Momentum and Downside Risk

Abstract

We examine whether time-variation in the profitability of momentum strategies is related to variation in macroeconomic conditions. We find reliable evidence that the momentum strategy exposes investors to greater downside risk. Momentum strategies deliver economically large and statistically reliable negative profits in bad economic states when the expected market risk premium is high, whereas positive profits in good economic states when the expected market risk premium is low. Our results are robust to alternative constructions of momentum portfolios, out-of-sample estimation of the expected market risk premium, and after controlling for the January effect, lagged market return, and investor sentiment.

JEL classification: G12; G14

Keywords: Momentum; Economic state; Expected market risk premium

1 Introduction

The pioneering work of Jegadeesh and Titman (1993) shows that the simple investing strategy of buying prior winners and selling prior losers generates significant profits both statistically and economically. Subsequent work has confirmed the robustness of this momentum effect.[1] There is substantial debate regarding the source of the profitability of momentum strategies.[2]

A recent and growing empirical literature on *time-series* analysis of momentum provides evidence that time-variation in momentum profits is not related to macroeconomic risk, but rather is consistent with theoretical predictions from behavioral models. Liew and Vassalou (2000) find that, whereas the Fama-French factors, HML and SMB, contain significant information about future GDP growth, momentum is not related to future economic growth. Griffin, Ji, and Martin (2003) provide international evidence that momentum profits are positive in both good and bad states, incompatible with the view that momentum is a reward for priced business cycle risk. Cooper, Gutierrez, and Hameed (2004) show that payoffs to momentum strategies are dependent on the lagged three-year market return, and they interpret their findings are consistent with behavioral models of momentum. Antoniou, Doukas, and Subrahmanyam (2013) study an intertemporal relation between momentum profits and investor sentiment and find that momentum profits arise mainly during periods of investor optimism.

We reexamine whether time-variation in the profitability of momentum strategies is related to variation in macroeconomic conditions. We adopt the novel approach taken by Lakonishok, Shleifer, and Vishny (1994) to determine whether momentum strategies expose

[1]Rouwenhorst (1998) documents that a momentum strategy works in international markets. Jegadeesh and Titman (2001) show that momentum profits persist even after the period covered by the 1993 study.

[2]Several behavioral and rational explanations for momentum have been suggested. Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), and Hong and Stein (1999) each posit a different behavioral or cognitive bias as causing the momentum anomaly. Empirical studies supporting these behavioral explanations of momentum include Jegadeesh and Titman (2001), Jiang, Lee, and Zhang (2005), Zhang (2006), and Chui, Titman, and Wei (2010). Studies exploring risk-based explanations of momentum include Berk, Green, and Naik (1999), Johnson (2002), Ahn, Conrad, and Dittmar (2003), Sagi and Seasholes (2007), and Liu and Zhang (2008).

investors to greater downside risk. Lakonishok, Shleifer, and Vishny (1994) argue that a strategy would be fundamentally risky if, first, there are at least some states of the world in which the strategy underperforms, and second, these periods of underperformance are, on average, "bad" states, in which the marginal utility of wealth is high, making the strategy unattractive to risk-averse investors. To investigate time-variation in the profitability of momentum strategies, we first define bad times as periods during which the expected market risk premium has high values, and good times as periods during which the expected market risk premium has low values. Specifically, four economic states are classified by lowest to highest expected market risk premium values: "peak," "expansion," "recession," and "trough." We then estimate average momentum profits conditional on each economic state and examine whether the profitability of momentum strategies varies depending on the state of the economy.

Our main findings are easy to summarize. First, momentum strategies lose money when investors need most, exposing investors to greater downside risk. During the period from 1960 to 2011, the average momentum profit is an economically large and statistically reliable negative –2.23% per month (t-value = –2.90) in bad times when the expected market risk premium is highest. This result is robust to the benchmark risk adjustments and after controlling for the January effect. In the "trough" state, the CAPM-adjusted and Fama-French-adjusted profits are –2.08% (t-value = –2.74) and –2.06% (t-value = –2.81) per month, respectively. When excluding January, a momentum strategy still delivers a large negative profit of –1.72% per month (t-value = –2.28) when the economy is in the "trough" state.

Second, the payoffs to momentum strategies tend to positively covary with macroeconomic conditions. As shown in Figure 1, the average momentum profits are 1.86%, 1.10%, 0.87%, and –2.23% in the "peak," "expansion," "recession," and "trough" states, respectively; as economic state becomes worse, average momentum profits show a monotonically decreasing pattern. As a result, the difference between momentum profits obtained in "non-trough" and "trough" periods is a huge and statistically significant 3.30% per month with a t-statistic of 4.10. Time-series regressions confirm a significant negative relation between momentum profits and the expected market risk premium. Moreover, we demonstrate that our evidence is robust to the out-of-sample estimation of the expected market risk premium in defining the economic states. We show that the classification of the state of the economy identified by the out-of-sample estimate of the market risk premium is essentially identical to that identified by the in-sample estimate.

The empirical finance literature has failed to provide evidence of distress risk in momentum strategies, because previous studies define economic states in terms of the *realized* market excess return or GDP growth. Most relevant to our work, Griffin, Ji, and Martin (2003) identify good states with high, and bad states with low, ex post realized market excess returns or GDP growth. Their results show that average momentum profits are positive during periods of negative GDP growth, and even more strongly positive during periods of negative market excess returns than during periods of positive market excess returns in the U.S. Thus, Griffin, Ji, and Martin conclude that "there is no evidence that the profitability of momentum strategies is related to risk arising from macroeconomic states" (p. 2539).[3]

However, *ex-post* realized market excess return is a noisy measure for marginal utility or business cycles (Fama, 1981; Harvey, 1989; Stock and Watson, 1989, 1999). Further, the standard asset pricing theory predicts that investors demand an *ex-ante* risk premium for holding risky securities, and risk premium is countercyclical (Merton, 1973; Campbell and Cochrane, 1999). Many studies point out that realized returns are a noisy measure of expected returns or expected risk premium (Blume and Friend, 1973; Sharpe, 1978; Elton, 1999; Campello, Chen, and Zhang, 2008). Petkova and Zhang (2005) argue that the *expected* market risk premium, not the *ex-post* realized market excess return, should be used to measure the state of the economy. Following Petkova and Zhang (2005), we classify macroeconomic states based on the expected market risk premium and show that the basic inferences of Griffin, Ji, and Martin (2003) can be overturned with this reasonable change

[3]Liew and Vassalou (2000) also report larger positive mean momentum profits during periods of negative GDP growth than during periods of positive GDP growth.

in measuring macroeconomic conditions.

Chordia and Shivakumar (2002) find that momentum profits are only reliably positive during NBER expansionary periods, with insignificant negative profits observed during NBER contractionary periods. The evidence presented in this paper, however, differs from Chordia and Shivakumar (2002) in several important ways. First, the explanatory power of the NBER classification of the business cycle for momentum payoffs seems to be driven by the January effect. We show that when controlling for the January effect, the relation between momentum profits and NBER contractionary periods disappears completely.[4] The finding of Chordia and Shivakumar (2002) that momentum profits are absent during NBER contractionary periods may thus be driven by the January effect. In contrast, as mentioned earlier, our evidence of distress risk in momentum strategies cannot be attributable to the January effect.

Second, whereas the NBER classification of the state of the economy is only available ex-post, our measure of the expected market risk premium can be obtained ex-ante from recursive out-of-sample forecasts.[5] This difference is particularly critical to investors looking to develop a real-time implementable trading strategy for enhancing the profitability. For instance, investors can implement a conditional momentum strategy that reverses the momentum trading rule (i.e., buying loser stocks and selling winner stocks) when the market risk premium forecasted for the next period is especially high. Such a conditional strategy cannot be achieved using NBER identification of economic states, since investors do not know in real-time whether the next period will be contractionary. Finally, the explanatory power of the NBER contraction indicator becomes insignificant in the presence of our measure of economic states, whereas our measure remains statistically significant.

Cooper, Gutierrez, and Hameed (2004) show that momentum profits are significant only after "UP" market where the lagged three-year market return is positive. Cooper, Gutierrez,

[4]During the contractionary periods where January is excluded, average momentum profits are no longer negative.

[5]Indeed, the NBER announces the turning points of the business cycle with a delay.

and Hameed interpret that if overconfidence is higher following market increases, then their findings are consistent with theoretical predictions from the behavioral models of Daniel, Hirshleifer, and Subrahmanyam (1998) and Hong and Stein (1999). Stambaugh, Yu, and Yuan (2012) and Antoniou, Doukas, and Subrahmanyam (2013) show that momentum profits are higher following periods of high sentiment, and that the sentiment index predicts positively the payoffs to momentum strategies. They interpret that sentiment-driven overpricing appears to be at least a partial explanation for the profitability of momentum strategies. We examine whether lagged three-year market return and investor sentiment can take away the explanatory power of the expected market risk premium. When we regress momentum profits on the expected market risk premium in the presence of either the lagged three-year market return or the investor sentiment index, the coefficient on the expected market risk premium is always significantly negative. Further, in the presence of the state variables suggested by the momentum literature, winner stocks continue to significantly underperform loser stocks in the "trough" state. These results indicate that the lagged three-year market return and the sentiment index do not capture the explanatory power of the expected market risk premium. Our interpretation that momentum strategies are fundamentally risky investments, combined with the robust explanatory power of the expected market risk premium, suggest that our findings are substantially distinct from those documented by Cooper, Gutierrez, and Hameed (2004), Stambaugh, Yu, and Yuan (2012), and Antoniou, Doukas, and Subrahmanyam (2013).

The remainder of the paper is organized as follows. Section 2 describes the data, and discusses the empirical specification used in our analysis. Section 3 presents our main findings that momentum strategies expose investors to greater downside risk and that the profitability of momentum strategies vary depending on the state of the economy. Section 4 provides evidence on the robustness of the relation between momentum profits and the expected market risk premium. Section 5 presents our conclusions.

2 Data and Empirical Specification

2.1 Portfolio Construction

Our main data source is the Center for Research in Security Prices (CRSP) monthly file. We use all common stocks (with CRSP share-code of 10 or 11) listed on NYSE and AMEX. The sample period is from January 1960 to December 2011.

We use two sets of momentum portfolios. The construction of the first set of portfolios follows Jegadeesh and Titman (1993). We rank NYSE and AMEX stocks into deciles based on their 6-month ranking period returns (months $t-7$ through $t-2$). To control for short-term return reversal and avoid microstructure bias, we skip one month between the end of the ranking period and the beginning of the holding period. Decile portfolios are formed by equally weighting all firms in the decile ranking. The momentum profit is the return of the top decile portfolio (the winners) less the return of the bottom decile portfolio (the losers). We form momentum portfolios every month and hold them for the subsequent 6-month period, from t through $t+5$. Thus, portfolios have overlapping holding period returns. We refer to this momentum portfolio construction as the JT momentum construction.

To evaluate the pervasiveness and robustness of our results, we also consider alternative way of constructing momentum portfolios. The construction of the second set of portfolios follows Fama and French (1996), and the data are obtained from the data library of Ken French.[6] The procedure is the same as for the JT momentum construction, except that the ranking period of the strategy is 11 months (from month $t-12$ to month $t-2$ with the skip-a-month) and the holding period is one month. This strategy is referred to as the FF momentum construction. Note that the JT momentum construction is an overlapping construction approach, while the FF momentum construction is a non-overlapping approach. Since the data are publicly available from French's web site, it allows one to easily replicate most of our results.

[6]Fama and French (1996) show that their momentum strategy is as strong as those constructed by Jegadeesh and Titman (1993) such that their three-factor model cannot explain the payoffs to this strategy.

Table 1 reports the averages and corresponding t-statistics for the monthly excess returns (returns in excess of the monthly Treasury bill rate) on the momentum decile portfolios for each type of momentum portfolio construction (JT construction in Panel A, FF construction in Panel B) as well as the Winner-Minus-Loser (WML) portfolios. Two benchmark-adjusted returns, the CAPM and Fama-French (1993) risk-adjusted returns, are also reported. The benchmark-adjusted returns are defined as returns net of what is attributable to exposures to risk factor(s). We estimate the benchmark-adjusted returns as the intercepts from the following regressions:

$$R_{i,t} = \alpha_i + \beta_1 MKT_t + \epsilon_t, \tag{1}$$

$$R_{i,t} = \alpha_i + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \epsilon_t, \tag{2}$$

where $R_{i,t}$ is the portfolio's excess return in month t, MKT_t is the market factor (CRSP value-weighted market excess return), SMB_t is the size factor (a return spread between small and big firms), and HML_t is the book-to-market factor (a return spread between stocks with high and low book-to-market ratios). The estimated intercepts in Equations (1) and (2) are the CAPM-adjusted alpha and the Fama-French-adjusted alpha, respectively.

During the entire sample period from January 1960 to December 2011, the average excess returns increase monotonically from the loser portfolio to the winner portfolio. The momentum payoff is sizable and reliably positive: the JT construction earns a significant return of 0.76% per month (t-value = 3.17) and the FF construction earns a comparable return of 0.99% per month (t-value = 3.98). All benchmark-adjusted momentum profits are significant positive, confirming that the momentum is identified as an anomaly with respect to the CAPM and Fama-French models.

2.2 Estimation of the Expected Market Risk Premium

In order to examine whether momentum profits are related to macroeconomic risk, we adopt the novel approach taken by Lakonishok, Shleifer, and Vishny (1994). They argue that a strategy would be fundamentally risky if, first, there are at least some states of the world in which the strategy underperforms, and second, these periods of underperformance are, on average, "bad" states, in which the marginal utility of wealth is high, making the strategy unattractive to risk-averse investors.

In prior research, Liew and Vassalou (2000) and Griffin, Ji, and Martin (2003) investigate whether momentum strategies are risky. Their approaches are similar to those used by Lakonishok, Shleifer, and Vishny (1994) to analyze value and growth strategies. For instance, Griffin, Ji, and Martin define economic states in terms of the realized market excess returns and GDP growth; they identify good states as periods with high ex post market excess returns or GDP growth, and bad states as those with low ex post market excess returns or GDP growth. Their results show that average momentum profits are positive during periods of negative GDP growth, and even more strongly positive during periods of negative market excess returns than during periods of positive market excess returns in the U.S. Therefore, Griffin, Ji, and Martin conclude that momentum strategies are not risky investments because they do not expose investors to greater downside risk.

However, *ex-post* realized market excess return is at best a very noisy measure for marginal utility or business cycles. It is well documented in the macroeconomic literature that the ex post market excess return does not have substantial predictive power for business cycles (Fama, 1981; Harvey, 1989; Stock and Watson, 1989, 1999).[7] Further, the standard asset pricing theory predicts that investors demand an *ex-ante* risk premium for holding risky securities, and that risk premium is countercyclical (Merton, 1973; Campbell

[7]Stock and Watson (2003) summarize it clearly, "Stock returns generally do not have substantial in-sample predictive content for future output, even in bivariate regressions with no lagged dependent variables (Fama 1981 and Harvey 1989), and any predictive content is reduced by including lagged output growth" (p. 797).

and Cochrane, 1999). Many studies point out that realized returns are a noisy measure of expected returns or expected risk premium (Blume and Friend, 1973; Sharpe, 1978; Elton, 1999; Campello, Chen, and Zhang, 2008).[8] Petkova and Zhang (2005) argue that more precise measures for aggregate economic conditions are the default spread, the term spread, and the short-term interest rate, macroeconomic variables that are common instruments used to model the expected market risk premium.

It is therefore reasonable to expect that inferences made by Griffin, Ji, and Martin (2003) could lead them to the incorrect conclusion. We argue that it is necessary to reevaluate the riskiness of momentum strategies by using the expected market risk premium as a measure of the state of the economy.

The expected market risk premium is unobservable and thus must be estimated. To model this risk premium, we use macroeconomic variables that are known for their ability to predict market excess return and capture fluctuations in economic condition. These conditioning variables include the default spread (DEF), the term spread (TERM), the three-month T-bill rate (RF), and the variable CAY. The motivation for using these variables comes from the time-series predictability literature.[9] The default spread is the yield spread between Moody's BAA and AAA corporate bonds. The term spread is the yield spread between ten-year government bonds and one-year government bonds. Data on bond yields are obtained from the Federal Reserve Bank of St. Louis. The CAY, created by Lettau and Ludvigson (2001), represents deviations from a common trend among consumption, asset wealth, and labor income. Since the CAY is quarterly in frequency, we use quarterly data for estimating the market risk premium.

[8]Elton (1999) shows that realized returns can deviate significantly from expected returns. He also questions the common practice of using realized returns as a proxy for expected returns in asset pricing tests.

[9]The three-month T-bill rate has been shown to be negatively related to future market returns, and can act as a proxy for expectations of future economic growth (Fama, 1981; Fama and Schwert, 1977). The default spread has been known to track long-term business conditions; it is higher during recessions and lower during expansions (Keim and Stambaugh, 1986; Fama and French, 1989). Fama and French (1989) show that term spread is closely related to short-term business cycles, identified by the NBER. Finally, Lettau and Ludvigson (2001) show that the CAY is superior to other popular forecasting variables in predicting future stock market returns over short horizons.

Following Fama and French (1989) and Ferson and Harvey (1991), the expected market risk premium is estimated by regressing the (quarterly) market excess return from time $t-1$ to t, $R^e_{m,t}$, on the (quarterly) macroeconomic variables known at time $t-1$:

$$R^e_{m,t} = c_0 + c_1 DEF_{t-1} + c_2 TERM_{t-1} + c_3 RF_{t-1} + c_4 CAY_{t-1} + e_{m,t}. \quad (3)$$

Then, the expected market risk premium, $EMRP_t$, is the fitted value from Equation (3) as follows:

$$EMRP_t = \hat{c}_0 + \hat{c}_1 DEF_{t-1} + \hat{c}_2 TERM_{t-1} + \hat{c}_3 RF_{t-1} + \hat{c}_4 CAY_{t-1}. \quad (4)$$

Table 2 presents the estimation results of Equation (3). Panel A reports the regression coefficients, with their t-statistics in parentheses. If the market excess return is not predictable, all of the coefficients on the lagged conditioning variables should be statistically indistinguishable from zero. The χ^2 is the Wald statistic on the null hypothesis that the coefficients of the four conditioning variables are jointly zero. We see that the set of instrumental variables have reliable predictive power for the market excess return. The p-value of the χ^2 statistic is less than 5% and the CAY is statistically significant (t-value = 2.74). This result indicates that including the CAY is critical to reliably estimating the expected market risk premium, and is consistent with the finding of Lettau and Ludvigson (2001) that the CAY has stronger forecasting power than other popular forecasting variable over short horizons.

Following Petkova and Zhang (2005), we classify economic states based on the expected market risk premium as follows: state "peak" includes the 10% of periods with the lowest expected risk premium; "expansion" state represents the remaining periods in which the premium is below its average; "recession" state represents the periods in which the premium is above its average but still below the 10% of periods with the highest premium; and "trough" state represents the 10% of periods with the highest expected market risk premium. This sorting procedure is consistent with the stock market return predictability literature, which shows that expected market risk premium is higher in bad times, and is correlated with business cycle (Fama and Schwert, 1977; Fama and French, 1989). This classification is also consistent with modern asset pricing theories, which feature the countercyclical price of risk (Campbell and Cochrane, 1999; Zhang, 2005). Panel B of Table 2 shows the average estimated market risk premium conditional on our definition of economic states. The averages of the market risk premium are –1.85%, 0.20%, 2.61%, and 4.90% per quarter for the "peak," "expansion," "recession," and "trough" states, respectively. The number of quarters classified as "peak," "expansion," "recession," and "trough" are 60, 258, 246, and 60, respectively. Figure 2 plots a time-series of the estimated expected market risk premium, along with the contractionary period (marked as shaded region) defined by the NBER. Consistent with aforementioned theoretical and empirical studies, Figure 2 demonstrates that our estimated expected market risk premium exhibits strong countercyclical variations over business cycles. For instance, the expected market risk premium becomes especially high during the recent financial crisis period.

3 Empirical Results

3.1 Momentum Profits and Economic States

The primary purpose of this paper is to examine whether the periods in which momentum strategies yield negative profits are "bad" states where the marginal utility of consumption is high. In addition, we examine whether the profits to momentum trading strategies vary across good and bad times and whether any differences observed are significant.

We estimate average momentum profits conditional on the economic states defined in Section 2.2. To test whether average momentum profits are equal to zero in each state, we regress the time-series of momentum profits on four dummy variables for PEAK, EXPANSION, RECESSION, and TROUGH without intercept. To test whether the average profits in the "trough" state are different from those in other states ("peak," "expansion," and "recession"), we regress the time-series of momentum profits on TROUGH and NON-TROUGH dummies, with an intercept.[10] This approach, adopted in Cooper, Gutierrez, and Hameed (2004), helps preserve the full time-series of returns, and enables us to reliably estimate t-statistics adjusting serial correlation. Table 3 reports average momentum profits for each series (raw, CAPM-adjusted, and Fama-French-adjusted) conditional on the state of the economy. Panel A reports results for the JT momentum construction, while Panel B reports results for the FF construction.

The results in Table 3 are fairly clear. First, the winner portfolios significantly under-perform the loser portfolios in the "trough" state. For the JT momentum construction in "trough" states when marginal utility of wealth is especially high, the averages of the raw, CAPM, and Fama-French momentum profits are large and statistically significantly negative at –2.23% (t-value = –2.90), –2.08% (t-value = –2.74), and –2.06% (t-value = –2.81) per month, respectively. The results for the FF construction are quantitatively similar to those for the JT construction. In "trough" states, the raw, CAPM, and FF momentum profits are –1.73%, –1.62%, and –1.63% per month, respectively, and are also statistically significant.

Second, the payoffs to momentum strategies tend to positively covary with macroeconomic conditions. For instance, average raw monthly momentum profits for the JT construction are 1.86%, 1.10%, 0.87%, and –2.23% in "peak," "expansion," "recession," and "trough" states, respectively, showing a monotonically decreasing pattern as economic state becomes worse. As a result, the difference between "non-trough" and "trough" momentum profits is large and statistically significant at 3.30% per month with a t-statistic of 4.10. The results from the risk-adjusted profits and those from the FF momentum construction both indicate that payoffs to momentum trading strategies show a monotonically increasing pattern where payoffs increase as macroeconomic distress risk decreases. In fact, the difference between "non-trough" and "trough" momentum profits are statistically significant for all

[10] Specifically, the NON-TROUGH dummy takes a value of one for "peak," "expansion," and "recession" states, and zero for "trough" state.

cases considered.

Figure 3 shows four scatter plots, each corresponding to a particular economic state, where the x-axis is the expected market risk premium and the y-axis denotes momentum profits.[11] During the "peak" state, most of WML portfolio returns reside in a positive range. In the "expansion" state, payoffs to momentum strategies overall shift down, but for the most part remain positive. The "recession" state shows that momentum profits are more biased toward negative values. Finally, during the "trough" state, about half of momentum profit observations are negative, and the volatility of the profits soars. Clearly, when momentum trading strategies lose money, they lose a significant amount of money. Momentum strategies can lose as much as 84% in a quarter.

In order to more thoroughly illustrate that momentum is related to economic distress risk, Figure 4 plots a time-series of quarterly profits of the momentum strategy (JT construction) and the estimated market risk premium. The figure clearly shows that momentum earns large negative returns when the predicted market risk premium is highest. In particular, the periods in which momentum trading generates the four most strongly negative profits coincide with our estimated "trough" state. Four largest negative quarterly profits are –84%, –83%, –53%, and –45%, occurring in 2009:Q2, 1991:Q1, 2009:Q3, and 1975:Q1, respectively.

Next, we examine whether our results hold after controlling for the January effect in momentum payoffs. A number of studies show that momentum profits are negative in January, and positive during non-January months (e.g., Jegadeesh and Titman, 1993; Grundy and Martin, 2001; George and Hwang, 2004).[12] Therefore, it is important to investigate whether significant negative momentum profits in the "trough" state can be attributable to this January effect.

Table 4 reports average momentum profits conditional on our economic states across two

[11] For brevity, we only report the results for the JT momentum construction. The results for the FF construction yield very similar results, and are available from the authors upon request.

[12] One possible explanation for the January effect in momentum profits, suggested by Grinblatt and Moskowitz (1999), is tax-loss selling of the loser stocks in December, leading the price of those stocks to rebound in January (thus resulting in negative momentum profits in January).

separate periods: January and non-January months. As in Table 3, Panel A reports results for the JT momentum construction, while Panel B reports results for the FF construction.[13] In January, momentum generates negative profits in all economic states, consistent with the literature. Our primary interest is the results for non-January months. The results for non-January months mirror the essential features drawn from the overall samples; that is, negative payoffs of momentum strategies are skewed toward the "trough" states in which investors require the highest risk premium. Specifically, during "trough" states excluding January, momentum strategies still deliver large negative profits: –1.72% (t-statistic of –2.28) and –1.12% (t-statistic of –1.43) per month for the JT and FF construction, respectively. These negative profits are still sizable in magnitude, although the statistical significance becomes weaker. Also, the difference between "non-trough" and "trough" momentum payoffs remains statistically significant for all cases considered. The results in Table 4 suggest that our finding that winner stocks underperform loser stocks in extremely bad economic states cannot be attributable to the January effect.

Chordia and Shivakumar (2002) find that momentum profits are only reliably positive during NBER expansionary periods, with insignificant negative profits observed during NBER contractionary periods. We examine whether results documented in Chordia and Shivakumar (2002) hold in our sample. The results, reported in Table 5, show that the average profits of momentum strategies during NBER expansionary periods are statistically positive for both JT and FF portfolio constructions, while momentum payoffs during NBER contractionary periods are negative and insignificant: –0.71% per month (t-statistic of –1.14) for the JT construction, and –0.15% per month (t-statistic of –0.23) for the FF construction. However, the dependency of momentum payoffs on NBER contractionary periods seems to be mainly driven by the January effect. To show this, we estimate the average profits of momentum strategies conditional on NBER expansionary and contractionary periods in January and non-January months. Surprisingly, when controlling for the January effect, the

[13] Unless stated otherwise, we maintain this format in the following Tables.

explanatory power of the NBER classification of the business cycle completely disappears. During the contractionary periods without January, average momentum payoffs are no longer negative for all cases considered. The WML portfolio return for the FF construction is even reliably positive at 1.08% per month (t-statistic of 1.72). These results raise the question of whether the finding of Chordia and Shivakumar (2002) that momentum profits are absent during NBER contractionary periods may be driven entirely by the January effect.[14]

We also examine whether our measure of "bad times" has more explanatory power for momentum profits than the NBER contraction indicator. We consider two dummy variables: (1) $TROUGH$, a dummy variable that takes a value of one during the "trough" state, and zero otherwise; and (2) $CONTRACTION$ is a dummy variable that takes a value of one during NBER contractionary periods, and zero otherwise. We regress the momentum payoffs on both the $TROUGH$ and $CONTRACTION$ variables. The objective is to compare the relative ability of each variable to explain momentum profits. The results, presented in Table 6, show that $CONTRACTION$ is not a significant variable for explaining momentum profits in the presence of our measure of bad economic states, $TROUGH$. The t-statistics of $CONTRACTION$ range between –1.57 and –1.16. In contrast, $TROUGH$ remains statistically significant, with corresponding t-statistics ranging between –2.48 and –2.18. Further, the magnitude of the coefficients on $TROUGH$ is more than double those on $CONTRACTION$. These results suggest that our measure of "bad times," based on the expected market risk premium, is a more useful indicator of momentum profits than the NBER contraction indicator.

In sum, we provide evidence that the payoffs to momentum strategies are closely related to risk arising from macroeconomic states classified by the expected market risk premium. Winner stocks indeed significantly underperform loser stocks in the "trough" state, when

[14]We are not the first to show that the relation between the contractionary periods designated by the NBER and momentum profits is not robust. Griffin, Ji, and Martin (2003) report that the explanatory power of NBER contractionary periods also critically depends on whether a month is skipped between the ranking and holding period. To address this concern, we skip a month between the ranking and holding period for both momentum portfolio constructions.

the marginal value of wealth is highest. This shows that the momentum strategy exposes investors to greater downside risk. Thus, our results support the view that momentum strategies are fundamentally risky.

3.2 Regression Analysis

In this section, we examine the relation between momentum profits and the expected market risk premium as a continuous measure of economic state, not just the discrete states as before. Even though informal, examining the profitability of momentum strategies conditional on economic states suggested by Lakonishok, Shleifer, and Vishny (1994) is perhaps the simplest and the most intuitive way to study the relation between momentum strategies and macroeconomic risk. We supplement this informal test with a more formal test. If momentum strategies expose investors to greater systematic risk, then momentum profits should have a *negative* relation with expected market risk premium. To test this hypothesis, we regress momentum profits on the expected market risk premium as a continuous variable. Since the estimated market risk premium is quarterly in frequency, we convert monthly holding period returns on momentum portfolios into quarterly holding period returns.

Table 7 reports results on whether returns on the momentum trading strategies are related to the expected market risk premium. Table 7 consists of two panels that differ in terms of the dependent variable of the regressions. In Panel A, the dependent variable is the WML portfolio return from the JT momentum construction. In Panel B, the dependent variable is the WML portfolio return from the FF construction. The results of Section 3.1 are confirmed here using a regression analysis. We find that the market risk premium contains critical information about the raw and risk-adjusted momentum profits. In all cases, the coefficient on the market risk premium is significantly negative, with t-statistics ranging between –2.45 and –2.05, confirming our finding that momentum is low (high) when investors require a high (low) risk premium. The adjusted R-squared values are in the 8% to 24% range across different specifications.

The market risk premium has large explanatory power for momentum profits in economic terms. Consider the JT constructed momentum raw profit. The regression coefficient of the market risk premium is –1.96 (t-statistic of –2.24). To measure the economic significance, note that the standard deviation of the estimated market risk premium is 2.03. Thus, a one-standard-deviation increase in the expected market risk premium is associated with a 3.98% decrease in momentum profits during a quarter, a roughly –16% annual decrease.

In sum, results from the regression analysis reported in Table 7 deliver the same message as the comparison of returns conditional on the economic states in Table 3. The data support the view that momentum is driven by macroeconomic risk.

4 Additional Results

This section presents evidence on the robustness of the relation between momentum profits and the expected market risk premium. Specifically, we examine whether lagged market return or investor sentiment can take away the explanatory power of the expected market risk premium. In addition, we investigate whether our evidence is robust to an out-of-sample estimation of the expected market risk premium for defining economic states.

4.1 Market State

Cooper, Gutierrez, and Hameed (2004) find that the profits to momentum strategies depend on the lagged (medium-term) market return. They show that momentum profits are significant only after "UP" market where the lagged three-year market return is positive. We explore whether our previous results, reported in Table 7, remain robust after controlling for the lagged market return. We estimate the following models:

$$WML_t = \delta_0 + \delta_1 LAGMKT_{t-1} + \delta_2 EMRP_t + \epsilon_t, \quad (5)$$

$$WML_t = \delta_0 + \delta_1 LAGMKT_{t-1} + \delta_2 TROUGH_t + \epsilon_t, \quad (6)$$

where $LAGMKT$ is the lagged three-year market return of the value-weighted index including dividends. Including the $TROUGH$ dummy variable in Equation (6) is an attempt to capture any difference in the momentum profits in the "trough" state.

Our results, reported in Table 8, confirm that $LAGMKT$ has explanatory power. When used alone, the coefficient on $LAGMKT$ is positive and statistically significant, indicating that momentum profits tend to be high when the lagged three-year market return becomes high. When both $LAGMKT$ and $EMRP$ are included in regressions, the coefficients on both variables are statistically significant across all specifications, indicating that each variable has independent power in explaining momentum profits. Specifically, when we use the JT momentum construction (Panel A), the coefficient on $EMRP$ is equal to –1.92 (t-statistic = –2.51). For the benchmark-adjusted profit using the Fama-French model, the coefficient is –1.72 (t-statistic = –2.29). These coefficients are very similar in magnitude to those reported in Table 7, suggesting that even the magnitude of the economic impact for the market risk premium is unchanged in the presence of $LAGMKT$.[15] Next, when $EMRP$ is replaced by the $TROUGH$ dummy variable, we still find that momentum payoffs are significantly lower during "trough" states, even after controlling for the lagged three-year market return.[16]

In sum, Table 8 shows that the explanatory power of the expected market risk premium in momentum profits goes beyond that of the lagged market return. Further, the winner portfolio continues to significantly underperform the loser portfolio in "trough" states in the presence of the lagged market return. We conclude that our findings are substantially distinct from those documented by Cooper, Gutierrez, and Hameed (2004).

Cooper, Gutierrez, and Hameed (2004) interpret that if overconfidence is higher following market increases, then their findings are consistent with theoretical predictions from the behavioral models of Daniel, Hirshleifer, and Subrahmanyam (1998) and Hong and Stein (1999). However, the more recent study of Sagi and Seasholes (2007) presents a rational

[15]We find that the correlation between our market risk premium measure and the lagged three-year (realized) market return is only –0.03.

[16]We repeat our analysis by defining $LAGMKT$ as lagged two-year and one-year returns. The results are qualitatively the same.

asset pricing model that can also reproduce the evidence in Cooper, Gutierrez, and Hameed (2004). It should therefore be emphasized that the dependency of momentum profits on the lagged market return no longer discriminates between behavioral and rational explanations for momentum profits. In contrast, our evidence that momentum strategies deliver significant negative returns when investors require the highest risk premium suggests a more straightforward interpretation that momentum strategies expose investors to greater downside risk.

4.2 Investor Sentiment

Stambaugh, Yu, and Yuan (2012) and Antoniou, Doukas, and Subrahmanyam (2013) show that momentum profits are higher following periods of high sentiment, and that the sentiment index predicts positively the payoffs to momentum strategies.[17] In particular, Stambaugh, Yu, and Yuan (2012) interpret that sentiment-driven overpricing appears to be at least a partial explanation for the profitability of momentum strategies. We investigate whether the relation between the expected market risk premium and momentum profits remains unchanged when controlling for the sentiment measure.

Following Stambaugh, Yu, and Yuan (2012) and Antoniou, Doukas, and Subrahmanyam (2013), we use the investor sentiment measure of Baker and Wurgler (2006).[18] Baker and Wurgler construct their composite sentiment index by taking the first principal component of the following six proxies: the closed-end fund discount, the number and the first-day returns of IPO's, NYSE turnover, the equity share in total new issues, and the dividend premium.[19] To remove a potential link to economic fundamentals, Baker and Wurgler regress raw sentiment measures on a set of macroeconomic variables including growth in industrial produc-

[17] Stambaugh, Yu, and Yuan (2012) study the role of investor sentiment in 11 financial market anomalies, including momentum, while Antoniou, Doukas, and Subrahmanyam (2013) focus exclusively on momentum.

[18] Antoniou, Doukas, and Subrahmanyam (2013) use the Consumer Confidence index published by the Conference Board for their main analysis. They show that their results are virtually unchanged when using the Baker Wurgler sentiment index as a robustness analysis.

[19] The principal component analysis eliminates idiosyncratic noise in the six measures, picking up their common movement.

tion, real growth in durable consumption, non-durable consumption, services consumption, growth in employment, and a NBER contraction indicator. Using this orthogonalized index measure, $SENT$, we run the following regressions:

$$WML_t = \gamma_0 + \gamma_1 SENT_{t-1} + \gamma_2 EMRP_t + \epsilon_t, \quad (7)$$

$$WML_t = \gamma_0 + \gamma_1 SENT_{t-1} + \gamma_2 TROUGH_t + \epsilon_t. \quad (8)$$

In this way we examine whether the sentiment measure can take away the explanatory power of either the expected market risk premium or our measure of the bad state (i.e., the "trough" state defined in Section 2.2). The results are similar when using the raw sentiment index, and are thus omitted. Since the Baker and Wurgler index data are available from July 1965 to December 2010, our regression is restricted to this sample period.

Table 9 reports the results. We confirm that sentiment affects momentum profits. We find a significant positive relation between the lagged sentiment index and the returns on the WML portfolio, consistent with previous findings that momentum payoffs tend to be higher when sentiment is high. The results also show that the expected market risk premium continues to have a significant negative relation with momentum profits even after controlling for the sentiment effect. For all cases considered, the coefficient on $EMRP$ is negative and significant, with t-statistics ranging from –2.58 to –2.18. Further, the coefficient on the $TROUGH$ dummy remains statistically significant in the presence of $SENT$, suggesting that the finding that momentum strategies deliver significantly lower returns when the expected risk premium is especially high is not materially related to investor sentiment. In contrast, the predictive power of the sentiment index depends on the benchmark adjustment. For the raw profits without benchmark adjustment, the explanatory power of sentiment remains unchanged when controlling for the expected market risk premium. After adjusting for benchmark exposure, however, we see that the predictive power of investor sentiment becomes weaker in the presence of either $EMRP$ or the $TROUGH$ variable, with t-statistics ranging from 1.04 to 1.55.

The results in Table 9 point to the conclusion that the Baker and Wurgler sentiment index is not linked to our market risk premium measure, and the predictive power of the sentiment index does not capture that of the expected risk premium. Overall, the expected market risk premium contains information about the profitability of momentum strategies over and above the information contained in the sentiment index.

4.3 Out-of-Sample Estimation of the Expected Market Risk Premium

One possible concern about the findings presented above is the potential for "look-ahead" bias due to the fact that the expected market risk premium is estimated using the full sample. In this section, we address this concern by performing out-of-sample estimation where the parameters in Equation (3) are reestimated every period, using only data available up to time $t-1$. The out-of-sample analysis complements the previous evidence on the robustness of the relation between the expected market risk premium and momentum profits.

The recursive out-of-sample forecasts of the market risk premium is formed as follows. The initial coefficient estimates are obtained over the twenty-year period from 1960:Q1 to 1979:Q4. The first out-of-sample quarter is 1980:Q1. The quarterly observation of 1980:Q1 is added to the initial period. Equation (3) is reestimated, and an out-of-sample forecast for 1980:Q2 is obtained. This process is repeated until the end of the sample, 2011:Q4. By implementing this approach, the predicted market risk premium at time t is obtained using the estimated coefficients from the most recent in-sample regression (i.e., from 1960:Q1 to time $t-1$) and the realizations of the lagged instrumental variables at time t.

To understand how the out-of-sample estimate of the market risk premium compares to the in-sample estimate, Figure 5 plots the time-series of the out-of-sample estimate (solid line) and in-sample estimate (dashed line) over the period from 1980:Q1 to 2011:Q4. The plot reveals two interesting facts. First, we see that the magnitude of the fluctuation in the out-of-sample estimate is larger than that in the in-sample estimate. This should not be a surprise, since the recursively estimated coefficients tend to show larger variations than the coefficients estimated using the full sample. Second and more importantly, the out-of-sample and in-sample estimates of the market risk premium strongly comove: the correlation between the two is 0.83. Of greater interest is the fact that the periods in which the out-of-sample estimate of the risk premium is especially high are essentially identical to those identified by the in-sample estimate. This suggests that classifying economic states based on the out-of-sample estimate is unlikely to identify different states from those identified by the in-sample estimate.

To assess the robustness of out-of-sample estimation of the market risk premium, we conduct the same exercise as in Section 3.1. That is, we redefine the economic states using the out-of-sample estimate of the expected market risk premium, and then estimate the averages of raw, CAPM-adjusted, and Fama-French-adjusted profits conditional on each state. Table 10 presents the results. As can be seen, the results confirm our main finding that momentum profits are negative and statistically significant when investors require the highest risk premium. In "trough" states, momentum strategies yield significant negative monthly profits of –2.39% and –1.83% for JT and FF portfolio constructions, respectively. Similar results are obtained for the benchmark risk-adjusted profits. Further, differences between "non-trough" and "trough" momentum profits are again large and statistically significant for all cases considered. These findings suggest that our evidence is robust to the out-of-sample estimation of the expected market risk premium for defining the economic states.

5 Conclusion

We study the profitability of momentum strategies during good and bad economic states. The main findings are twofold. First, we find that winner stocks significantly underperform loser stocks when the marginal value of wealth is highest, showing that the momentum strategy exposes investors to greater downside risk. Second, the payoffs to momentum strategies tend to positively covary with macroeconomic conditions. When we regress momentum profits on the expected market risk premium, the coefficient on the expected market risk premium is always negative and statistically significant. Overall, our results support the view that momentum strategies are fundamentally risky investments.

The large negative momentum profit observed in extremely bad economic states is particularly noteworthy. Even though previous studies (e.g., Chordia and Shivakumar, 2002; Cooper, Gutierrez, and Hameed, 2004) show that momentum profits are procyclical, the procyclical nature alone (i.e., the lower, but not necessarily significantly negative, profits in bad times) is not sufficient evidence that momentum strategies are risky investments. As Cooper, Gutierrez, and Hameed (2004) interpret, procyclical payoffs could be also consistent with theoretical predictions from the behavioral models. In contrast, we provide direct evidence that momentum strategies deliver *significant* negative profits in bad times, demonstrating that momentum strategies expose investors to downside risk.

Behavioral studies have concluded that momentum strategies cannot be risky investments. Barberis and Thaler (2003) summarize the related literature: "Stocks are risky if they fail to pay out at times of high marginal utility – in 'bad' times – and instead pay out when marginal utility is low – in 'good' times. The problem is that..., there is little evidence that the portfolios with anomalously high average returns do poorly in bad times, whatever plausible measure of bad times is used" (p. 1091-1092). Our findings suggest that when we identify "bad times" according to the expected market risk premium, as opposed to ex-post realized market excess return as used in previous studies, we do find evidence of distress risk for momentum strategies.

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Table 1
Descriptive Statistics of Momentum Portfolios

The table reports the average monthly excess return, CAPM alphas, and Fama-French alphas of momentum portfolios, along with their *t*-statistic reported in parenthesis. Two sets of momentum portfolios are used. The first set of portfolio follows Jegadeesh and Titman (1993) and is reported in Panel A. All NYSE and AMEX stocks are ranked into deciles based on their 6-month ranking period returns (months *t-7* through *t-2* with the skip-a-month). Decile portfolios are formed by equally weighting all firms in the decile ranking. The Winner-Minus-Loser (WML) portfolio is the return difference between the top decile portfolio (Winner) and the bottom decile portfolio (Loser). The momentum portfolios are formed every month and held for the subsequent 6-month period, from *t* through *t+5*. The second set of portfolio follows Fama and French (1996) and is reported in Panel B. The procedure is the same as for the Jegadeesh and Titman (1993) momentum construction, except that the ranking period of the strategy is 11 months (from month *t-12* to month *t-2* with the skip-a-month) and the holding period is one month. The sample period is from January 1960 to December 2011.

Panel A: Jegadeesh and Titman (1993) Momentum Portfolios											
	Loser	2	3	4	5	6	7	8	9	Winner	WML
Mean return	0.35	0.53	0.70	0.73	0.79	0.80	0.85	0.89	0.97	1.11	0.76
(*t*-stat)	(0.96)	(1.94)	(2.89)	(3.25)	(3.68)	(3.90)	(4.14)	(4.22)	(4.33)	(4.23)	(3.17)
CAPM alpha	-0.28	0.00	0.21	0.26	0.33	0.36	0.40	0.43	0.48	0.57	0.85
(*t*-stat)	(-1.15)	(-0.03)	(1.60)	(2.30)	(3.24)	(3.77)	(4.29)	(4.43)	(4.54)	(4.02)	(3.76)
FF alpha	-0.78	-0.41	-0.17	-0.09	0.01	0.06	0.12	0.15	0.22	0.31	1.09
(*t*-stat)	(-3.99)	(-3.61)	(-1.89)	(-1.13)	(0.15)	(0.96)	(1.93)	(2.42)	(3.16)	(3.43)	(4.98)
Panel B: Fama and French (1996) Momentum Portfolios											
	Loser	2	3	4	5	6	7	8	9	Winner	WML
Mean return	0.36	0.53	0.63	0.66	0.77	0.81	0.89	0.98	1.14	1.35	0.99
(*t*-stat)	(0.99)	(2.06)	(2.76)	(3.18)	(3.84)	(4.14)	(4.59)	(4.88)	(5.26)	(4.99)	(3.98)
CAPM alpha	-0.26	0.03	0.17	0.22	0.34	0.39	0.47	0.55	0.68	0.80	1.06
(*t*-stat)	(-1.04)	(0.20)	(1.36)	(2.16)	(3.51)	(4.20)	(5.16)	(5.73)	(6.18)	(5.25)	(4.47)
FF alpha	-0.58	-0.28	-0.14	-0.06	0.06	0.13	0.23	0.33	0.48	0.69	1.27
(*t*-stat)	(-2.79)	(-2.46)	(-1.64)	(-0.89)	(1.10)	(2.33)	(4.30)	(6.25)	(7.14)	(7.37)	(5.21)

Table 2
Estimation of the Expected Market Risk Premium

The table shows estimation results for the following regression using quarterly observations:

$$R^e_{m,t} = c_0 + c_1 DEF_{t-1} + c_2 TERM_{t-1} + c_3 RF_{t-1} + c_4 CAY_{t-1} + e_{m,t}.$$

$R^e_{m,t}$ is the market excess return. DEF_{t-1} is the default spread (DEF), defined as the yield spread between Moody's BAA and AAA corporate bonds. $TERM_{t-1}$ is the term spread, computed as the yield spread between ten-year government bonds and one-year government bonds. RF_{t-1} is the three-month T-bill rate. CAY_{t-1} is represents deviations from a common trend among consumption, asset wealth, and labor income created by Lettau and Ludvigson (2001). Panel A reports the regression coefficients and their *t*-statistics in parentheses. The $\chi^2_{(4)}$ is the Wald statistic on the null hypothesis that the coefficients of the four conditioning variables are jointly zero. Panel B reports the average of the estimated market risk premium conditional on the economic states, and the number of quarters in each state. State "peak" is defined as the lowest 10% periods of the expected risk premium; state "expansion" represents the remaining periods with the premium below its average; state "recession" represents the periods with the premium above its average except the 10% highest; and state "trough" represents the highest 10% periods of the expected market risk premium. The sample period is from 1960 :Q1 to 2011 :Q4.

Panel A: Estimation of the Expected Market Risk Premium

Constant	DEF	TERM	RF	CAY	$\chi^2_{(4)}$	*p*-value	Adj.R^2
0.66	3.60	-0.39	-0.52	1.06	11.184	0.048	3.59
(0.36)	(1.33)	(-0.39)	(-1.13)	(2.74)			

Panel B: Properties of the Estimated Market Risk Premium

	Peak	Expansion	Recession	Trough
Average	-1.85	0.20	2.61	4.90
Number	60	258	246	60

Table 3
Momentum Profits and Economic States

The table reports the average raw monthly momentum profits, CAPM alphas, and Fama-French alphas conditional on the economic states. The economic states are classified based on the expected market risk premium, which is estimated as a following model: $R_{m,t}^{e} = \alpha + \beta \boldsymbol{Z_{t-1}} + e_{m,t}$, where $\mathbf{Z_{t-1}}$ is a vector representing conditioning variables that include the default spread, term spread, three-month T-bill rate, and CAY. State "peak" is defined as the lowest 10% periods of the expected risk premium; state "expansion" represents the remaining periods with the premium below its average; state "recession" represents the periods with the premium above its average except the 10% highest; and state "trough" represents the highest 10% periods of the expected market risk premium. The difference of momentum profits between "non-trough" and "trough" is reported in the last column. Panel A reports the results for the Jegadeesh and Titman (1993) momentum construction, while Panel B reports the results for the Fama and French (1996) construction. The sample period is from January 1960 to December 2011.

	Peak	Expansion	Recession	Trough	Non-trough vs Trough
Panel A: Jegadeesh and Titman (1993) Momentum Construction					
Average profit	1.86	1.10	0.87	-2.23	3.30
(*t*-stat)	(2.43)	(2.97)	(2.30)	(-2.90)	(4.10)
CAPM alpha	1.64	1.11	1.08	-2.08	3.23
(*t*-stat)	(2.15)	(3.02)	(2.85)	(-2.74)	(4.05)
Fama-French alpha	1.81	1.43	1.36	-2.06	3.50
(*t*-stat)	(2.46)	(4.02)	(3.68)	(-2.81)	(4.53)
Panel B: Fama and French (1996) Momentum Construction					
Average profit	2.17	1.44	0.89	-1.73	3.01
(*t*-stat)	(2.74)	(3.77)	(2.27)	(-2.17)	(3.60)
CAPM alpha	2.01	1.45	1.05	-1.62	2.95
(*t*-stat)	(2.53)	(3.80)	(2.64)	(-2.05)	(3.55)
Fama-French alpha	2.18	1.73	1.30	-1.63	3.21
(*t*-stat)	(2.80)	(4.59)	(3.32)	(-2.10)	(3.93)

Table 4
Momentum Profits and Economic States: January versus Non-January Months

The table reports the average raw monthly momentum profits, CAPM alphas, and Fama-French alphas conditional on the economic states across two separate periods, January and Non-January months. The economic states are classified based on the expected market risk premium, which is estimated as a following model: $R^e_{m,t} = \alpha + \beta \boldsymbol{Z_{t-1}} + e_{m,t}$, where $\mathbf{Z_{t-1}}$ is a vector representing conditioning variables that include the default spread, term spread, three-month T-bill rate, and CAY. State "peak" is defined as the lowest 10% periods of the expected risk premium; state "expansion" represents the remaining periods with the premium below its average; state "recession" represents the periods with the premium above its average except the 10% highest; and state "trough" represents the highest 10% periods of the expected market risk premium. The difference of momentum profits between "non-trough" and "trough" is reported in the last column. Panel A reports the results for the Jegadeesh and Titman (1993) momentum construction, while Panel B reports the results for the Fama and French (1996) construction. The sample period is from January 1960 to December 2011.

Panel A: Jegadeesh and Titman (1993) Momentum Construction					
	Peak	Expansion	Recession	Trough	Non-trough vs Trough
			January		
Average profit	-2.24	-4.43	-8.11	-6.73	0.82
(*t*-stat)	(-0.98)	(-3.38)	(-6.84)	(-2.97)	(0.34)
CAPM alpha	-2.28	-4.45	-7.72	-6.70	0.97
(*t*-stat)	(-1.01)	(-3.42)	(-6.53)	(-2.97)	(0.41)
Fama-French alpha	-1.07	-2.89	-6.46	-6.97	2.62
(*t*-stat)	(-0.48)	(-2.21)	(-5.45)	(-3.15)	(1.10)
			Non-January		
Average profit	2.32	1.51	1.75	-1.72	3.42
(*t*-stat)	(3.07)	(4.21)	(4.72)	(-2.28)	(4.29)
CAPM alpha	2.10	1.52	1.92	-1.59	3.34
(*t*-stat)	(2.79)	(4.27)	(5.16)	(-2.11)	(4.22)
Fama-French alpha	2.10	1.66	2.02	-1.53	3.39
(*t*-stat)	(2.84)	(4.74)	(5.52)	(-2.08)	(4.37)

Table 4 (Continued)
Momentum Profits and Economic States:
January versus Non-January Months

Panel B: Fama and French (1996) Momentum Construction					
	Peak	Expansion	Recession	Trough	Non-trough vs Trough
January					
Average profit	-2.74	-4.35	-8.63	-7.23	1.04
(*t*-stat)	(-1.17)	(-3.22)	(-7.05)	(-3.08)	(0.42)
CAPM alpha	-2.77	-4.36	-8.36	-7.21	1.15
(*t*-stat)	(-1.19)	(-3.24)	(-6.82)	(-3.08)	(0.46)
Fama-French alpha	-1.86	-3.25	-7.42	-7.50	2.45
(*t*-stat)	(-0.80)	(-2.37)	(-5.97)	(-3.23)	(0.98)
Non-January					
Average profit	2.72	1.88	1.83	-1.12	3.06
(*t*-stat)	(3.48)	(5.07)	(4.76)	(-1.43)	(3.71)
CAPM alpha	2.57	1.89	1.94	-1.02	3.00
(*t*-stat)	(3.29)	(5.11)	(5.03)	(-1.31)	(3.65)
Fama-French alpha	2.59	2.00	2.03	-0.99	3.06
(*t*-stat)	(3.34)	(5.43)	(5.29)	(-1.28)	(3.76)

Table 5
Momentum Profits Conditional on the NBER Expansionary and Contractionary Periods

The table reports the average raw monthly momentum profits, CAPM alphas, and Fama-French alphas conditional on the NBER expansionary and contractionary periods. The column titled "January" reports the results for January, while the column titled "Non-January" reports the results for non-January months. Panel A reports the results for the Jegadeesh and Titman (1993) momentum construction, and Panel B reports the results for the Fama and French (1996) construction. The sample period is from January 1960 to December 2011.

	Whole Period		January		Non-January	
	Expansionary	Contractionary	Expansionary	Contractionary	Expansionary	Contractionary
Panel A: Jegadeesh and Titman (1993) Momentum Construction						
Average profit	1.02	-0.71	-4.70	-13.15	1.54	0.47
(*t*-stat)	(3.93)	(-1.14)	(-5.59)	(-6.66)	(6.07)	(0.77)
CAPM alpha	1.14	-0.78	-4.48	-13.18	1.63	0.39
(*t*-stat)	(4.40)	(-1.27)	(-5.37)	(-6.75)	(6.50)	(0.65)
Fama-French alpha	1.37	-0.49	-3.48	-11.62	1.73	0.47
(*t*-stat)	(5.43)	(-0.82)	(-4.12)	(-5.98)	(6.95)	(0.80)
Panel B: Fama and French (1996) Momentum Construction						
Average profit	1.19	-0.15	-5.06	-13.18	1.76	1.08
(*t*-stat)	(4.43)	(-0.23)	(-5.82)	(-6.47)	(6.73)	(1.72)
CAPM alpha	1.28	-0.21	-4.89	-13.21	1.83	1.02
(*t*-stat)	(4.76)	(-0.33)	(-5.65)	(-6.52)	(7.01)	(1.64)
Fama-French alpha	1.49	0.04	-4.18	-12.15	1.91	1.08
(*t*-stat)	(5.57)	(0.06)	(-4.72)	(-5.96)	(7.31)	(1.75)

Table 6
Momentum Profits and Bad States:
Trough from the Expected Market Risk Premium versus the NBER Contraction

The table presents results from regressing momentum profits on $TROUGH$ and $CONTRACTION$ variables, where $TROUGH$ is defined as a dummy variable that takes a value of one during the state "trough", and zero otherwise, and $CONTRACTION$ is defined as a dummy variable that takes a value of one during the NBER contractionary periods, and zero otherwise. State "trough" represents the highest 10% periods of the expected market risk premium. In Panel A, the dependent variable is the WML portfolio return from the Jegadeesh and Titman (1993) momentum construction. In Panel B, the dependent variable is the WML portfolio return from the Fama and French (1996) momentum construction. Reported are the regression coefficients, the *t*-statistics (in parentheses), and the adjusted *R*-squares. The sample period is from 1960 :Q1 to 2011 :Q4.

Panel A: Jegadeesh and Titman (1993) Momentum Construction						
	$TROUGH$	$CONTRACTION$	MKT	SMB	HML	Adj-R^2 (%)
Average profit	-3.09	-1.41				3.01
(*t*-stat)	(-2.18)	(-1.41)				
CAPM alpha	-2.99	-1.61	-0.20			5.01
(*t*-stat)	(-2.20)	(-1.58)	(-2.12)			
FF alpha	-3.27	-1.52	-0.18	-0.45	-0.43	12.10
(*t*-stat)	(-2.28)	(-1.57)	(-1.87)	(-3.24)	(-2.32)	
Panel B: Fama and French (1996) Momentum Construction						
	$TROUGH$	$CONTRACTION$	MKT	SMB	HML	Adj-R^2 (%)
Average profit	-2.85	-1.05				2.08
(*t*-stat)	(-2.24)	(-1.16)				
CAPM alpha	-2.77	-1.20	-0.15			3.12
(*t*-stat)	(-2.28)	(-1.32)	(-2.07)			
FF alpha	-3.04	-1.14	-0.15	-0.34	-0.39	7.51
(*t*-stat)	(-2.48)	(-1.36)	(-1.92)	(-2.39)	(-2.45)	

Table 7
Regressions of Momentum Profits on the Expected Market Risk Premium

The table reports on whether returns on the momentum trading strategies are related to the expected market risk premium. We consider following three regression models:

Model 1: $WML_t = a + bEMRP_t + u_t$,

Model 2: $WML_t = a + bEMRP_t + cMKT_t + u_t$,

Model 3: $WML_t = a + bEMRP_t + cMKT_t + dSMB_t + eHML_t + u_t$,

where WML_t is the quarterly momentum profits, $EMRP_t$ is the expected market risk premium, MKT_t is the market factor (CRSP value-weighted market excess return), SMB_t is the size factor (a return spread between small and big firms), and HML_t is the book-to-market factor (a return spread between stocks with high and low book-to-market ratios). In Panel A, the dependent variable is the WML portfolio return from the Jegadeesh and Titman (1993) momentum construction. In Panel B, the dependent variable is the WML portfolio return from the Fama and French (1996) momentum construction. Reported are the regression coefficients, the *t*-statistics (in parentheses), and the adjusted *R*-squares. The sample period is from 1960 :Q1 to 2011 :Q4.

Panel A: Jegadeesh and Titman (1993) Momentum Construction					
	$EMRP$	MKT	SMB	HML	Adj-R^2 (%)
Average profit	-1.96				8.42
(*t*-stat)	(-2.24)				
CAPM alpha	-1.71	-0.24			10.35
(*t*-stat)	(-2.05)	(-1.96)			
FF alpha	-1.86	-0.10	-0.84	-0.48	23.64
(*t*-stat)	(-2.11)	(-0.76)	(-4.16)	(-2.42)	
Panel B: Fama and French (1996) Momentum Construction					
	$EMRP$	MKT	SMB	HML	Adj-R^2 (%)
Average profit	-1.93				8.77
(*t*-stat)	(-2.45)				
CAPM alpha	-1.68	-0.25			11.06
(*t*-stat)	(-2.21)	(-1.99)			
FF alpha	-1.82	-0.12	-0.79	-0.47	24.07
(*t*-stat)	(-2.41)	(-0.88)	(-4.86)	(-2.29)	

Table 8
Regressions of Momentum Profits on Lagged Market Return and the Expected Market Risk Premium

The table presents results from regressing momentum profits on lagged market return and the expected market risk premium. $LAGMKT$ is the lagged three-year market return of the value-weighted index including dividends. $EMRP_t$ is the expected market risk premium. $TROUGH$ is a dummy variable that takes a value of one during the state "trough", and zero otherwise. In Panel A, the dependent variable is the WML portfolio return from the Jegadeesh and Titman (1993) momentum construction. In Panel B, the dependent variable is the WML portfolio return from the Fama and French (1996) momentum construction. Reported are the regression coefficients, the *t*-statistics (in parentheses), and the adjusted *R*-squares. The sample period is from 1960 :Q1 to 2011 :Q4.

Panel A: Jegadeesh and Titman (1993) Momentum Construction							
	$LAGMKT$	$EMRP$	$TROUGH$	MKT	SMB	HML	Adj-R^2 (%)
Average profit	9.65						5.22
(*t*-stat)	(2.53)						
Average profit	9.33	-1.92					13.33
(*t*-stat)	(3.07)	(-2.51)					
Average profit	7.81		-9.88				9.39
(*t*-stat)	(2.47)		(-1.95)				
FF alpha	9.68	-1.72		-0.21	-0.76	-0.46	28.64
(*t*-stat)	(3.01)	(-2.29)		(-1.47)	(-3.72)	(-2.51)	
FF alpha	8.58		-10.00	-0.29	-0.73	-0.49	26.79
(*t*-stat)	(2.55)		(-1.98)	(-1.77)	(-3.66)	(-2.64)	

Panel B: Fama and French (1996) Momentum Construction							
	$LAGMKT$	$EMRP$	$TROUGH$	MKT	SMB	HML	Adj-R^2 (%)
Average profit	8.66						4.43
(*t*-stat)	(2.30)						
Average profit	8.35	-1.89					12.91
(*t*-stat)	(2.48)	(-2.60)					
Average profit	7.07		-8.55				7.68
(*t*-stat)	(2.15)		(-1.60)				
FF alpha	8.78	-1.69		-0.22	-0.72	-0.45	28.43
(*t*-stat)	(2.76)	(-2.52)		(-1.56)	(-4.54)	(-2.37)	
FF alpha	7.95		-8.63	-0.30	-0.69	-0.47	25.39
(*t*-stat)	(2.58)		(-1.83)	(-1.95)	(-4.39)	(-2.25)	

Table 9
Regressions of Momentum Profits on Investor Sentiment and the Expected Market Risk Premium

The table presents results from regressing momentum profits on investor sentiment and the expected market risk premium. $SENT$ is the investor sentiment measure of Baker and Wurgler (2006). $EMRP$ is the expected market risk premium. $TROUGH$ is a dummy variable that takes a value of one during the state "trough", and zero otherwise. In Panel A, the dependent variable is the WML portfolio return from the Jegadeesh and Titman (1993) momentum construction. In Panel B, the dependent variable is the WML portfolio return from the Fama and French (1996) momentum construction. Reported are the regression coefficients, the *t*-statistics (in parentheses), and the adjusted *R*-squares. The sample period is from 1960 :Q1 to 2011 :Q4.

Panel A: Jegadeesh and Titman (1993) Momentum Construction

	$SENT$	$EMRP$	$TROUGH$	MKT	SMB	HML	Adj-R^2 (%)
Average profit	1.71						0.90
(*t*-stat)	(2.30)						
Average profit	2.09	-2.23					10.60
(*t*-stat)	(2.37)	(-2.40)					
Average profit	1.64		-12.69				7.65
(*t*-stat)	(2.18)		(-2.13)				
FF alpha	1.40	-2.10		-0.15	-0.81	-0.54	25.49
(*t*-stat)	(1.45)	(-2.18)		(-1.05)	(-3.76)	(-2.55)	
FF alpha	0.93		-12.81	-0.24	-0.77	-0.57	24.17
(*t*-stat)	(1.12)		(-2.03)	(-1.48)	(-3.65)	(-2.63)	

Panel B: Fama and French (1996) Momentum Construction

	$SENT$	$EMRP$	$TROUGH$	MKT	SMB	HML	Adj-R^2 (%)
Average profit	1.62						0.86
(*t*-stat)	(1.83)						
Average profit	1.99	-2.18					10.89
(*t*-stat)	(2.16)	(-2.58)					
Average profit	1.56		-11.21				6.43
(*t*-stat)	(1.70)		(-1.82)				
FF alpha	1.32	-2.05		-0.16	-0.77	-0.53	25.99
(*t*-stat)	(1.55)	(-2.50)		(-1.09)	(-4.41)	(-2.40)	
FF alpha	0.87		-11.28	-0.25	-0.74	-0.55	23.26
(*t*-stat)	(1.04)		(-1.95)	(-1.54)	(-4.22)	(-2.28)	

Table 10
Momentum Profits and Economic States Based on the Out-Of-Sample Estimate of the Expected Market Risk Premium

The table reports the average raw monthly momentum profits, CAPM alphas, and Fama-French alphas conditional on the economic states based on the out-of-sample estimate of the expected market risk premium. The recursive out-of-sample forecasts of the market risk premium is as follows. The initial coefficient estimates are obtained over the twenty-year period from 1960:Q1 to 1979:Q4 from the following model: $R^e_{m,t} = \alpha + \beta \boldsymbol{Z_{t-1}} + e_{m,t}$, where $\mathbf{Z_{t-1}}$ is a vector representing conditioning variables that include the default spread, term spread, three-month T-bill rate, and CAY. The first out-of-sample quarter is 1980:Q1. Subsequently, the quarterly observation of 1980:Q1 is added to the initial period. The regression model is re-estimated, and an out-of-sample forecast for 1980:Q2 is obtained. This process is repeated until the end of the sample, 2011:Q4. By implementing this approach, the predicted market risk premium at time *t* is obtained using the estimated coefficients from the most recent in-sample regression (i.e., from 1960:Q1 to time *t-1*) and the realizations of the lagged instrumental variables at time *t*. Then, the economic states are re-defined using the out-of-sample estimate of the expected market risk premium as in Table 3. Panel A reports the results for the Jegadeesh and Titman (1993) momentum construction, while Panel B reports the results for the Fama and French (1996) construction. The sample period is from January 1960 to December 2011.

	Peak	Expansion	Recession	Trough	Non-trough vs Trough
Panel A: Jegadeesh and Titman (1993) Momentum Construction					
Average profit	2.11	1.24	1.10	-2.39	3.63
(*t*-stat)	(1.59)	(2.24)	(2.18)	(-2.78)	(3.90)
CAPM alpha	2.11	1.21	1.35	-2.28	3.62
(*t*-stat)	(1.61)	(2.21)	(2.66)	(-2.67)	(3.93)
Fama-French alpha	1.79	1.59	1.55	-2.25	3.84
(*t*-stat)	(1.40)	(2.92)	(3.10)	(-2.70)	(4.24)
Panel B: Fama and French (1996) Momentum Construction					
Average profit	2.83	1.41	1.07	-1.83	3.17
(*t*-stat)	(2.04)	(2.43)	(2.03)	(-2.03)	(3.26)
CAPM alpha	2.82	1.39	1.23	-1.76	3.17
(*t*-stat)	(2.04)	(2.41)	(2.29)	(-1.96)	(3.26)
Fama-French alpha	2.64	1.69	1.39	-1.78	3.39
(*t*-stat)	(1.92)	(2.91)	(2.59)	(-2.00)	(3.50)

Figure 1
Average Momentum Profits Conditional on Economic States

The figure shows the average monthly momentum profits conditional on the economic states. The economic states are classified based on the expected market risk premium, which is estimated as a following model: $R^{e}_{m,t} = \alpha + \beta \boldsymbol{Z_{t-1}} + e_{m,t}$, where $\mathbf{Z_{t-1}}$ is a vector representing conditioning variables that include the default spread, term spread, three-month T-bill rate, and CAY. State "peak" is defined as the lowest 10% periods of the expected risk premium; state "expansion" represents the remaining periods with the premium below its average; state "recession" represents the periods with the premium above its average except the 10% highest; and state "trough" represents the highest 10% periods of the expected market risk premium. The sample period is from January 1960 to December 2011.

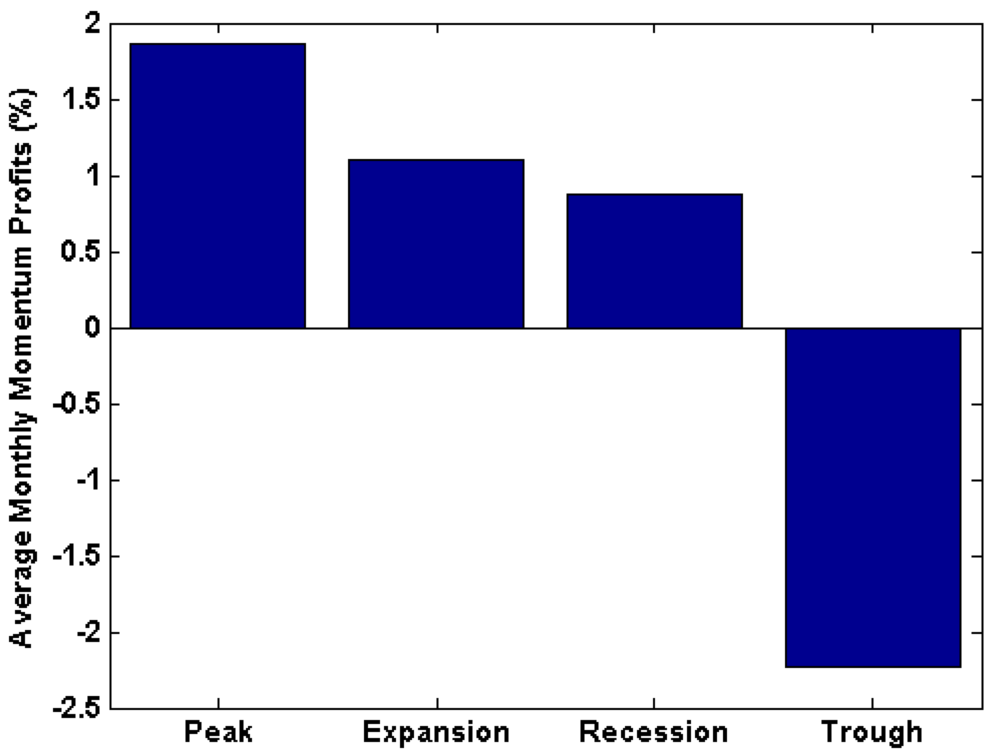

Figure 2
Time-Series of the Expected Market Risk Premium

The figure is a time-series plot of the quarterly expected market risk premium, which is estimated as a following model: $R^e_{m,t} = \alpha + \beta \boldsymbol{Z}_{t-1} + e_{m,t}$, where $\mathbf{Z_{t-1}}$ is a vector representing conditioning variables that include the default spread, term spread, three-month T-bill rate, and CAY. The shaded regions are the contractionary periods defined by the NBER. The sample period is from 1960 :Q1 to 2011 :Q4.

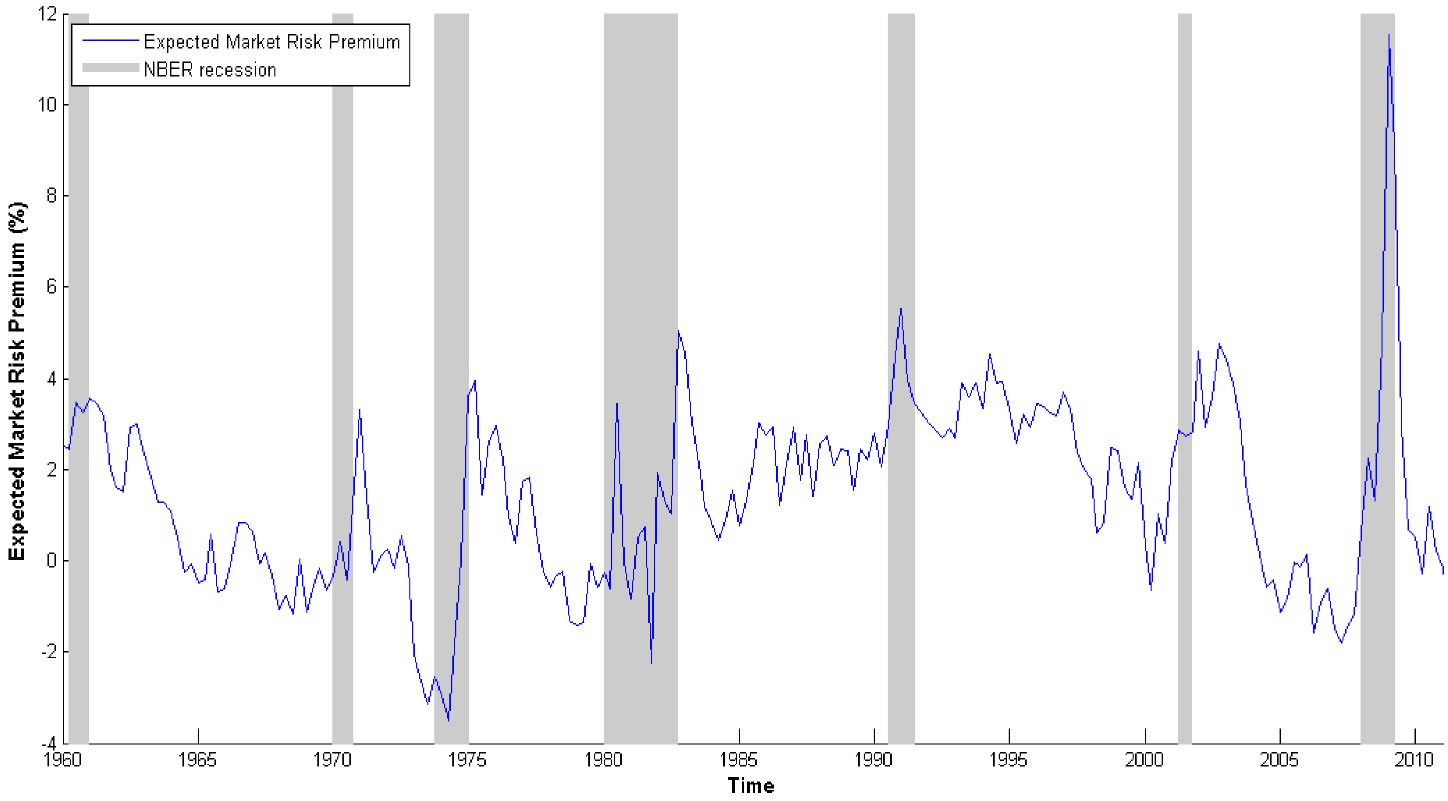

Figure 3
Expected Market Risk Premium & Momentum Profits

The figure shows scatter plots of quarterly momentum profits against the expected market risk premium across different economic states. The expected market risk premium is estimated as a following model: $R^e_{m,t} = \alpha + \beta \boldsymbol{Z_{t-1}} + e_{m,t}$, where $\mathbf{Z_{t-1}}$ is a vector representing conditioning variables that include the default spread, term spread, three-month T-bill rate, and CAY. State "peak" is defined as the lowest 10% periods of the expected risk premium; state "expansion" represents the remaining periods with the premium below its average; state "recession" represents the periods with the premium above its average except the 10% highest; and state "trough" represents the highest 10% periods of the expected market risk premium. The sample period is from 1960 :Q1 to 2011 :Q4.

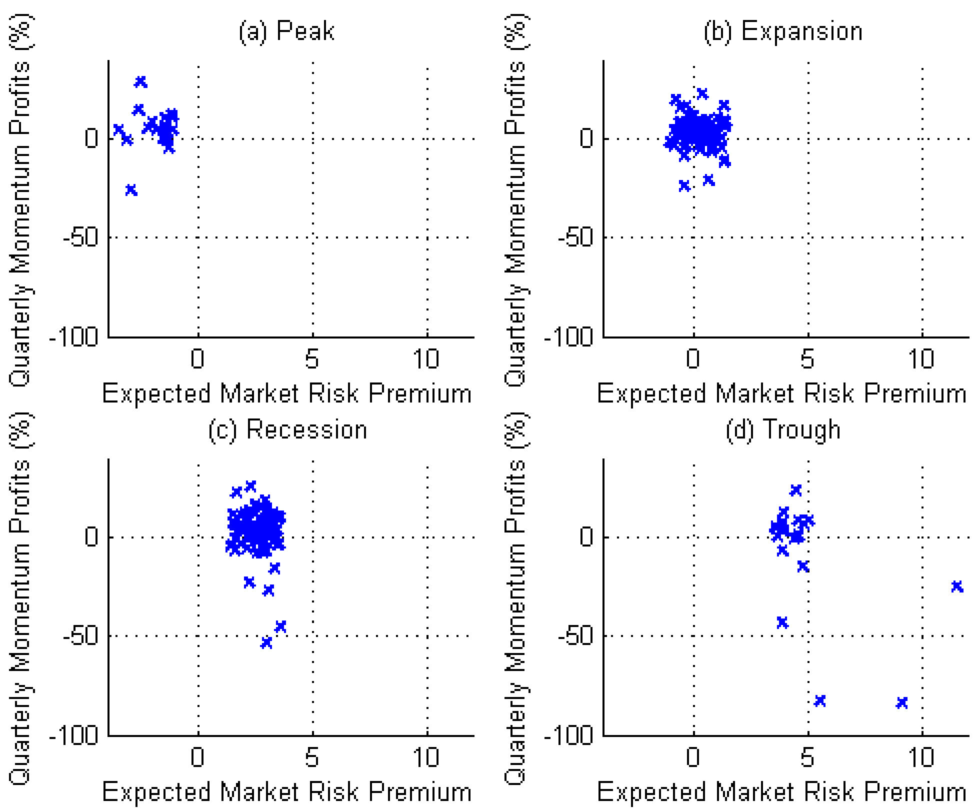

Figure 4
Time-Series of Momentum Profits with the Expected Market Risk Premium

The figure is time-series plots of quarterly momentum profits (bar graph) from the Jegadeesh and Titman (1993) momentum construction and the expected market risk premium (dashed line). The expected market risk premium is estimated as a following model: $R^{e}_{m,t} = \alpha + \beta \boldsymbol{Z}_{\boldsymbol{t-1}} + e_{m,t}$, where $\mathbf{Z}_{\mathbf{t-1}}$ is a vector representing conditioning variables that include the default spread, term spread, three-month T-bill rate, and CAY. The sample period is from 1960 :Q1 to 2011 :Q4.

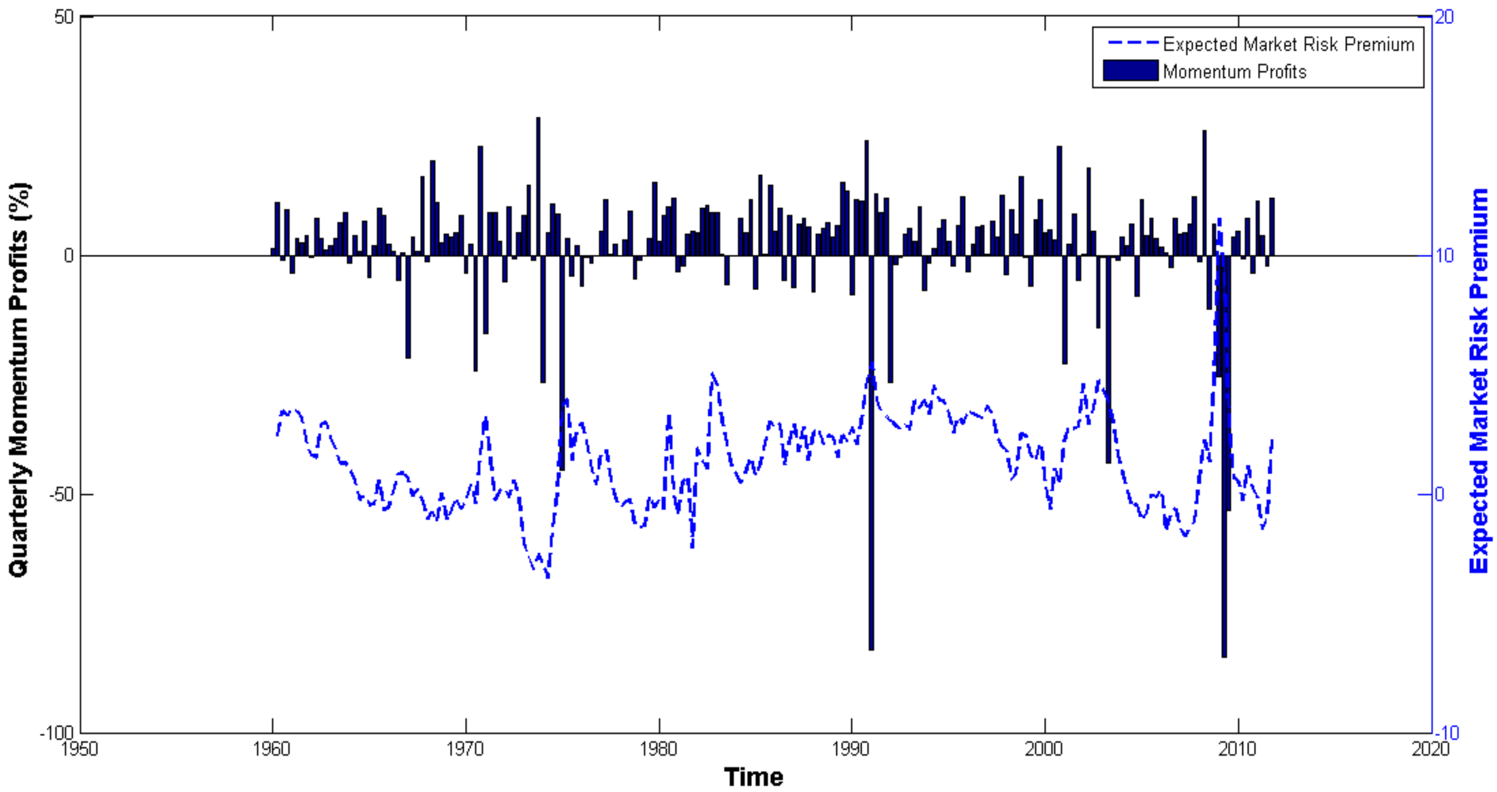

Figure 5
Out-Of-Sample and In-Sample Estimates of the Expected Market Risk Premium

The figure is time-series plots of the out-of-sample estimate of the expected market risk premium (solid line) and in-sample estimate of the expected market risk premium (dashed line). The sample period is from 1960 :Q1 to 2011 :Q4.