to capital gains. One possible explanation for such behavior is based on theories of dividend clienteles, such as Graham and Kumar (2006). In this view, some investors have reasons to not want to regularly sell small amounts of stock, such as trading costs, time costs or self-control issues (Shefrin and Statman 1984), and use dividends as a way to generate a lower-cost stream of cash flows for consumption.

While this is plausible, especially for individual investors, a lack of dividend reinvestment may occur for psychological reasons. If dividends are considered to be cash flows that are separate from the "value" of a position, investors may treat the dividend payments as belonging to a separate mental account to be used elsewhere. As a consequence, investors may not be inclined to reinvest dividends into the stocks from which they came. If dividends are viewed as income to be spent, even if this is reinvested, it may be invested in a different manner or asset, rather than reinvested into the original stock as if it were just part of the same position value. Reinvesting dividends outside of the stocks that paid them would be consistent with the general disconnect between dividends and price changes that we show in evaluating performance.

To test this possibility, we examine the dividend reinvestment policies of investors for whom consumption motives seem less likely, namely mutual funds and institutions. Mutual funds have

no obvious consumption motive, as they are legally required to distribute all dividends and capital gains to the fund's investors by the end of the year to avoid paying income tax at the fund level (known as the "pass-through rule"). However, the timing of the fund's dividend receipts need not affect the short-term decision to reinvest, as many funds pay out dividends only once per year. Dividends received during the year are simply part of the fund's asset base until the fund makes its own dividend payment, and in the meantime can either be reinvested or left in cash. Institutional investors will have different tax arrangements, but many also lack an equivalent consumption motive. Some, such as charities, may be constrained by the terms of their charters to not spend the principal in their endowment, but many institutional investors are financial firms who (like mutual funds) lack consumption needs. This tends to militate against behavioral consumption-based motives, such as self-control and consumption-based-regret in Shefrin and Statman (1984), which similarly have difficulty explaining why funds and institutions would not reinvest their dividends.

To test the level of dividend reinvestment we examine the changes in quarterly holdings for mutual funds and institutions. There are several possible benchmarks for the level of dividend reinvestment. Given tradings costs and frictions, investors may not always reinvest exactly the amount of the dividend, or may wait some days (at which point the share price, and the amount of shares that the dividend can purchase, may have changed). However, one easy comparison is the frequency with which an investor holds exactly the same number of shares from one quarter to the next. Investors that hold exactly the same number of shares, when the stock in question has paid dividends, are either holding the payment as cash or investing it elsewhere. If dividend reinvestment is common, then dividend-paying holdings should be less likely to have exactly the same number of shares held from one quarter to the next, relative to non-dividend-paying holdings.

We examine this question in Figure 3. It shows the change in shares from last quarter (the prior report) for positions that paid dividends over the period (the left figure) and those that did not (the right figure), for mutual funds (Panel A) and institutions (Panel B). The green and red bars represent the fraction of positions with exactly zero change in shares, and blue bars represent the fraction of positions with the indicated number of shares, binned in 50 share change increments.

Several aspects of this picture are important for understanding the hypothesis of low dividend reinvestment rates. First, both mutual funds and institutions are much more likely to hold exactly the same number of shares next quarter in a dividend-paying stock than they are to hold a small amount of shares more (as under reinvestment). Zero reinvestment is a very common outcome for both types of investors, as shown by the left figure in both panels. Second, a comparison of the left and right figures indicates that the likelihood of holding exactly the same number of shares next quarter is similar regardless of whether or not the stock paid a dividend that quarter. For mutual funds, the fraction of dividend-paying holdings where the fund holds exactly the same number of shares next quarter is 31.7%, compared to non-dividend-paying holdings where the fraction is 32.2%, with the difference being insignificant. For institutions, the exact number of shares fraction is 18.2% for dividend-paying holdings, versus 19.0% for non-dividend-paying holdings. The presence of a dividend does not make a large difference to the likelihood that a fund changes the number of shares it holds, consistent with dividend reinvestment being rare.

Another plausible baseline against which to test dividend reinvestment is how often investors' holdings change by the amount corresponding to full dividend reinvestment. We test this hypothesis in Figure 4. To avoid issues related to round lots or trading costs of small amounts we limit the sample to dividends where reinvestment involves at least 100 shares. Further we examine only positions where there was a change in shares between reports (thus excluding the large zero investment bars in Figure 3). If investors are reinvesting dividends, then if they *do* change the amount of shares they hold, their position should be more likely to increase by the amount of shares corresponding to dividend reinvestment, rather than some other number of shares. To test this, we plot the difference between the actual change in shares, and the change in shares that would occur if all dividends were reinvested back into the stock on the payment date. A fund that engages in full reinvestment will have a difference of zero. Examining the figure, we see that exact reinvestment (within 100 shares of the number implied by full reinvestment) occurs at a very similar rate to other nearby amounts of share changes. The number of trades motivated by exact reinvestment does not seem large compared to the number of trades of other sizes. Another way of putting this is that if

the investor *does* change their holding in a dividend-paying asset, they are not particularly likely to change it by an amount corresponding to dividend reinvestment.

Table 6 uses regression analysis to examine similar questions about dividend reinvestment rates. Panel A examines mutual fund holdings, while Panel B examines institutional holdings. In columns 1 and 2, we examine the likelihood of an investor (mutual fund or institution) holding the exact same number of shares in the subsequent quarter, as a function of whether the holding paid dividends or not. The dependent variable is *Same Shares*, a dummy variable that equals one if the number of shares in the following quarter is exactly the same as the number in the current quarter. The main independent variable is *Dividend Paying Holding,* a dummy variable that equals one if the stock paid a dividend between the current quarter and the following quarter.

In Panel A (the mutual fund sample), the coefficient on *Dividend Paying Holding* is -0.00483, and statistically insignificant. In other words, the presence of a dividend does not change the likelihood that a fund alters their holdings in a stock. When fund fixed effects are added in column 2, the coefficient increases to 0.00309, with an insignificant t-statistic of 1.37 (when clustered by fund and quarter). If there were widespread dividend reinvestment we would have expected a significantly negative coefficient (as funds would be more likely to change their holdings when the stock paid a dividend), not the insignificant coefficients with inconsistent signs.

In column 3 and 4, we examine the likelihood of the fund increasing its position as a function of whether the share paid dividends. The dependent variable is now a dummy variable that equals one if the fund increased its holdings from one quarter to the next. The univariate coefficient on *Dividend Paying Holding* is 0.0179, which decreases to 0.0135 with the addition of fund fixed effects (with t-statistics of 6.44 and 6.71 respectively). This indicates that funds are significantly more likely to increase their holdings of dividend-paying stocks relative to other stocks. However, the magnitude of this increase is still relatively small - the intercept of 0.304 means that funds have a 30.4% chance of increasing their holdings of a non-dividend-paying stock, versus a 32% (0.304 + 0.0179 = 0.3219) of increasing their holdings of a dividend-paying stock.

In column 5 we examine the likelihood of exact dividend reinvestment. We limit the sample to

dividend-paying holdings where the amount of the dividend could have purchased at least 100 shares at the closing price on the payment date. We compute the proportion of holdings corresponding to exact reinvestment - cases where holdings increase and the number of shares purchased is within 100 shares of the exact reinvestment amount. This proportion is 0.00719, meaning that mutual funds exactly reinvest dividends in only 0.719% of instances for dividend-paying holdings.[14]

In Panel B, we examine the same questions for institutions, and find that they are somewhat more likely than mutual funds to reinvest their dividends, but that dividend reinvestment is still relatively uncommon. In columns 1 and 2, the likelihood of holding exactly the same number of shares is somewhat lower for dividend-paying holdings. The univariate coefficient on *Dividend Paying Holding* is -0.00781 (with a t-statistic of -2.76), which increases with the addition of investor fixed effects to -0.0235, with a t-statistic of -12.01. Given the constant of 0.190, this means that institutions have 19.0% chance of holding the same number of shares for non-dividend-paying stocks, and a (univariate) 18.2% chance of the exact same number of shares for dividend-paying stocks. In columns 3 and 4, the likelihood of increasing the number of shares held for dividend-paying stocks is similar to the mutual fund case - a univariate coefficient on *Dividend Paying Holding* of 0.0222, increasing to 0.0330 with investor fixed effects (both highly significant), relative to a univariate constant of 0.338. Finally, the probability of exact dividend-reinvestment for institutions is 1.17%.

Taken together, these results indicate that dividend reinvestment is relatively uncommon among both mutual funds and institutions. Put differently, suppose that an investor plans to leave their holding "as is," either by reinvesting the dividend on the payment date or by leaving their holding unchanged and doing something else with the dividend. By comparing the "reinvestment within 100 shares" rate (0.00719) to the exact same number of shares fraction (from column 1, 0.315-0.00483= 0.3102), a mutual fund is 43.1 times more likely to leave their holdings unchanged than they are to reinvest the dividend. For institutions, the corresponding rates are 0.0117 for reinvestment within 100 shares versus 0.1822 for the exact same number of shares. Thus, an institution is 15.6 times

[14] In the internet appendix, we show that these reinvestment results are substantially similar if additional controls for the investor's propensity to change holdings are included, such as whether the position is overweighted or the level of recent fund flows.

more likely to leave their holdings unchanged than they are to reinvest the dividend.

3.2 Dividend Induced Portfolio Drift

If investors are not reinvesting dividends into the shares they came from, the weights in dividend-paying stocks will decrease relative to non-dividend-paying stocks over time. Each dividend payment decreases the price of the share by roughly the amount of the dividend, so if total returns are similar, some fraction of the position is being effectively removed with each dividend. We refer to this decrease in relative portfolio weights as dividend-induced drift.

To test for dividend-induced drift, we examine how the portfolio weights of dividend-paying positions change with holding period compared to non-dividend-paying positions. Specifically, for an investor i, we examine the portfolio weight of stock j, that has been held for a number of periods h, and compare it to the weight of that position when it was opened at $h = 0$.[15] For individual investors we examine holdings at the end of every month. For mutual funds and institutions we examine holdings at the quarterly horizon to match the reporting frequency for most of the filings in the sample. Using this sample we run the following regression:

$$\frac{weight_{i,j,h}}{weight_{i,j,0}} = \alpha + \sum_{n=1}^{N} \beta_{div_n} (dividend * hp_n) + \sum_{n=1}^{N} \beta_{hp_n} hp_n \tag{1}$$

The dependent variable is the portfolio weight of a position after h periods, divided by the weight when that position was opened. This is regressed on dummy variables for the number of holding periods to control for the trend in portfolio weights by period (e.g hp_h is equal to one in holding period h and zero otherwise). We also include the interactions of holding period with a dummy variable equal to one if the position received a dividend (*dividend*). The variable of interest is the interaction term β_{div_n}. This term describes how different the change in portfolio weight in a holding period h is for a dividend paying position versus a non-dividend-paying positions.

Figure 2 graphs these regression coefficients and shows evidence of dividend-induced drift for

[15] Each newly opened position is treated as its own series. If the same stock is purchased and liquidated multiple times by the same investor, each sequence is considered separately.

individual investors, mutual funds and institutions. Panel A shows that for individual investors, over the 24 months after a position is opened (roughly the 75th percentile of holding period), the portfolio weight of dividend-paying positions has decreased by roughly 9% compared to that of non-dividend-paying positions. Panel B and Panel C show the regression coefficients for mutual funds and institutions for the 16 quarters subsequent to a position being opened (again, about the 75th percentile of holding period). Mutual funds see relative portfolio weights of dividend-paying positions decrease by about 15%, while institutions see a decrease of roughly 20%. To put these numbers into perspective, all else equal, a position paying a 4% annual dividend would be expected to decrease in portfolio weight of 15% over 16 quarters ($(1 - 0.96^4) = 0.151$) absent reinvestment, which is close to the mutual fund estimate and well within the confidence intervals for both.

The failure of funds and institutions to reinvest dividends into the shares that paid them may be a deliberate choice to change their portfolio weights for reasons other than dividend payment. However, the changes in weights thus implied are puzzling. Investors would need to desire to reduce their portfolio weight by exactly the amount of the dividend payment, on exactly the ex-dividend date. This seems somewhat implausible. The fact that funds and institutions, who lack any obvious consumption motives, display the same behavior as individuals, suggests the possibility that these actions may have a single underlying rationale across investor types. The lack of reinvestment is consistent with investors viewing the dividend payments as separate from the underlying value of the stocks that paid them.

4 Analysts' Forecast Errors and Dividends

We next turn towards the second major prediction of the paper - that investors may suffer from the free dividends fallacy, and fail to appreciate that dividends come at the expense of price declines. While this notion is a potential consequence of using separate mental accounts, it does not appear to have been explicitly considered in the behavioral literature. Shefrin and Statman (1984) discuss how separating capital gains and dividends into separate mental accounts can help investors solve

self-control problems or reduce regret from consuming out of stock sales. Importantly, these notions would create a preference for dividends regardless of whether or not investors perceived the dividends to be free, and so do not directly speak to the question. Other predictions of Shefrin and Statman (1984), such as hedonic editing, contemplate that investors may either segregate dividends and price changes or combine them into a single returns variable depending on which will provide greater prospect theory value. For example, the prediction of hedonic editing is that for small capital losses, investors will integrate dividends and capital gains to a single returns variable that is treated as a gain. Our results in section 2.1 suggest that for stocks where adding the dividend would turn the position into a gain, investors trade as if they think of the stock as being at a loss.

In this regard, Shefrin and Statman (1984) investors are relatively sophisticated, with heuristics regarding dividends being useful ways to circumvent other behavioral tendencies. By contrast, the free dividends fallacy is a more basic error - investors simply do not understand the tradeoff between price changes and dividends. While holding dividend-paying assets longer is consistent with investors making this mistake, we seek to directly test for evidence of a failure to predict the effect of dividends on prices.

To do this, we turn to a different setting, namely analysts' forecasts of future stock prices for firms. These are a group of informed market participants who are incentivized to correctly estimate future developments for the companies they follow. While investors may trade stocks for a wide variety of reasons even conditional on price (such as risk, taxes, and financing consumption streams), analysts have only the relatively clean task of forecasting the future stock price itself.

If analysts suffer from the free dividend fallacy, they would be unlikely to forecast the price decrease that results from recurring dividend payments. In this case, if their assessments of future stock prices are otherwise equally accurate across firms, this should lead to a greater negative surprise for dividend-paying firms, and one that is increasing with the size of the dividend yield.

To test this, we examine the forecast error in analysts' price predictions. We utilize the monthly IBES mean consensus 12-month ahead stock price forecasts for each stock, which we call $Forecast\,(t)$. We match the date of the consensus to the actual price on the same calendar date the

next year, which we call $Price\,(t+12)$. For example, if the one-year-ahead IBES consensus price forecast, $Forecast\,(t)$, is on May 5, 2010, we match this forecast to the price, $Price\,(t+12)$, on May 5, 2011 to calculate the forecast error.[16] We analyze the forecast error as:

$$Forecast\ Error = \frac{Price(t+12) - Forecast(t)}{Forecast(t)} \tag{2}$$

We then compare this to the cumulative dividend yield for the year prior to the consensus forecast, namely across months t-13 to t-1. This is the information available to an analyst making a forecast at time t with no look-ahead bias. We winsorise both the forecast error and the dividend yield at the 99th percentile. Our prediction is that firms with higher dividend yields will have predictably more negative forecast errors - that is, analysts will be overly optimistic about future stock prices due to forgetting to correct for the predictable price decline due to dividends.

We present these results in Table 7. Column 1 is a univariate regression of forecast error on dividend yield, limiting the sample to firms that paid a dividend between $t-13$ and $t-1$. The coefficient on dividend yield is -1.073 with a t-statistic of -2.34 when clustered by firm and month. We also include the p-value for the test of the hypothesis that the coefficient on the dividend yield is -1. This corresponds to complete neglect of the dividend yield if the forecast of the dividend in the next year is the same as that in the prior year. The p-value is 0.873, indicating a failure to reject the null hypothesis of completely ignoring dividends. Column 2 includes non-dividend-paying firms, and adds a dummy for whether the stock paid a dividend. It finds very similar results. Column 3 adds year-by-month fixed effects, and the coefficient on dividend yield is -0.884, still significant at the 5% level. Column 4 limits the sample to firms in the top quartile of the number of analysts making forecasts, to ensure that the result is not just being driven by a lack of analyst coverage. The coefficient for this sample is, if anything, slightly larger, at -1.256, significant at the 5% level. In all specifications, we are unable to reject the hypothesis that the coefficient equals -1.

These results are consistent with the free dividends fallacy. Analysts have more negative forecast errors for dividend-paying firms and are optimistic by an amount that corresponds to the amount

[16] If that day is not a trading day (e.g. a weekend or holiday) we move it forward until the next date with trading.

of the dividend yield, consistent with failing to correct for the effect of dividends on prices.

5 Dividends as an Income Stream

We next turn to the other aspect of the free dividends fallacy - that dividends are perceived as a free, desirable income stream independent of the price level of a stock. To do so, we develop predictions related to time variation in marketwide demand for dividends. Compared with the individual behavior studied up to now, the marketwide analysis requires stronger assumptions and is not as cleanly identified. That said, these assumptions are well founded in the prior literature and yield novel testable predictions about the impact of the free dividends fallacy on the market.

To study the market impact of the free dividends fallacy we need a measure of market demand for dividend income, and also variables that proxy for how such demand is likely to vary for investors suffering from the free dividends fallacy. The proxy for dividend demand is meant to capture demand for receiving a dividend cash payout itself, not demand related to other characteristics associated with holding dividend-paying assets. While these two aspects of demand for dividend-paying securities may seem difficult to disentangle, Hartzmark and Solomon (2013) provide a measure of short-term price pressure from investors seeking to receive a dividend payout, namely the returns after a dividend is announced and before the ex-date.

We call the cumulative characteristic-adjusted returns over this period the interim period return. As marketwide demand for a dividend payout increases, so should this price pressure.[17] In this period there is no information about the dividend (as the announcement has already been made), no uncertainty about the payment (since paying the dividend is now a legal obligation for the firm), and no dividend-specific tax consequences (since an investor who sells before the ex-date never receives the dividend). The returns are a time-series increase relative to other periods, and reverse

[17] Baker and Wurgler (2004a) demonstrate that firms are more likely to issue dividends when the book-to-market ratio of dividend-paying stocks is higher. Our paper focuses on the demand side of this equation, namely why investors have time-varying demand for dividends, while Baker and Wurgler (2004a) focus on the supply side - why firms issue dividends in response to shifts in this demand. As validation that the interim return measure is capturing dividend demand and firms are responding to it, in the internet appendix we show that firms are more likely to initiate dividends when the interim period return is higher.

in the period after the ex-date, so they do not reflect dividend-paying firms being more risky overall. Further, as discussed in Hartzmark and Solomon (2013), it is difficult to explain this return based on changing exposure to systematic risk factors. The average positive abnormal interim returns are most consistent with price pressure from dividend-seeking investors. Thus, the interim return proxies for investors wanting to receive the dividend payout, not investors who want to buy the security based on its characteristics that may be correlated with the dividend.[18]

If investors view dividends as a free income stream, the attractiveness of dividends relative to capital gains is likely to vary over time according to how valuable the income stream appears. We develop three distinct proxies based on aspects of the relative attractiveness of dividends over time. The first proxy is based on the level of the interest rate. Investors are likely to compare the income from stocks with other potential sources of income. Of these, the most likely candidate is the interest payments on a fixed income asset like a bond. Anecdotal evidence of such a comparison is widespread. Among numerous examples published recently in the Wall Street Journal, is an article with the headline "Dividends Climb Amid Rising Competition From Bonds."[19] We have seen similar statements made by finance academics,[20] and have been present at multiple quant investing conferences with professional investors making the same point. A link to this paper was posted on Reddit's personal investing forum, and commenters claimed this was the comparison that they were making, leading one commenter to state "my reasons for focusing on dividend stocks were/are ... beat inflation and low interest rates."[21] This is related to the finding in Baker and Wurgler (2012)

[18] In the internet appendix, we show similar patterns in the time variation in the book-to-market of stocks based on their dividend yield (similar to Baker and Wurgler 2004b and Baker and Wurgler 2004a). The book-to-market ratio of stocks has a number of possible interpretations other than mispricing, such as those related to growth and risk among others. Thus, we consider the measure as secondary to the interim return variable which represents a more direct measure of demand for receiving dividend payments.

[19] (Wursthorn 2/27/2018). Other examples include claims such as "Investors, desperate for yield with interest rates so low, have driven up the price of dividend stocks to lofty levels" (Courmarianos 9/5/2016), "investors turn to high yielding shares as interest rates slide" (Eisen 8/24/2016), "lower interest rates are actually hurting investment by encouraging companies to pay dividends " (Ip 6/5/2016). Many similar examples can be found.

[20] Burton Malkiel wrote in the Wall Street Journal (December 11, 2011): *"But bond yields today are unusually low... So what are investors... who seek steady income to do?.. Substitute a portfolio of blue-chip stocks with generous dividends for an equivalent high-quality U.S. bond portfolio. Many excellent U.S. common stocks have dividend yields that compare very favorably with the bonds issued by the same companies."*

[21] More colorfully, one commenter claimed to focus on dividends, not total returns because "If I could predict total returns I wouldn't have to worry about dividend yields. In a world of uncertainty, I prefer my gains in the market to tend toward cold hard cash in my pocket."

that stocks with bond-like characteristics tend to covary with bond market factors and Lian et al. (2017) who show when interest rates are low investors shift to riskier assets. Thus, we predict that when interest rates are low, dividend-paying stocks will be more attractive and demand for dividend payouts as proxied by interim returns will be higher.

In addition, the attractiveness of a dividend stream is likely to be compared to the perceived attractiveness of capital gains. Greenwood and Shleifer (2014) present evidence that there is a positive correlation between recent market performance and expected future returns, and argue this is due to investors having extrapolative beliefs. Investors with such a perception would thus view the expected price change component of returns as relatively more valuable when the market delivered large recent gains.[22] Consistent with this, Previtero (2014) shows that investors display a greater demand for fixed income annuitization products when recent stock market returns were lower. Thus, we also predict that the demand for dividends will be higher when market performance has been lower, as dividends will be perceived as relatively more valuable.

For our third proxy of the attractiveness of dividends we examine the stability of dividend payment. If investors are holding a stock to receive a dividend payment, demand for the dividend should be higher when the payout stream is perceived as stable or growing. This reflects the notion that investors may be risk averse over dividend amounts, an idea explored in Baker et al. (2016). This assumption would clearly not hold for a rational investor who understood that, all else equal, more dividends should not directly make him better or worse off. To an investor suffering from the free dividends fallacy and focusing on dividend income, more dividends would be a good thing.

We begin the analysis of the determinants of dividend demand by examining the time-series behavior of the interim period returns. Figure 5 graphs the average interim period returns over time using a local linear plot. The first notable aspect of this plot is the finding of Hartzmark and Solomon (2013) that the returns are generally positive. The one major exception occurs in the green shaded area, when returns were systematically negative. This area is from January 1995 through the end of April 2000, which coincides with the tech boom. Anecdotally, during this period

[22]Examples of such viewpoints are common in the popular press, for example from the Wall Street Journal: "Dividends are so passe... [after] a heated stock market rally." (Eisen 1/10/2018).

investors focused on price appreciation rather than dividends. The blue shaded area represents the recent period with low interest rates, specifically January 2009 to June 2016 (the end of our sample) when the federal funds rate was below 0.50. As the quote at the beginning of the paper suggests, investors suffering from the free dividend fallacy desire dividend-paying stocks when interest rates are low. As a further example, dividend-paying products were so popular over this period that some of the larger dividend-focused funds closed themselves to new investment.[23] This period had large positive interim returns, consistent with investors focusing on dividends.

We test this intuition more formally in Table 8 Panel A which examines how the demand for dividends varies with the interest rate and recent market performance. We regress the interim return on these measures. We control for the level of the dividend yield and the number of days in the interim period, as Hartzmark and Solomon (2013) show these are related to price pressure during the interim period. Regressing the interim return on the interest rate we find a coefficient of -4.088 with a t-statistic of -3.40. A one standard deviation decrease in the daily interest rate leads to an interim period return 5 basis points higher (relative to a mean interim return of 16 basis points).[24] Regressing the interim return on the market return over the prior month we find a coefficient of -0.0196 with a t-statistic of -5.92. A one standard deviation decrease in the market return increases the interim return by roughly 8 basis points.

In Table 8 Panel B we examine how the interim period return varies with dividend increases and dividend reliability. For dividend increases, we use *Dividend Change Amount,* equal to the difference in dividends for that firm between the current quarter and the previous quarter. In Column 1 the interim period return is regressed on *Dividend Change Amount,* along with the dividend yield and days in interim period. The coefficient is a highly significant 0.0313, indicating that each penny of additional dividends is associated with higher interim returns by 3 basis points. To examine

[23]"Famously low bond yields have encouraged a stampede into stock funds that invest in dividend-rich companies. Vanguard Group closed its $31 billion Vanguard Dividend Growth Fund (VDIGX) to new assets after the fund doubled in size over three years." -John Coumarianos, The Wall Street Journal September 5, 2016

[24]In a related contemporaneous paper, Jiang and Sun (2016) find that the prices of dividend-paying stocks increase more than other stocks when interest rates fall. They relate this to the duration of dividend-paying stocks. In our setting, by looking at the relatively short return window during the interim period, we are able to focus specifically on the demand for dividends themselves, over and above the general properties of dividend-paying firms.

stability, in Column 2 we examine a dummy variable *No Div. Cut in Prior Year,* equal to one if, in the current quarter and the three quarters prior, the dividend paid was greater than or equal to that of the quarter before. Consistently paying at least the same dividend amount over the prior year is associated with a higher interim returns of roughly 13 basis points. In Columns 3 we include both variables and find similar results. To ensure that this not simply capturing time-variation in the overall level of interim returns, in Column 4 we add a year-by-quarter fixed effect and find materially similar coefficients, suggesting the effect comes from the change in dividends itself. It is interesting to note that adding these extra variables drives out the effect of the dividend yield in explaining the size of the interim return. This suggests an important aspect of the psychology is how the dividend is perceived, not only the amount of the dividend.

Comparing dividend payments on a stock to interest payments on a bond or bank account is consistent with the free dividend fallacy, but not with Miller and Modigliani (1961). If an investor puts money into a bank account with an interest rate of 4% instead of 2%, he receives more money as a result. But if he puts money into a stock with a dividend yield of 4% instead of 2%, in general he does not receive more money, because higher dividends lead to offsetting price decreases. Interest rates and dividend yields are fundamentally different economic quantities. However, if the price decline from dividend payment is not understood, then investors are likely to treat dividends and interest as similar ways of getting an income stream, consistent with our results. Alternative theories must explain not only why there are high returns in the interim period (which lacks dividend news, tax consequences, or uncertainty), but why such returns should be related to interest rates, recent market performance, and the stability of dividend payments. All of these relations flow naturally if dividends and capital gains are treated as separate, unrelated attributes of stocks.

One potential class of alternative explanation is that the interim period return is related to dividend-related price pressure, but that this does not stem from psychology or investor mistakes. In particular, it is possible that the price rise over this period represents tax-free investors trying to arbitrage the high pre-tax returns on the ex-dividend day. Such an explanation does not obviously predict the observed relation with interest rates and recent market returns, but more complicated

versions of the basic idea may generate such a pattern.

However, two facts militate against this explanation. First, it is difficult to explain both the positive interim returns and the positive ex-date returns using simple rational tax models. The Elton and Gruber (1970) explanation for the positive ex-date return is that the marginal investor pays dividend taxes. However, the tax argument for the positive interim returns implies that the marginal investor prior to the ex-date is a tax-free institution pushing up the price through their purchases. If these two groups of investors have offsetting demand, it is unclear why they should not trade with each other at the same time and create a single price reflecting demand from both groups, rather than both pay higher prices by trading a few days apart. Second, an explanation based on tax-free institutions buying in the interim period would predict that the interim returns should be higher when the ex-date returns are also higher. In untabulated results, the correlation between these two returns is -0.05, not a positive relation as tax based explanations would predict. This suggests that even modified tax arbitrage explanations are unlikely to drive the results we find.

Interpreting these results as being driven by the free dividend fallacy requires that the assumptions we developed above hold, and that the results are not driven by some other related source. While these assumptions could in principle arise under alternative explanations, we are aware of no other parsimonious theory that predicts the patterns in the data which we document.

The free dividend fallacy has various costs to investors. The most direct cost is the tax effect of receiving dividends versus selling the equivalent number of shares. For taxable investors, dividends will generally have tax consequences, whereas selling shares only results in capital gains tax if the position was sold at a gain, in which case only the capital gains portion is taxed. As a result, dividends are likely to be worse on average for tax purposes. If an investor needs a certain amount of money, receiving it via a dividend lets him avoid trading costs from selling shares. Alternatively, if an investor would have kept the value of a dividend in his portfolio without the dividend, but does not reinvest it when he receives the dividend, he loses out on the future expected returns.

While these are the direct costs, the previous analysis suggests another potentially large indirect cost. Because investors systematically demand dividends at the same time, high dividend

demand leads to increases in the overall valuation (measured by book-to-market ratios) of dividend-paying companies. To the extent that this book-to-market ratio can be interpreted as a stock being relatively over- or under-priced, this suggests that in periods of high dividend demand, dividend-paying stocks are likely to have lower future returns. To understand the magnitude of this cost we conduct a simple, back-of-the-envelope calculation. Our predictor of future mispricing is the average book-to-market ratio of dividend-paying firms in a given month, divided by the average of non-dividend-paying firms.[25] Our measure of future returns is the average cumulative return over the next 12 months of dividend-paying firms minus the average for non-dividend-paying firms. We regress this return gap on the difference in book-to-market ratios between dividend-paying and non-dividend-paying firms. We find a coefficient of 0.225 with a t-statistic of 2.16 (with Newey West standard errors with a 12 month lag). The interpretation is that the difference in book-to-market ratio of dividend-paying stocks to non-dividend-paying stocks predicts the future return gap between these two types of firms. In other words, when dividend-paying firms are relatively highly valued compared to other firms, they also have relatively lower future returns.

Because dividend demand increases the valuations of dividend-paying firms, investors who buy such firms due to a demand for dividends are likely to receive lower future returns. During the recent period of low interest rates this ratio of book-to-market dropped by slightly more than 0.1, and as the tech boom ended this ratio decreased by more than 0.2. Using our regression estimate, a decrease of 0.1 is associated with lower expected 12-month-returns of 2.3%, and 0.2 is associated with lower expected returns of 4.6%. The exact impact on an individual's expected returns on their portfolio will depend on how actively they shift from dividend to non-dividend-paying stocks over time, but the simple back-of-the-envelope calculation suggests that the costs of buying dividend-paying stocks when dividend demand is high could lead to lower expected returns of roughly 2-4% over the next year, a substantial fraction of the equity premium itself.

[25] We focus on the book-to-market ratio because of its widespread use in predictability regressions. In untabulated results we find slightly larger estimates of total costs using average interim returns over the prior year.

6 Conclusion

The idea that a value maximizing investor is indifferent between receiving value through capital gains or dividends is an economically sensible one - by combining the two into a single returns variable, an investor can measure the total profit he receives on a position. Nonetheless, the wedge between normative theories of how to account for investment profits (which provide sound measures of an investor's overall economic performance), and positive theories (which describe how investors actually think of their positions) may be considerable. We document that investors behave as if they track capital gains and dividends as separate and largely independent variables. Their behavior does not suggest that these two components are conceived of as part of a single combined source of money, and this has important marketwide consequences.

When considering whether to sell assets, stock performance is mostly considered through price changes, not returns. Dividend-paying stocks are sold less frequently, and the propensity to sell depends less on price changes. These results hold across a wide range of investors, including individuals, mutual funds and institutions. Analysts are too optimistic when forecasting prices of dividend-paying stocks, consistent with neglecting the effect of dividends on prices. Demand for dividend-paying assets increases when interest rates are low and when recent market returns are low, suggesting that investors value these stocks as an income stream, and compare them to income streams on bonds and the potential for capital gains. Even sophisticated investors rarely reinvest dividends back into the asset from which they came, leading to a downward drift in the weights of dividend-paying assets.

These findings are all consistent with a broad set of investors suffering from the free dividends fallacy. Prior rational theories (e.g. related to taxes or trading costs) and behavioral theories (e.g. using dividends to solve a self-control problem while understanding performance as total returns) are unable to provide a parsimonious explanation for all of the findings. The results flow directly from the idea that investors view price changes and dividends in separate mental accounts and often miss the tradeoff inherent between the two.

Absent considerations of taxes and transaction costs, dividends are merely another source of profit along with capital gains, and one which mechanically reduces the price of the stock. However, popular discourse often discusses them as if they are a cost-free stream of income, independent of capital gains. Many investors and commentators, if pushed, will readily admit that any given dividend will result in a price drop. However, they will then make puzzling statements such as claiming that the reliability of dividend payments provides a good hedge against uncertain fluctuations in prices, or that a high dividend yield is valuable when bond yields are low. A better understanding of the relation between dividends and price changes would help investors appropriately characterize their profits on each position. How best to teach investors about the proper role of dividends in finance remains an open and interesting question.

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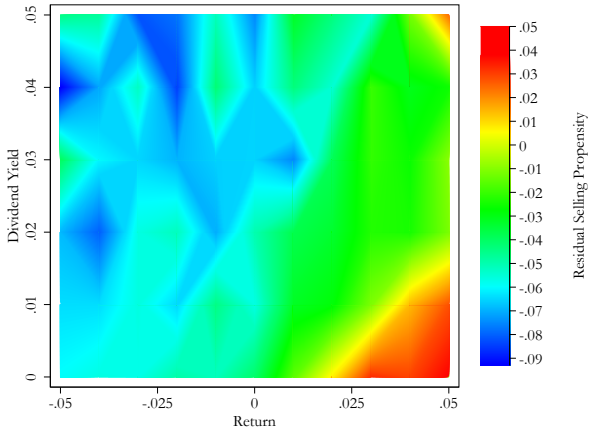
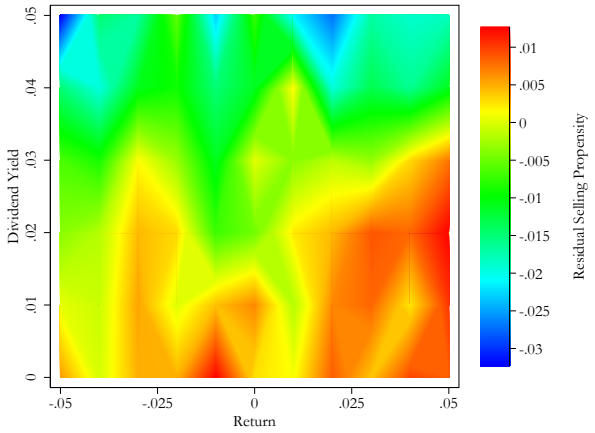
Figure 1
Selling propensity based on Return and Dividend Yield

This graph shows a contour plot of the residual selling propensity after controlling for investor-specific holding period, past volatility, number of positions and an account fixed effect. The x-axis shows the total return on a position while the y-axis shows the dividend yield. The color indicates the selling propensity shown in the legend to the right of the graph. The sample includes investors displaying a disposition effect on prior trades. The range examined is returns from -5% to 5% and dividend-paying stocks with dividend yields less than or equal 5%.

Panel A: Individual Investor



Panel B: Mutual Fund



Panel C: Institutional Investor

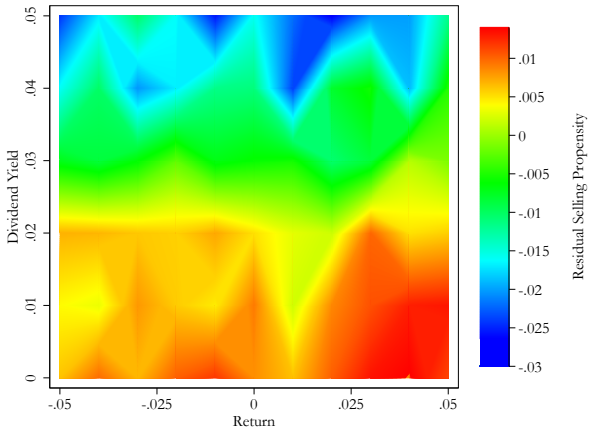
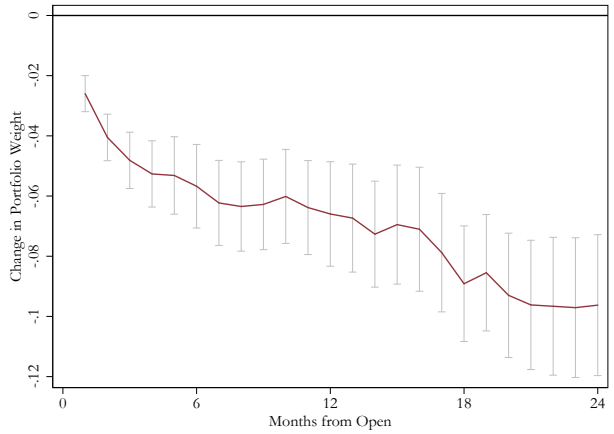


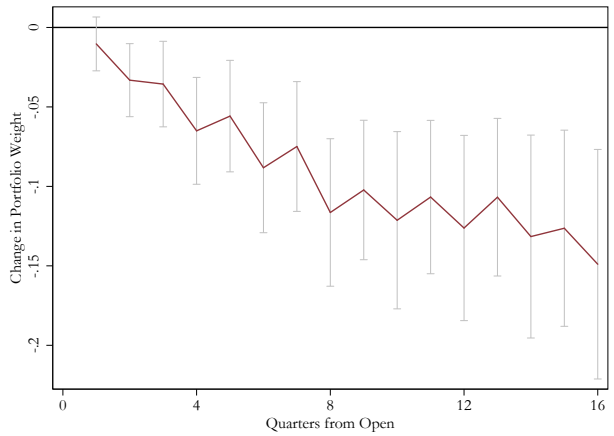
Figure 2
Dividend-Induced Drift

This graph shows the change over time in portfolio weights of dividend-paying positions relative to non-dividend-paying positions. The dependent variable is the portfolio weight at time t divided by the portfolio weight when the position was opened at $t = 0$. This is regressed on dummy variables for time since opened and an interaction of this variable with a dummy variable equal to one if the position paid a dividend in the holding period. The graph is of the interaction coefficient, which is the difference in change in portfolio weight for dividend paying positions compared to non-dividend paying positions. For the individual investors the time period is monthly, while for the mutual funds and institutions it is quarterly. The change in portfolio weight variable is winsorised at the 99th percentile and positions are excluded if the initial or current portfolio weight is one, or if the initial portfolio weight was below 0.0001 of the portfolio. Standard errors are clustered by time period and investor, fund or institution and the 95% confidence intervals are graphed.

Panel A: Individual Investor



Panel B: Mutual Fund



Panel C: Institutional Investor

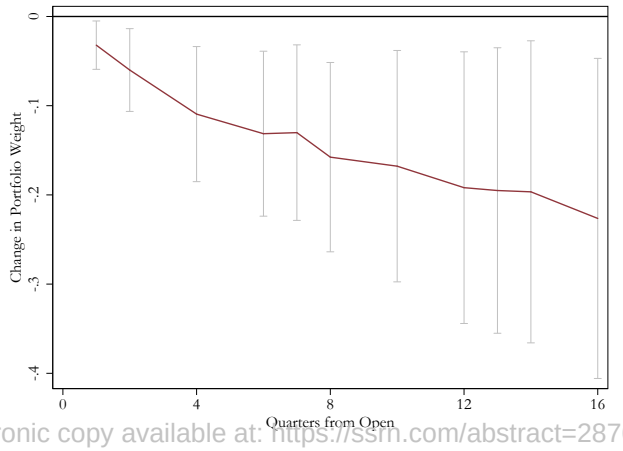
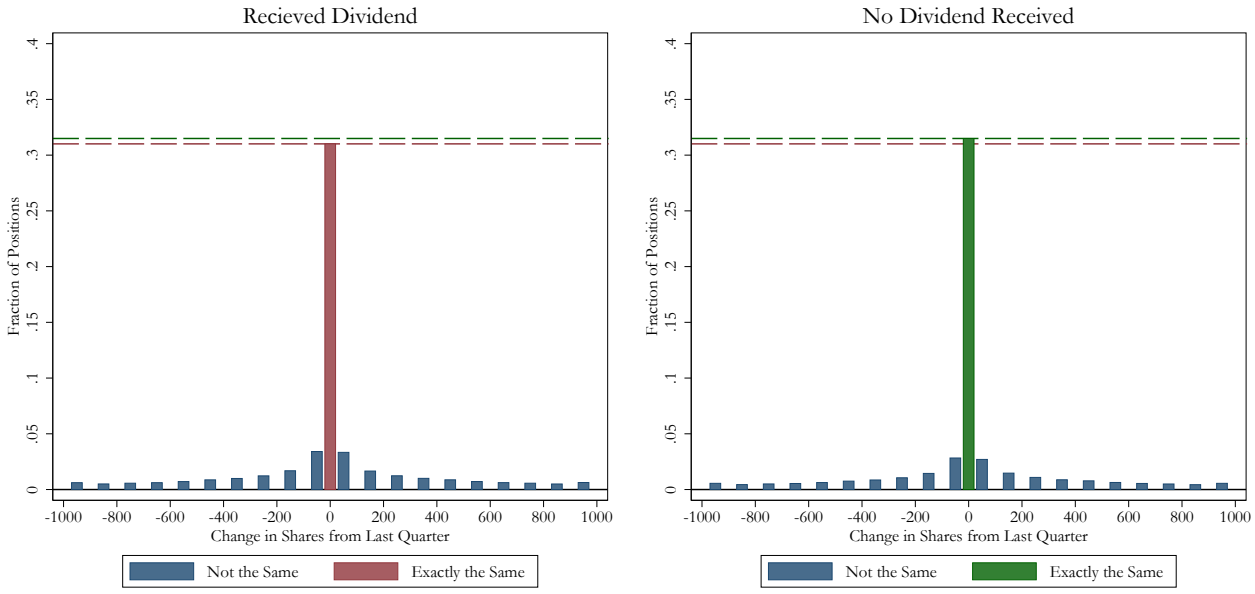


Figure 3

Changes in Holdings for Dividend-Paying and Non-Dividend-Paying Stocks

This graph shows the distribution of the change in number of shares of a given holding from one report date to the next, for holdings that paid a dividend between the two report days (left graph) and those that did not (right graph). Panel A examines holdings changes for mutual funds, and Panel B examines holdings changes for institutions. The maroon and green bars represents the number of holdings with the exact same number of positions from quarter to quarter. The blue bars represent changes in number of position in 100s. Bars are centered at x and to the right of the maroon bar contain changes from $(x - 50,\ x + 50]$ and to the left $[x - 50,\ x + 50)$.

Panel A: Mutual Funds



Panel B: Institutional Investors

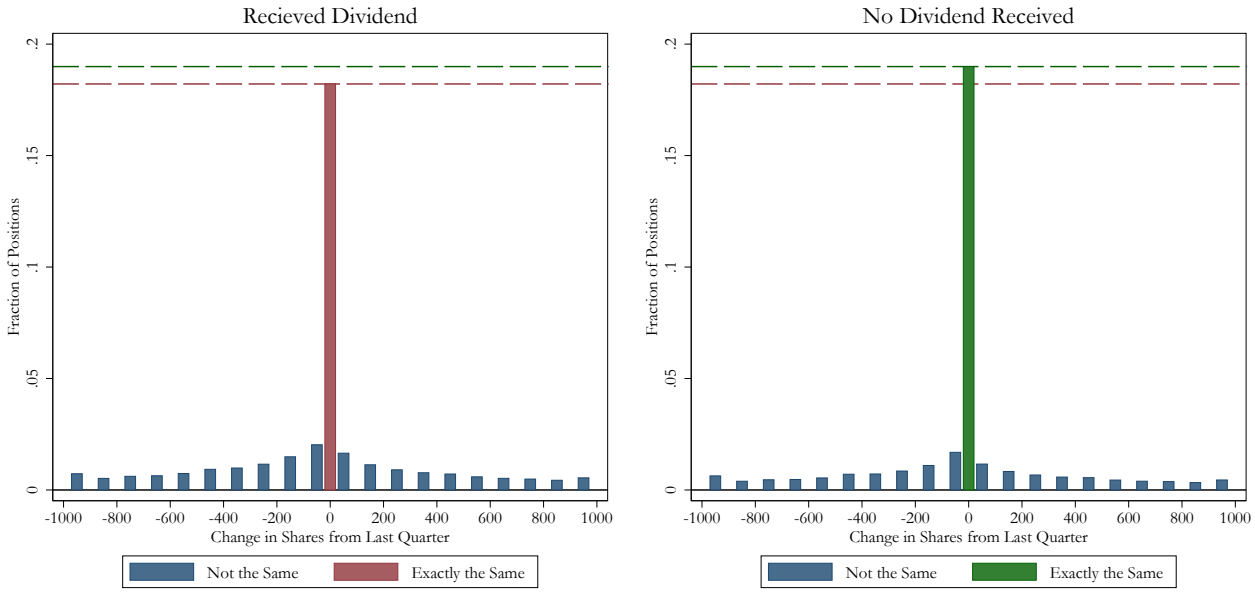
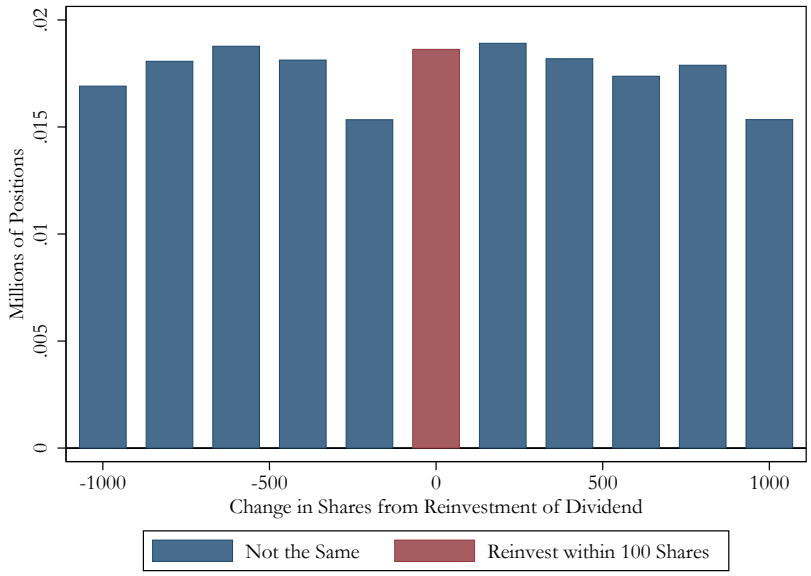


Figure 4

Difference Between Actual Change in Mutual Fund and Institutional Holdings and Amount Corresponding to Full Reinvestment of Dividends

This graph examines the amount by which changes in mutual fund and institutional holdings differ from the amount corresponding to dividend reinvestment, given that the investor made some change in holdings. For holdings that paid a dividend during the quarter, we compute the actual change in holdings minus the change in holdings that would occur if the dividend were immediately reinvested into the stock on the payment date. As a result, a fund that exactly reinvests the dividend will show a difference of zero. The figure plots the distribution of this difference for all dividend-paying fund holdings where the amount to be reinvested was at least 100 shares. The maroon bar represents a difference between -99 and +100 (i.e. the fund invested within 100 shares of the amount of the dividend). The blue bars are difference amounts binned into units of 100 shares. We exclude observations where the fund made no change in shares. Only funds with a difference of report days between 60 and 100 calendar days are included. Panel A examines mutual funds while Panel B examines the holdings of institutional investors.

Panel A: Mutual Funds



Panel B: Institutional Investors

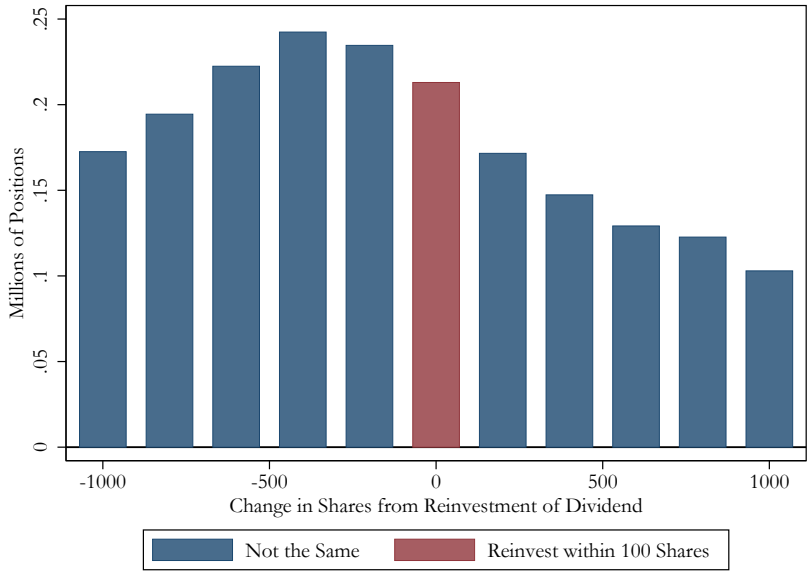


Figure 5
Dividend Interim Returns over Time

This graph shows a local linear plot of the interim period return (the cumulative characteristic-adjusted return after a dividend announcement and before the ex-date) over time. The green shaded area coincides roughly with the tech boom from January 1995 through April 2000. The blue shaded area represents low interest rates beginning in from January 2009 through June 2016 where the federal funds rate was below 0.50. The gray area indicates the 90 percent confidence interval.

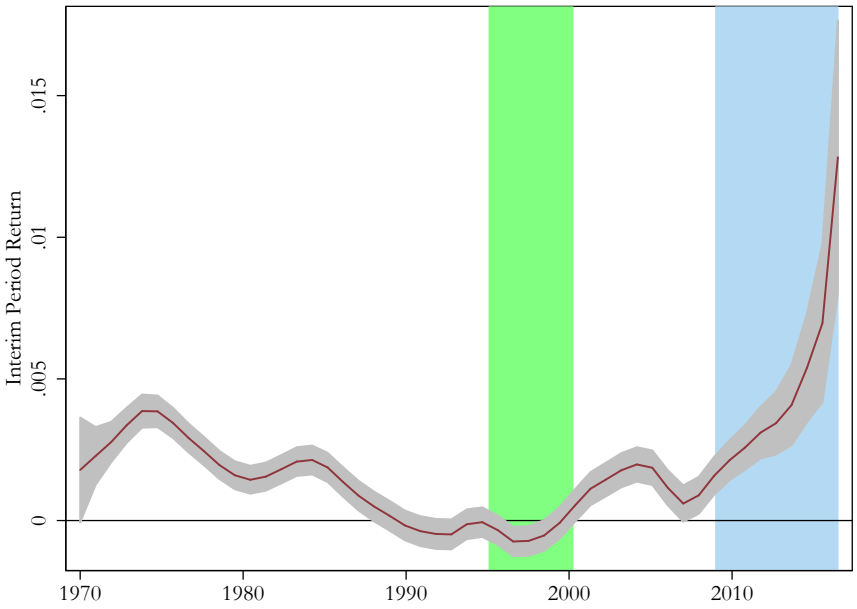


Table 1
Summary Statistics

Panel A shows summary statistics for the individual investor data which covers January 1991 to November 1996. Panel B shows summary statistics for mutual funds and institutional investors covering 1980 through 2015. Panel C explores the returns of stocks, their percentage price changes and their dividend yield at the daily, monthly and annual horizon. The first three rows show the mean value of each. The next three rows show correlations, and the final two row shows the total number of observations and the total number of observations with a positive dividend yield.

Panel A: Individual Investor Summary Statistics

	Obs	Mean	SD	Min	25th Pctile	Median	75th Pctile	Max
Accounts	54,176							
Sell Days	313,625							
Observations	1,506,274							
Portfolio Size	313,625	4.803	7.577	1	2	3	6	358
Dividend Paying Obs.	696,138							
Unambiguous Gain	437,805							
Gain Only with Dividends	40,866							
Unambiguous Loss	217,467							

Panel B: Mutual Fund and Institutional Investor Statistics

	Mutual Funds	Institutional Investors
Filing Entities	21,743	6,761
Report Days	279,018	229,528
Observations	24,570,258	57,040,527
Dividend in Current Quarter	11,521,670	28,359,091

Panel C: Returns by Dividend Yield

	Daily	Monthly	Annual
Return	0.0008	0.0113	0.1601
Percentage Price Change	0.0007	0.0094	0.134
Dividend Yield	0.0001	0.0019	0.0242
Corr(Ret, Div Yield)	0.0061	0.0171	-0.0097
Corr(Ret, Div Yield|Div Yield>0)	0.0925	0.0664	-0.0263
Corr(Price Change, Div Yield|Div Yield>0)	-0.5039	-0.1031	-0.067
Total Observations	87,124,042	3,752,363	287,540
Observations with Div Yield>0	744,409	658,238	155,561

Table 2
The Disposition Effect With and Without Dividends

This table explores the propensity of individual investors, mutual funds and institutional investors to sell positions when they are at a gain, measured using either price changes or returns including dividends. Panel A includes investors displaying a disposition effect on prior trades, while Panel B includes the other investors. The dependent variable is *Sell*, a dummy variable for whether a particular share was sold that day (for individuals) or between the two reporting dates (for funds and institutions), given that some sale occurred. The two main independent variables are *Unambiguous Gain*, a dummy variable that equals one for any share at a gain relative to purchase price, computed using only the capital gain and excluding dividends, and *Gain Only With Dividends*, a dummy variable for a share at a gain relative to purchase price if dividends are included but at a loss when dividends are not included. All regressions include a *Received Dividend* dummy that equals one if the share has received any dividends since being purchased. *Additional Controls* include a portfolio size fixed effect, *GainPrc*(% Price Change)*, *LossPrc*(% Price Change)*, *GainRet*(Return)*, *LossRet*(Return)*, *Gain*Variance*, *Loss*Variance,* and *√Holding Days* interacted with account fixed effects. *GainPrc/LossPrc* are defined on % price change and *GainRet/LossRet* are defined based on returns including dividends. *p*-values for the test of *Unambiguous Gain=Gain Only With Dividends* are reported after the regression values. Individual investor data covers January 1991 to November 1996. Fund and institutional data covers 1980 to 2015. Standard errors are clustered by account/fund and date, and *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Disposition Effect

	Individual Investor		Mutual Fund		Institutional Investor	
	(1)	(2)	(3)	(4)	(5)	(6)
Unambiguous Gain	0.125***	0.139***	0.0466***	0.0362***	0.0306***	0.0248***
	(33.57)	(36.77)	(9.12)	(10.39)	(7.05)	(9.14)
Gain Only With Dividends	0.0240***	0.0212***	0.0113***	0.0256***	0.0146***	0.0159***
	(5.78)	(6.91)	(2.74)	(11.93)	(4.33)	(6.72)
p: Unambiguous=With Dividends	0	0	0	0	0	0
Account FE	No	Yes	No	Yes	No	Yes
Additional Controls	No	Yes	No	Yes	No	Yes
R^2	0.0265	0.260	0.00312	0.180	0.00110	0.0760
Observations	819185	818053	10051341	10051341	16226120	16226120

Panel B: Reverse Disposition Effect

	Individual Investor		Mutual Fund		Institutional Investor	
	(1)	(2)	(3)	(4)	(5)	(6)
Unambiguous Gain	-0.0548***	-0.0276***	-0.0421***	-0.0211***	-0.0350***	-0.0219***
	(-8.35)	(-6.36)	(-10.11)	(-7.06)	(-9.86)	(-9.22)
Gain Only With Dividends	-0.0534***	-0.0187***	-0.0205***	0.0125***	-0.00319	0.00230
	(-8.03)	(-2.98)	(-5.27)	(5.88)	(-0.81)	(0.82)
p: Unambiguous=With Dividends	0.774	0.104	0	0	0	0
Account FE	No	Yes	No	Yes	No	Yes
Additional Controls	No	Yes	No	Yes	No	Yes
R^2	0.00982	0.289	0.00201	0.132	0.00125	0.0541
Observations	495157	493762	12780729	12780729	23038856	23038856

Table 3
The Rank Effect With and Without Dividends

This table explores how the the tendency of individual investors, mutual funds and institutional investors to sell stocks varies with the ranking of performance within the portfolio, measured both using returns including dividends and using price changes. The dependent variable is *Sell*, a dummy variable for whether a particular share was sold that day (for individuals) or between the two reporting dates (for funds and institutions), given that some sale occurred. *Best*, *Worst*, *2nd Best* and *2nd Worst* are dummy variables for the ranking of stocks within the investor's portfolio based on total performance. *(Including Dividends)* ranks based on returns including dividends, while *(Price Only)* ranks based only on the capital gain. An investor must hold at least 5 stocks on a sell day to be included in the analysis. *Additional Controls* are listed in Table 2 and also include *GainPrc* and *GainRet*. Account FE indicates a fixed effect for each account. All regressions include a *Received Dividend* dummy variable. Standard errors are clustered by account/fund and date and t-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Individual Investor		Mutual Fund		Institutional Investor	
	(1)	(2)	(3)	(4)	(5)	(6)
Best (Price Only)	0.146***	0.105***	0.0486***	0.0480***	0.0427***	0.0502***
	(23.72)	(18.49)	(11.13)	(9.78)	(9.39)	(8.25)
Best (Including Dividends)	0.00739	0.0204***	0.0292***	0.00116	0.0306***	-0.0209***
	(1.13)	(3.59)	(7.19)	(0.21)	(7.13)	(-3.95)
Worst (Price Only)	0.0526***	0.0428***	0.112***	0.0789***	0.0780***	0.0218***
	(9.74)	(8.56)	(22.57)	(16.52)	(15.56)	(3.95)
Worst (Including Dividends)	0.0318***	0.0153***	0.00702**	0.0130***	-0.0126***	0.0130***
	(6.25)	(3.09)	(2.17)	(3.47)	(-3.06)	(2.79)
2nd Best (Price Only)	0.0818***	0.0436***	0.0381***	0.0349***	0.0381***	0.0371***
	(17.88)	(11.64)	(14.38)	(12.77)	(13.25)	(10.41)
2nd Best (Including Dividends)	0.0247***	0.0146***	0.0275***	0.0120***	0.0291***	-0.000869
	(5.45)	(4.05)	(11.93)	(4.06)	(10.56)	(-0.29)
2nd Worst (Price Only)	0.0234***	0.0105***	0.0641***	0.0440***	0.0538***	0.0190***
	(6.87)	(3.61)	(20.43)	(14.80)	(16.40)	(5.27)
2nd Worst (Including Dividends)	0.0272***	0.00544*	0.0134***	0.0131***	0.00550*	0.0136***
	(8.02)	(1.85)	(5.60)	(4.91)	(1.88)	(4.49)
Account FE	No	Yes	Yes	Yes	Yes	Yes
Additional Controls	No	Yes	No	Yes	No	Yes
R^2	0.0262	0.100	0.132	0.142	0.0491	0.0595
Observations	1058711	1058711	23293975	23293975	39833612	39833612

Table 4
The Rolled Disposition Effect With and Without Dividends

This table examines the propensity of individual investors to sell positions purchased as part of a reinvestment episode, according to whether the combined position is at a gain or a loss (with or without dividends included). Stocks are included as observations if they were purchased on the same day that another stock was sold (a reinvestment day). For these stocks, we take all days on which some position was sold and use as a dependent variable *Sell*, a dummy variable for whether the particular share was sold that day. The main independent variables are *Original Gain*, either including or excluding dividends. These are dummy variables that equal one if the new asset (purchased on a reinvestment day) has a value that exceeds the amount initially invested into the old asset (which got sold on the reinvestment day) - in other words, whether the combined reinvested position is at a gain or a loss. *Including Dividends* adds the dividends paid on both the old and the new stock to compute whether the combined position is at a gain or a loss. *Gain* (either with or without dividends) is a dummy variable that equals one if the new asset is at a gain just relative to its own purchase price, as a single stock investment. *Additional Controls* are listed in Table 2 and also include *GainPrc* and *GainRet*. All regressions include a *Received Dividend* dummy variable. Standard errors are clustered by account and date and t-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Original Gain (Price Only)	0.0395***		0.0377***	0.0290***	0.0185***
	(5.88)		(5.56)	(4.37)	(5.55)
Original Gain (Including Dividends)		0.0167***	0.00682	-0.0245***	0.000708
		(3.00)	(1.23)	(-4.52)	(0.20)
Gain (Price Only)				0.0936***	0.0739***
				(20.28)	(18.57)
Gain (Including Dividends)				-0.0259***	0.000369
				(-6.32)	(0.15)
Additional Controls	No	No	No	No	Yes
R^2	0.000164	0.0000713	0.000167	0.00708	0.296
Observations	1830815	1830815	1830815	1830815	1809992

Table 5
The Holding Period and Price Sensitivity of Dividend-Paying Stocks

This table examines the likelihood that investors sell stocks that pay dividends, and whether dividends are associated with a lower selling response to price changes. The dependent variable is *Sell*, a dummy variable for whether a particular share was sold. *Dividend Yield in Prior Year* is a stock's dividend yield over the prior 12 months and *Dividend in Prior Year* is a dummy variable equal to one if this variable is positive. The following six variables are dummy variables equal to one if the dividend yield over the prior year is in the indicated range of values (e.g. *Dividend Yield (0,1]* is equal to 1 if *Dividend Yield in Prior Year* is greater than 0 and less than or equal to 1%). *GainPrc* is a dummy variable equal to one if the stock is at a gain based on price appreciation. *Received Dividend* is a dummy that equals one if the share received dividends since being purchased. *Stock Controls* include book-to-market, company age, annual volatility of return on assets over the previous five years, and market capitalization in the prior month. *Additional Controls* are listed in Table 2 and also include *GainPrc* and *GainRet*. Panel B includes only investors displaying a disposition on prior trades. It regresses a *Sell* dummy on a *Gain (Price Only)* dummy, a *Received Dividend* dummy (not shown), and the interaction of the two. Standard errors are clustered by account/fund and date. *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Selling Based on Dividends

	Individual Investor		Mutual Fund		Institutional Investor	
	(1)	(2)	(3)	(4)	(5)	(6)
Dividend Yield in Prior Year	-0.419***		-0.451***		-0.560***	
	(-7.65)		(-5.23)		(-8.69)	
Dividend in Prior Year	-0.00417*		-0.00281		0.00515*	
	(-1.88)		(-1.12)		(1.88)	
Dividend Yield (0,1]		-0.00972***		-0.00612**		0.00307
		(-3.90)		(-2.56)		(1.13)
Dividend Yield (1,2]		-0.0102***		-0.00702***		-0.00235
		(-3.77)		(-2.77)		(-0.90)
Dividend Yield (2,3]		-0.00534*		-0.0129***		-0.00831***
		(-1.82)		(-5.02)		(-3.00)
Dividend Yield (3,4]		-0.0190***		-0.0220***		-0.0173***
		(-6.00)		(-6.85)		(-5.99)
Dividend Yield (4,5]		-0.0168***		-0.0294***		-0.0254***
		(-3.64)		(-7.29)		(-7.40)
Dividend Yield 5+		-0.0344***		-0.0358***		-0.0338***
		(-9.15)		(-7.15)		(-8.24)
Stock Controls	Yes	Yes	Yes	Yes	Yes	Yes
Account FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.351	0.351	0.176	0.176	0.0768	0.0768
Observations	583065	583187	4757827	4758438	7000889	7002374

Panel B: Disposition Effect Based on Dividends

	Individual Investor		Mutual Fund		Institutional Investor	
	(1)	(2)	(3)	(4)	(5)	(6)
Gain (Price Only)	0.160***	0.155***	0.0558***	0.0380***	0.0365***	0.0262***
	(33.93)	(34.46)	(10.81)	(11.39)	(7.45)	(8.48)
Gain (Price Only)*Received Dividend	-0.0844***	-0.0410***	-0.0167***	-0.0113***	-0.0115***	-0.00670***
	(-19.79)	(-10.74)	(-4.73)	(-5.20)	(-3.88)	(-2.99)
Account FE	No	Yes	No	Yes	No	Yes
Additional Controls	No	Yes	No	Yes	No	Yes
R^2	0.0291	0.260	0.00317	0.180	0.00110	0.0760
Observations	819185	818053	10051341	10051341	16226120	16226120

Table 6
Dividend Reinvestment Among Mutual Funds and Institutions

This table examines the propensity of mutual funds (Panel A) and institutional investors (Panel B) to reinvest dividends. In the first two columns, the dependent variable is a dummy variable equal to one if there is no change in shares between the current and previous report. This is regressed on a dummy variable for whether the holding paid a dividend over that time period. In the third and fourth columns the dependent variable is equal to one if there is an increase in shares. In column five the sample is limited to observations where reinvesting a dividend would require buying at least 100 shares and the constant displays the mean value of a dummy variable equal to one if the investor reinvests within 100 shares of what would be necessary for exact reinvestment. Columns 2 and 4 include fund fixed effects. Standard errors are clustered by fund and quarter, and t-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Mutual Funds

	Same Shares		Increase Shares		Change Shares
	(1)	(2)	(3)	(4)	(5)
Dividend Paying Holding	-0.00483	0.00309	0.0179***	0.0135***	
	(-1.00)	(1.37)	(6.44)	(6.71)	
Constant	0.315***	0.311***	0.304***	0.306***	0.00719***
	(35.58)	(129.63)	(54.21)	(86.03)	(19.27)
Fund FE	No	Yes	No	Yes	No
R^2	0.0000271	0.254	0.000373	0.119	0
Observations	24570258	24570258	24570258	24570258	5410720

Panel B: Institutional Investors

	Same Shares		Increase Shares		Change Shares
	(1)	(2)	(3)	(4)	(5)
Dividend Paying Holding	-0.00781***	-0.0235***	0.0222***	0.0330***	
	(-2.76)	(-12.01)	(11.46)	(19.25)	
Constant	0.190***	0.198***	0.338***	0.332***	0.0117***
	(31.37)	(84.75)	(69.60)	(201.83)	(31.06)
Manager FE	No	Yes	No	Yes	No
R^2	0.000101	0.122	0.000542	0.0426	0
Observations	57040527	57040527	57040527	57040527	18255322

Table 7
Analysts' Price Forecast Errors by Dividend Yield

This table examines how analyst forecast errors based on target prices vary with dividend yield. A forecast error is measured as the actual price in month $t+12$ minus the IBES consensus forecast made in month t of the future price at month $t+12$, divided by the forecast. Dividend yield is measured in the year prior to the forecast, from months $t-13$ through $t-1$. Column one includes only dividend-paying stocks, columns two through four include all positions and a dummy variable equal to one if the stock pays a dividend. Column four includes only positions with 7 or more analysts, which represents the 75th percentile of analyst coverage. Columns 3 and 4 include year-by-month fixed effects. The p-value for the test that the coefficient on dividend yield is equal to negative one is underneath the regression. Standard errors are clustered by firm and month. t-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Full Sample			Top Quartile Coverage
	(1)	(2)	(3)	(4)
Div Yield	-1.073**	-1.073**	-0.884**	-1.256**
	(-2.34)	(-2.34)	(-2.01)	(-2.05)
Div Yield=-1	0.873	0.873	0.793	0.677
Only Div Payers	Yes	No	No	No
Year Month FE	No	No	Yes	Yes
R^2	0.00108	0.00930	0.0862	0.0820
Observations	279154	560453	560453	207377

Table 8
The Market Impact of Time-Varying Dividend Demand

This table examines how the interim return (the characteristic-adjusted cumulative return from one day after a dividend announcement to one day before the ex-date) varies with the nominal risk-free interest rate, past market returns, changes in the dividend paid and stability of the dividend paid. Regressions include the interim return as the dependent variable. In Panel A this is regressed on the interest rate and the market return over the prior month (trading days t-20 to t-40), In Panel B this is regressed on *Dividend Change Amount,* the difference in quarterly dividend from the current quarter minus the amount paid in the prior quarter and *No Div. Cut in Prior Year,* a dummy variable equal to one if in the current quarter and the three quarters preceding it the dividend change amount is zero or positive. Column 4 includes a year-by-quarter fixed effect. All regressions also include the stock's dividend yield over the previous year and the number of days between the ex-date and the announcement date. Each observation represents the interim return for an individual dividend payment for a given stock. Data covers January 1964 to June 2016. Standard errors are clustered by firm and date. t-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Interim Returns on the Interest Rate and the Market

	(1)	(2)	(3)
Interest Rate	-4.088***		-4.121***
	(-3.40)		(-3.44)
Market Return		-0.0196***	-0.0196***
		(-5.92)	(-5.93)
Dividend Yield	0.393***	0.369***	0.392***
	(15.76)	(15.83)	(15.76)
Days in Interim Period	-0.000140***	-0.000139***	-0.000140***
	(-8.74)	(-8.67)	(-8.76)
R^2	0.00207	0.00220	0.00226
Observations	283654	283654	283654

Panel B: Interim Returns on Dividend Stability and Increases

	(1)	(2)	(3)	(4)
Dividend Change Amount	0.0313***		0.0318***	0.0313***
	(9.18)		(9.43)	(9.31)
No Div. Cut in Prior Year		0.00126***	0.00139***	0.00130***
		(3.46)	(3.80)	(3.55)
Days in Interim Period	-0.000130***	-0.000133***	-0.000131***	-0.000131***
	(-6.86)	(-6.98)	(-6.87)	(-6.87)
Dividend Yield	0.0294	0.0231	0.0338	-0.0129
	(1.00)	(0.78)	(1.16)	(-0.39)
Quarter FE	No	No	No	Yes
R^2	0.000871	0.000528	0.000934	0.00607
Observations	283539	283464	283464	283464