

# Cross-sectional Return Dispersion and Time-Variation in Value and Momentum Premia<sup>1</sup>

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# Cross-sectional Return Dispersion and Time-Variation in Value and Momentum Premia

## **Abstract**

We find that the market's recent cross-sectional dispersion in stock returns is positively related to the subsequent value book-to-market premium and negatively related to the subsequent momentum premium. The partial relation between return dispersion and the subsequent value and momentum premia remains strong when controlling for macroeconomic state variables suggested by the literature. Our findings are consistent with recent theoretical insights and empirical evidence which suggest that the market's return dispersion may serve as a leading countercyclical state variable, the value premium is countercyclical, and the momentum premium is procyclical.

JEL Classification: G12, G14

Keywords: Momentum, Value, Book-to-Market Equity Ratio, Return Dispersion

# I. Introduction

Cross-sectional variation in average stock returns tied to book-to-market equity ratios (or value) and past relative-return strength (or momentum) has an important role in both current financial practice and theory.<sup>1</sup> Recent theoretical and empirical work suggest that the value premium is expected to be higher during weaker economic times, or countercyclical; and that the momentum premium is expected to be higher in stronger economic times, or procyclical.<sup>2</sup> Recent theoretical and empirical work also suggest that the stock market's cross-sectional dispersion in stock returns is countercyclical and may serve as a market state variable.<sup>3</sup> Collectively, this literature suggests that the stock market's cross-sectional return dispersion may contain information about time-variation in the value and momentum premia.

We study the intertemporal relation between the cross-sectional dispersion in stock returns and subsequent value and momentum premia. Over our 1962 to 2005 sample, we document that the market's recent return dispersion (RD) is positively related to subsequent value payoffs and negatively related to subsequent momentum payoffs. Our findings are robust across subperiods. Further, the partial relation between RD and the subsequent value and momentum premia remains strong when controlling for macroeconomic state variables suggested by the literature. Our collective evidence suggests that the market's RD serves as a leading countercyclical state variable.

Our empirical investigation has both a solid theoretical and empirical basis. To begin with, the theoretical link between RD and the state of the aggregate economy has been formally established by Gomes, Kogan, and Zhang (2003) (GKZ) and Zhang (2005). GKZ present a general equilibrium

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<sup>1</sup>By the value premium, we refer to the average return spread between a portfolio of high book-to-market stocks and a portfolio of low book-to-market stocks. By the momentum premium, we refer to the average return spread between a portfolio of past relative winners and a portfolio of past relative losers. See the following alphabetical list (to name a few): Ahn, Conrad, and Dittmar (2003), Avramov and Chordia (2006), Bulkley and Nawosah (2007), Chordia and Shivakumar (2002), Conrad and Kaul (1998), Cooper, Gutierrez, and Hameed (2004), Fama and French (1993), (1996), (1998), and (2008), Gomes, Kogan, and Zhang (2003), Griffin, Ji, and Martin (2003), Grundy and Martin (2001), Gulen, Xing, and Zhang (2008), Hahn and Lee (2006), Jegadeesh and Titman (1993) and (2002), Johnson (2002), Liu and Zhang (2008), Petkova and Zhang (2005), Sagi and Seasholes (2007), and Zhang (2005).

<sup>2</sup>See Chordia and Shivakumar (2002), Gomes, Kogan, and Zhang (2003), Cooper, Gutierrez, and Hameed (2004), Zhang (2005), Avramov and Chordia (2006), and Gulen, Xing, and Zhang (2008).

<sup>3</sup>See Gomes, Kogan, and Zhang (2003), Zhang (2005), Stivers (2003), and Loungani, Rush, and Tave (1990).

model where the conditional CAPM holds, where firm betas vary with the market state, and where firm betas are related to a firm's size and book-to-market equity ratio. Given that firm betas cannot be measured perfectly in practice, a firm's size and book-to-market equity ratio are likely to contain incremental information about the cross-sectional variation in mean returns. Their model suggests that RD may contain incremental information about the current state of the economy, beyond market-level returns. RD should vary countercyclically in their framework because of the countercyclical nature of both aggregate return volatility and the dispersion in conditional market betas. Further, their model predicts a countercyclical variation in the value premium.

The model in Zhang (2005) extends the GKZ (2003) framework and features costly reversibility of capital investment, the countercyclical price of risk, and variation in the level of growth options across firms. His model demonstrates that value firms can be riskier than growth firms in recessions when the price of risk is high, which could help explain the unconditional value premium. Furthermore, Zhang's framework predicts that "some seemingly idiosyncratic risk variables, for example, the average stock return variance, can affect firm-level systematic risk and expected returns because they can be used in predicting the future evolution of the output price" (page 92). Table VI (page 93) of Zhang's article suggests that the market's cross-sectional stock return volatility may be positively related to the future industry cost of capital, based on simulation data. Further, Zhang's model also predicts a countercyclical variation in the value premium.

Empirical evidence in Gulen, Xing, and Zhang (2008) supports the notion that the value premium is countercyclical. They find that value-minus-growth returns, based on a stock's book-to-market equity ratio, display strong countercyclical variations when estimating a Markov switching model. Empirical evidence in Stivers (2003) and Loungani, Rush, and Tave (1990) support the notion that RD may serve as a state variable. Stivers (2003) notes that RD is higher during economic recessions and finds that RD has incremental information about subsequent market volatility. Loungani, Rush, and Tave (1990) find that RD tends to lead unemployment, which suggests a link between RD and economic reallocation across firms. Taken together, this theoretical and empirical literature suggests a potential positive empirical linkage between RD and the subsequent value premium, if RD serves as a countercyclical state variable and value payoffs are countercyclical.

Next, theoretical insights from Johnson (2002) and Sagi and Seasholes (2007) suggest that

momentum payoffs are likely to be procyclical. Johnson presents a rational framework where growth-rate risk is increasing with the growth-rate level. Thus, a momentum sort will tend to sort firms by recent growth rate changes, and recent winners will tend to have both higher growth-rate changes in the recent past and higher subsequent expected returns. Johnson’s model highlights the mechanism through which momentum profits, nonlinear growth rates, and shifts in economic states are fundamentally tied together. Liu and Zhang (2008) provide direct empirical support to Johnson’s model by showing that the growth rate of industrial production is a priced risk factor that explains more than half of momentum profits. Sagi and Seasholes build from Johnson and argue that a firm’s revenues, costs, and growth options combine to determine its momentum properties. Their model implies, “During up markets, firms tend to move closer to exercising their growth options, which tend to increase return autocorrelations” (page 391). They present simulation data that indicates momentum profits should be higher in up markets and lower in down markets.

Empirically, Chordia and Shivakumar (2002) and Cooper, Gutierrez, and Hameed (2004) (CGH) provide evidence that momentum payoffs are procyclical. Chordia and Shivakumar find that momentum payoffs are only reliably positive in economic expansions, with insignificant negative payoffs in recessions. CGH find that subsequent momentum payoffs are only reliably positive when the lagged 3-year stock market return is positive. In our view, it seems intuitive that if a high RD is associated with changes to a weaker market state; then subsequent momentum payoffs may be lower because past relative performance is unlikely to be sustained with a changing market state. Taken together, this theoretical and empirical literature suggests a potential negative empirical linkage between the market’s RD and the subsequent momentum premium, if RD serves as a countercyclical market variable and momentum payoffs are procyclical.

Wall Street practitioners have suggested that a high RD may indicate higher market uncertainty. For example, the Dow Theory suggests that dispersion in sector return performance indicates higher uncertainty.<sup>4</sup> A recent example of significant RD occurred in the early months of 2000, with clear divergence as the DJIA stalled but the NASDAQ continued its bull run. For this high RD episode, one observed: (1) growth stocks outperforming value stocks, prior to the episode, and (2) a bear market with value stocks outperforming growth stocks, following the episode.

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<sup>4</sup>See Brown, Goetzmann, and Kumar (1998) for evidence that supports the performance of the Dow Theory.

Our empirical investigation analyzes whether the market’s recent RD contains reliable information about variation in the subsequent value and momentum premia. For our value strategy based on book-to-market equity ratios, we focus on a 12-month strategy as a compromise that provides a sizable number of independent observations, that has a sizable economic duration, and that appeals to the notion of an annual investment decision. For our momentum strategy based on past relative return strength, we focus on the 6-month horizon because this horizon is prominent in the momentum literature with performance that survives standard risk adjustments.

In our empirical work, we focus on the 3-month moving average of the market’s monthly RD, where a month’s RD is defined as the cross-sectional standard deviation of monthly disaggregate stock returns. Our primary monthly RD is constructed from 100 stock portfolios formed on size and book-to-market equity ratios. We choose this primary RD because: (1) a portfolio-level RD may be less noisy RD than a firm-level RD, since the influence of extreme individual stock returns is mitigated; (2) this RD seems a natural choice given the widely used Fama and French 3-factor model and the theory of GKZ (2003); and (3) to foreshadow our results, the size and book-to-mark RD performs similarly, but generally better, in our setting than comparable firm-level RD metrics. Since a month’s simple RD should vary positively with the absolute monthly market return (see Stivers (2003)), we also investigate a monthly market-adjusted “relative RD” (or RRD) in addition to the simple RD. The RRD is constructed to be orthogonal to the concurrent absolute market return by regressing the simple RD against the absolute market return.

Over our 1962 to 2005 sample, we find that the market’s recent RD is positively related to subsequent value payoffs and negatively related to subsequent momentum payoffs, relative to the unconditional premia. Further, as compared to the “RD-subsequent payoff” relation, the RD exhibits an even stronger relation to the change-in-payoff, defined as the difference between the payoff that follows the RD moving-average and the payoff that precedes the RD moving-average.

The partial relations between RD and the subsequent value and momentum premia remain virtually unchanged while controlling for macroeconomic variables suggested by the literature, and the macroeconomic variables add little explanatory power in our setting. Further, our RD findings remain reliably evident: (1) in subperiod analysis, (2) for alternate RD metrics, (3) for alternate statistical methods, (4) for large-firm only strategies, (5) for strategies that omit extreme book-to-

market stocks for the value strategy or omit extreme past winners and losers for the momentum strategy, and (6) for a momentum strategy implemented on industry-level portfolio returns.

To illustrate, consider the payoffs to our primary 12-month value strategy, defined as the cumulative 12-month difference between the monthly high book-to-market portfolio return and the monthly low book-to-market portfolio return. When our lagged RRD moving-average is in its top quartile, the average payoff following (preceding) the RRD realization is 9.66% (2.41%), for an average increase of 7.25% following the RRD realization. When our lagged RRD moving-average is in its bottom quartile, the average payoff following (preceding) the RRD realization is 0.64% (8.70%), for an average decrease of 8.05% following the RRD realization. Thus, for value when comparing the high RRD quartile to the low RRD quartile, the difference in the average change-in-payoffs is +15.3%.

Next, consider the payoffs to our primary 6-month momentum strategy, defined as the cumulative 6-month return difference between the past relative-winner portfolio and past relative-loser portfolio. When our lagged RRD moving-average is in its top quartile, the average payoff following (preceding) the RRD realization is 5.20% (11.31%), for an average decrease of 6.11% following the RRD realization. When our lagged RRD moving-average is in its bottom quartile, the average payoff following (preceding) the RRD realization is 10.93% (4.92%), for an average increase of 6.01% following the RRD realization. Thus, for momentum when comparing the high RRD quartile to the low RRD quartile, the difference in the averages change-in-payoffs is -12.1%.

To sum up, we document a sizable and pervasive relation between the market's RD and the subsequent value and momentum premia. Our findings reinforce the notion that value and momentum premia vary with the economic state, and suggest a practical importance for investors who vary their loadings on these strategies in the sense of Avramov and Chordia (2006). Consistent with theoretical insights in GKZ (2003) and Zhang (2005), our evidence suggests that RD is a leading countercyclical indicator of the market state.

This article proceeds as follows. Section II presents our data and variable construction. Section III investigates RD and the value premium, and Section IV investigates RD and the momentum premium. Section V presents pervasiveness and robustness evidence. Section VI concludes.

## II. Data and Variable Construction

### A. Data Sources

Our empirical work features stock return data from two sources. For U.S. individual stocks, we examine monthly NYSE and AMEX stock returns from CRSP. We also use the following monthly, value-weighted portfolio returns from the Kenneth French data library: (1) decile portfolios formed on stocks' book-to-market equity ratios; (2) 100 book-to-market and size-based portfolios, formed from the intersection of decile sorts on a stock's book-to-market equity ratio and market capitalization; (3) 25 book-to-market and size-based portfolios, formed from the intersection of quintile sorts on a stock's book-to-market equity ratio and market capitalization; and (4) 48 industry portfolios.

Our study also uses the following: (1) business cycle data from the National Bureau of Economic Research (NBER), (2) the yield of Moody's BAA bonds, Moody's AAA rated bonds, 10-year T-notes, and 3-month T-bills from the Federal Reserve Statistical Release H.15, and (3) the lagged 12-month dividend yield data for the U.S. stock market estimated from CRSP data. Finally, our study uses the investor sentiment data of Baker and Wurgler (2007).<sup>5</sup>

Following Jegadeesh and Titman (1993) and Conrad and Kaul (1998), our sample commences in January 1962. Our sample extends through December 2005.

### B. Measuring Value Book-to-Market Strategy Payoffs

Our main value results in Section III report on a 12-month value book-to-market strategy, for the reasons offered in our introduction. Admittedly, the choice of a 12-month horizon is somewhat arbitrary. In additional results, we have also examined a 6-month and an 18-month value horizon and find qualitatively consistent results.

Our primary 12-month value payoff is constructed as follows. First, we take the difference between the average monthly return of the two highest book-to-market (B/M) decile portfolios and the two lowest B/M decile portfolios, using the B/M decile portfolios from the French data library. We then aggregate these monthly high-minus-low B/M payoffs to form a 12-month HML

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<sup>5</sup>We thank Kenneth French and Jeffrey Wurgler for making the stock portfolio return data and the investor sentiment data available on their respective websites.

value payoff. For our 12-month value payoffs, our timing convention is that  $HML_t$  denotes this aggregate payoff over months  $t$  to  $t + 11$  with the 12-month horizon. For a given  $HML_t$ , this notation is convenient because our empirical work uses explanatory variables that are constructed with information up through month  $t - 1$ .

Secondarily, we also examine two alternate value series to help evaluate the pervasiveness and robustness of our results. First, we examine a “large-firm only” 12-month HML strategy, which allows us to examine whether our primary findings are also evident in strategies that only include larger, more economically important firms. For this strategy, we use the 25 size and B/M portfolios from the French data library. Then, our large-firm HML payoff is the difference in returns between the highest and lowest B/M portfolio of the largest quintile size grouping.

Finally, we examine a less-extreme, “decile 9-minus-2” value strategy that goes long the decile-9 B/M stocks and goes short the decile-2 B/M stocks, using the value-weighted B/M decile stocks from the French data library. This strategy allows us to examine whether our primary findings are also evident in firms that have less extreme book-to-market equity ratios.

### C. Measuring Momentum Strategy Payoffs

Our main momentum results in Section IV report on a symmetric momentum strategy, where both the ranking and holding periods are six months long. We report on a 6-month momentum strategy because this horizon is prominent in the momentum literature with performance that survives standard risk adjustments.

Our momentum strategies form a zero-cost initial portfolio by starting with an equally-sized long and short position, based on the relative performance of stock returns over the lagged ranking period. For the ranking periods, we use the standard skip-a-month case (where the ranking period is gapped by one month from the holding period).

Our primary momentum strategy is a decile-based strategy implemented on NYSE and AMEX stocks. We rank NYSE and AMEX stocks into deciles based on their 6-month ranking-period return (months  $t - 7$  through  $t - 2$  with the skip-a-month). Equally-weighted, decile-portfolios are formed based on this ranking-period sort. The momentum payoff is the return of the top decile portfolio (the relative winners) less the return of the bottom decile portfolio (the relative losers)

over the subsequent 6-month period (months  $t$  to  $t + 5$ ). We exclude stocks priced less than five dollars at the beginning of each holding period to minimize microstructure issues related to illiquid and low-priced stocks. Finally, we also require a stock to be in the top 80<sup>th</sup> percentile by market capitalization in the last month of the ranking period. This choice ensures the smallest micro-cap stocks are not driving our results.

Secondarily, we also examine three alternate momentum series to help evaluate the pervasiveness and robustness of our results. First, we examine a “large-firm only” 6-month momentum strategy. This strategy allows us to examine whether our primary findings are also evident in strategies that only include larger, more economically important firms. The procedure is the same as for our primary firm-level series, except a stock’s market capitalization must be in the top 20<sup>th</sup> percentile in the last month of the ranking period in order for it to be selected for the winner or loser grouping.

Second, we also examine a less-extreme, “decile 9-minus-2” momentum strategy. Again, the procedure is the same as for our primary firm-level series, except that the procedure goes long the decile-9 winners and goes short the decile-2 losers. This allows us to examine whether our primary findings are also evident in firms that experienced less extreme ranking-period returns.

Finally, we examine an industry-level 6-month momentum strategy. We perform the same ranking-period and holding-period procedure, as described above, but on the 48 industry returns discussed in Section II.A and with a quartile threshold (so the winner and loser groupings contain a sizable number of 12 industries). Quartiles are close to the 30-percentile threshold in Moskowitz and Grinblatt (1999).

In our time-series empirical work, we use the following timing convention and notation. The momentum payoff for month  $t$ ,  $MOM_t$ , refers to the aggregate payoff for the holding period over months  $t$  to  $t + 5$ . Thus, an important difference between our approach and previous time-series work in Jegadeesh and Titman (1993), Chordia and Shivakumar (2002), and Griffin, Ji, and Martin (2003), is that their momentum profits for a given month use an averaging across the last  $n$  investment portfolios and thus reflect  $n$  different ranking periods, where  $n$  is the number of months for the ranking and holding period (typically 6). In contrast, in our work, each month’s payoff corresponds to the outcome from a single “ranking period/holding period” event. Our timing convention is more appropriate for our work because the momentum outcome for month  $t$  corresponds

directly to the explanatory variables up through month  $t - 1$ .

Table 1 reports descriptive statistics for the value and momentum payoffs for both our two primary series and our five secondary series. Note that: (1) the average 6-month momentum payoff is sizable and reliably positive for all four momentum strategies, which is consistent with the momentum literature; (2) the average value payoff is positive and sizable for all three HML strategies (although the “large-firm only” average value payoff lacks statistical significance), which is consistent with the value-versus-growth literature, and (4) all of the strategies have an appreciable proportion of negative outcomes. Our Appendix provides additional details on the timing for the value and momentum observations that are used in our subsequent empirical work.

#### D. The Stock Market’s Cross-sectional Return Dispersion

Our work features the cross-sectional dispersion in stock returns over a calendar month. In this subsection, we describe our primary RD that is constructed from the monthly returns of 100 disaggregate portfolios formed on size and book-to-market equity ratios. This RD(BM&SZ) is featured in our main empirical results in the next two sections. We later describe and evaluate two alternate firm-level RD metrics in Section V.<sup>6</sup>

In general, a month’s RD is simply the cross-sectional standard deviation of the monthly disaggregate returns, as follows:

$$(1) \quad \text{RD}_t = \sqrt{\left[ \frac{1}{n-1} \sum_{i=1}^n (R_{i,t} - R_{\mu,t})^2 \right]}$$

where  $n$  is the number of disaggregate portfolios (or individual stocks) that is used for the particular RD metric,  $R_{i,t}$  is the return of disaggregate portfolio  $i$  (or individual stock  $i$ ) in month  $t$ , and  $R_{\mu,t}$  is the equally-weighted portfolio return of the disaggregate portfolios (or individual stocks) included in the RD metric for month  $t$ .

Recall that our primary monthly RD(BM&SZ) is constructed from the 100 size and book-to-market portfolios from the French data library. The 100 portfolios are an intersection of 10 portfolios formed on size and 10 portfolios formed on book-to-market ratios, using breakpoints for

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<sup>6</sup>See Bekaert and Harvey (1997), (2000), and Chang, Cheng, and Khorana (2000) for examples of other uses of RD in the literature.

NYSE stocks.<sup>7</sup>

In addition to the simple RD from equation (1), our work also features a market-adjusted relative return dispersion (or RRD). As Stivers (2003) shows, a month’s RD should vary positively with the month’s absolute market return, due to dispersion in market betas. Since we are interested in whether the RD is relatively high or low beyond the variation tied to the realized market return, we construct a monthly RRD that is orthogonal to the month’s simple market return and absolute market return. The RRD is defined as the estimated residual,  $\epsilon_t$ , from the following regression:

$$(2) \quad \text{RD}_t = \lambda_0 + \lambda_1 |R_{M,t}| + \lambda_2 D_t^- |R_{M,t}| + \epsilon_t$$

Where  $\text{RD}_t$  is the month’s simple RD from equation (1),  $|R_{M,t}|$  is the concurrent absolute market-level stock return,  $D_t^-$  is a dummy variable that equals one when the market return is negative, and the  $\lambda$ s are coefficients to be estimated. The CRSP value-weighted market index is used as the market return.

When estimating (2) with our RD(BM&SZ) over 1962 to 2005, we find that  $\lambda_1$  is reliably positive ( $\lambda_1=0.154$ , t-statistic=6.80) and  $\lambda_2$  is essentially zero ( $\lambda_2=-0.01$ , t-statistic=-0.00). The R-squared value is 11.5%, which indicates that much of the RD variability is not directly tied to the variation in the market return.

Table 2, Panel A, reports descriptive statistics for the monthly RD(BM&SZ) and RRD(BM&SZ) that are featured in our empirical work. Note that each RD series is substantially autocorrelated, which indicates persistence in the market’s RD environment. The simple correlation between RD(BM&SZ) and RRD(BM&SZ) is 0.94 for our overall sample period. For comparison purposes, a similar RD constructed from the 25 French portfolios formed on size and book-to-market has a correlation of 0.97 with our primary RD(BM&SZ) and performs similarly in our setting.

In terms of our subsequent empirical work, we examine a variety of moving-average and de-trended RD expressions that are constructed from the monthly RD(BM&SZ) and RRD(BM&SZ). We choose to focus on the simple 3-month RD and RRD moving averages for our main tabular results in the next two sections, denoted as  $\text{RD}_{1-3}$  and  $\text{RRD}_{1-3}$  where the “1 – 3” subscript refers

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<sup>7</sup>A few months have less than 100 portfolio returns because there are no stocks that intersect for that point in the 10 by 10 grid.

to months  $t - 1$  to  $t - 3$  relative to the strategy payoff that commences in month  $t$ . We choose this 3-month horizon because we feel that 3 months is a reasonable compromise that is responsive to changing market conditions but also removes some of the noise in month to month variations. We later show that our primary results are robust to alternate timing choices. Table 2, Panel B, reports descriptive statistics for these 3-month moving-average expressions.

Figure 1 displays the time-series of our two primary 3-month moving-average RD expressions. The two series appear well behaved, in terms of a reasonably stable distribution over time, except for very high realizations around the year 2000 when the market transitioned from the technology boom to the bear market of the early 2000's. We address concerns that the high RD observations around the year 2000 may have an undesirable excessive influence on our conclusions by: (1) performing extensive subperiod analysis, (2) re-estimating our main regression models with a winsorized distribution for the RD explanatory terms, and (3) examining the relation between RD and the strategy payoffs through a non-parametric sorting exercise.

Next, the literature review offered in our introduction suggests that RD tends to be countercyclical. If so, this suggests that RD is likely to be higher around economic recessions. Accordingly, we explore the relation between RD and economic recessions per the NBER. Recessions are uncommon (only 12.3% of our sample's months) and are associated with market stress.

We examine whether the 3-month RD moving average (which is featured in our subsequent empirical work) is different when the subsequent month  $t$  is in an economic recession. For our primary book-to-market/size RD, when month  $t$  is a recessionary month (expansionary month), then the mean of the 3-month RD moving average over months  $t - 1$  to  $t - 3$  is 3.43% (2.97%). This difference of 0.46% is statistically significant with a 1.8% p-value. Thus, recessionary months tends to be preceded by a high RD environment, which supports the premise of our empirical investigation.

Next, if the market's RD serves as a countercyclical state variable, then we would expect to observe clustering of the relatively high RD observations during times that seem plausibly associated with weaker economic and market episodes. We evaluate time-series clustering in the high values of our primary  $RD_{1-3}$  and  $RRD_{1-3}$  variables.

Over 1963 to 2005, the  $RD_{1-3}$  and  $RRD_{1-3}$  observations that fall in the upper quintile of their

respective distribution are concentrated in ten of the 43 calendar years.<sup>8</sup> Specifically, 75.4% of these high RD moving-average observations occur in 1966-1968, 1973, 1975, 1992, and 1999-2002. Eleven other calendar years have the remaining 24.6% of the high RD observations (1970-1972, 1974, 1976, 1980-81, 1983, 1993, 1996, and 2003). This leaves 22 different calendar years that have no  $RD_{1-3}$  or  $RRD_{1-3}$  observations that fall in their respective upper quintile. Clustering of high RD observations in weak and/or transitional times such as the mid 1970's, the early 1980's, and 1999-2002 supports the notion that a high RD is not random, but rather is informative about the economic state or transitions in the economic state.

### III. Return Dispersion and the Subsequent Value Premium

This section provides our primary empirical results regarding the intertemporal relation between the market's RD and the value premium, based on a stock's book-to-market equity ratios. Section III.A specifies our primary empirical models. Section III.B reviews the empirical predictions. Section III.C provides our main empirical results for value.

#### A. Empirical Models

We begin by estimating two variations of the following two models for our primary value strategy:

$$(3) \quad HML_t = \gamma_0 + \gamma_1 RD_{term} + \gamma_2 StRt_{1-36} + \epsilon_t$$

$$(4) \quad \Delta HML_{t,t-15} = \gamma_0 + \gamma_1 RD_{term} + \gamma_2 StRt_{1-36} + \epsilon_t$$

where  $HML_t$  is the payoff of our primary HML value strategy over holding-period months  $t$  to  $t+11$ ;  $\Delta HML_{t,t-15}$  is the difference between  $HML_t$  and  $HML_{t-15}$  (where  $HML_{t-15}$  is the HML payoff over months  $t-15$  to  $t-4$ );  $RD_{term}$  is one of our two primary lagged RD moving-average expressions;  $StRt_{1-36}$  is the lagged 3-year stock market return;  $\epsilon_t$  is the residual; and the  $\gamma$ 's are coefficients to be estimated. For the  $RD_{term}$ , we evaluate the 3-month moving average of both the simple RD ( $RD_{1-3}$ ) and the RRD ( $RRD_{1-3}$ ), using the RD from the book-to-market/size portfolios. Note that our  $\Delta HML$  term has a 3-month gap between the forward-looking payoff and the lagged reference

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<sup>8</sup>We begin this analysis in 1963 because, with our payoff-change timing, the RD terms are not used until 1963.

payoff, so the realization of the RD moving-average is before the forward-looking payoff and after the lagged payoff of the payoff-change term.

Here, and for our models in the next section on momentum, we estimate the coefficients by ordinary least squares, but we report  $t$ -statistics with heteroskedastic- and autocorrelation-consistent standard errors. The number of correlated residual lags are set to equal the number of months in the strategy's horizon, since our estimation has overlapping monthly observations.

For our first model variation, we only include the lagged 3-month RRD moving average as an explanatory variable. This is a simple approach that depicts the simple relation between RD and the value payoff, with an RD metric that is constructed to be orthogonal to the market return. Given the natural relation between RD and the absolute market return, we feel this orthogonality is attractive to better isolate the relation with RD.

Next, we feel it is important to control for the recent stock market return to take into account the results in Cooper, Gutierrez, and Hameed (2004). They find that momentum payoffs are only reliably positive following a positive 3-year stock market return and they interpret this long horizon return as being indicative of the market state. Accordingly, in our second model variation, we control for the lagged 3-year stock market return, for both the value payoffs in this section and the momentum payoffs in our next section. (We consider other potential state variables during robustness checks in Section V.) In our second model variation, since we directly control for the recent stock market return, we use the simple 3-month moving average RD (rather than the RRD) as the RD explanatory term. The simple  $RD_{1-3}$  is attractive because it can be constructed in real time without any required estimated parameters. Further, by examining the simple  $RD_{1-3}$ , we can examine whether our results rely upon the RRD construction.

## **B. Empirical Predictions for RD and Value Payoffs**

Models (3) and (4) will investigate whether the RD contains intertemporal information about the subsequent level and change in the value payoffs, respectively. Recall that the theoretical insights and the empirical evidence offered in our introduction suggest the following two time-series behaviors. First, RD may serve as a countercyclical state variable that tends to be relatively higher in bad times. Second, expected value payoffs are countercyclical.

Taken together, these two time-series implications suggest a potential positive empirical linkage between RD and the subsequent value payoffs. Model (3) evaluates the subsequent value payoff conditional on the lagged RD, relative to the unconditional value premium. Thus, for model (3), we predict that the  $\gamma_1$  estimates on the lagged RD terms will be positive. The magnitude of any  $\gamma_1$  relation is an empirical question.

Next, consider the change-in-value-payoffs ( $\Delta\text{HML}_{t,t-15}$ ). If a high RD tends to indicate a change to a weaker market state; then not only might the subsequent value payoff be higher with the weaker economic state, but also the payoff preceding the RD realization should be relatively lower (since the earlier economic state should have been relatively stronger). If so, the RD should be especially informative about changes in payoffs. Model (4) evaluates the subsequent value payoff, relative to the earlier realized value payoff that just precedes the lagged RD term. Thus, for model (4), we predict both that the  $\gamma_1$  estimates on the lagged RD terms will be positive and that the  $\gamma_1$  estimates for model (4) will be larger than the  $\gamma_1$  estimates for model (3).

### C. Main Empirical Results for Value

Table 3, Panel A, reports on whether the market's RD is related to the subsequent 12-month value payoff. We find that the RD contains reliable information about the subsequent 12-month value payoff. When estimating the two variations of equation (3) for the overall sample, the  $\gamma_1$  estimate on both the  $\text{RRD}_{1-3}$  term (for Specification I) and the  $\text{RD}_{1-3}$  term (for Specification II) is reliably positive with a  $p$ -value less than 0.1%. The  $R$ -squared values seem sizable at about 11%. One-half subperiod results are consistent with positive  $\gamma_1$ 's estimated for both subperiods. However, the RD relation is only statistically significant in the second one-half subperiod.

Table 3, Panel B, reports on whether the market's RD is related to the subsequent change in the value payoffs (the  $\Delta\text{HML}_{t,t-15}$  term). We find that the RD contains reliable information about the subsequent change in the 12-month value payoff. When estimating the two variations of equation (4) for the overall sample, the  $\gamma_1$  estimate on both the  $\text{RRD}_{1-3}$  term (for Specification I) and the  $\text{RD}_{1-3}$  term (for Specification II) is reliably positive with a  $p$ -value less than 0.1%. The  $R$ -squared values seem sizable at about 15%. One-half subperiod results are consistent with  $p$ -values less than 1% for the  $\gamma_1$  estimates for both subperiods.

We also extend our subperiod analysis by evaluating one-quarter subperiods: 1962-1972, 1973-1983, 1984-1994, and 1995-2005. We re-estimate our primary models separately for each of these 11-year subperiods, using equations (3) and (4) with our primary 3-month RRD moving average ( $RRD_{1-3}$ ). For the subsequent value payoff ( $HML_t$ ), we find that the  $\gamma_1$  estimates are positive for all four subperiods and positive and statistically significant for the second, third, and fourth subperiods with  $p$ -values of less than 3.6%, 0.1%, and 0.1%, respectively. For the change-in-HML-payoffs ( $\Delta HML_{t,t-15}$ ), we find that the  $\gamma_1$  estimates are positive for all four subperiods and positive and statistically significant for the second, third, and fourth subperiods with  $p$ -values of 0.2%, 0.1%, and 0.3%, respectively. The results from the one-quarter subperiod analysis support the robustness of our results.

Next, compare the results in Table 3, Panel A, to those in Table 3, Panel B. As suggested in Section III.B, note that the  $\gamma_1$  estimates for the payoff-change model in Panel B are always appreciably greater than the  $\gamma_1$  estimates for the payoff-level model in Panel A. The  $R^2$  values and the statistical significance of the  $\gamma_1$  estimates also tend to be greater for Panel B.

These “Panel A versus Panel B” comparisons imply that our RD expressions are also related to the lagged value payoff that just precedes the RD term (the  $HML_{t-15}$  term that is used in the change-in-payoff expression), but negatively rather than positively as for the forward-looking  $HML_t$ . We formally evaluate this issue by re-estimating equation (3), but now with the lagged value payoff ( $HML_{t-15}$ ) as the dependent variable. For the  $HML_{t-15}$  term, we find that the  $\gamma_1$  estimates are reliably negative for the overall sample, with  $p$ -values of 0.9% or better. One-half subperiod results are consistent, with  $p$ -values of 10.7% or better on the  $\gamma_1$  estimates.

Overall then, compared to the unconditional value-over-growth performance, our combined results indicate that the market’s RD environment is related: (1) positively, to the value performance following the RD realization, and (2) negatively, to the value performance preceding the RD realization. These collective findings support the notion that the market’s RD serves as a state variable.

## IV. Return Dispersion and the Subsequent Momentum Premium

This section provides our primary empirical results regarding the intertemporal relation between the market's RD and the momentum premium. Section IV.A specifies our primary empirical models. Section IV.B reviews the empirical predictions. Section IV.C provides our main empirical results for momentum.

### A. Empirical Models

For the 6-month momentum payoffs, we estimate two variations of the following two models.

$$(5) \quad \text{MOM}_t = \beta_0 + \beta_1 \text{RD}_{term} + \beta_2 \text{StRt}_{1-36} + \epsilon_t$$

$$(6) \quad \Delta\text{MOM}_{t,t-9} = \beta_0 + \beta_1 \text{RD}_{term} + \beta_2 \text{StRt}_{1-36} + \epsilon_t$$

where  $\text{MOM}_t$  is the payoff of our primary momentum series over holding-period months  $t$  to  $t + 5$  with a ranking period over  $t - 2$  to  $t - 7$ ;  $\Delta\text{MOM}_{t,t-9}$  is the difference between  $\text{MOM}_t$  and  $\text{MOM}_{t-9}$  (where  $\text{MOM}_{t-9}$  is the momentum payoff over holding-period months  $t - 9$  through  $t - 4$ );  $\text{RD}_{term}$  is one of our two primary lagged RD moving-average expressions;  $\text{StRt}_{1-36}$  is the lagged 3-year stock market return; and the  $\beta$ 's are coefficients to be estimated.

For the  $\text{RD}_{term}$ , we again evaluate our primary two 3-month RD moving-average expressions,  $\text{RD}_{1-3}$  and  $\text{RRD}_{1-3}$ , using the RD from the book-to-market/size portfolios. Note that our  $\Delta\text{MOM}$  term has a 3-month gap between the forward-looking payoff and the lagged reference payoff, so the realization of the RD moving-average is before the forward-looking payoff and after the lagged payoff of the payoff-change term.

For our first model variation, we only include the lagged 3-month RRD moving average as an explanatory variable. For our second model variation, we control for the lagged 3-year stock market return and use the simple 3-month moving average RD (rather than the RRD) as the  $\text{RD}_{term}$ . Our reasoning for these two model variations are the same as provided for the comparable value models in Section III.A.

## B. Empirical Predictions for RD and Momentum Payoffs

Models (5) and (6) will investigate whether the RD contains intertemporal information about the subsequent level and change in the momentum payoffs, respectively. Recall that the theoretical insights and the empirical evidence offered in our introduction suggest the following two time-series behaviors. First, RD may serve as a countercyclical state variable that tends to be relatively higher in bad times. Second, the expected momentum premium is procyclical.

Taken together, these two time-series implications suggest a potential negative empirical linkage between RD and the subsequent momentum payoffs. Model (5) evaluates the subsequent momentum payoff conditional on the lagged RD, relative to the unconditional momentum premium. Thus, for model (5), we predict that the  $\beta_1$  estimates on the lagged RD terms will be negative. The magnitude of any  $\beta_1$  relation is an empirical question.

Next, consider the change-in-momentum-payoffs ( $\Delta\text{MOM}_{t,t-9}$ ). If a high RD tends to indicate a change to a weaker market state, then not only might the subsequent momentum payoff be lower with the weaker economic state, but the payoff preceding the RD realization should be relatively higher (since the earlier economic state should have been relatively stronger). If so, the RD should be especially informative about changes in payoffs. Model (6) evaluates the subsequent momentum payoff, relative to the earlier realized momentum payoff that just precedes the RD term. Thus, for model (6), we expect both that the  $\beta_1$  estimates on the lagged RD terms will be negative and that the  $\beta_1$  estimates for model (6) will be more negative than the  $\beta_1$  estimates for model (5).

## C. Main Empirical Results for Momentum Strategies

Table 4, Panel A, reports on whether the market's RD is related to the subsequent 6-month momentum payoff. We find that the RD contains reliable information about the subsequent momentum payoff. When estimating the two variations of equation (5) for the overall sample, the  $\beta_1$  estimate on both the  $\text{RRD}_{1-3}$  term (for Specification I) and the  $\text{RD}_{1-3}$  term (for Specification II) is reliably negative with a  $p$ -value less than 0.1%. One-half subperiod results are consistent with negative  $\beta_1$  estimates that have  $p$ -values less than 5.1%, or better. The  $R$ -squared values are in the 3 to 8% range across the different subperiods and model variations.

Table 4, Panel B, reports on whether the market’s RD is related to the subsequent change in momentum payoffs (the  $\Delta\text{MOM}_{t,t-9}$  term). We find that the RD contains reliable information about the subsequent change in the momentum payoffs. When estimating the two variations of equation (6) for the overall sample, the  $\beta_1$  estimate on both the  $\text{RRD}_{1-3}$  term (for Specification I) and the  $\text{RD}_{1-3}$  term (for Specification II) is reliably negative with a  $p$ -value less than 0.1%. One-half subperiod results are consistent with negative  $\beta_1$  estimates that have  $p$ -values less than 0.4%, or better. The  $R^2$  values are in the 7 to 12% range across the different subperiods and model variations.

We also extend our subperiod analysis by evaluating one-quarter subperiods: 1962-1972, 1973-1983, 1984-1994, and 1995-2005. We re-estimate our primary models separately for each of these 11-year subperiods, using equations (5) and (6) with our primary 3-month RRD moving average ( $\text{RRD}_{1-3}$ ). For the subsequent momentum payoff ( $\text{MOM}_t$ ), we find that the  $\beta_1$  estimates are negative for all four subperiods and negative and statistically significant for the second, third, and fourth subperiods with  $p$ -values of 5.1%, 0.3%, and 0.1%, respectively. For the change-in-momentum-payoffs ( $\Delta\text{MOM}_{t,t-9}$ ), we find that the  $\beta_1$  estimates are negative for all four subperiods and negative and statistically significant for the second, third, and fourth subperiods with  $p$ -values of 0.1%, 0.1%, and 1%, respectively. Thus, the results from the one-quarter subperiod analysis support the robustness of our results.

Next, compare the results in Table 4, Panel A, to those in Table 4, Panel B. As suggested in Section IV.B, note that the  $\beta_1$  estimates for the payoff-change model in Panel B are always appreciably greater in magnitude than the  $\beta_1$  estimates for the payoff-level model in Panel A. The  $R^2$  values and the statistical significance of the  $\beta_1$  estimates also tend to be greater for Panel B.

These “Panel A versus Panel B” comparisons imply that our RD expressions are also related to the lagged momentum payoff that just precedes the RD term (the  $\text{MOM}_{t-9}$  that is used in the change-in-payoff expression), but positively rather than negatively as for the forward-looking  $\text{MOM}_t$ . We formally evaluate this issue by re-estimating equation (5), but with the lagged momentum payoff ( $\text{MOM}_{t-9}$ ) as the dependent variable, rather than the forward-looking payoff ( $\text{MOM}_t$ ). For the  $\text{MOM}_{t-9}$  term, we find that the  $\beta_1$  estimates are reliably positive for the overall sample, with  $p$ -values of 0.3% or better. One-half subperiod results are consistent, with  $p$ -values of 4.3%

or better for the  $\beta_1$  estimates.

Overall then, compared to the unconditional momentum performance, our combined results indicate that the market's RD environment is related: (1) negatively, to the momentum performance following the RD realization, and (2) positively, to the momentum performance preceding the RD realization. These collective findings also support the notion that the market's RD serves as a state variable.

## V. Pervasiveness and Robustness Evidence

### A. Controlling for Macroeconomic Variables

The stock market's aggregate dividend yield, the default yield spread between riskier and safer corporate bonds, the term yield spread in Treasury debt, and the short-term Treasury yield are widely used as state variables in the finance literature. Further, Chordia and Shivakumar (2002) and Avramov and Chordia (2006) find that these macroeconomic variables are informative about time-variation in momentum payoffs. Additionally, Cooper, Gutierrez, and Hameed (2004) find that the market-return state is informative about time-variation in momentum payoffs. We next investigate whether the relation between RD and the value and momentum premia remains evident when including these macroeconomic and market explanatory variables suggested by the literature.

We estimate the following four models:

$$(7) \text{HML}_t = \theta_0 + \theta_1 \text{RRD}_{1-3} + \theta_2 \text{StRt}_{1-36} + \theta_3 \text{DY}_{t-1} + \theta_4 \text{DIV}_{t-1} + \theta_5 \text{TRM}_{t-1} + \theta_6 \text{YD3}_{t-1} + \epsilon_t$$

$$(8) \text{MOM}_t = \theta_0 + \theta_1 \text{RRD}_{1-3} + \theta_2 \text{StRt}_{1-36} + \theta_3 \text{DY}_{t-1} + \theta_4 \text{DIV}_{t-1} + \theta_5 \text{TRM}_{t-1} + \theta_6 \text{YD3}_{t-1} + \epsilon_t$$

$$(9) \Delta \text{HML}_{t,t-15} = \theta_0 + \theta_1 \text{RRD}_{1-3} + \theta_2 \text{StRt}_{1-36} + \theta_3 \text{DY}_{t-1} + \theta_4 \text{DIV}_{t-1} + \theta_5 \text{TRM}_{t-1} + \theta_6 \text{YD3}_{t-1} + \epsilon_t$$

$$(10) \Delta \text{MOM}_{t,t-9} = \theta_0 + \theta_1 \text{RRD}_{1-3} + \theta_2 \text{StRt}_{1-36} + \theta_3 \text{DY}_{t-1} + \theta_4 \text{DIV}_{t-1} + \theta_5 \text{TRM}_{t-1} + \theta_6 \text{YD3}_{t-1} + \epsilon_t$$

where  $\text{DY}_{t-1}$  is the lagged default yield spread, equal to the yield difference between Moodys BAA and AAA bonds,  $\text{DIV}_{t-1}$  is the stock market's trailing 12-month dividend yield,  $\text{TRM}_{t-1}$  is the lagged difference between the yield of 10-year T-bonds and 3-month T-bills,  $\text{YD3}_{t-1}$  is the lagged

3-month T-bill yield, the  $\theta$ 's are coefficients to be estimated, and the other terms are as defined in equations (3) through (6).

Table 5 reports the results from estimating equations (7) through (10). For all four equations, we find that the  $\theta_1$  estimate on the RRD term is sizable and highly statistically significant (p-values  $< 0.1\%$ ). The five other explanatory variables generally add little explanatory power. Collectively, for the four equations reported on in Table 5, the macroeconomic variables are only reliably related to the  $HML_t$  term for equation (7) (as reported by the F-statistic in column eight of the table). We conclude that our findings are substantially distinct from earlier time-series findings in Chordia and Shivakumar (2002), Cooper et al (2004), and Avramov and Chordia (2006).

## B. Alternate RD Metrics

In this subsection, we discuss results from different RD metrics. Our investigation includes variations in the timing for our primary RD(BM&SZ) expressions and an evaluation of firm-level RD metrics, when used in place of our primary RD(BM&SZ).

First, our primary results in Tables 3 through 5 rely on a 3-month RD moving-average expression. We evaluate whether our results are robust to minor variations in the length of the moving average. In Table 6, Panel A, we evaluate both a 2-month and a 4-month RD moving-average term in place of the primary 3-month moving average. The results are comparable to those in Tables 3 and 4. We conclude that our results are robust to minor variations in the moving-average duration.

Second, instead of a simple RD moving average, we evaluate detrended RD expressions; defined as the difference between a recent short-run RD moving average and an older, longer-run RD moving average. We evaluate detrended RD expressions because it seems plausible that detrended measures could perform well in our setting. For example, the detrended expressions might better measure whether the recent short-run RD environment is economically high, relative to the recent longer-run RD environment.

We evaluate two detrended RD expressions and report results in Table 6, Panel B. For Specifications I and II of Table 6, Panel B; we evaluate  $RRD_{1-3,5-16}$  and  $RD_{1-3,5-16}$  terms that are equal to “the 3-month RD moving-average expression over months  $t - 1$  through  $t - 3$ ” minus “the 12-month RD moving-average expression over months  $t - 5$  through  $t - 16$ ”. For Specifications III

and IV of Table 6, Panel B; we evaluate an  $RRD_{1-2,8-19}$  and  $RD_{1-2,8-19}$  that are equal to “the 2-month RD moving-average expression over months  $t - 1$  through  $t - 2$ ” minus “the 12-month RD moving-average expression over months  $t - 8$  through  $t - 19$ ”.

When using the detrended RD expressions in place of the simple moving-average RD, we find qualitatively comparable results to those in Tables 3 and 4. For the change-in-momentum payoffs ( $\Delta MOM_{t,t-9}$ ), subsequent momentum payoffs ( $MOM_t$ ), and change-in-HML payoffs ( $\Delta HML_{t,t-15}$ ), the estimated relations between the detrended RD expressions and the payoff terms are also highly statistically reliable. For the subsequent HML payoff ( $HML_t$ ), the RD relation is appreciably weaker than the comparable relation in Table 3 and the estimated  $\psi_1$  coefficient is not statistically significant. However, for the momentum payoffs, the relation with the detrended RD expressions is somewhat stronger than the comparable relation in Table 4, both in terms of statistical significance on the estimated coefficients and the  $R^2$  values.

Overall, when comparing the performance of the detrended RD expressions to the simple RD moving-average terms, we prefer the moving-average because of the consistency in the results for all four payoff terms ( $HML_t$ ,  $\Delta HML_{t,t-15}$ ,  $MOM_t$ , and  $\Delta MOM_{t,t-9}$ ) and because of the simplicity of the measure. Also, with the simple RD moving average, we avoid the subjectivity in choosing the timing for the detrended expressions.

Third, we also evaluate two firm-level RD measures, used in place of primary RD(BM&SZ). We construct and evaluate a large-firm RD, defined as the cross-sectional return standard deviation of the largest 10% of NYSE/AMEX stocks by market capitalization, excluding stocks priced less than one dollar, with the size ranking repeated each month. We examine a large-firm RD because large firms may be more indicative of the economic environment, since small firms may add noise through non-synchronous trading or high idiosyncratic volatility. Second, we construct and evaluate a broad-market RD, that is equal to the dispersion across all individual NYSE/AMEX stocks, except stocks in the smallest size quintile and stocks priced less than one dollar. The correlation between the monthly dispersion for our primary RD(BM&SZ) and the two alternate firm-level RD’s is 0.72 and 0.73 for the large-firm RD and broad-firm RD, respectively.

We then re-estimate our primary models in Tables 3 and 4, but using the two firm-level RD metrics in place of our primary RD(BM&SZ). The results are qualitatively consistent to those

depicted in Tables 3 and 4, but tend to be weaker. We conclude that our results are not unique to our primary RD(BM&SZ), but that the RD(BM&SZ) is a better overall performer in our setting than firm-level RD metrics.

### C. Addressing the High RD Values around the Year 2000

Our primary regression models in Sections III and IV assume that the relation between RD and the payoff terms can be approximated as linear. As depicted in Figure 1, our primary RD moving-average expressions tend to be extremely high around the year 2000, with a maximum  $RRD_{1-3}$  value of 8.58% and 12 different observations over 3%. There are no other  $RRD_{1-3}$  observations greater than 3% elsewhere over our sample period. Thus, one concern is that the high RD values around the year 2000 may have an undesirable excessive influence when estimating a regression model. While we believe that the subperiod reliability (Sections III.C and IV.C) and the pervasiveness and robustness evidence (Sections V.A and V.B) mitigate this concern, this subsection reports on two additional evaluations that are intended to address this concern.

First, we re-estimate our primary regression models with a winsorized  $RRD_{1-3}$  distribution. If the  $RRD_{1-3}$  observation for a given month is above 3%, then we replace that month's observation with a value of 3% (the substitution occurs for 2.4% of the observations). We then re-estimate our primary RRD regression models from Tables 3 and 4, but with this winsorized  $RRD_{1-3}$  distribution.

When using the winsorized RRD in our value models from Table 3, we find that the estimated  $\gamma_1$  coefficient on the winsorized  $RRD_{1-3}$  remains reliably positive for both the  $HML_t$  and  $\Delta HML_{t,t-15}$  terms with p-values of 1.0% and 1.3%, respectively. One-half subperiod results are consistent. When using the winsorized RRD in our momentum models from Table 4, we find that the estimated  $\beta_1$  coefficient on the winsorized  $RRD_{1-3}$  remains reliably negative for both the  $MOM_t$  and  $\Delta MOM_{t,t-9}$  terms with p-values of 0.6% and 0.7%, respectively. One-half subperiod results are again consistent. We conclude that our primary regression results are not dependent upon the extreme  $RRD_{1-3}$  values greater than 3%.

Second, another way to evaluate the relation between RD and the strategy payoffs is to sort the payoff outcomes into subset groupings based on a lagged RD term, and then report subset statistics. In terms of expressing the relation between RD and the payoffs, such a sorting exercise

requires no estimated regression coefficients. We perform this sorting exercise and contrast the payoff observations that correspond to the bottom quartile and the upper quartile for both our primary RRD moving-average distribution and the secondary detrended RRD distribution (the  $RRD_{1-3,5-16}$  term, as defined in the preceding subsection). For all cases, our sorting exercise also indicates that the payoffs vary with the market's RD environment, in a manner consistent with our primary results in Table 3, Table 4, and Table 6, Panel B. When contrasting the average payoff terms for the bottom quartile and upper quartile of the RRD terms, the difference in means is statistically significant in all cases, except for the  $HML_t$  term for the sort on the detrended RRD term ( $RRD_{1-3,5-16}$ ).

Figures 2 and 3 report representative results of these sorting exercises graphically. The figures clearly illustrate the payoff variation with the market's RD.

#### **D. Variation in the Risk of Value-versus-Growth and RD**

Consistent with views in Zhang (2005) and Petkova and Zhang (2005); we also note that not only is the observed value premium relatively higher following a high RD environment, but also value-portfolio returns are more volatile than growth-portfolio returns following a high RD environment. Specifically, our primary value portfolio (growth portfolio) has a monthly return standard deviation of 5.52% (4.82%) following the highest RRD moving-average quartile. Conversely, our primary value portfolio (growth portfolio) has a monthly return standard deviation of 4.27% (5.19%) following the lowest RRD moving-average quartile. This additional finding is consistent with the notion that value stocks are relatively riskier in weaker economic times; and, thus, the value premium is countercyclical.

#### **E. Investor Sentiment**

Next, we expect some readers might suspect that a relatively high RD could be associated with a weakening of investor sentiment in the sense of Baker and Wurgler (2007), and that the changing sentiment might influence subsequent momentum and value performance. However, we find that the concurrent correlation between the 3-month moving-average of the sentiment changes index of Baker and Wurgler (2007) and our primary 3-month RRD moving-average is only a negative

0.12. This near-zero correlation casts doubt that our RD results are tied to changes in the investor sentiment index of Baker and Wurgler (2007).

## F. Alternate Value and Momentum Strategies

In this subsection, we examine whether our primary results are also evident in alternate value and momentum strategies. The findings will bear both on robustness and on evaluating the pervasiveness of the RD relations.

First, we are interested in whether our value and momentum findings are substantially driven by small-cap firms. We examine alternate series that include only stocks that are in the largest quintile of stocks, by market capitalization (see Sections II.B and II.C). We report the results in Table 6, Panel C.1 and C.2. For these alternate large-firm-only strategies, we find that the relations between RD and the payoff terms are also highly reliable and as depicted for our main results in Tables 3 and 4. We conclude that our primary results are also evident in large-firm-only strategies.

Second, we are also interested in whether our value and momentum findings are also evident in strategies that exclude the extreme stocks. By extreme, we refer to stocks that have extreme book-to-market ratios for the value strategy, or stocks that have extreme returns in the ranking period for the momentum strategy. We examine “Decile-9 minus Decile-2” strategies, as defined in Sections II.B and II.C, in place of our primary series. We report the results in Table 6, Panel C.3 and C.4. Again, consistent with our primary findings in Tables 3 and 4, we find that the relations between RD and these alternate “Decile-9 minus Decile-2” strategy payoffs are also sizable and highly reliable. We conclude that our primary results are pervasive and evident in strategies that exclude the most extreme stocks.

Third, we are also interested in whether our momentum findings are evident in a momentum strategy implemented on industry-level returns. We examine a 6-month momentum strategy implemented on 48 value-weighted industry returns (see Section II.C). We report the results in Table 6, Panel C.5. We find that the RD-momentum relations are also consistently evident in the industry-level momentum strategy.

## VI. Conclusions

Value and momentum premia have a prominent place in current financial practice and theory. In this paper, we show that time-variation in the value and momentum premia can be tied to variation in the market's cross-sectional return dispersion. Specifically, the recent RD is shown to be positively related to the subsequent value premium and negatively related to the subsequent momentum premium, both relative to the unconditional premia and relative to payoffs in the recent past. Over our 1962 to 2005 sample, these empirical regularities are robust in subperiods, to different RD metrics, and for alternate value and momentum strategies. Further, the partial relations between RD and the subsequent value and momentum premia remain strong when controlling for macroeconomic state variables suggested by the literature.

Our findings are consistent with recent theoretical insights and empirical evidence which suggest that the momentum premium is procyclical and that the value premium and the market's RD are countercyclical. Further, our results support the idea that the market's cross-sectional return dispersion is a leading countercyclical state variable, a notion consistent with theory in Gomes, Kogan, and Zhang (2003) and Zhang (2005). We also note that the apparent forward-looking information in RD meets one key criteria of a state variable, emphasized in Cochrane (2005).

Concerning the implications for value and momentum premia, we favor a rational interpretation of our evidence because: (1) our findings are consistent with insights from recent rational asset-pricing theory, and (2) our findings tie time-variation in both the value and momentum premia to a proposed RD state variable. Under this interpretation, our evidence supports recent studies that suggest rational perspectives can explain at least a portion of value and momentum premia; see, for example, Johnson (2002), Gomes, Kogan, and Zhang (2003), Ahn, Conrad, and Dittmar (2003), Zhang (2005), Petkova and Zhang (2005), Sagi and Seasholes (2007), and Liu and Zhang (2008).

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TABLE 1

**Summary Statistics for the Value and Momentum Payoffs**

Table 1 reports the means, standard deviations, minimum, maximum, and the percentage of negative observations for the value and momentum strategies that are featured in this study. All return statistics are in percentage units corresponding to the cumulative holding period.  $HML_t$  is the 12-month value spread that goes long high book-to-market stocks and shorts low book-to-market stocks with a holding-period over months  $t$  to  $t+11$ .  $\Delta HML_{t,t-15}$  is the difference between the 12-month HML spread over holding months  $t$  to  $t+11$  and the 12-month HML spread over holding months  $t-15$  to  $t-4$ .  $MOM_t$  is the 6-month momentum spread that goes long past relative winners and short past relative losers, where the holding period is over  $t$  to  $t+5$  and the ranking period is over  $t-7$  through  $t-2$ .  $\Delta MOM_{t,t-9}$  is the difference between the 6-month payoff over holding months  $t$  to  $t+5$  and the 6-month payoff over holding months  $t-9$  to  $t-4$ . This table reports on seven alternate strategies. Series One is our primary value series and Series Two is our primary momentum series, as defined in Sections II.B and II.C respectively. Series Three through Seven are secondary series that are intended to evaluate robustness and pervasiveness, as described in Sections II.B or II.C. For the means of the average payoff levels, a t-statistic (in parentheses) indicates whether the mean is reliably different than zero, calculated with heteroskedastic- and autocorrelation-consistent standard errors. The sample period is 1962 through 2005.

Strategy	Variable	Mean	Std. Dev.	Minim.	Maxim.	% Negat. Observ.
1. Value	$HML_t$	5.74 (3.12)	14.10	-23.62	54.04	35.8
(Quintile "5 minus 1")	$\Delta HML_{t,t-15}$	0.29	21.23	-59.31	71.69	53.5
2. Momentum	$MOM_t$	7.26 (7.48)	11.78	-45.22	49.23	24.4
(Decile "10 minus 1")	$\Delta MOM_{t,t-9}$	0.03	18.07	-59.22	61.91	49.5
3. Value	$HML_t$	2.46 (1.23)	15.67	-31.43	57.32	51.1
(Large-firm only)	$\Delta HML_{t,t-15}$	0.45	24.78	-78.36	87.49	53.5
4. Momentum	$MOM_t$	4.58 (4.29)	12.94	-51.80	47.98	32.5
(Large-firm only)	$\Delta MOM_{t,t-9}$	0.08	20.09	-71.19	74.80	47.5
5. Value	$HML_t$	3.79 (2.65)	10.80	-22.29	29.92	41.4
(Decile "9 minus 2")	$\Delta HML_{t,t-15}$	0.44	15.33	-41.01	44.52	48.9
6. Momentum	$MOM_t$	2.83 (4.46)	7.97	-39.38	33.56	31.0
(Decile "9 minus 2")	$\Delta MOM_{t,t-9}$	0.10	11.95	-50.86	47.86	46.7
7. Momentum	$MOM_t$	3.25 (4.46)	8.80	-34.70	34.83	35.3
(Industry strategy)	$\Delta MOM_{t,t-9}$	-0.02	13.15	-49.82	43.76	49.7

TABLE 2

**Summary Statistics for Cross-section Return Dispersion (RD) Expressions**

Table 2 reports summary statistics on our primary cross-sectional return dispersion (RD) measure and the constructed RD expressions. Our primary RD, RD(BM&SZ), is the cross-sectional standard deviation across the 100 book-to-market/size portfolio monthly returns from the French data library, where the value-weighted portfolios are formed from the intersection of decile-sorts on size and book-to-market. Panel A reports statistics on the monthly simple RD and the constructed “relative RD” (RRD), where the monthly RRD is constructed to be orthogonal to the simple and absolute monthly stock market return. For Panel A,  $\rho$  denotes an autocorrelation with the timing in parentheses. Panel B reports summary statistics on our primary 3-month moving-average RD expressions, as defined in Section II.D. For Panel B, the subscript “1 – 3” denotes a 3-month moving-average RD term over months  $t - 1$  to  $t - 3$ . For Panel B, the autocorrelation is the correlation between  $RD_{1-3}$  and  $RD_{4-6}$  for row one and the correlation between  $RRD_{1-3}$  and  $RRD_{4-6}$  for row two. The sample period is 1962 to 2005.

Panel A: Monthly RD and RRD Statistics

Variable	Mean	Median	Standard Deviation	$\rho(1)$ ( $t, t - 1$ )	$\rho(2)$ ( $t, t - 2$ )	$\rho(2)$ ( $t, t - 3$ )
RD	3.02	2.72	1.28	0.589	0.537	0.522
RRD	0.00	-0.24	1.21	0.580	0.496	0.485

Panel B: Statistics for the 3-month Moving-Average RD Expressions

Variable	Mean	Median	Standard Deviation	Autocorrelation
$RD_{1-3}$	3.03	2.77	1.11	0.619
$RRD_{1-3}$	0.0	-0.18	1.03	0.591

TABLE 3

**Return Dispersion and the Payoffs to a 12-month Value Strategy**

Table 3 reports how the market's return dispersion (RD) is related to the payoffs of high-minus-low (HML) value strategies based on book-to-market equity ratios. We report on the 12-month value horizon, see Section II.B. We estimate two variations of the following two models.

$$\text{Model 1 : } \text{HML}_t = \gamma_0 + \gamma_1 \text{RD}_{term} + \gamma_2 \text{StRt}_{1-36} + \epsilon_t$$

$$\text{Model 2 : } \Delta\text{HML}_{t,t-15} = \gamma_0 + \gamma_1 \text{RD}_{term} + \gamma_2 \text{StRt}_{1-36} + \epsilon_t$$

where  $\text{HML}_t$  is the payoff of our primary HML value strategy over holding-period months  $t$  to  $t + 11$ ;  $\Delta\text{HML}_{t,t-15}$  is the difference between  $\text{HML}_t$  and  $\text{HML}_{t-15}$ ;  $\text{RD}_{term}$  is one of our two primary lagged RD moving-average expressions as defined in Section II.D;  $\text{StRt}_{1-36}$  is the lagged 3-year stock market return;  $\epsilon_t$  is the residual; and the  $\gamma$ 's are coefficients to be estimated. Panel A reports on Model 1 for the subsequent payoff level, and Panel B reports on Model 2 for the change-in-payoffs expression. The  $\text{RD}_{term}$  is a lagged 3-month moving-average RD expression; either our primary  $\text{RRD}_{1-3}$  for Specification I or  $\text{RD}_{1-3}$  for Specification II.  $T$ -statistics are in parentheses, based on heteroskedastic- and autocorrelation-consistent standard errors. The sample period is 1962 to 2005.

Panel A: Model 1 on the Subsequent Payoff Level, $\text{HML}_t$							
Sample	Dates	Specification I.			Specification II.		
		$\gamma_1$	$\gamma_2$	$R^2$	$\gamma_1$	$\gamma_2$	$R^2$
		$(\gamma_1 \text{ on } \text{RRD}_{1-3})$			$(\gamma_1 \text{ on } \text{RD}_{1-3})$		
Full	1962-	4.69	n/a	11.5%	4.02	-0.040	10.6%
	2005	(4.27)			(3.07)	(-0.66)	
1st Half	1962-	2.84	n/a	1.6%	2.49	0.077	2.9%
	1983	(1.13)			(1.02)	(0.74)	
2nd Half	1984-	5.16	n/a	20.6%	4.70	-0.068	21.5%
	2005	(4.49)			(3.34)	(-0.95)	

Panel B: Model 2 on the Change-in-Payoffs, $\Delta\text{HML}_{t,t-15}$							
Sample	Dates	Specification I.			Specification II.		
		$\gamma_1$	$\gamma_2$	$R^2$	$\gamma_1$	$\gamma_2$	$R^2$
		$(\gamma_1 \text{ on } \text{RRD}_{1-3})$			$(\gamma_1 \text{ on } \text{RD}_{1-3})$		
Full	1962-	7.90	n/a	15.0%	7.24	0.068	15.2%
	2005	(4.18)			(4.19)	(0.82)	
1st Half	1962-	10.28	n/a	9.5%	9.00	0.199	12.3%
	1983	(3.19)			(3.01)	(1.44)	
2nd Half	1984-	7.52	n/a	19.1%	7.23	0.031	20.1%
	2005	(3.33)			(3.38)	(0.26)	

TABLE 4

**Return Dispersion and the Payoffs to a 6-month Momentum Strategy**

Table 4 reports how the market's return dispersion (RD) is related to the payoffs of our primary 6-month firm-level momentum strategy, see Section II.C. We estimate two variations of the following two models.

$$\text{Model 1 : } \text{MOM}_t = \beta_0 + \beta_1 \text{RD}_{term} + \beta_2 \text{StRt}_{1-36} + \epsilon_t$$

$$\text{Model 2 : } \Delta\text{MOM}_{t,t-9} = \beta_0 + \beta_1 \text{RD}_{term} + \beta_2 \text{StRt}_{1-36} + \epsilon_t$$

where  $\text{MOM}_t$  is the payoff of our primary momentum series over holding-period months  $t$  to  $t + 5$  with a ranking period over  $t - 2$  to  $t - 7$ ;  $\Delta\text{MOM}_{t,t-9}$  is the difference between  $\text{MOM}_t$  and  $\text{MOM}_{t-9}$ ;  $\text{RD}_{term}$  is one of our two primary lagged RD moving-average expressions as defined in Section II.D;  $\text{StRt}_{1-36}$  is the lagged 3-year stock market return;  $\epsilon_t$  is the residual; and the  $\beta$ 's are coefficients to be estimated. Panel A reports on Model 1 for the subsequent payoff level, and Panel B reports on Model 2 for the change-in-payoffs expression. The  $\text{RD}_{term}$  is a lagged 3-month moving-average RD expression; either our primary  $\text{RRD}_{1-3}$  for Specification I or  $\text{RD}_{1-3}$  for Specification II.  $T$ -statistics are in parentheses, based on heteroskedastic- and autocorrelation-consistent standard errors. The sample period is 1962 to 2005.

Panel A: Model 1 on the Subsequent Momentum Payoff,  $\text{MOM}_t$ 

Sample	Dates	Specification I.			Specification II.		
		$\beta_1$	$\beta_2$	$R^2$	$\beta_1$	$\beta_2$	$R^2$
		$(\beta_1 \text{ on } \text{RRD}_{1-3})$			$(\beta_1 \text{ on } \text{RD}_{1-3})$		
Full	1962- 2005	-2.05 (-3.84)	n/a	3.2%	-2.14 (-3.91)	0.050 (1.60)	6.0%
1st Half	1962- 1983	-4.28 (-2.13)	n/a	3.9%	-3.54 (-1.95)	0.078 (1.22)	7.5%
2nd Half	1984- 2005	-1.62 (-3.11)	n/a	3.3%	-1.75 (-3.09)	0.047 (1.25)	6.7%

Panel B: Model 2 on the Change-in-Payoffs,  $\Delta\text{MOM}_{t,t-9}$ 

Sample	Dates	Specification I.			Specification II.		
		$\beta_1$	$\beta_2$	$R^2$	$\beta_1$	$\beta_2$	$R^2$
		$(\beta_1 \text{ on } \text{RRD}_{1-3})$			$(\beta_1 \text{ on } \text{RD}_{1-3})$		
Full	1962- 2005	-4.94 (-3.93)	n/a	7.9%	-4.98 (-4.02)	-0.008 (-0.17)	9.2%
1st Half	1962- 1983	-8.41 (-2.99)	n/a	7.3%	-8.58 (-3.18)	-0.094 (-1.06)	9.4%
2nd Half	1984- 2005	-4.36 (-2.95)	n/a	10.0%	-4.46 (-3.12)	0.011 (0.21)	11.7%

TABLE 5

**Return Dispersion, Value and Momentum Premia, and Macroeconomic Variables**

Table 5 examines whether the relations between RD and the value and momentum premia remain, while controlling for well-known macroeconomic variables suggested by the literature. We estimate the following four regressions:

$$\text{Model 1: } \text{HML}_t = \theta_0 + \theta_1 \text{RRD}_{1-3} + \theta_2 \text{StRt}_{1-36} + \theta_3 \text{DY}_{t-1} + \theta_4 \text{DIV}_{t-1} + \theta_5 \text{TRM}_{t-1} + \theta_6 \text{YD3}_{t-1} + \epsilon_t$$

$$\text{Model 2: } \text{MOM}_t = \theta_0 + \theta_1 \text{RRD}_{1-3} + \theta_2 \text{StRt}_{1-36} + \theta_3 \text{DY}_{t-1} + \theta_4 \text{DIV}_{t-1} + \theta_5 \text{TRM}_{t-1} + \theta_6 \text{YD3}_{t-1} + \epsilon_t$$

$$\text{Model 3: } \Delta \text{HML}_{t,t-15} = \theta_0 + \theta_1 \text{RRD}_{1-3} + \theta_2 \text{StRt}_{1-36} + \theta_3 \text{DY}_{t-1} + \theta_4 \text{DIV}_{t-1} + \theta_5 \text{TRM}_{t-1} + \theta_6 \text{YD3}_{t-1} + \epsilon_t$$

$$\text{Model 4: } \Delta \text{MOM}_{t,t-9} = \theta_0 + \theta_1 \text{RRD}_{1-3} + \theta_2 \text{StRt}_{1-36} + \theta_3 \text{DY}_{t-1} + \theta_4 \text{DIV}_{t-1} + \theta_5 \text{TRM}_{t-1} + \theta_6 \text{YD3}_{t-1} + \epsilon_t$$

where  $\text{RRD}_{1-3}$  is our primary lagged 3-month RRD moving-average as defined in Section II.D,  $\text{DY}_{t-1}$ ,  $\text{DIV}_{t-1}$ ,  $\text{TRM}_{t-1}$ ,  $\text{YD3}_{t-1}$  are the lagged macroeconomic explanatory variables; the  $\theta$ 's are coefficients to be estimated; and the other terms are as defined in Tables 3 and 4. Panel A reports on Models 1 and 2 for the subsequent payoff levels. Panel B reports on Models 3 and 4 for the change-in-payoff expressions. DY is the default yield spread, DIV is the stock market's trailing 12-month dividend yield, TRM is the difference between the yield of 10-year T-bonds and 3-month T-bills, and YD3 is the 3-month T-bill yield, all defined in Section II.A.  $T$ -statistics are in parentheses, based on heteroskedastic- and autocorrelation-consistent standard errors. The column labeled "F-stat" reports the F-statistic for a joint test that  $\theta_2$  through  $\theta_6$  are all equal to zero, with the  $p$ -value in brackets. The sample period is 1962 through 2005.

Panel A: Models 1 &amp; 2 - Subsequent Payoffs of Value and Momentum Strategies

Model	$\theta_1$	$\theta_2$	$\theta_3$	$\theta_4$	$\theta_5$	$\theta_6$	F-stat ( $\theta_2$ to $\theta_6=0$ )	$R^2$
1. $\text{HML}_t$	6.89 (6.91)	0.006 (0.11)	-0.007 (-0.17)	4.71 (2.17)	0.022 (1.70)	-0.0052 (-0.64)	2.29 [0.043]	22.3%
2. $\text{MOM}_t$	-2.74 (-5.13)	0.030 (0.85)	-0.008 (-0.21)	-1.88 (-1.25)	-0.005 (-0.49)	0.005 (0.79)	1.06 [0.380]	7.0%

Panel B: Models 3 &amp; 4 - Change-in-Payoffs of Value and Momentum Strategies

Model	$\theta_1$	$\theta_2$	$\theta_3$	$\theta_4$	$\theta_5$	$\theta_6$	F-stat ( $\theta_2$ to $\theta_6=0$ )	$R^2$
3. $\Delta \text{HML}_{t,t-15}$	7.51 (4.84)	0.069 (0.80)	0.046 (0.73)	-1.04 (-0.28)	0.0013 (0.06)	0.0031 (0.25)	0.59 [0.705]	15.7%
4. $\Delta \text{MOM}_{t,t-9}$	-5.73 (-4.90)	-0.049 (-0.99)	-0.054 (-1.09)	-3.84 (-1.65)	0.024 (1.48)	0.016 (1.59)	1.22 [0.296]	11.2%

TABLE 6

**Pervasiveness and Robustness - Alternate RD Metrics and Alternate Strategies**

Table 6 presents additional evidence to evaluate the pervasiveness and robustness of the main empirical results. We estimate models with the following general form, with either different RD metrics or different value and momentum strategies, as compared to those in Tables 3 and 4:

$$\text{Subsequent Payoff Level (or Change-in-payoffs)} = \psi_0 + \psi_1 \text{RD}_{term} + \epsilon_t$$

where the “Subsequent Payoff Level” is either  $\text{HML}_t$  or  $\text{MOM}_t$  and the “Change-in-payoffs” is either  $\Delta\text{HML}_{t,t-15}$  or  $\Delta\text{MOM}_{t,t-9}$  with the timing defined in Tables 3 and 4;  $\text{RD}_{term}$  is a lagged RD expression;  $\epsilon_t$  is the residual; and the  $\psi$ 's are coefficients to be estimated. Panels A and B examines four alternate RD expressions, as denoted in the column heading for the specification and defined in Section V.B, with our primary value and momentum strategies from Tables 3 and 4 as the dependent variables. Panel C presents results for five alternate value and momentum strategies with our primary RD expressions, as denoted in the panel headings and defined in Sections II.B and II.C.  $T$ -statistics are in parentheses, based on heteroskedastic- and autocorrelation-consistent standard errors. The sample period is 1962 to 2005.

Panel A: With alternate timing for the RD moving-average expressions

Dependent Variable	Spec. I (RRD <sub>1-2</sub> )		Spec. II (RD <sub>1-2</sub> )		Spec. III (RRD <sub>1-4</sub> )		Spec. IV (RD <sub>1-4</sub> )	
	$\psi_1$	$R^2$	$\psi_1$	$R^2$	$\psi_1$	$R^2$	$\psi_1$	$R^2$
HML <sub><i>t</i></sub>	4.12 (4.00)	10.0%	3.55 (3.11)	8.4%	5.12 (4.46)	12.7%	4.41 (3.52)	10.9%
$\Delta\text{HML}_{t,t-15}$	7.14 (4.23)	13.8%	6.50 (3.69)	12.9%	8.26 (3.93)	15.2%	7.53 (3.54)	14.6%
MOM <sub><i>t</i></sub>	-2.02 (-4.21)	3.5%	-2.01 (-4.24)	3.9%	-1.85 (-3.18)	2.4%	-2.14 (-3.64)	3.7%
$\Delta\text{MOM}_{t,t-9}$	-4.47 (-3.85)	7.3%	-4.38 (-3.84)	7.9%	-5.00 (-3.71)	7.6%	-5.13 (-3.95)	9.2%

Panel B: With detrended RD expressions, used in place of the RD moving average

Dependent Variable	Spec. I (RRD <sub>1-3,5-16</sub> )		Spec. II (RD <sub>1-3,5-16</sub> )		Spec. III (RRD <sub>1-2,8-19</sub> )		Spec. IV (RD <sub>1-2,8-19</sub> )	
	$\psi_1$	$R^2$	$\psi_1$	$R^2$	$\psi_1$	$R^2$	$\psi_1$	$R^2$
HML <sub><i>t</i></sub>	2.56 (1.59)	2.5%	1.89 (1.01)	1.5%	2.88 (2.27)	4.5%	2.20 (1.42)	2.8%
$\Delta\text{HML}_{t,t-15}$	9.16 (5.27)	14.6%	7.79 (4.21)	11.6%	9.18 (7.09)	20.7%	8.06 (5.31)	17.5%
MOM <sub><i>t</i></sub>	-2.76 (-4.30)	4.2%	-2.87 (-4.19)	5.0%	-2.16 (-3.86)	3.6%	-2.14 (-4.02)	3.9%
$\Delta\text{MOM}_{t,t-9}$	-7.46 (6.92)	13.1%	-7.90 (-7.20)	16.2%	-5.72 (-5.80)	10.9%	-5.95 (-6.50)	12.9%

TABLE 6 (Continued)

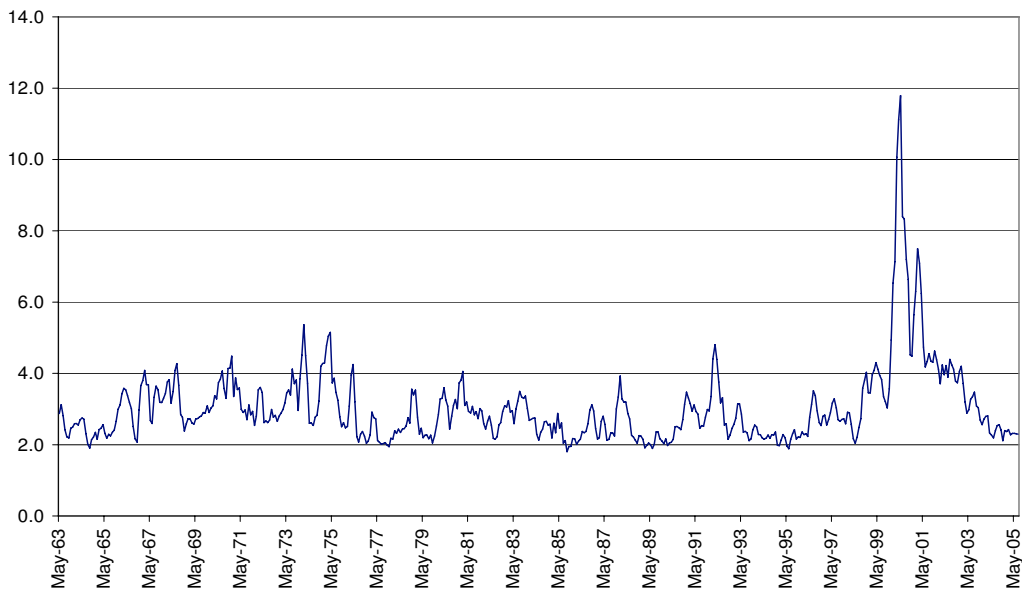
Panel C: Alternate Value and Momentum Strategies				
Dependent Variable	Spec. I (RRD <sub>1-3</sub> )		Spec. II (RD <sub>1-3</sub> )	
	$\psi_1$	$R^2$	$\psi_1$	$R^2$
Panel C.1: "Large-firm only" Value Strategy				
HML <sub>t</sub>	4.35 (3.19)	8.3%	3.70 (2.53)	6.9%
$\Delta$ HML <sub>t,t-15</sub>	8.50 (3.67)	12.7%	7.72 (3.26)	12.0%
Panel C.2: "Large-firm only" Momentum Strategy				
MOM <sub>t</sub>	-2.91 (3.65)	5.4%	-2.96 (-3.95)	6.4%
$\Delta$ MOM <sub>t,t-9</sub>	-5.39 (-2.64)	7.6%	-5.29 (-2.71)	8.4%
Panel C.3: Value Strategy that "longs decile-9 and shorts decile-2"				
HML <sub>t</sub>	2.64 (3.84)	6.4%	2.03 (2.59)	4.4%
$\Delta$ HML <sub>t,t-15</sub>	5.09 (4.46)	11.9%	4.49 (3.81)	10.6%
Panel C.4: Momentum Strategy that "longs decile-9 and shorts decile-2"				
MOM <sub>t</sub>	-1.20 (-3.28)	2.4%	-1.40 (-3.22)	3.7%
$\Delta$ MOM <sub>t,t-9</sub>	-2.27 (-4.08)	3.8%	-2.49 (-4.06)	7.5%
Panel C.5: Industry Momentum Strategy with 48 industries				
MOM <sub>t</sub>	-0.97 (-1.50)	1.3%	-1.04 (-1.67)	1.7%
$\Delta$ MOM <sub>t,t-9</sub>	-3.31 (-2.41)	6.8%	-3.31 (-2.56)	7.9%

FIGURE 1

**Time-series of Primary RD and RRD Moving-Averages**

Figure 1 displays the time-series for our primary 3-month moving-average RD and RRD expressions. The raw dispersion is our RD(BM&SZ). In the figure, month  $t$  plots the lagged 3-month RD moving-average expression, either  $RD_{1-3}$  in Panel A or  $RRD_{1-3}$  in Panel B.

**Graph A: Lagged 3-month RD Moving Average**



**Graph B: Lagged 3-month RRD Moving Average**

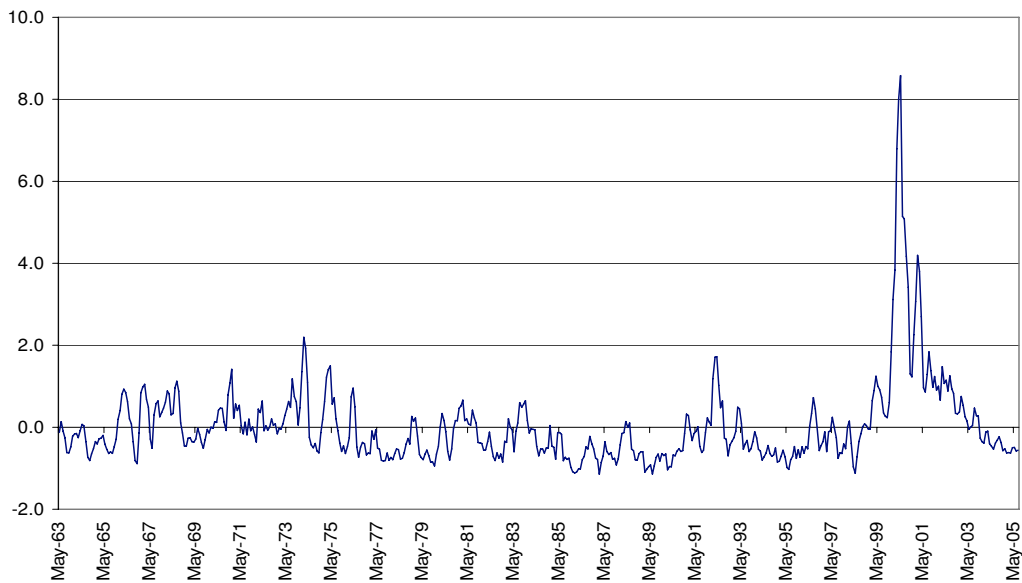
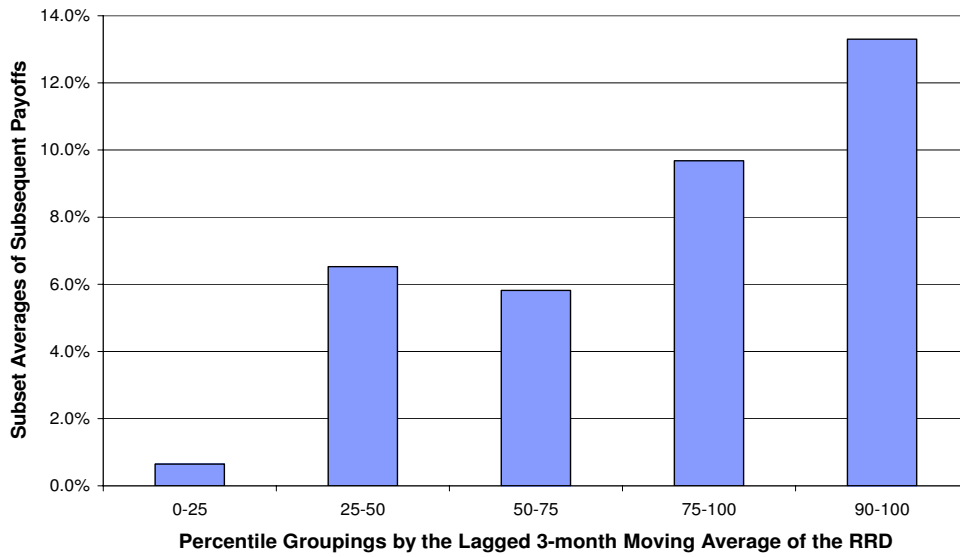


FIGURE 2

**Value Payoffs, when Sorted on the Lagged Relative Return Dispersion**

Figure 2 reports on subset averages for value book-to-market payoffs, when sorted by the lagged 3-month RRD moving average (the  $RRD_{1-3}$  as used in Table 3). Panel A below reports on subset average for the subsequent 12-month value payoff ( $HML_t$ ) when sorted into percentile groupings on the lagged 3-month RRD moving average. Panel B below reports on the subset averages for the change-in-HML-payoffs ( $\Delta HML_{t,t-15}$ ) when sorted into percentile groupings on the lagged 3-month RRD moving average. The figure reports on our primary value strategy as used in Table 3.

**Graph A: Subset Averages of Subsequent HML B/M Payoffs**



**Graph B: Subset Averages of Change-in-HML B/M Payoffs**

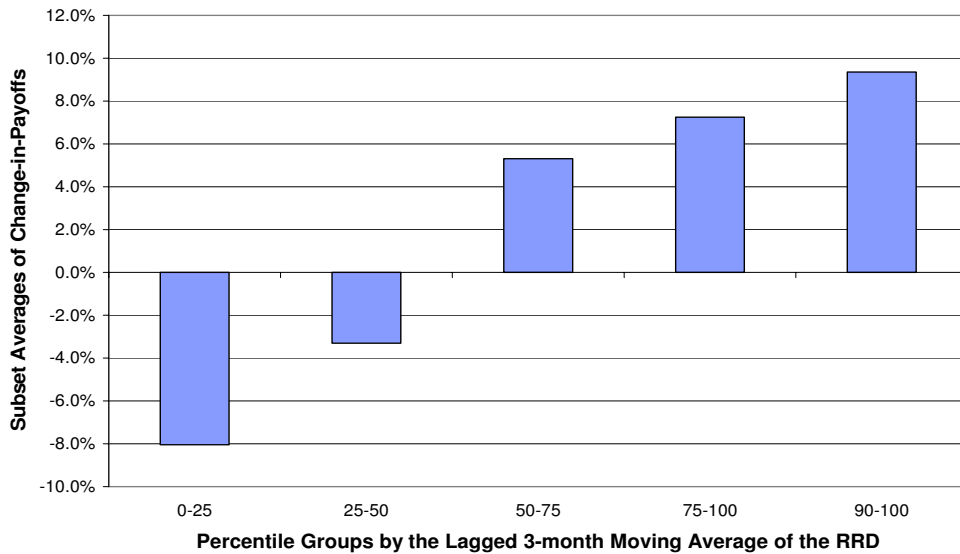
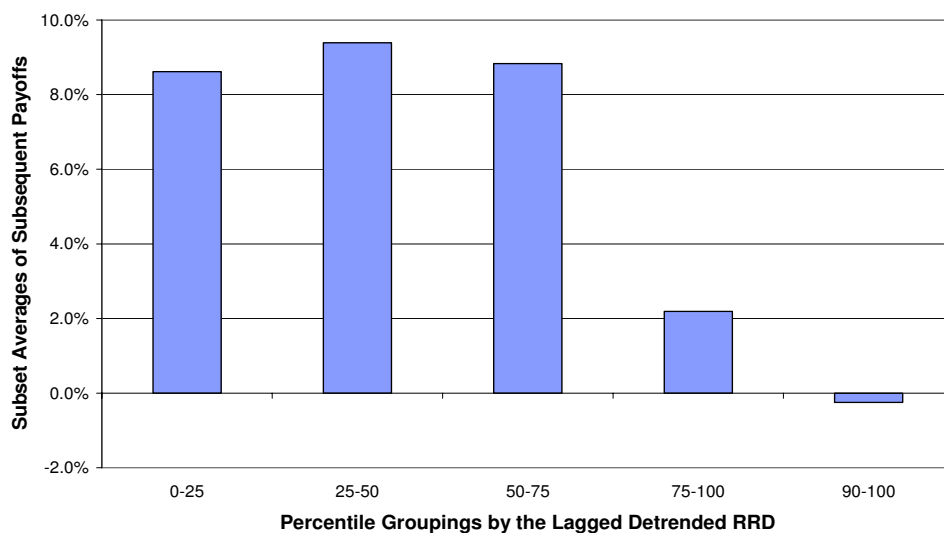


FIGURE 3

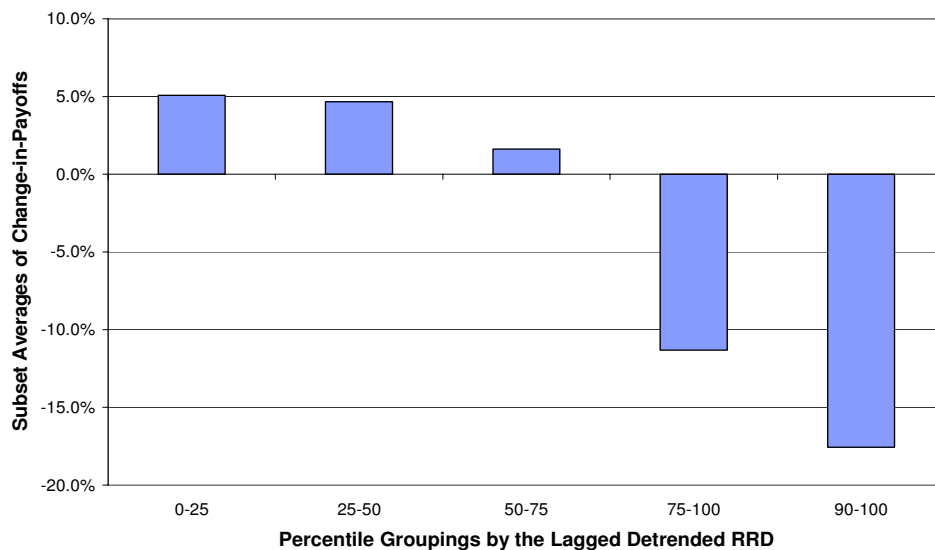
**Momentum Payoffs, when Sorted on the Lagged Relative Return Dispersion**

Figure 3 reports on subset averages for momentum payoffs, when sorted by the lagged detrended RRD (the  $RRD_{1-3,5-16}$  as used in Panel B of Table 6). Panel A below reports on subset average for the subsequent 6-month momentum payoff ( $MOM_t$ ) when sorted into percentile groupings on the lagged detrended RRD. Panel B below reports on the subset averages for the change-in-momentum-payoffs ( $\Delta MOM_{t,t-9}$ ) when sorted into percentile groupings on the lagged detrended RRD. The figure reports on our primary momentum strategy as used in Table 4.

**Graph A: Subset Averages of Subsequent Momentum Payoffs**



**Graph B: Subset Averages of Change-in-Momentum Payoffs**



## Appendix

### Timing Details for the Observations of the Strategy Payoff Terms

Recall that our empirical work examines both the subsequent payoff level and a change-in-payoff term, for both value and momentum strategies. Our change-in-payoff terms measure the difference between the subsequent payoff and a lagged payoff, with a 3-month gap between the two payoffs that corresponds to the lagged 3-month RD moving average that is featured in our empirical work.

Our sample period for the monthly returns is 1962 to 2005. With this choice, we align the data so that our first monthly momentum and value payoff observation commences in August 1962, which follows from the first 6-month momentum ranking period over January to June 1962 with July 1962 as the skip-a-month. The final month of return data is December 2005. Thus, the monthly observations for the 6-month overlapping momentum payoffs commence in August 1962 (with the first holding period over August 1962 to January 1963); and conclude in July 2005 (with the final holding period over July 2005 to December 2005). For the monthly observations for the 12-month overlapping HML value payoffs, the first holding period is over August 1962 to July 1963 and the final holding period is over January 2005 to December 2005.

With this timing convention, this means that the change-in-payoff observations must commence later to take into account the required lagged payoff observation and the 3-month gap for the RD moving average. Thus, for our empirical work, the observations for the 6-month momentum payoffs begin in May 1963 (for the  $\Delta\text{MOM}_{t,t-9}$  term, the  $\text{MOM}_t$  term covers the holding-period over May 1963 to October 1963 and the  $\text{MOM}_{t-9}$  term covers the holding-period over August 1962 to January 1963). The observations for the 12-month HML value payoffs begin in November 1963 (for the  $\Delta\text{HML}_{t,t-15}$  term, the  $\text{HML}_t$  term covers the holding-period over November 1963 to October 1964 and the  $\text{HML}_{t-15}$  term covers the holding-period over August 1962 to July 1963).