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A Tale of Two Anomalies: Higher Returns of Low-Risk Stocks and Return Seasonality

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Abstract

Prior studies have shown that low beta and low volatility stocks earn higher average returns than high beta and high volatility stocks, contradicting the prediction of the capital asset pricing model and the fundamental relationship between risk and return. In this paper, we demonstrate that this phenomenon is driven by the seasonality of stock returns. We show that the risk-return tradeoff does hold in the nonsummer months, and that switching to a portfolio of low-risk stocks in summer outperforms—both in terms of absolute and in risk-adjusted returns—buy and hold strategies as well as the Sell in May strategy of switching to treasury bills in summer.

Keywords: low-risk anomaly, beta, idiosyncratic volatility, Halloween effect, sell in May, return seasonality

JEL Classifications: G11, G12, G14

1. Introduction

The fundamental concept of asset pricing is that investors are rewarded with higher returns in compensation for greater exposure to risk. There is a tradeoff

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between risk and return: if one invests in a portfolio with greater risk, then one can earn higher returns on average; and, if one invests in safe assets, one must expect to earn lower average returns.

The capital asset pricing model (CAPM), originally put forth by Sharpe (1964) and Lintner (1965), postulates that an asset's exposure to overall market movements is the relevant risk measure. In other words, the risk of an asset should be measured by the extent to which it contributes to the volatility of a well-diversified portfolio. These authors have pointed to beta, the measure of an asset's covariance with the market, as the relevant risk measure. Thus, according to CAPM, higher beta assets should command a higher average return to compensate investors for bearing higher risk. The CAPM theory also predicts that any risk that is idiosyncratic can be diversified away and will not command a risk premium: it will instead yield the same expected return as a risk-free asset.

Evidence has shown, however, that, at best, the market factor does not entirely explain how assets are priced, and, at worst, it is not a relevant factor. According to Black (1972), Black, Jensen and Scholes (1975), and Haugen and Heins (1975), the relationship between beta and return is much flatter than predicted by CAPM. Fama and French (1992) also find that the relationship between beta and returns is flat when controlling for size.

Baker, Bradley and Wurgler (2011), analyzing a period of 50 years from 1968 through 2008, find that high beta and high volatility stocks have consistently underperformed low beta and low volatility stocks. This finding not only contradicts CAPM, but it seemingly violates the very principle behind risk and return: low-risk portfolios seem to have yielded greater reward than high-risk portfolios. The finding begs the question: why are low beta and low volatility stocks priced as if they were less risky than high beta and high volatility stocks?

Ang, Hodrick, Xing and Zhang (2006, 2009) find that across a variety of countries, stocks with low idiosyncratic volatility (based on the Fama-French three-factor model) outperform stocks with high idiosyncratic volatility. That is, stocks appear to earn a negative risk premium when risk is measured in idiosyncratic volatility. This finding is interesting for two reasons. First, as noted earlier, CAPM suggests that idiosyncratic volatility should not be priced. Second, theories suggest that idiosyncratic volatility, if anything, should earn a positive risk premium. For example, Malkiel and Xu (2002) and Ewens, Jones and Rhodes-Kropf (2013) argue that idiosyncratic volatility is to be priced if investors are not fully able to diversify this risk.

Several explanations have been put forth in the literature for the observed "inverted" risk-reward relationship. Baker, Bradley and Wurgler (2011), for example, suggest benchmarking as an explanation; they argue that because mutual fund returns are typically compared to a benchmark, such as the Standard & Poor's 500, fund managers underweight low-risk investments that do not track the benchmark as well. Asness, Frazzini and Pedersen (2012) suggest that investors are averse to leverage; as a result, they prefer to invest in higher-risk stocks rather than leveraging low-risk stocks. Finally, the behavioral finance literature provides an explanation based on investors' preference for stocks that exhibit lottery-like characteristics; investors are willing to sacrifice expected return for a small chance at a large payout (Mitton and Vorkink 2007; Barberis and Huang, 2008; Kumar, 2009).

The key contribution of our paper is to provide an alternative explanation of the observed "inverted" relationship between risk and reward. We demonstrate that this phenomenon is related to the seasonality of stock returns. The seasonality of the overall market returns has been documented in Bouman and Jacobsen (2002), who show that a strategy of investing in the stock market in the nonsummer months and switching to treasury bills in summer outperforms a passive buy and hold strategy.[1] Jacobsen and Visaltanachoti (2009) also show the strength of this effect varies across sectors. We, however, demonstrate that high beta and high idiosyncratic volatility stocks display significantly greater seasonality than low beta and idiosyncratic volatility stocks. In fact, in summer, low beta stocks outperform high beta stocks, and similarly, low idiosyncratic volatility stocks outperform high idiosyncratic volatility stocks. We also show that in summer, stocks which are characterized by both low beta and low idiosyncratic volatility perform considerably better than stocks exhibiting only one of these characteristics. However, we demonstrate that higher-risk stocks do indeed earn higher returns in the nonsummer months. But, the nonsummer returns are dominated by the summer returns, leading to the overall annual results of high-risk stocks earning lower returns. Therefore, the "inversion" of the risk-reward relationship observed in many prior studies is in fact driven by the return seasonality of stocks.

Finally, we examine the portfolio implications of our findings. We show that seasonal strategies of switching to a portfolio of low beta and low idiosyncratic volatility stocks in summer performs better—not only in terms of average annual returns but also when measured in risk-adjusted performance—than buy and hold strategies. The switching strategies also earn higher returns than the "Sell in May" strategy, which stays invested in the overall market in the nonsummer months and in treasury bills during the summer. We thus show that it is not necessary to follow the adage of "Sell in May and Go Away"; one should stay in stocks, but hold a different set of stocks in summer than in nonsummer months.

2. Annual returns across risk characteristics

In this section, we demonstrate that low beta and low volatility stocks do outperform high beta and high volatility stocks. To undertake the analysis, we use the U.S. Stock Database provided by the CRSP. We construct a monthly rolling sample

[1] Haggard and Witte (2010) confirm that these results hold even after controlling for outliers and the January effect.

Table 1

Annual average returns (%), 1968–2012

All stocks in the sample are sorted by beta and idiosyncratic volatility, which are estimated at the start of each month using the previous five years of data, and placed into quintiles according to these estimates. The "sorted by beta" column shows the average return of the average beta quintile, and the "sorted by idiosyncratic volatility" column shows the performance of each idiosyncratic volatility quintile.

Quintile	Sorted by beta	Sorted by idiosyncratic volatility
Low	13.35	12.36
2	13.57	13.17
3	13.57	12.79
4	12.71	12.93
High	10.65	11.58
All	12.94	12.94

in which, at each month, we include all stocks that have data for the previous five years. As in Baker, Bradley and Wurgler (2011), we begin our analysis in 1968.

We calculate beta and idiosyncratic volatility at each month with respect to the Fama-French three-factor model using monthly data over the previous five years

$$r_{i,t} - r_{f,t} = \alpha^i + \beta^i_{MKT}\left(r_{M,t} - r_{f,t}\right) + \beta^I_{SMB} SMB_t + \beta^I_{HML} HML_t + \varepsilon^i_t,$$

where $(r_{i,t} - r_{f,t})$ is the excess return of the individual stock, $(r_{M,t} - r_{f,t})$ is the market excess return, SMB_t is the return difference between small and large stocks, and HML_t is the return difference between stocks with high and low book-to-market ratios.

Beta is defined as $\hat{\beta}^i_{MKT}$ and idiosyncratic volatility is defined as the SD of the error term, $\sqrt{var(\hat{\varepsilon}^i_t)}$. Data on the three factors, as well as the risk-free rate, were taken from Kenneth French's website.[2]

Each month, all stocks in the sample are ranked separately by both beta and idiosyncratic volatility and then sorted into quintiles for these two risk measures. We calculate these quintiles every month in our sample period; as a result, the constituents of each quintile change over time.

Table 1 shows the annual return of all stocks in the sample as well as the annual average returns of the stocks in the beta and idiosyncratic volatility quintiles. Note that throughout this paper, the average returns reported are actually log returns, found by taking the average monthly log return and scaling up by 12 to annualize it. The difference between average arithmetic returns and average log returns is increasing in volatility, and therefore, reporting average log returns enables us to achieve a

[2] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Table 2

Seasonality of the aggregate market, 1968–2012

The sample period is broken down into two seasonal periods: "nonsummer" and "summer," where summer is defined as May through October and nonsummer is defined as November through April. The table below shows the annualized average return of the portfolio of all stocks in the sample in the nonsummer and summer periods.

	Annualized returns (%)		
	Nonsummer	Summer	Difference
All stocks	23.70	2.18	21.52
Treasury rate	5.12	5.26	−0.14
Excess return	18.59	−3.08	21.66

conservative estimate of the average return difference between low and high volatility stocks.

The results in Table 1 are consistent with those in previous studies: average return is generally declining in beta and idiosyncratic volatility. Our finding seems to conflict with the fundamental idea of the risk-return tradeoff; we find instead that, on average, low-risk stocks have earned higher returns than stocks with higher risk, when risk is measured by a stock's beta or its idiosyncratic volatility.

3. Seasonality across characteristics

In this section, we examine more closely the reasons for the apparently inverted relationship between risk and return of stocks. We show that this phenomenon is explained in large part by the return seasonality of stocks: the "inversion" of the expected relationship occurs in summer. We first show that the aggregate stock market displays strong seasonality. We then demonstrate that this seasonality varies across stocks: riskier stocks have far more pronounced seasonality.

Table 2 shows the average annualized returns of the aggregate market across nonsummer and summer months for our sample period of 1968–2012. As in Bouman and Jacobsen (2002), summer is defined as the period from May through October, and nonsummer is November through April.

We see that, on average, the annualized return of the overall market during the summer months is more than 21% lower than that during the nonsummer months. Similarly, while the excess return of the stock market in nonsummer months is over 18%, the excess return in the summer is negative. These findings explain why, in the academic literature and popular press, a portfolio strategy has emerged that involves investing in the stock market in the nonsummer months and switching to the risk-free asset in summer. The associated adage, "Sell in May and Go Away," refers to the fact that investors are encouraged to switch entirely out of the stock market in summer since treasury bills yield higher returns (over 3%) than the overall market.

Table 3

Seasonality across beta and idiosyncratic volatility quintiles, 1968–2012

Stocks in Panel A are sorted by beta and stocks in Panel B are sorted by idiosyncratic volatility, which are estimated at the start of each month using the previous five years of data, and placed into quintiles. In addition, the sample period is broken down into two seasonal periods: "nonsummer" and "summer," where summer is defined as May through October and nonsummer is defined as November through April. The table below shows the annualized average return of each beta and idiosyncratic volatility quintile across the summer and nonsummer periods. In Panel A, "Low_B less $High_B$" refers to amount by which the low beta quintile outperforms the high beta quintile. In Panel B, "Low_{IV} less $High_{IV}$" refers to amount by which the low idiosyncratic volatility quintile outperforms the high idiosyncratic volatility quintile.

	Annualized returns (%)		
Quintile	Nonsummer	Summer	Difference
Panel A: Stocks sorted by beta			
Low_B	22.48	4.22	18.25
2	22.16	4.97	17.20
3	23.74	3.40	20.34
4	24.79	0.64	24.15
$High_B$	24.50	−3.20	27.70
Low_B less $High_B$	−2.02	7.42	
Panel B: Stocks sorted by idiosyncratic volatility			
Low_{IV}	16.72	8.00	8.72
2	21.37	4.97	16.40
3	23.84	1.74	22.10
4	26.72	−0.86	27.58
$High_{IV}$	27.50	−4.34	31.85
Low_{IV} less $High_{IV}$	−10.79	12.34	

Next, we demonstrate that the return seasonality varies considerably across stocks with different levels of risk, measured by beta and idiosyncratic volatility. The average annualized returns of the beta and idiosyncratic volatility quintiles across nonsummer and summer months are shown in Tables 3, for the sample period 1968–2012.

We first see that seasonality, as measured by the difference between summer and nonsummer returns, is increasing in both beta and idiosyncratic volatility. The return seasonality is particularly pronounced for the highest beta and the highest idiosyncratic volatility stocks; for these stocks, the annualized average returns in the nonsummer months are more than 27% and 31% greater than those in the summer months. Recall from Table 2 that for the overall market, the corresponding difference was less than 22%.

We also observe that the "inversion" of the risk-return relationship is only evidenced in the summer months: the returns in summer are generally declining in both beta and volatility. We find that the lowest beta quintile earns more than 7% higher return than the highest beta quintile during the summer months; similarly, the lowest idiosyncratic volatility quintile earns more than 12% higher return than the highest idiosyncratic volatility quintile during summer. However, the pattern of risk-return "inversion" does not hold in the nonsummer months: high beta and high idiosyncratic volatility stocks do indeed outperform low beta and volatility stocks in the nonsummer months. In fact, when risk is measured by idiosyncratic volatility, riskiest stocks earn on average nearly 11% higher annualized returns than lowest risk stocks during the nonsummer months. Furthermore, the portfolio of all stocks actually achieves higher average returns than the low beta quintile stocks or the low idiosyncratic volatility quintile stocks in the nonsummer months.

We find that the results in Table 1 in which annual stock returns were generally declining in both beta and volatility does not hold throughout the entire year. Instead, that phenomenon occurs only during the summer months, and the summer effect dominates the return pattern in the nonsummer months, yielding an "inverted" risk-return pattern for the overall year.

Since one can earn greater returns in summer by taking advantage of beta and idiosyncratic volatility effects, it is natural to examine the returns of portfolios formed based on both characteristics. In particular, we take the stocks that reside in both the lowest beta and the lowest idiosyncratic volatility quintiles (denoted by Low_{B} & Low_{IV} in Table 3); separately, we consider the set of stocks that reside in both the highest beta and the highest idiosyncratic volatility quintiles (denoted by High_{B} & High_{IV} in Table 3). These two sets of stocks allow us to create two separate portfolios, which we denote as Low_{B} & Low_{IV} and High_{B} & $\text{High}_{\text{IV.}}$ We show the annualized average returns of these two portfolios across the nonsummer and summer months in Table 4.

In the intersection of these extreme cases, we can see that seasonality is even more pronounced than when stocks are sorted based on only one characteristic. The lowest beta and idiosyncratic volatility portfolio has a difference of 6% between the annualized average returns of the two seasons, whereas this difference for the highest beta and highest idiosyncratic volatility portfolio is over 32%.

Table 4 also shows the larger "inversion" of risk-return relationship during the summer months; low-risk stocks now earn almost 16% higher returns than the high-risk stocks. By contrast, in the nonsummer months, the expected relationship between risk and return holds: high-risk stocks earn more than 10% higher returns than the low-risk stocks.

Another less direct way to combine the beta and idiosyncratic volatility effects is to sort stocks based on total volatility, as total volatility includes volatility related to the overall market, as measured by beta, and idiosyncratic volatility. The results, displayed in Table A1, show that similar results hold: low volatility stocks outperform high volatility stocks in the summer, but the opposite is true in nonsummer months.

Table 4

Seasonality of combined effects, 1968–2012

All stocks in the sample are sorted by beta and idiosyncratic volatility, which are estimated at the start of each month using the previous five years of data, and placed into quintiles according to these estimates. Based on this sorting, two portfolios are created: the Low_B & Low_{IV} portfolio contains stocks that are in both the lowest beta and lowest idiosyncratic volatility quintiles, and the $High_B$ & $High_{IV}$ portfolio contains stocks that are in both the highest beta and highest idiosyncratic volatility quintiles. In addition, the sample period is broken down into two seasonal periods: "nonsummer" and "summer," where summer is defined as May through October and nonsummer is defined as November through April. The average annualized return of each portfolio across summer and nonsummer periods is shown. Low_B & Low_{IV} less $High_B$ & $High_{IV}$ refers to the amount by which the portfolio of lowest beta and idiosyncratic volatility stocks outperforms the portfolio of highest beta and idiosyncratic volatility stocks.

	Annualized returns (%)		
Portfolio	Nonsummer	Summer	Difference
Low_B & Low_{IV}	15.28	8.99	6.29
$High_B$ & $High_{IV}$	25.38	−6.73	32.11
Low_B & Low_{IV} less $High_B$ & $High_{IV}$	−10.10	15.72	

In Table A2, we show that our results are not driven by an anomalous period. We break the sample into smaller subperiods of approximately a decade long and show that low beta and idiosyncratic volatility stocks outperform high beta and idiosyncratic volatility stocks in the summer in each decade. The results are robust regardless of the sample period.

The results are also not driven by the inclusion of small stocks in the sample. In Table A3, we limit the sample at each date to the largest 500 stocks by market capitalization, and the results continue to hold.

Finally, in Table A4, we show that our results are not explained by sectoral differences. Jacobsen and Visaltanachoti (2009) find differences in return seasonality among various sectors: sectors with strong seasonality tend to be procyclical, such as the raw materials and production sectors. By contrast, sectors displaying weak return seasonality tend to be defensive consumer-oriented sectors related to products with short lifespans. To explore industry differences, we use the Standard Industrial Classification code (according to French's website) to classify our universe of stocks into the 17 industries considered in Jacobsen and Visaltanachoti (2009). While we confirm their results, we also discover that our results are not fully explained by sectoral differences. When we sort stocks by beta and idiosyncratic volatility within each sector and conduct the analysis separately for each sector, we find the same result: low beta and idiosyncratic volatility stocks outperform high beta and idiosyncratic volatility stocks in the summer, for all sectors. However, the degree of this outperformance does vary by sector.

Table 5

Buy and hold strategies, 1968–2012

All stocks in the sample are sorted by beta and idiosyncratic volatility, which are estimated at the start of each month using the previous five years of data, and placed into quintiles according to these estimates. Then, portfolios are formed based on these quintiles. Strategy 1 refers to the portfolio of all stocks in the sample, strategy 2 refers to the portfolio of stocks in the lowest beta quintile, strategy 3 refers to the portfolio of stocks that are in both the lowest beta and lowest idiosyncratic volatility quintiles, strategy 4 refers to the portfolio of stocks in the highest beta quintile, and strategy 5 refers to stocks that are in both the highest beta and highest idiosyncratic volatility quintiles. For each strategy, the table shows the average annualized return, the volatility of excess returns, and the Sharpe and Sortino ratios.

				Performance ratios	
#	Portfolio	Returns (%)	Vol (%)	Sharpe	Sortino
1	All Stocks	12.94	19.28	0.4023	0.6124
2	Low_{B}	13.35	16.06	0.5083	0.8194
3	Low_{B} & Low_{IV}	12.13	9.59	0.7245	1.2309
4	High_{B}	10.65	26.81	0.2038	0.3000
5	High_{B} & High_{IV}	9.33	31.97	0.1295	0.1924

4. Portfolio strategies

In this section, we consider the portfolio strategy implications of our seasonality results. We first analyze the performance of various buy and hold strategies. These results provide the benchmark for comparison for the performance of the various switching strategies, which are the focus of this section.

Table 5 contains the performance statistics of the buy and hold strategies. In the second and third columns of this table, we show the average annualized return and the annualized volatility of excess returns (over the risk-free rate). In the fourth and fifth columns, we use two risk-adjusted performance measures: the Sharpe ratio and the Sortino ratio. The Sharpe ratio is the ratio of the mean excess return to the SD of excess returns. The Sortino ratio, on the other hand, is a measure that only takes downside risk into account. Specifically, the discretized version of the annualized Sortino ratio is given by

$$Sortino\ Ratio = \frac{\frac{1}{n}\sum_{i=1}^{n}(r_{i,t} - r_{f,t})}{\sqrt{\frac{1}{n}\sum_{i=1}^{n}\min(0, r_{i,t})^2}} \times \sqrt{12}.$$

Based on these results, one might conclude that investing in a portfolio of lowest beta (i.e., Low_{B}) achieves the best results: this portfolio earns higher returns relative to other buy and hold alternatives. In addition, on a risk-adjusted basis, one might conclude that the portfolio of lowest beta and lowest idiosyncratic volatility stocks (i.e., the Low_{B} & Low_{IV} portfolio) performs the best: it has the highest Sharpe and Sortino ratios.

Table 6

Switching strategies, 1968–2012

All stocks in the sample are sorted by beta and idiosyncratic volatility, which are estimated at the start of each month using the previous five years of data, and placed into quintiles according to these estimates. In addition, the sample period is broken down into two seasonal periods: "nonsummer" and "summer," where summer is defined as May through October and nonsummer is defined as November through April. Strategies that involve holding different portfolios in summer and nonsummer months are analyzed. "All Stocks" refers to the portfolio of all stocks in the sample, "All Stocks × 2 (leveraged)" refers to investing 200% of the value of your assets in the portfolio of all stocks by borrowing the value of your assets at the risk-free rate, and "Treasury Bills" are assumed to achieve a rate of return proportional to the three-month Treasury-bill rate. "Low_B" refers to the portfolio of stocks in the lowest beta quintile, "$High_B$" refers to the portfolio of stocks in the highest beta quintile, "Low_B & Low_{IV}" refers to the portfolio of stocks in both the lowest beta and lowest idiosyncratic volatility quintiles, and "$High_B$ & $High_{IV}$" refers to the portfolio of stocks in both the highest beta and highest idiosyncratic volatility quintiles. For each strategy, the table shows the average annualized return, the volatility of excess returns, and the Sharpe and Sortino ratios.

					Performance ratios	
#	Nonsummer	Summer	Annual returns (%)	Vol (%)	Sharpe	Sortino
1	All Stocks	Treasury Bills	14.48	13.43	0.6919	1.3225
2	All Stocks × 2 (leveraged)	Treasury Bills	23.77	26.86	0.6919	1.2802
3	All Stocks	Low_B & Low_{IV}	16.35	14.83	0.7527	1.3437
4	Low_B	Low_B & Low_{IV}	15.73	13.59	0.7762	1.4241
5	$High_B$	Low_B & Low_{IV}	16.74	19.41	0.5955	1.0404
6	$High_B$ & $High_{IV}$	Low_B & Low_{IV}	17.19	23.88	0.5025	0.8677

However, in light of the pronounced seasonality of returns, one would be expected to improve performance relative to buy and hold by implementing switching strategies: holding a different set of stocks in the summer and nonsummer months. The main thrust of these strategies is to take advantage of both return patterns observed earlier in the paper, seasonality, and risk-return "inversion."

In Table 6, we show the performance characteristics of various switching strategies. We first consider the traditional "Sell in May" strategy which switches from the overall market in nonsummer months to the risk-free asset in summer months. Although this strategy earns only about 1.5% higher average return than staying in the market throughout the year, it yields considerably higher Sharpe and Sortino ratios. In fact, this strategy's Sortino ratio is more than double than that of staying in the market throughout the year.

We also consider a second Sell in May strategy that involves investing 100% in the stock market on average throughout the year: invest in treasury bills in the summer, and invest doubly in the stock market during the nonsummer months by leveraging at the risk-free rate. One can earn returns of over 23% with this strategy, if one is willing to accept a high volatility. This strategy also earns the same Sharpe ratio and a slightly lower Sortino ratio. In addition, if one were to take into account the fact that most investors cannot borrow at the risk-free rate, the performance measure would decline further.

Next, we consider four other switching strategies, all of which involve investing in the portfolio of lowest beta and lowest idiosyncratic volatility stocks in the summer. This choice during summer is motivated by results reported in Table 4, which show that this intersection portfolio outperforms all beta or idiosyncratic volatility quintiles during summer.

Based on Table 6, we first observe that given a strategy which invests in all stocks in nonsummer months, switching to the portfolio of lowest beta and lowest idiosyncratic volatility stocks (i.e., the Low_B & Low_{IV} portfolio) in the summer has higher risk-adjusted returns, as measured by Sharpe and Sortino ratios, than the strategy that involves switching to treasury bills in summer. Hence, rather than taking the advice of "Sell in May and Go Away," it is better to stay in stocks during the summer months and invest in a portfolio of the lowest beta and lowest idiosyncratic volatility stocks.

Turning to the remaining three switching strategies in Table 6, the portfolio choice for the nonsummer months is not clear-cut. The final row in this table shows that it is indeed possible to earn higher returns during the nonsummer months by investing in riskier stocks, in particular, the highest beta and the highest idiosyncratic volatility stocks. Although this strategy earns the highest annualized return of 17.2%, it comes at the cost of higher volatility and downside risk, as evidenced by the lower Sharpe and Sortino ratios. Based on the risk-adjusted performance measures, it is clear from Table 6 that the fourth switching strategy of holding lowest beta stock in nonsummer and holding lowest beta and lowest idiosyncratic volatility stocks in the summer yields the highest Sharpe (0.78) and Sortino (1.42) ratios.

It is clear from a comparison of Tables 5 and 6, however, that these switching strategies each outperform their corresponding buy and hold strategies in terms of both annualized return and risk-adjusted performance metrics. For example, if one were to invest in a portfolio of high beta stocks in the nonsummer, the annual return of the strategy that involves switching to the portfolio of low beta and low idiosyncratic volatility stocks in the summer (Table 6, Strategy #5) would be more than 6% greater than that of holding the high beta portfolio throughout the year (Table 5, Strategy #4).

It is also important to consider whether transaction costs will erode the performance improvement of the switching strategies. In our analysis, we assume that portfolios are formed on a monthly basis. However, this does not have to be the case. One can form portfolios twice per year, in May and November, when it is necessary to switch; in fact, we show the results of this analysis in Tables B1 and B2 of Appendix B and find that there were no meaningful changes to the strategy returns. Thus, if a biannual rotation cycle is adopted, switching strategies involves changing your portfolios only twice per year. Consequently, we do not expect transaction costs to be significant.

5. Conclusion/Discussion

Previous literature shows that average returns generally decline with higher risk. This finding seems to contradict the very concept of the risk-return tradeoff that underlies asset pricing theories. In this paper, we show that this phenomenon is related to the seasonality of the stock market.

We show that during the summer months, riskier stocks do earn lower returns, but that is not the case in the nonsummer months. However, the summer effect dominates, yielding the "inverted" relationship between risk and annual returns documented in many prior studies.

Some explanations of the Sell in May effect have posited that assets are priced correctly on average, but an increase in market-wide risk aversion causes prices to decrease in the summer. Then, when risk aversion returns to former levels after October, prices return to normal. Some causes of this change in risk aversion in the literature include vacations (Bouman and Jacobsen, 2002) and changes in mood due to temperature (Cao and Wei, 2005). While this can explain the disparity of returns between summer and nonsummer months, it cannot explain why the summer effect dominates average returns throughout the year.

On the other side, explanations of the low-risk anomaly focus on investors' appetite for risk. However, our results suggest that these explanations must detail why this appetite for risk is strongest in the summer. For example, Kumar (2009) documents investors' preference for stocks with lottery-like characteristics. However, if this preference can explain the low-risk anomaly, then the literature must then answer why this preference is so much stronger in the summer than in the nonsummer months. Kamstra, Kramer and Levi (2003) do indeed offer one potential explanation: changes in mood due to Seasonal Affective Disorder (SAD) cause investors to have a strong appetite for risk in the summer. However, one may be naturally skeptical that the effect of SAD is so drastic, even among sophisticated institutional investors, as to invert the risk-return relationship in the summer and restore it to normal levels in the nonsummer months.

Therefore, these results open the door for future avenues of research. First, since none of the previous papers offer a compelling reason why market-wide risk aversion might change during the summer, finding an explanation (confirmed by empirical data) would be an important next step. Second, it will be useful to explore the extent to which the low-risk anomaly and the Sell in May effect are related in international markets, in both developed and developing countries.

Even though the risk premium for the aggregate stock market becomes negative in summer, our results suggest that it is not necessary to "Sell in May and Go Away." There is a subset of stocks that performs well in the summer: they are characterized by lowest beta and lowest idiosyncratic volatility. We show that switching to a portfolio of such stocks in the summer outperforms switching to treasury bills during summer. In addition, we show that strategies that switch to the lowest beta and lowest idiosyncratic volatility stocks outperform the corresponding buy and hold strategies both in terms of average return and in terms of Sharpe and Sortino ratios.

Appendix A

Robustness of seasonality results

Table A1

Seasonality across total volatility quintiles, 1968–2012

All stocks in the sample are sorted by total volatility of excess returns, which is estimated at the start of each month using the previous five years of data, and placed into quintiles. In addition, the sample period is broken down into two seasonal periods: "nonsummer" and "summer," where summer is defined as May through October and nonsummer is defined as November through April. The table below shows the annualized average return of each volatility quintile across the summer and nonsummer periods. "Low_{TV} less $High_{TV}$" refers amount by which the low volatility quintile outperforms the high volatility quintile.

	Annualized returns (%)		
Quintile	Nonsummer	Summer	Difference
Low_{TV}	16.20	8.40	7.80
2	21.13	4.96	16.17
3	24.23	1.88	22.35
4	27.02	−0.79	27.81
$High_{TV}$	27.41	−5.10	32.51
Low_{TV} less $High_{TV}$	−11.21	13.50	

Table A2

By decade, 1968–2012

All stocks in the sample are sorted by beta and idiosyncratic volatility, which are estimated at the start of each month using the previous five years of data, and placed into quintiles according to these estimates. Based on this sorting, two portfolios are created: the portfolio that contains stocks that are in both the lowest beta and lowest idiosyncratic volatility quintiles, and the portfolio that contains stocks that are in both the highest beta and highest idiosyncratic volatility quintiles. In addition, the sample period is broken down into two seasonal periods: "nonsummer" and "summer," where summer is defined as May through October and nonsummer is defined as November through April. The table below shows the amount by which the low beta and idiosyncratic volatility portfolio outperforms the high beta and idiosyncratic volatility portfolio across each decade and across the summer and nonsummer periods.

	Low less high beta and idiosyncratic volatility annualized return difference (%)	
Period	Nonsummer	Summer
1968–1979	−6.02	14.01
1980–1989	0.35	27.86
1990–1999	−24.44	3.49
2000–2012	−10.89	17.36

Table A3

Sorted using only the largest 500 stocks, 1968–2012

At the start of each month, the largest 500 stocks by market capitalization are sorted by beta and idiosyncratic volatility, using the previous five years of data, and placed into quintiles according to these estimates. Then, based on this sorting, two portfolios are created: the Low_B & Low_{IV} portfolio contains stocks that are in both the lowest beta and lowest idiosyncratic volatility quintiles, and the $High_B$ & $High_{IV}$ portfolio contains stocks that are in both the highest beta and highest idiosyncratic volatility quintiles. In addition, the sample period is broken down into two seasonal periods: "nonsummer" and "summer," where summer is defined as May through October and nonsummer is defined as November through April. The average annualized return of each portfolio across summer and nonsummer periods is shown. Low_B & Low_{IV} less $High_B$ & $High_{IV}$ refers to the amount by which the portfolio of lowest beta and idiosyncratic volatility stocks outperforms the portfolio of highest beta and idiosyncratic volatility stocks.

	Annualized returns (%)		
Portfolio	Nonsummer	Summer	Difference
Low_B & Low_{IV}	11.59	9.51	2.08
$High_B$ & $High_{IV}$	16.83	−2.69	19.51
Low_B & Low_{IV} less $High_B$ & $High_{IV}$	−5.24	12.20	

Table A4

Sorted within sectors, 1968–2012

All stocks in the sample are classified into the 17 sectors, considered in Jacobsen and Visaltanachoti (2009), as defined on Kenneth French's website.[a] Stocks within each sector are then sorted by beta and idiosyncratic volatility, which are estimated at the start of each month using the previous five years of data, and placed into quintiles according to these estimates. Based on this sorting, two portfolios are created for each sector: the Low_B & Low_{IV} portfolio contains stocks that are in both the lowest beta and lowest idiosyncratic volatility quintiles, and the $High_B$ & $High_{IV}$ portfolio contains stocks that are in both the highest beta and highest idiosyncratic volatility quintiles. In addition, the sample period is broken down into two seasonal periods: "nonsummer" and "summer," where summer is defined as May through October and nonsummer is defined as November through April. The table below shows the amount by which the lowest beta and idiosyncratic volatility stocks outperformed the highest beta and idiosyncratic volatility stocks within each sector, across nonsummer and summer months.

	Low less high beta and idiosyncratic volatility annualized return difference (%)	
Sector name	Nonsummer	Summer
Food	−1.47	16.50
Mines	10.45	16.33
Oil	−2.48	14.72
Clothing	5.19	20.93
Consumer durables	5.64	6.42

(*Continued*)

Table A4 (*Continued*)

Sorted within sectors, 1968–2012

	Low less high beta and idiosyncratic volatility annualized return difference (%)	
Sector name	Nonsummer	Summer
Chemicals	2.62	24.00
Consumer	0.34	11.17
Construction	1.42	21.49
Steel	−3.57	17.06
Fabricated products	19.06	25.33
Machinery	−4.64	11.77
Cars	20.21	10.78
Transportation	3.10	16.44
Utilities	−5.75	6.53
Retail stores	−6.70	19.52
Finance	−16.78	18.26
Other	−6.82	13.95

[a]http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Appendix B

Portfolio strategy returns, rebalancing biannually

Table B1

Buy and hold strategies, 1968–2012

All stocks in the sample are sorted by beta and idiosyncratic volatility, which are estimated at the start of each May and November using the previous five years of data, and placed into quintiles according to these estimates. Then, portfolios are formed based on these quintiles. Strategy 1 refers to the portfolio of all stocks in the sample, strategy 2 refers to the portfolio of stocks in the lowest beta quintile, strategy 3 refers to the portfolio of stocks that are in both the lowest beta and lowest idiosyncratic volatility quintiles, strategy 4 refers to the portfolio of stocks in the highest beta quintile, and strategy 5 refers to stocks that are in both the highest beta and highest idiosyncratic volatility quintiles. For each strategy, the table shows the average annualized return, the volatility of excess returns, and the Sharpe and Sortino ratios.

				Performance ratios	
#	Portfolio	Returns (%)	Vol (%)	Sharpe	Sortino
1	All Stocks	13.00	19.24	0.4063	0.6191
2	Low_B	11.11	26.73	0.2217	0.3293
3	Low_B & Low_{IV}	9.63	31.84	0.1395	0.2093
4	$High_B$	13.30	15.92	0.5094	0.8173
5	$High_B$ & $High_{IV}$	12.11	9.66	0.7171	1.2236

Table B2

Switching strategies, 1968–2012

All stocks in the sample are sorted by beta and idiosyncratic volatility, which are estimated at the start of each May and November using the previous five years of data, and placed into quintiles according to these estimates. In addition, the sample period is broken down into two seasonal periods: "nonsummer" and "summer," where summer is defined as May through October and nonsummer is defined as November through April. Strategies that involve holding different portfolios in summer and nonsummer months are analyzed. "All Stocks" refers to the portfolio of all stocks in the sample, "All Stocks × 2 (leveraged)" refers to investing 200% of the value of your assets in the portfolio of all stocks by borrowing the value of your assets at the risk-free rate, and "Treasury Bills" are assumed to achieve a rate of return proportional to the three-month Treasury-bill rate. "Low_B" refers to the portfolio of stocks in the lowest beta quintile, "$High_B$" refers to the portfolio of stocks in the highest beta quintile, "Low_B & Low_{IV}" refers to the portfolio of stocks in both the lowest beta and lowest idiosyncratic volatility quintiles, and "$High_B$ & $High_{IV}$" refers to the portfolio of stocks in both the highest beta and highest idiosyncratic volatility quintiles. For each strategy, the table shows the average annualized return, the volatility of excess returns, and the Sharpe and Sortino ratios.

					Performance ratios	
#	Nonsummer	Summer	Annual returns (%)	Vol (%)	Sharpe	Sortino
1	All Stocks	Treasury Bills	14.48	13.40	0.6931	1.3260
2	All Stocks × 2 (leveraged)	Treasury Bills	23.77	26.81	0.6931	1.2834
3	All Stocks	Low_B & Low_{IV}	16.43	14.82	0.7583	1.3559
4	Low_B	Low_B & Low_{IV}	15.61	13.50	0.7720	1.3949
5	$High_B$	Low_B & Low_{IV}	17.34	19.47	0.6243	1.1133
6	$High_B$ & $High_{IV}$	Low_B & Low_{IV}	17.93	23.95	0.5320	0.9374

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