RESEARCH

Premium Timing with Valuation Ratios

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Research

The predictability of expected stock returns is an old topic and an important one. While investors may increase expected returns by focusing on market, size, value, and profitability premiums, over any time period, the realized premiums can be negative. If one could accurately predict when the premiums will and will not appear, it would enable investors to collect superior returns. Not surprisingly, there have been numerous attempts to do so. Among the variables that have been proposed to accurately predict market movements, aggregate valuation ratios such as earnings-to-price and book-to-market have received a great deal of attention.[1]

One way to understand the rationale behind using valuation ratios is through a simplified model[2] for a security's expected return:

$$Expected\ return = \frac{Next\ period's\ expected\ cash\ flow}{Current\ price} + Expected\ growth\ rate\ of\ cash\ flow$$

If current book value or earnings contains information about future book value or earnings, then book-to-market or earnings-to-price ratios can be used as proxies for the first term on the right hand side. This is equivalent to saying book-to-market and earnings-to-price ratios have information about expected returns. The expected return of an asset class is the weighted average of the expected return of each security included in that asset class. Building on the assumptions above, it follows that the weighted average book-to-market and earnings-to-price ratios of an asset class have information about its expected return. Thus, it is reasonable to expect that differences in these aggregate valuation ratios between asset classes, which we will call valuation spreads, have information about differences in their expected returns.

1. See, for example, Cohen, Polk, and Vuolteenaho (2003), Rizova (2007), and Davis (2007).
2. It is often called the constant growth model.

The question then becomes: How accurate is the information contained in the valuation spreads about time varying differences in expected returns between asset classes? Is it possible to reliably earn abnormal returns by moving in and out of equity markets or switching back and forth between asset classes based on valuation spreads?

Whether that is the case is ultimately an empirical question on which this study aims to shed light. In particular, we focus on two valuation ratios, earnings-to-price and book-to-market, and examine their predictive power for the four premiums in US equity returns—market, size, value, and profitability premiums. First, we run forecasting regressions to test for a reliable relation between the valuation spreads and future premiums. Then, we simulate a set of timing strategies to see whether they can generate reliably positive excess returns.

THE VARIABLES

As detailed in the Appendix, each return premium is defined as the return difference between two hypothetical value-weighted portfolios, which represent the long and short sides of the premium. For example, the long side of the value premium is a US marketwide portfolio consisting of stocks with the highest book-to-market ratios that together make up 30% of aggregate market capitalization. Similarly, the short side is a marketwide portfolio of stocks with the lowest book-to-market ratios that together are 30% of aggregate market capitalization. To predict future premiums, the key variable in this study is the valuation spreads, defined as the difference in valuation ratios between the long and short sides of the corresponding premium. For example, the valuation spread corresponding to the value premium is the difference in valuation ratios between the value and growth hypothetical portfolios that are used to construct the value premium. In the case of the market premium where the short side is the risk-free rate, the valuation spread is simply the valuation ratio of the long side—the market portfolio. This study focuses on two specific valuation spreads constructed in this way: book-to-market spreads and earnings-to-price spreads.

Exhibit 1 reports the summary statistics of monthly premiums. The market, size, and value premiums begin in July 1926, and the profitability premium begins in July 1963 when the profitability data becomes available. These monthly premiums, while reliably positive on average, have been fairly volatile.

Exhibit 1: Summary Statistics of Monthly Premiums

Premium	Average	Standard Deviation	t-statistic
Market	0.67%	5.36%	4.05
Size	0.26%	3.14%	2.67
Value	0.21%	3.40%	2.04
Profitability	0.19%	2.22%	2.12

The sample period is from July 1926 to June 2015 for the market, size and value premiums, and from July 1963 to June 2015 for the profitability premium.

Past performance is no guarantee of future results. Filters were applied to data retroactively and with the benefit of hindsight. Returns are not representative of indices or actual strategies and do not reflect costs and fees associated with an actual investment. Actual returns may be lower. Please see Appendix for data and sample universe descriptions.

Exhibit 2 presents the summary statistics—average magnitude, standard deviation, and the percentage of years with negative values—of the book-to-market spreads for the various premiums. Unlike the spreads for the market, size, and value premiums, which were positive in most or all years, the book-to-market spread for the profitability premium was negative during its sample period. This is consistent with the fact that profitable firms tend to have lower book-to-market ratios, and less profitable firms tend to have higher book-to-market ratios. All the spreads exhibit some variation over time as captured by their standard deviations.

On the other hand, measuring earnings-to-price spreads is less straightforward. For any group of stocks, we expect their weighted average expected return to be positive—it is

Exhibit 2: Summary Statistics of the Book-to-Market Spreads

Book-to-Market Spreads for	Average	Standard Deviation	% Years with Negative Spread
Market	0.73	0.38	0%
Size	0.49	0.68	6%
Value	1.10	0.77	0%
Profitability	−0.51	0.14	100%

The observations are annual. The sample period is from 1926 to 2015 for the market, size, and value premiums and from 1963 to 2015 for the profitability premium. Filters were applied to data retroactively and with the benefit of hindsight. Please see Appendix for data and sample universe descriptions.

difficult to imagine investors demanding a negative return to bear the uncertainty associated with holding those stocks. That poses an interesting empirical challenge when using earnings-to-price ratios as a proxy for expected returns. What happens when earnings are negative?[3] Going back to the expected return model in the beginning, it might imply current earnings is a poor proxy for future earnings, and therefore expected cash flow to investors, or the expected growth rate of cash flow is the driver of expected returns, or a combination of both. Whatever the reason, one implication is that given two groups of stocks, if one group has more stocks with negative earnings, the weighted average earnings-to-price ratio is likely a poor proxy for its expected returns.

One way to mitigate this problem is to exclude stocks with negative earnings when computing the aggregate earnings-to-price ratio for a group of stocks, but the logic above still applies—even if only positive earnings firms are included, weighted average earnings-to-price ratio is likely a poorer proxy for expected returns for the group with more stocks with negative earnings. When looking at valuation spreads between groups of stocks, the presence of firms with negative earnings introduces additional noise about differences in expected returns between those groups. One example of this is large cap stocks versus small cap stocks. Among small cap companies, there have been more firms with negative earnings than for large cap companies.

Apart from the treatment of negative earnings, the choice of measurement horizon is also likely to have an impact on the earnings-to-price measure. Following Davis (2011),

Exhibit 3: The Four Varieties of Earnings-to-Price Ratios, Depending on the Choices of Measurement Horizon and the Treatment of Negative Earnings

	Earnings are measured over ...	Excluding firms with negative (average) earnings?
E/P	the preceding year	No
E+/P+		Yes
avg E/P	the previous ten years (average real earnings)	No
(avg E)+/P+		Yes

we examine four varieties of earnings-to-price ratios based on these choices. The resulting measures, summarized in **Exhibit 3**, are used to construct various earnings-to-price spreads.

Exhibit 4 summarizes the different measures of earnings-to-price spreads. Both E/P and E+/P+ spreads begin in 1963 when the earnings data becomes available, while the other two measures that calculate earnings over the previous 10 years begin in 1972. The magnitude and sign of average spreads vary across earnings-to-price measures. For example, as discussed earlier, earnings-to-price spreads for the size premium tend to be noisy because there have been more small cap companies with negative earnings—spreads that include negative earnings (E/P and avg E/P) have been negative on average while excluding negative earnings has led to positive average spreads (E+/P+ and (avg E)+/P+). In terms of standard deviation, for each premium the spreads that do not exclude negative (average) earnings tend to exhibit more volatility than their counterparts that do.

Exhibit 4: Summary Statistics of the Four Varieties of Earnings-to-Price Spreads

	E/P			E+/P+			avg E/P			(avg E)+/P+		
Earnings-to-Price Spreads for	Avg.	Std. Dev.	% Years with Negative Spread	Avg.	Std. Dev.	% Years with Negative Spread	Avg.	Std. Dev.	% Years with Negative Spread	Avg.	Std. Dev.	% Years with Negative Spread
Market	0.061	0.028	0%	0.070	0.025	0%	0.057	0.029	0%	0.061	0.028	0%
Size	–0.028	0.043	77%	0.010	0.017	30%	–0.013	0.023	80%	0.010	0.017	23%
Value	0.035	0.036	11%	0.049	0.025	0%	0.052	0.036	0%	0.055	0.033	0%
Profitability	0.012	0.030	30%	–0.006	0.015	60%	–0.014	0.024	66%	–0.022	0.020	89%

The observations are annual. The sample period is from 1963 to 2015 for the E/P and E+/P+ spreads, and from 1972 to 2015 period for the avg E/P and (avg E)+/P+ spreads. Filters were applied to data retroactively and with the benefit of hindsight. Please see Appendix for data and sample universe descriptions.

3. This tends to be much less of an issue when using book-to-market ratios, because there have been far fewer firms with negative book equity across markets.

FORECASTING REGRESSIONS

Valuation spreads and premiums vary over time. To see whether the current spreads might accurately predict future premiums, we run the following regression:

$$Annual\ Premium_{t+1} = \alpha + \beta * Valuation\ Spread_t + \epsilon_{t+1}$$

That is, we use valuation spreads observed in June of year t to predict their corresponding annual premiums over the following 12 months from July of year t to June of year t+1. A slope reliably different from zero (e.g., indicated by a t-statistic of more than two in absolute value) coupled with a high R^2 would serve as evidence of predictability.

Exhibit 5 presents the results for the forecasting regressions. On the left side, book-to-market spreads show some predictive power for all premiums over the whole sample period: a greater spread tends to be followed by a higher future premium.[4] The sub-period regressions for market, size, and value suggest that this positive relation is more pronounced in the first half of the sample period and much weaker in the second half—the R^2 drops from as high as 70% to 10% or below, and the slopes in the market and value regressions are no longer reliably different from zero. On the right side, the results using various earnings-to-price spreads as predictors are mixed but generally weak. Most notable are the size premium regressions, where the two earnings-to-price spreads that exclude negative (average) earnings produce reliably positive slope coefficients and reasonably high R^2 at 11 to 12%.

Exhibit 6 visualizes the regressions based on book-to-market spreads over two sub-periods. The annual market, size, value, and profitability premiums are plotted against their corresponding book-to-market spreads, and what a linear regression does is to determine a straight line across the cloud of points that best represents the general trend. As such, the dark blue lines are a visualization of the regression results. We can see that the regression lines are mostly upward sloping, which reconfirms the positive slope coefficients shown earlier. However, the model fit is far from perfect as most observations deviate from the straight line by various amounts. Given the wide range of realized premiums for any level of book-to-market spread, it is not surprising that the R^2—which measures the goodness of fit—of these regressions is generally low.

What about some of the regressions that did report high t-statistics and R^2, in particular those using book-to-market spreads over the early sample period? The scatter plots for

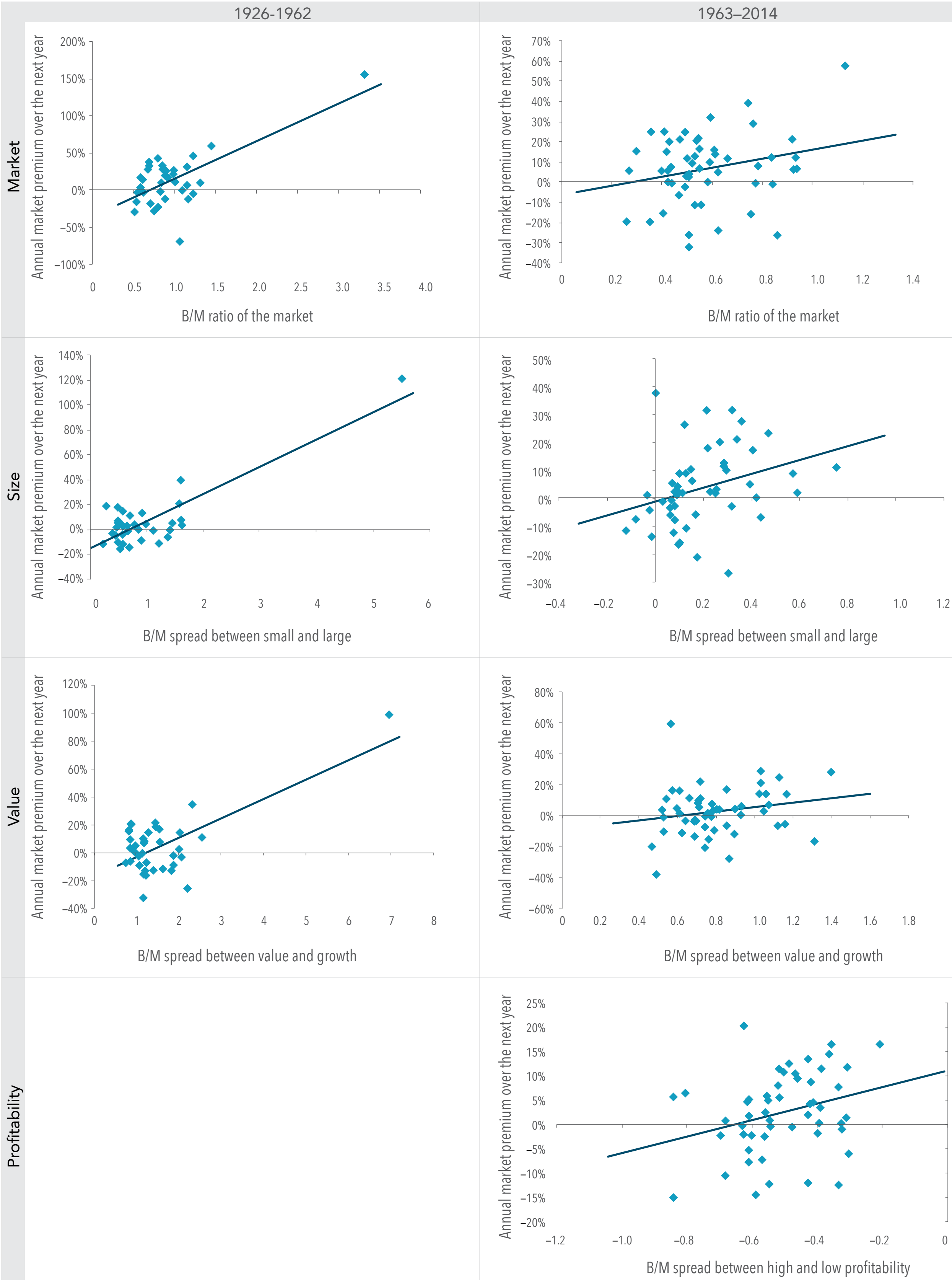
Exhibit 5: Regressions of Annual Premiums on Corresponding Valuation Spreads

		Valuation Spreads						
		B/M			E/P	E+/P+	avg E/P	(avg E)+/P+
	t	1926-2014	1926-1962	1963-2014	1963-2014		1972-2014	
Market	slope	0.39	0.50	0.22	1.02	1.57	0.94	1.18
		(6.32)	(5.49)	(1.76)	(1.17)	(1.63)	(1.04)	(1.23)
	adj. R^2	0.31	0.45	0.04	0.01	0.03	0.00	0.01
Size	slope	0.16	0.22	0.26	0.36	3.01	1.20	2.85
		(7.46)	(9.28)	(2.49)	(0.80)	(2.79)	(1.37)	(2.53)
	adj. R^2	0.38	0.70	0.09	−0.01	0.12	0.02	0.11
Value	slope	0.11	0.14	0.14	0.69	1.50	1.18	1.35
		(5.09)	(5.42)	(1.41)	(1.12)	(1.71)	(1.67)	(1.81)
	adj. R^2	0.22	0.44	0.02	0.00	0.04	0.04	0.05
Profitability	slope			0.17	−0.12	0.53	0.61	0.87
				(2.11)	(−0.30)	(0.66)	(1.17)	(1.34)
	adj. R^2			0.06	−0.02	−0.01	0.01	0.02

The t-statistics are in parentheses. Filters were applied to data retroactively and with the benefit of hindsight. Please see Appendix for data and sample universe descriptions.

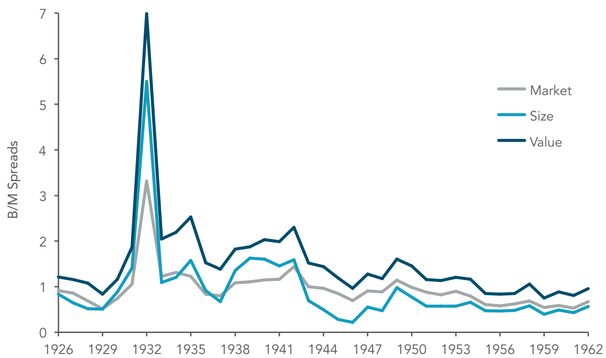
4. When the spread is negative, for example, in the case of the book-to-market spread for the profitability premium, a "greater" spread should be interpreted as being less negative, rather than being larger in absolute magnitude. Regardless of the sign of the spread, a positive relation between the valuation spread and future premium says when the valuation ratio of the long side of the premium rises relative to that of the short side (so the spread becomes either more positive or less negative depending on its sign), a higher premium tends to follow.

Exhibit 6: Scatter Plots of Annual Premiums against Corresponding Book-to-Market Spreads



Filters were applied to data retroactively and with the benefit of hindsight. Please see Appendix for data and sample universe descriptions.

Exhibit 7: The Effect of One Observation on the Regression Results



		B/M Spreads			
	t	1926–2014	Excluding 1932	1926–1962	Excluding 1932
Market	slope	0.39	0.18	0.50	0.22
		(6.32)	(2.07)	(5.49)	(1.28)
	adj. R^2	0.31	0.04	0.45	0.02
Size	slope	0.16	0.05	0.22	0.09
		(7.46)	(1.53)	(9.28)	(2.02)
	adj. R^2	0.38	0.02	0.70	0.08
Value	slope	0.11	0.02	0.14	0.01
		(5.09)	(0.47)	(5.42)	(0.25)
	adj. R^2	0.22	−0.01	0.44	−0.03

The line chart plots the book-to-market spreads for 1926–1962 with large spikes in 1932. The table shows the effect of excluding 1932 on the regressions of market, size, and value premiums on their corresponding book-to-market spreads.

The t-statistics are in parentheses. Filters were applied to data retroactively and with the benefit of hindsight. Please see Appendix for data and sample universe descriptions.

the first sub-period reveal something interesting: there is one observation in the top right corner that seems to have contributed disproportionally to the overall results. That was 1932, when large spikes in book-to-market spreads occurred, as shown in the upper panel of **Exhibit 7**. If a relation is largely driven by a few unusual observations and absent elsewhere, it may not have many practical implications for investors. A simple robustness check in the lower panel of Exhibit 7 confirms this concern. Excluding that one year from the early or the full sample period results in a substantial decrease in the reliability of the slope coefficients and the R^2 of the regressions and wipes out a great portion of the predictability observed previously.

One take away from the regressions and scatter plots presented in Exhibits 5 and 6 is that while equity, size, value, and profitability premiums have been economically significant, their returns have been volatile leading to low R^2 in forecasting regressions. This indicates that it may be challenging to earn abnormal returns by using information in aggregate valuation ratios about the time varying nature of these premiums.

TRADING SIMULATIONS

Forecasting regressions, like those in the previous section, look for a statistical relation between valuation spreads and future premiums using the full data sample, which serves as evidence of in-sample predictability. However, they do not directly show whether one can profit from the observed relation. Barring other concerns such as turnover and trading costs, a viable signal needs to make good out-of-sample predictions for real-time trading without the benefit of hindsight. To formally test that, we simulate a broad set of timing strategies based on valuation spreads.

We examine timing strategies that trade back and forth between the long and the short sides of the premiums in an attempt to generate abnormal returns. For example, timing the value premium involves switching between hypothetical value and growth portfolios. To evaluate the performance of a strategy, we use the monthly average return of the long side of the premium as a benchmark to measure its excess return. This excess return should be positive in order to qualify for further assessment. That is, a strategy that tries to time a premium should at least generate a higher average return than the simple alternative of remaining invested in the long side of the premium.

In addition, both magnitude and reliability are important aspects of the excess return. Since the simulations in this study ignore transaction costs, a tiny positive excess return may not be able to survive the costs of implementing the strategy. Here we look for trading rules that outperform the benchmark by at least two basis points per month—a timing strategy that only added 25 basis points per year can hardly justify the potential risk and costs associated with dramatically shifting the asset allocation. The reliability check, on the other hand, assesses the likelihood of a positive excess return being a chance result. If the observed return is likely to have occurred by random chance, it raises concern about whether the trading strategy will continue to be profitable going forward. Following Davis (2014), this study assesses the reliability of excess return by calculating bootstrapped p-values.[5]

We use these measures to evaluate market timing strategies based on valuation spreads. Since the observations of valuation spreads are available on an annual basis, the strategies in this study rebalance annually on June 30. Depending on how they use the potential information in valuation spreads, these strategies can be divided into two broad categories: nonparametric and parametric.

NONPARAMETRIC RULES

We consider nonparametric trading rules that invest in the long side of a premium and move into the short side when the valuation spread of interest is small. For example, when the book-to-market spread between value and growth is small, it suggests the subsequent value premium may be low so the trading rule invests in the growth side.

To implement such a strategy, it is necessary to define a "small" valuation spread. At each point in time, we compare the current value with its past realizations. Small spreads are defined as those below the 10th, 20th, or 50th percentile of the historical distribution. This percentile is called the breakpoint.

Once the switch to the short side has been made, how long should the strategy remain focused on that side? One straightforward choice is to switch back to the long side of the premium as soon as the valuation spread exceeds the aforementioned breakpoint. Another option is to remain in the short side until the spread passes its historical median (50th percentile), which allows the switch more time to take effect. In either case, the percentile used is called the switchback.

One other detail is how far back we should go when constructing a historical distribution of the variable of interest. In this study we explore two possibilities, an expanding-window approach that includes all available data from the beginning of the time series to the trading day, and a rolling-window approach that uses the most recent 20 years prior to the trading day. While the latter approach may be able to capture some time variation in the distribution, it may also lose useful information by discarding earlier data points.

For each pair of premiums and valuation spreads, we run a variety of trading rules defined by the triplet (breakpoint, switchback, and window). **Exhibit 8** shows that, among all 200 trading rules, most underperformed their benchmarks, which stay invested in the long side. Five, or 2.5%, of the simulations generated a reliably positive excess return—an excess return that is greater than two basis points per month and has a p-value below 0.05. The smallest and largest excess returns are -67 and 14 basis points per month, respectively, and the average is -12 basis points per month. In light of the lack of persistence and robustness of the regression results, it is not surprising that the observed statistical relation did not translate into successful trading rules.

Exhibits 12 and 13 in the Appendix report the detailed simulation results. Interestingly, the attempt to time the market premium was the least successful—none of the rules yielded higher returns than the simple strategy of remaining in the stock market all the time. Also note that a number of excess returns for the profitability dimension are exactly zero. This is because the valuation signals never triggered those trading rules to switch to the short side in the simulation, and as a result, they ended up always investing in the securities with high profitability.

PARAMETRIC RULES

A parametric trading rule uses a regression approach to forecast future premiums—"parametric" refers to the parameters in the regression model. Since a premium is constructed by subtracting the return on the short side from the return on the long side, it reflects the relative performance of each side. Thus, the trading rule invests in the side of a premium that is predicted to do better (or the one that is more likely to do so).

We consider two parametric models. One is a linear model:

$$Average\ Premium_{t+1} = \alpha + \beta * Valuation\ Spread_t + \epsilon_{t+1}$$

5. For each historical sample that is used to simulate the excess return of a trading strategy, we reshuffle the premium in the original sample. Since the reshuffled sample decouples the original pairing of the premium and the valuation spread, it represents a null distribution with no relation between the two. We then run the same trading strategy on the reshuffled sample and compute its excess return. This process is repeated 1,000 times. The p-value for each trading simulation is the proportion of these 1,000 reshuffled samples that generated a higher excess return than the trading rule applied to the original sample. Note: A bootstrap simulation is a method of analysis that can be used to approximate the probability of certain outcomes by running multiple trial runs, called bootstrapped samples, using historical returns. See the Appendix for data sources.

Exhibit 8: Monthly Average Excess Returns for 200 Nonparametric Trading Rules

Monthly average excess returns for 200 nonparametric trading rules using different breakpoints (the 10th, 20th or 50th percentile), switchback points (the same as breakpoint or the 50th percentile), and historical distributions (expanding or rolling window)

The excess returns that are reliably positive (greater than two basis points per month and has a p-value below 0.05) are plotted in blue. The nonparametric trading rules switch to the short side of each premium when the valuation spread is below the breakpoint of its historical distribution and switch back to the long side when the variable of interest exceeds the switchback point.

The projections or other information generated by bootstrapped samples regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Results will vary with each use and over time.

When a future premium is estimated to be positive, the linear trading rule chooses the long side of the premium. When the estimate is negative, the short side is chosen. The other model, called a logit regression, directly models the probability of a premium being positive as a function of the corresponding valuation spread:

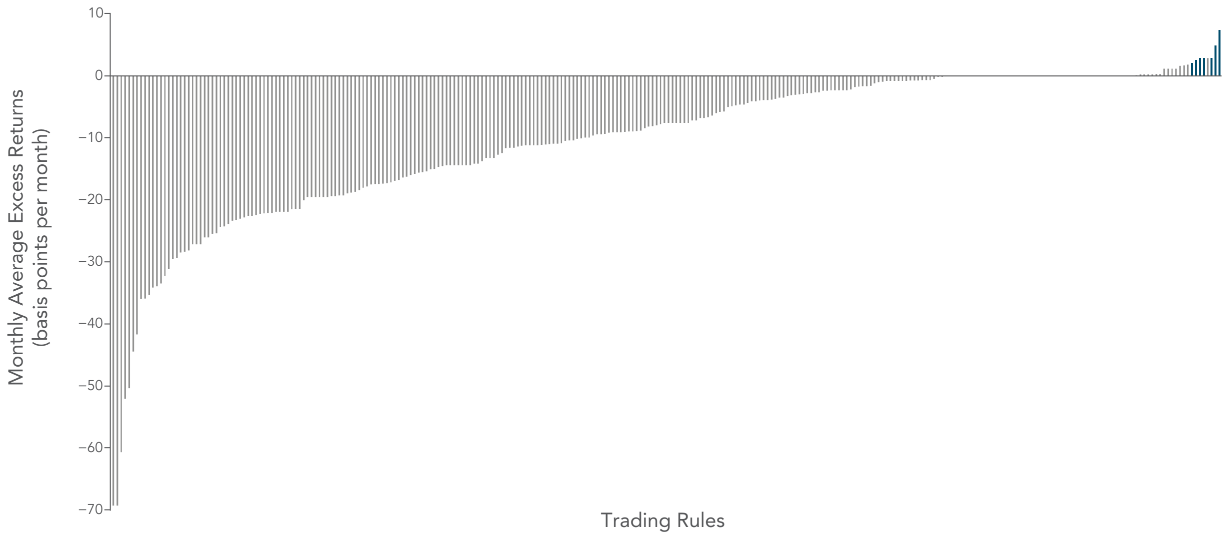
$$P(Average\ Premium_{t+1} \geq 0) = logit^{-1}(\alpha + \beta * Valuation\ Spread_t)$$

If the prediction is 70%, it means the long side has a 70% chance to generate higher average returns than the short side, resulting in a positive premium. The probability of the short side having higher returns is the remainder, 30%. We first examine logit trading rules that use a 50% threshold to invest in the side that is more likely to outperform the other. To determine the parameters (α and β) in both models, we only use data before the trading day to avoid look-ahead bias, following either an expanding- or a rolling-window approach.

First, we run 20 trading rules based on linear and logit regression models for each premium (5 valuation spreads × 2 window lengths × 2 parametric models). The detailed results for these 80 simulations can be found in **Exhibit 14** in the Appendix. Altogether, two trading rules generated reliably positive excess returns. One is a logit rule for the size dimension that uses E+/P+ spread as predictor, which measures earnings over the preceding year and removes negative earnings from the calculation, and generated an excess return of 4 basis points per month. The other one is a linear rule based on E+/P+ for the profitability dimension, which outperformed the long side (profitable stocks) by 2 basis points per month. In contrast, there is no evidence of successful timing rules in the market and value premium simulations.

The parametric rules in the above discussion use thresholds that are neutral to both sides of a premium. That is, one side is chosen as soon as it is predicted to outperform the other or the predicted probability of outperforming is higher than a coin toss. Alternatively we can apply other threshold values so that the criterion for investing in one side is more stringent than the other. For example, we can simulate a linear rule that switches to the short side

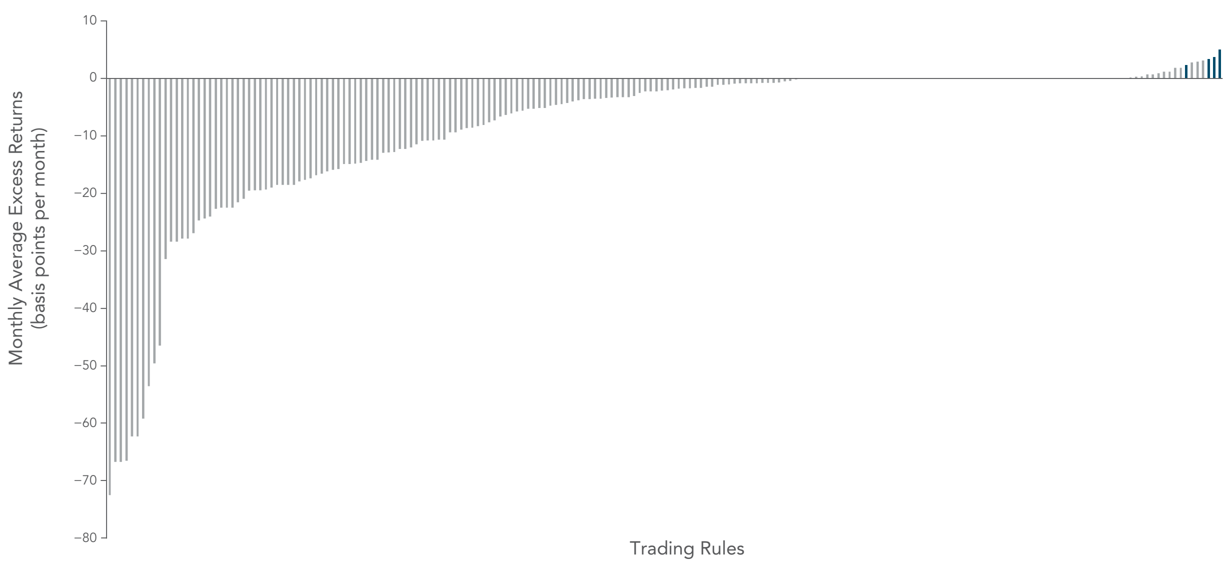
Exhibit 9: Monthly Average Excess Returns for 280 Linear Trading Rules



Monthly average excess returns for 280 linear trading rules using different threshold values (0, ±10, ±20, or ±50 basis points). The excess returns that are reliably positive (greater than two basis points per month and has a p-value below 0.05) are plotted in blue. The linear trading rules invest in the long side of each premium when the predicted future premium is greater than the threshold and switch to the short side when the prediction falls below the threshold. Model parameters are fitted using either all available data from the begin date to the trading day (expanding window), or the most recent 20 years prior to the trading day (rolling window).

The projections or other information generated by bootstrapped samples regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Results will vary with each use and over time.

Exhibit 10: Monthly Average Excess Returns for 200 Logit Trading Rules



Monthly average excess returns for 200 logit trading rules using different threshold values (20, 40, 50, 60, or 80 percent). The excess returns that are reliably positive (greater than two basis points per month and has a p-value below 0.05) are plotted in blue. The logit trading rules invest in the long side of each premium when the probability of future premium being positive is predicted to be higher than the threshold value and switch to the short side when the predicted probability falls below the threshold. Model parameters are fitted using either all available data from the begin date to the trading day (expanding window), or the most recent 20 years prior to the trading day (rolling window).

The projections or other information generated by bootstrapped samples regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Results will vary with each use and over time.

only when the predicted premium is sufficiently negative, e.g., -20 basis points per month. Similarly we can apply a different probability threshold to the logit model, so that the simulation remains in the long side unless its chance of outperforming the short side is predicted to be small.

We experimented with a number of threshold values, ±10, ±20, and ±50 basis points for linear rules and 20, 40, 60, and 80 percent for logit rules—these alternative choices amount to 400 additional simulations. **Exhibits 9 and 10** show the excess returns achieved by the linear and logit trading rules, respectively, using both neutral and alternative thresholds. Seven linear rules and four logit rules, which account for 2.5% and 2% of the simulations in their respective strategy category, produced a reliably positive excess return. Across all 480 parametric rules, the smallest and largest excess returns are -72 and 8 basis points per month, respectively, and the average is -10 basis points per month.

Exhibit 11 provides an overview of all the 680 trading simulations conducted in this study. Given the large number of simulations, we expect some to have low p-values just by chance—the fraction is called the "false discovery rate" in the statistics literature. For example, under a simplified multiple testing framework where trials are independent, about 5% of the trials are expected to have a p-value below 0.05 even if all the signals are pure noise. In light of this, the percentages observed here, 2.4% overall and 2% to 2.5% when grouped by simulation category, do not constitute strong evidence that one can reliably time the subsequent year's premiums using valuation spreads.

CONCLUSIONS

There has been a lot of research investigating the variables that can be used to time markets. This study is yet another attempt. The question is not whether one can find a variable that has worked in one regression or trading simulation—that is relatively easy—but whether a strategy can be expected to be profitable going forward. The latter demands a much more careful evaluation of the results.

Forecasting regressions provide a quick overview of the tendency of a predictor to move with future returns. A reliable coefficient coupled with a high R^2 is often a good starting point but far from proving the predictor's practical value. If an outcome largely depends on a few unusual data points—recall the impact on the regressions of excluding a single year from the sample—the outcome may not be representative of what should be expected going forward. From an implementation perspective, building strategies around such tenuous empirical relations is unlikely to increase the probability of investment success. On the other hand, even if the regression results were relatively robust, we would still need more information to assess whether a statistical relation is strong and stable enough to trade on. That is why we turn to strategy simulations for more insights.

Sixteen valuation ratio-based timing rules in this study have generated a reliably positive excess return. These seem to be promising results—if the remaining 97.6% of the 680 simulations were ignored or simply not shown. While good outcomes often attract the most attention, they can easily happen by chance, especially when there are a large

Exhibit 11: Overall Summary of the Trading Simulations by Each Category

Timing Strategies	Number of Simulations	Fraction with Reliably Positive Excess Returns	Excess Return (basis points per month) Average	Highest	Lowest
Nonparametric	200	2.5%	−12	14	−67
Parametric (Linear)	280	2.5%	−11	8	−71
Parametric (Logit)	200	2.0%	−9	5	−72
All	**680**	**2.4%**	**−10**	**14**	**−72**

A reliably positive excess return is defined as an excess return that is greater than two basis points per month and has a p-value below 0.05. Refer to Exhibits 8-10 and 12-14 for more details.

The projections or other information generated by bootstrapped samples regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Results will vary with each use and over time. Filters were applied to data retroactively and with the benefit of hindsight. Returns are not representative of indices or actual strategies and do not reflect costs and fees associated with an actual investment. Actual returns may be lower. Please see Appendix for data and sample universe descriptions.

number of simulations from which to cherry-pick. In fact, the observed success rate here is even lower than what is typically expected for independent multiple tests on purely random signals. More interestingly, going through all of the 680 simulation results reveals that not a single timing rule has consistently outperformed the simple buy-and-hold strategy across all four premiums.

Taking into account the above issues, there is fairly weak evidence supporting the predictive power of valuation spreads for future premiums at an annual horizon. This may be another piece of disappointing news, adding to the evidence on mean reversion-based timing strategies documented by Davis (2014) for investors who hope to exploit market timing opportunities. On the bright side, the ability to time the market is not a necessary condition for successful investment. For investors, building a broadly diversified portfolio with consistent focus on the reliable drivers of expected returns and continuously balancing the tradeoffs among competing premiums, diversification, and costs when managing the portfolio, appears to be a more reliable way to pursue higher expected returns.

APPENDIX

Premiums and Valuation Spreads

We use CRSP and Compustat data for US firms listed on the NYSE, AMEX, or NASDAQ, as well as the historical book equity data available on Ken French's website. In June of each year the stocks are sorted independently on market capitalization, book-to-market and profitability,[6] where the construction of the sorting variables follows Fama and French (1993, 2014). Based on the breakpoints (by percentage market capitalization) described below, stocks are sorted into value-weighted portfolios that represent the two sides of the premiums: small vs. big, value vs. growth, and high profitability vs. low profitability. The return premiums are then defined as the return difference between these pairs of portfolios.

Market premium: The return of the value-weighted market portfolio minus the one-month US Treasury bill rate.

Size premium: The return difference between a small portfolio and a big portfolio. The small portfolio consists of stocks with the lowest market capitalization that together make up 10% of the aggregate market capitalization. The big portfolio consists of stocks with the highest market capitalization that together make up 90% of the aggregate market capitalization.

Value premium: The return difference between a value portfolio and a growth portfolio. The value portfolio consists of stocks with the highest book-to-market ratios that together make up 30% of the aggregate market capitalization. The growth portfolio consists of stocks with the lowest book-to-market ratios that together make up 30% of the aggregate market capitalization.

Profitability premium: The return difference between a high profitability portfolio and a low profitability portfolio. The high profitability portfolio consists of stocks with the highest profitability that together make up 30% of the aggregate market capitalization. The low profitability portfolio consists of stocks with the lowest profitability that together make up 30% of the aggregate market capitalization.

In this study we focus on two valuation ratios, book-to-market and earnings-to-price, applied to the aggregate market or asset class level. More generally, for any value-weighted portfolio, the aggregate book-to-market ratio is the sum of book equity value of all firms in the portfolio divided by the sum of their market capitalization (or equivalently, the value-weighted average of individual firms' book-to-market ratios). The calculation of various earnings-to-price ratios follow a similar procedure: the numerator is the sum of firms' earnings—depending on the choices of measurement horizon and the treatment of negative earnings summarized in **Exhibit 3**, earnings are measured in the preceding year or averaged over the previous ten years with inflation adjustment, for all firms or excluding those with negative (average) earnings; the denominator is the sum of market capitalization of the firms that are included in the numerator.

The key variable to predict future premiums, the valuation spread, is the difference in valuation ratios between the portfolios underlying the two sides of the corresponding premium. For example, the book-to-market spread corresponding to the value premium is the book-to-market ratio of the value portfolio minus the book-to-market ratio of the growth portfolio. The spread corresponding to the size and profitability premiums are constructed in the same

6. Operating income before depreciation and amortization minus interest expense scaled by book equity.

way. In the case of the market premium where one side is the one-month US Treasury bill, the corresponding book-to-market spread is simply the book-to-market ratio of the value-weighted market portfolio. Replacing book-to-market with various earnings-to-price measures in the above definitions gives the definitions for corresponding earnings-to-price spreads.

Exhibit 12 The Results for a Set of Nonparametric Trading Rules Using an Expanding-Window Approach

			Market			Size			Value			Profitability		
Valuation	Break Point	Switch Back	Excess Return (bps/month)	p-value	% in Short	Excess Return (bps/month)	p-value	% in Short	Excess Return (bps/month)	p-value	% in Short	Excess Return (bps/month)	p-value	% in Short
B/M	0.1	0.1	−9	0.09	40%	−6	0.29	34%	−9	0.53	40%	−1	0.54	3%
	0.1	0.5	−28	0.14	63%	−12	0.09	83%	−8	0.24	71%	−1	0.54	3%
	0.2	0.2	−25	0.19	54%	−3	0.06	56%	−11	0.46	59%	−2	0.58	6%
	0.2	0.5	−39	0.20	76%	−14	0.13	86%	−9	0.22	79%	−1	0.39	12%
	0.5	0.5	−52	0.28	87%	−16	0.11	94%	−22	0.62	93%	0	0.26	18%
E/P	0.1	0.1	−22	0.53	39%	−7	0.48	30%	−12	0.64	33%	0	0.00	0%
	0.1	0.5	−37	0.48	73%	−5	0.06	88%	−7	0.17	85%	0	0.00	0%
	0.2	0.2	−28	0.65	45%	−4	0.35	33%	−7	0.32	55%	0	0.00	0%
	0.2	0.5	−37	0.49	73%	−5	0.06	88%	−8	0.18	88%	0	0.00	0%
	0.5	0.5	−45	0.51	85%	−5	0.05	88%	−11	0.24	94%	0	0.00	0%
E+/P+	0.1	0.1	−7	0.30	24%	−1	0.40	9%	−10	0.63	27%	0	0.00	0%
	0.1	0.5	−24	0.49	45%	6	0.06	24%	−10	0.34	70%	0	0.00	0%
	0.2	0.2	−13	0.43	30%	−2	0.28	27%	−10	0.40	61%	0	0.00	0%
	0.2	0.5	−24	0.50	45%	5	0.05	42%	−7	0.17	85%	0	0.00	0%
	0.5	0.5	−44	0.66	73%	5	0.02	73%	−6	0.14	91%	−3	0.48	18%
avg E/P	0.1	0.1	−26	0.61	42%	−10	0.70	29%	−1	0.16	67%	0	0.00	0%
	0.1	0.5	−63	0.75	96%	−15	0.50	75%	−14	0.24	96%	0	0.00	0%
	0.2	0.2	−39	0.69	58%	−19	0.71	58%	−13	0.27	83%	0	0.00	0%
	0.2	0.5	−67	0.73	100%	−15	0.46	79%	−14	0.19	96%	0	0.00	0%
	0.5	0.5	−67	0.72	100%	−20	0.57	83%	−15	0.21	100%	−1	0.55	4%
(avg E)+/P+	0.1	0.1	−33	0.82	38%	−1	0.41	8%	5	0.08	71%	0	0.00	0%
	0.1	0.5	−28	0.28	71%	−1	0.42	8%	−14	0.22	96%	0	0.00	0%
	0.2	0.2	−39	0.67	58%	−1	0.34	25%	−16	0.33	79%	0	0.00	0%
	0.2	0.5	−32	0.30	75%	1	0.24	29%	−14	0.22	96%	0	0.00	0%
	0.5	0.5	−61	0.71	96%	−3	0.28	46%	−15	0.21	100%	3	0.14	8%

For each trading rule, the monthly average excess return (in excess of the long side of each premium) and its bootstrapped p-value, as well as the percentage of years investing in the short side are shown. Excess returns that are reliably positive (greater than two basis points per month and has a p-value below 0.05) are highlighted in blue. The trading rules switch to the short side of each premium when the valuation spread is below the breakpoint of its historical distribution and switch back to the long side when the variable of interest exceeds the switchback point. The historical distribution uses all available data up to the trading day (June of each year), and a minimum of 20 years of past data is required. The simulation of each rule begins as soon as the corresponding premium and valuation data becomes available and there are enough observations to calculate the first trading signal.

Exhibit 13 The Results for a Set of Nonparametric Trading Rules Using a Rolling-Window Approach

			Market			Size			Value			Profitability		
Valuation	Break Point	Switch Back	Excess Return (bps/month)	p-value	% in Short	Excess Return (bps/month)	p-value	% in Short	Excess Return (bps/month)	p-value	% in Short	Excess Return (bps/month)	p-value	% in Short
B/M	0.1	0.1	−15	0.46	24%	−5	0.50	20%	5	0.07	29%	0	0.33	9%
	0.1	0.5	−25	0.35	46%	−1	0.05	49%	−12	0.44	64%	−1	0.31	21%
	0.2	0.2	−22	0.33	40%	−4	0.20	36%	−6	0.32	46%	3	0.08	12%
	0.2	0.5	−28	0.27	56%	−2	0.03	60%	−13	0.47	66%	−1	0.29	21%
	0.5	0.5	−42	0.39	70%	−6	0.06	69%	−13	0.44	69%	−2	0.25	33%
E/P	0.1	0.1	−11	0.39	27%	−8	0.64	21%	−14	0.78	27%	0	0.00	0%
	0.1	0.5	−35	0.65	58%	−8	0.27	58%	5	0.07	61%	0	0.00	0%
	0.2	0.2	−28	0.63	45%	−7	0.49	30%	−15	0.72	36%	−3	0.83	3%
	0.2	0.5	−39	0.69	61%	−8	0.29	58%	0	0.17	64%	0	0.31	6%
	0.5	0.5	−35	0.54	64%	−10	0.32	61%	2	0.07	76%	−8	0.61	33%
E+/P+	0.1	0.1	−15	0.64	21%	−1	0.29	21%	−8	0.60	27%	0	0.00	0%
	0.1	0.5	−27	0.68	42%	5	0.05	42%	14	0.01	73%	0	0.00	0%
	0.2	0.2	−22	0.59	36%	−5	0.38	30%	−2	0.21	55%	0	0.00	0%
	0.2	0.5	−30	0.66	45%	2	0.08	45%	12	0.01	76%	0	0.00	0%
	0.5	0.5	−36	0.60	61%	3	0.07	52%	10	0.02	82%	−10	0.76	33%
avg E/P	0.1	0.1	−33	0.80	38%	−8	0.71	21%	6	0.09	46%	0	0.00	0%
	0.1	0.5	−42	0.69	63%	−14	0.56	58%	−18	0.40	75%	0	0.00	0%
	0.2	0.2	−30	0.65	46%	−13	0.69	42%	−1	0.13	67%	0	0.00	0%
	0.2	0.5	−46	0.68	67%	−20	0.68	71%	−18	0.40	75%	0	0.00	0%
	0.5	0.5	−46	0.70	67%	−24	0.77	75%	−14	0.25	88%	−1	0.41	21%
(avg E)+/P+	0.1	0.1	−33	0.80	38%	2	0.24	17%	1	0.15	63%	0	0.00	0%
	0.1	0.5	−37	0.51	67%	3	0.18	25%	−22	0.55	67%	0	0.00	0%
	0.2	0.2	−30	0.63	46%	−1	0.30	33%	5	0.08	71%	0	0.00	0%
	0.2	0.5	−40	0.52	71%	−1	0.33	33%	−17	0.39	75%	0	0.00	0%
	0.5	0.5	−40	0.56	71%	−4	0.35	42%	−14	0.25	88%	−1	0.45	17%

For each trading rule, the monthly average excess return (in excess of the long side of each premium) and its bootstrapped p-value, as well as the percentage of years investing in the short side are shown. Excess returns that are reliably positive (greater than two basis points per month and has a p-value below 0.05) are highlighted in blue. The trading rules switch to the short side of each premium when the valuation spread is below the breakpoint of its historical distribution and switch back to the long side when the variable of interest exceeds the switchback point. The historical distribution uses the most recent 20 years prior to the trading day (June of each year). The simulation of each rule begins as soon as the corresponding premium and valuation data becomes available and there are enough observations to calculate the first trading signal.

Exhibit 14 The Results for a Set of Parametric Trading Rules Based on Linear and Logit Regression Models

		Market			Size			Value			Profitability		
	Valuation	Excess Return (bps/month)	p-value	% in Short	Excess Return (bps/month)	p-value	% in Short	Excess Return (bps/month)	p-value	% in Short	Excess Return (bps/month)	p-value	% in Short
Linear													
Expanding Window	B/M	−30	1.00	61%	−9	0.96	86%	−16	0.97	67%	−1	0.45	3%
	E/P	−12	0.93	21%	−4	0.55	42%	−17	0.87	27%	0	0.08	0%
	E+/P+	−1	0.66	9%	−4	0.72	27%	−2	0.46	30%	0	0.05	0%
	avg E/P	−20	0.93	21%	−26	0.99	58%	−20	0.83	46%	0	0.05	0%
	(avg E)+/P+	−28	0.98	25%	−2	0.72	38%	−16	0.74	50%	−1	0.34	4%
Rolling Window	B/M	−9	0.45	19%	−4	0.34	26%	−8	0.54	26%	−1	0.24	12%
	E/P	−11	0.72	21%	−12	0.79	42%	−27	0.96	24%	1	0.05	3%
	E+/P+	−11	0.73	18%	−3	0.36	42%	−12	0.66	21%	2	0.03	6%
	avg E/P	−8	0.61	8%	−29	0.99	46%	−20	0.83	46%	0	0.11	0%
	(avg E)+/P+	−8	0.63	8%	−2	0.36	38%	−15	0.72	54%	−1	0.26	4%
Logit													
Expanding Window	B/M	−2	0.85	1%	0	0.03	63%	−7	0.78	16%	−1	0.46	3%
	E/P	0	0.07	0%	−2	0.48	45%	−4	0.47	6%	−1	0.47	6%
	E+/P+	0	0.05	0%	4	0.03	39%	0	0.16	0%	0	0.07	0%
	avg E/P	−6	0.78	4%	−25	0.99	50%	−24	0.87	25%	0	0.08	0%
	(avg E)+/P+	−13	0.90	8%	−1	0.81	33%	−21	0.85	29%	−1	0.32	4%
Rolling Window	B/M	−3	0.33	14%	−5	0.28	40%	−15	0.87	21%	−2	0.35	9%
	E/P	−8	0.77	15%	−6	0.49	42%	−17	0.83	12%	2	0.05	15%
	E+/P+	−4	0.68	9%	−2	0.31	36%	−2	0.28	15%	1	0.07	9%
	avg E/P	0	0.04	0%	−22	0.97	33%	−28	0.90	42%	−3	0.40	8%
	(avg E)+/P+	0	0.05	0%	−1	0.39	33%	−28	0.90	42%	−4	0.46	8%

For each trading rule, the monthly average excess return (in excess of the long side of each premium) and its bootstrapped p-value, as well as the percentage of years investing in the short side are shown. Excess returns that are reliably positive (greater than two basis points per month and has a p-value below 0.05) are highlighted in blue. The linear trading rules invest in the long side of each premium when the predicted future premium is positive and switch to the short side when the prediction turns negative. The logit trading rules invest in the long side of each premium when the probability of future premium being positive is predicted to be higher than 50% and switch to the short side when the predicted probability falls below 50%. Model parameters are fitted using either all available data up to the trading day (expanding window) in which case a minimum of 20 years of past data is required, or the most recent 20 years prior to the trading day (rolling window). The simulation of each rule begins as soon as the corresponding premium and valuation data becomes available and there are enough observations to calculate the first trading signal.

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