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Investor Sentiment, Anomalies, and Macroeconomic Conditions*

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We examine whether the results supporting the sentiment-related overpricing story by Stambaugh, Yu, and Yuan (J. Financial Economics, v.104, p.288-302) is still valid after controlling for macroeconomic conditions. We no longer find the results consistent with the sentiment-related overpricing story after adjusting for the effect of macroeconomic conditions. The risk factors associated with macroeconomic conditions are mostly priced and the average return spread in the anomalies is largely accounted for by the expected return spread implied by the risk factors. Their results might be a consequence of the use of an inadequately constructed sentiment index. It is premature to argue that the returns in the anomalies are driven by investor sentiment.

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JEL classification: G12; G14

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Abstract

We examine whether the results supporting the sentiment-related overpricing story by Stambaugh, Yu, and Yuan (J. Financial Economics, v.104, p.288-302) is still valid after controlling for macroeconomic conditions. We no longer find the results consistent with the sentiment-related overpricing story after adjusting for the effect of macroeconomic conditions. The risk factors associated with macroeconomic conditions are mostly priced and the average return spread in the anomalies is largely accounted for by the expected return spread implied by the risk factors. Their results might be a consequence of the use of an inadequately constructed sentiment index. It is premature to argue that the returns in the anomalies are driven by investor sentiment.

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1. Introduction

Investor sentiment is a psychological belief about future cash flows with excessive optimism (high sentiment) or pessimism (low sentiment), and therefore may erroneously assess the value of assets, resulting in stock prices to deviate from their fundamental values. According to Daniel et al. (1998), high (low) investor sentiment is formed with good (bad) news related to the economy or firms, which leads to overpricing (underpricing). In an efficient market, the mispricing should be eventually corrected by arbitrageurs. Due to short sales impediments, however, the mispricing can persist. In particular, sentiment-driven overpricing is more prevalent than underpricing. This could result in anomalies.

By combining market-wide investor sentiment with Miller's (1977) argument about the effect of short-sale impediments, Stambaugh, Yu, and Yuan (2012) (hereafter, SYY) suggest three hypotheses on the role of investor sentiment in affecting the degree of mispricing in 11 anomalies widely known in the literature.[1] The first hypothesis is that the anomalies should be stronger following high sentiment than following low sentiment; the second hypothesis is that the returns on the short-leg portfolio of each anomaly should be lower following high sentiment than following low sentiment; and the third hypothesis is that investor sentiment should not greatly affect the returns on the long-leg portfolio of each anomaly. In short, the pattern in the returns of the anomalies is attributed to sentiment-related overpricing, in particular for the stocks in the short-

[1] The 11 anomalies examined in SYY are (i) failure probability of Campbell, Hilscher, and Szilagyi (2008), (ii) Ohlson's (1980) O-score, (iii) net stock issuance of Ritter (1991) and Loughran and Ritter (1995), (iv) composite equity issuance of Daniel and Titman (2006), (v) total accruals of Sloan (1996), (vi) net operating assets of Hirshleifer, Hou, Teoh and Zhang (2004), (vii) momentum of Jegadeesh and Titman (1993), (viii) gross profitability premium of Novy-Marx (2010), (ix) asset growth of Cooper, Gulen, and Schill (2008), (x) return on assets of Fama and French (2006) and Chen, Novy-Marx, and Zhang (2010), and (xi) investment to assets of Titman, Wei, and Xie (2004) and Xing (2008).

leg portfolio following high sentiment. When sorting the returns in the anomalies according to the level (high or low) of investor sentiment, SYY find empirical results consistent with their hypotheses and conclude that sentiment-related overpricing is the main explanation for the 11 asset pricing anomalies.

SYY use the investor sentiment index constructed by Baker and Wurgler (2006) (hereafter, BW) as a measure of market-wide investor sentiment. The BW sentiment index is constructed by estimating the first principal component of the six proxies for investor sentiment orthogonalized by a set of some macroeconomic variables to remove business cycle variations from each of the proxies prior to principal components analysis. Although Baker and Wurgler (2006) attempt to remove business cycle variations from their sentiment index, a substantial portion of the effects of macroeconomic conditions could remain in the sentiment index. If this were the case, the sentiment index would be correlated with the premium on the risk factor(s) associated with the macroeconomic variables that are not included in the set of variables used by Baker and Wurgler (2006). Further, if this risk factor is more sensitive to the stocks in each short-leg portfolio but less to those in each long-leg portfolio, the results could be consistent with the predictions of SYY's hypotheses, whether or not investor sentiment plays a role in explaining the returns of the anomalies. Thus, SYY's results supporting their hypotheses might be mixed with the effect of such a risk factor. In that SYY's results are obtained from using the BW sentiment index, it would be premature to conclude that the return spreads between the long-leg and short-leg portfolios in the anomalies are attributed to sentiment-related overpricing rather than to the spread in risk.

The purpose of this paper is two-fold. We first examine whether the results supporting SYY's hypotheses are still maintained even after separating the effect of the risk factor from SYY's original results, and then examine to what extent the returns of the anomalies can be accounted for by the expected returns implied by the risk factor(s) associated with some macroeconomic variables. In the context of Merton's (1973) Intertemporal Capital Asset Pricing Model, we use a set of macroeconomic variables as state variables that proxy for such a risk factor and that are possibly linked to the investor sentiment index. As state variables, we select the following five macroeconomic variables: the Lettau and Ludvigson (2001) consumption-wealth ratio, cay, term spread, default spread, the three-month Treasury-bill yield, and inflation rate. These variables are not the ones Baker and Wurgler (2006) used to remove business cycle variations from the proxies for investor sentiment, although they are often used as stock return predictors in the literature.

To examine the first purpose, we decompose the BW sentiment index into the predicted sentiment index by the one-month-lagged five macroeconomic variables and the residual sentiment index comprising the BW sentiment index component remaining after removing the component linked to the macroeconomic variables. We find that when the predicted sentiment index is used, results consistent with SYY's three hypotheses are obtained. The BW sentiment index component predicted by the five macroeconomic variables has as much predictive power for the returns of the short-leg, long-leg, and long-short portfolios in the anomalies, as does the BW sentiment index itself. However, results that are consistent with SYY's hypotheses can no longer be obtained once the residual sentiment index is used. Our results are contradictory to SYY, since they report that even after controlling for these five macroeconomic variables, the results are consistent with their hypotheses. We find that the discrepancy in the results between the two studies is attributed to the difference in the estimation window used to control the macroeconomic variables for the sentiment index. We use the 60-month rolling-window due to nonstationarity of the parameters, while SYY use the whole-period window.

To examine whether components of macroeconomic conditions are successfully removed in the BW sentiment index used in SYY, following Baker and Wurgler (2006), we construct a new investor sentiment indexes by estimating the first principal component of Baker and Wurgler's (2006) six sentiment proxies orthogonalized by the five macroeconomic variables used in this study. We find that when this new sentiment index is used, the predictability of the sentiment index for the returns in the anomalies disappears. Note that these five variables are not used in Baker and Wurgler (2006) to remove components of macroeconomic conditions. These results indicate that the BW sentiment index still contains components of macroeconomic conditions, and a substantial portion of the predictability of the BW sentiment index used in SYY for the returns of the anomalies is attributed to the component of the BW sentiment index linked to those macroeconomic variables. Our results are consistent with Sibley, Wang, Xing, and Zhang's (2016) findings that macro-related sentiment is the driving force behind the predictability of investor sentiment for cross-sectional stock returns.

To examine the pricing ability of the macroeconomic variables in the anomalies, which is the second purpose of this paper, we identify the risk factors associated with the five macroeconomic variables by constructing factor-mimicking portfolios for innovations in those macroeconomic variables. The risk factors associated with the macroeconomic variables are mostly priced. In cross-sectional regressions (CSR) of the test asset returns on factor loadings on the factor mimicking portfolios, the risk premium estimates are mostly statistically significant. We also find that a large portion of the average return spread across the long- and short-leg portfolios in the anomalies is generally accounted for by their expected return spread implied by the risk factors associated with the macroeconomic variables. Furthermore, we find that such factors become more sensitive to the return in each short-leg portfolio but less sensitive to the return in each long-leg portfolio and that the BW sentiment index is significantly correlated with the risk premium estimates of those factors. These results indicate that a substantial amount of the predictability of the sentiment index for the anomaly returns is attributed to the sentiment index co-varying with the risk premiums of the factors associated with the macroeconomic variables.

Overall, our results indicate that SYY's results might be a consequence of the use of an inadequately constructed sentiment index in that it is still mixed with the effects of macroeconomic conditions. Based on our empirical evidence, it is therefore premature to argue that the returns in the anomalies are driven by investor sentiment. Rather, our empirical evidence supports a risk-based explanation than a sentiment-based explanation for the returns in the anomalies.

The rest of the paper is organized as follows. Section 2 reviews the literature and provides the motivation for the paper, and Section 3 describes the data. Section 4 reports the results after controlling for the macroeconomic variables and examines what causes the discrepancy in the results between this study and SYY, and Section 5 examines the extent to which macroeconomic risk explain the anomaly returns. Section 6 concludes.

2. Literature Review and Motivation

Numerous studies in the literature show that the anomalous behavior of stock returns could be largely explained by macroeconomic variables. By narrowing down our attention to the 11 anomalies examined in SYY, we refer to only a few of the numerous related studies in the literature that provide risk-based explanations based on macroeconomic variables for the returns in the anomalies. For example, we refer to Denis and Denis (1995) and Vassalou and Xing (2004) for failure probability and Ohlson's O-score; Eckbo, Masulis, and Norli (2000), Brav, Geczy, and Gompers (1996, 2000), and Mitchell and Strafford (2000) for net stock issuance and composite equity issuance;[2] Khan (2008) and Kim and Qi (2010) for total accruals;[3] Chordia and Shivakumar (2002) and Kim et al. (2014) for momentum;[4] and Cooper and Priestley (2011) for asset growth and investment-to-asset.[5] To our knowledge, no prior study has attempted yet to formally examine the possibility of explaining the returns in the remaining three among the 11 anomalies (net operating assets, gross profitability premium, and return-on-asset) by factor models associated with macroeconomic variables.[6] However, one would find it hard to believe that profitability-related anomalies such as gross profitability premium and return-on-asset are unrelated to macroeconomic conditions and that the future profitability of firms is not priced. To the extent that the returns in total accruals can be explained by factor models (e.g., Khan, 2008) and the level of accruals are closely related to macroeconomic conditions (Kim and Qi, 2010), one can expect the returns in net operating assets to be explained by factors associated with

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[2] Using a six-factor asset pricing model based on macroeconomic variables to price portfolios of equity issuing firms, Eckbo, Masulis, and Norli (2000) show that equity issuers are less risky than non-issuers since their risk exposure to unexpected inflation and default risks are lower, and argue that the difference in stock price performance between issuers and non-issuers is due to the difference in risk. Using factor models based on firm characteristics such as the Fama and French (1993) three-factor model, Brav, Geczy, and Gompers (1996, 2000) and Mitchell and Strafford (2000) also show that factor models can price equity issuer returns.

[3] Khan (2008) shows that a considerable portion of the cross-sectional variation in average returns to high and low accrual firms is explained by a four-factor model motivated by Merton's (1973) Intertemporal Capital Asset Pricing Model. This author also provides evidence that financial distress is one characteristic associated with total accruals and distress has an influence on the returns to an accruals strategy. This in turn suggests that an accrual strategy is vulnerable to some of the macroeconomic risks as a distress index. Kim and Qi (2010) show that accruals quality and its pricing effect systematically vary with business cycles and macroeconomic variables.

[4] Chordia and Shivakumar (2002) show that momentum can be explained by a set of lagged macroeconomic variables and profits to momentum strategies disappear once stock returns are adjusted for their predictability based on these macroeconomic variables. Kim et al. (2014) show that winner stocks are riskier than loser stocks in the expansion state, whereas loser stocks are riskier in the recession state, and, consequently, expected momentum profits display strong procyclical variations.

[5] Cooper and Priestley (2011) show that the average return spread across portfolios constructed by asset growth and investment-to-asset is largely accounted for by the spread in their risk exposures on the macroeconomic variables used in Chen, Roll, and Ross (1986).

[6] Some factor models including firm characteristics-based, not macroeconomic-based, factors are also suggested to explain asset pricing anomalies (e.g., Chen, Novy-Marx, and Zhang (2011) and Fama and French (2015)).

macroeconomic variables, as the net operating assets equal a cumulative measure of accruals (Hirshleifer et al., 2004).

Given the evidence in the literature described above, to the extent which SYY obtain explanatory power from using the BW sentiment index, we can obtain the explanatory power of macroeconomic variables (or factors associated with them) for the returns in the anomalies. A variety of macroeconomic variables are used to explain the returns in the anomalies. Nevertheless, following the principle of parsimony, we select the macroeconomic variables most frequently used in the asset pricing literature, but not ones used in constructing the BW sentiment index.

To construct the investor sentiment index, Baker and Wurgler (2006) choose six proxies for investor sentiment: closed-end fund discount, NYSE turnover ratio, annual number of IPOs, average annual first-day returns of IPOs, gross annual equity issuance divided by gross annual equity plus debt issuance, and dividend premium. In fact, these proxies are to an extent the outcome of changes in market-wide investment opportunities and reflect economic fundamentals; therefore, they must be influenced by macroeconomic conditions. To remove such influence, Baker and Wurgler regress each of the six raw proxies on a set of six macroeconomic variables (growth in industrial production; growth in consumption of each of durables, nondurables, and services; growth in employment; and a dummy variable for National Bureau of Economic Research (NBER) recessions). They regard the residuals from these regressions as their investor sentiment proxies orthogonalized to macroeconomic conditions. To filter out idiosyncratic components in the six orthogonalized proxies and capture their common component, they take the first principal component of these six orthogonalized proxies as the BW sentiment index.

However, if some influences of macroeconomic conditions still remain in the BW sentiment index, this sentiment index can be correlated with the time-varying risk premium of the risk factor associated with the macroeconomic variables. If this is the case and the spread in exposure on the risk factor across the short-leg and long-leg portfolios in each anomaly appears consistent with the spread in the average returns across the portfolios, we obtain results consistent with SYY's hypotheses, whether or not (pure) investor sentiment plays a role in explaining the returns of the anomalies.[7] Thus, we need to separate the influences of some macroeconomic variables from the results obtained from the BW sentiment index and then examine the extent to which the risk factor associated with these macroeconomic variables accounts for the returns in the anomalies. In the context of Merton's (1973) Intertemporal Capital Asset Pricing Model, these macroeconomic variables can be considered as state variables. As such state variables, we select the following five macroeconomic variables; cay, term spread, default spread, three-month Treasury-bill yield, and inflation rate.

The above-mentioned state variables affect investment opportunity sets and, consequently, investors' expected return. Further, these macroeconomic variables are commonly perceived to influence investor sentiment, as confirmed by several studies. For example, Kurov (2010) shows that monetary policy decisions have a significant effect on investor sentiment, and Tang and Yan (2010) show that investor sentiment is the most important determinant of credit spreads. These studies show that factors associated with interest rates and default spread affect investor sentiment. Chung, Hung, and Yeh (2012) show that the predictive power of investor sentiment in the cross-section of stock returns is asymmetric across states of the economy. Sibley et al. (2016) report that Treasury bill yield and term spread are the most influential variables used to explain the variation

[7] In addition to SYY, a number of papers argue that investor sentiment predicts stock returns for the cross-section of stock returns. See, for example, Baker and Wurgler (2006, 2007), Brown and Cliff (2005), and Kumar and Lee (2006).

in the BW sentiment index. Indeed, we provide evidence that the sentiment index is highly correlated with these macroeconomic variables (see Section 3.2 for details and Table 1).[8]

Given the influence of macroeconomic variables on investor sentiment, for the first purpose of this paper, we show that the returns in the anomalies are linked to the component of investor sentiment predicted by the macroeconomic variables but not to the component remaining after removing the predicted component. For this, we decompose the BW sentiment index into the predicted component and the residual component. As in SYY, we sort the returns in the anomalies on the predicted sentiment index and the residual sentiment index, respectively, obtained from month-by-month regression of the sentiment index on one-month-lagged five macroeconomic variables with a 60-month rolling-window. If the pattern in the returns of the long-leg and short-leg portfolios in the anomalies from sorting on the predicted sentiment index is consistent with SYY's hypotheses but that from sorting on the residual sentiment index is not, we can argue that the sentiment index is largely influenced by the macroeconomic variables and that the predictability of the sentiment index for the returns in the anomalies might be attributed mainly to macroeconomic conditions rather than to sentiment-related overpricing.[9]

After confirming that the predictive power of the BW sentiment index for the anomalies is mainly attributed to the BW sentiment index component linked to the macroeconomic variables,

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[8] Shen, Yu, and Zhao (2017) also show that the BW sentiment index is highly correlated with the macro-related factors used in Chen, Roll, and Ross (1986).

[9] Our approach is different from Sibley, Wang, Xing, and Zhang (2016) in that they obtain the predicted (actually, fitted) and residual components from the full-sample regression of the BW sentiment index on contemporaneous 13 business cycle variables. These authors regress the returns in the anomalies on the one-month-lagged fitted and residual sentiment indexes and report that the coefficient estimates on the fitted sentiment index are statistically significant but those on the residual sentiment index are not. Based on this regression estimation result alone, these authors conclude that macro-related sentiment is a driving force of the predictability of investor sentiment for the cross-sectional stock returns. The set of 13 business cycle variables consists of 10 macroeconomic variables and three stock market-related risk factors (the CRSP value-weighted market return, market volatility, and a liquidity factor).

we examine, for the second purpose of the paper, how much of the spreads in average return across the long-leg and short-leg portfolios in the anomalies can be accounted for by the spreads in risk exposure on factors associated with the macroeconomic variables. From the evidence in the asset pricing literature described at the beginning of this section and confirmation of the link between the sentiment index and the macroeconomic variables, we can expect a substantial portion of the average return spread across the portfolios in the anomalies to be explained by their expected return spread implied by the risk factors associated with the macroeconomic variables.

3. Data

3.1. Description

To compare our results with those of SYY, we use the same proxy for investor sentiment, the Baker and Wurgler (2006) investor sentiment index ($SENT$), spanning from July 1965 to December 2007, as in SYY (2012).[10] Note that this is equivalent to $SENTIMENT^{\perp}$ in Baker and Wurgler. As predictors for the BW sentiment index, we choose the five macroeconomic variables: : (i) the Lettau and Ludvigson (2001) consumption-wealth ratio, cay, (ii) the term spread (TERM), defined as the difference in yields between three-month and 10-year Treasuries, (iii) the default spread (DEF), defined as the difference in yields between Baa- and Aaa-rated corporate bonds, (iv) the three-month Treasury bill yield, and (v) the monthly inflation rate.[11] We do not include macro

[10] The Baker and Wurgler (2006) sentiment index is obtained from Jeffrey Wurgler's website: http://people.stern.nyu.edu/jwurgler/.

[11] The Lettau and Ludvigson (2001) consumption-wealth ratio, cay, is obtained from Martin Lettau's website: http://faculty.haas.berkeley.edu/lettau/data_cay.html. Aaa- and Baa-rated corporate bond yields, three-month and 10-year Treasury yields, and inflation rates are obtained from the Federal Reserve Bank of St. Louis Economic Data website (http://research.stlouisfed.org/fred2/).

variables directly related to the stock market, such as dividend yield, as argued in Stambaugh, Yu, and Yuan (2015).[12] [13] We do not include the macroeconomic variables as well used in Baker and Wurgler (2006) to remove macro-related variation from their sentiment index. These five variables are a parsimonious set of macro variables.[14]

We use the same 11 market-wide anomalies as in SYY: (i) failure probability, (ii) Ohlson's O-score, (iii) net stock issuance, (iv) composite equity issuance, (v) total accrual, (vi) net operating assets, (vii) momentum, (viii) gross profitability premium, (ix) asset growth, (x) return on assets (ROA), and (xi) investment-to-assets.[15] As in SYY, we also consider a combination strategy that combines the 11 anomalies equally within a given month. For comparison to SYY, this paper covers the same sample period from August 1965 to January 2008, except for anomaly (i), where the data period begins in December 1974, and anomaly (ii) and (x), for which the sample period begins in January 1972.

3.2. Relation between the investor sentiment index and the macroeconomic variables

To examine how closely the BW sentiment index is related to macroeconomic conditions, we provide figures showing the time-series behavior of the BW sentiment index against each of the

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[12] Stambaugh, Yu, and Yuan (2015) argue that sentiment that affects stock prices is likely to affect dividend yield by lowering the yield when sentiment is high and vice versa.

[13] Even when dividend yield is included in the set of macroeconomic variables, the overall results remain qualitatively unchanged.

[14] To examine the effect of macro-related sentiment on the predictability of anomaly returns, Sibley et al. (2016) use 13 business cycle variables: the U.S. unemployment rate, the change in inflation from CPI, the consumption growth rate, the growth rate of disposal personal income, the growth rate of industrial production, the NBER recession dummy, the three-month Treasury bill rate, DEF, TERM, the dividend yield, the return on CRSP all market index, the stock market volatility, and the average percentage of zero return days. Among these 13 variables, the dividend yield, the stock market volatility, and the average percentage of zero return days are the macro variables that, as Stamabugh, Yu, and Yuan point out (2015), could contain sentiment effects.

[15] We thank Jianfeng Yu for providing data for all 11 anomalies.

five macroeconomic variables in Figure 1. These graphs show the quarterly time-series patterns of the series. It can be observed from these figures that the BW sentiment index tends to move positively with cay, default spread, and three-month Treasury-bill rate and move negatively with term spread. However, it is seemingly less correlated with inflation rates. In fact, the degree of these relationships is confirmed by the correlation coefficients in Table 1.

Panel A of Table 1 reports the Spearman contemporaneous correlation coefficients between the BW sentiment index and each of the five macroeconomic variables. The BW sentiment index is statistically significantly correlated with all of these macroeconomic variables at the 5 percent level except for inflation rates. Specifically, the contemporaneous correlation coefficients of the BW sentiment index with these five variables are 0.203 (cay), 0.182 (default spread), 0.312 (three-month Treasury bill yield), -0.089 (term spread), and -0.057 (inflation rate), respectively. To examine preliminarily if these macroeconomic variables have a predictive relation to the BW sentiment index, we also compute the correlation coefficients between the BW sentiment index and the one-month-lagged macroeconomic variables. Panel B reports that these correlation coefficients are similar to the contemporaneous correlation coefficients. That is, they are also all highly statistically significant except for inflation rates. These high contemporaneous and lagged correlations indicate that although Baker and Wurgler (2006) try to explicitly remove macroeconomic components from the proxies for investor sentiment, a significant amount of macro-related variations still remain in their sentiment index.

4. Anomalies after Adjusting for Macroeconomic Variables

4.1. Anomaly Returns over Investor Sentiment Predicted by Macroeconomic Variables

The results in Tables 1 and 2 indicate that although the BW sentiment index, $SENT$, is constructed after removing the influence of some macroeconomic variables, it is still linked to some macroeconomic components. We therefore decompose $SENT$ into two components: the component predicted by the macroeconomic variables, which contains the macroeconomic components, and the residual component, which does not. To do this, we estimate the following time-series regression model:

$$SENT_t = \theta_0 + \theta_1 X_{t-1} + \varepsilon_t, \quad (1)$$

where $SENT_t$ is the BW sentiment index at month t and X_{t-1} is a vector of the one-month-lagged five macroeconomic variables.

The prediction accuracy of the sentiment through the regression model (1) depends on the regression coefficients estimated under stationarity. Since investor sentiment could be sensitive to macroeconomic conditions, it would be necessary to test stationarity of the regression coefficients of the model (1). Following Krämer et al. (1988), and Ploberger and Krämer (1992), we conduct the cumulative sum of recursive residuals of square (CUSUMSQ) test developed by Brown et al. (1975).[16] Figure 2 plots CUSUMSQ of the recursive residuals from estimating the model (1) over the whole sample period. Since the plot of CUSUMSQ crosses the upper bound in the 95 percent confidence band, stationarity of the regression coefficients is rejected at the 5 percent significance level. We therefore estimate the model (1) by rolling over month by month by using the previous 60 monthly observations (a minimum of 24 observations) of the macroeconomic variables available up to t-1. This approach allows the parameters to vary every month.[17] The predicted

[16] According to Lin and Teräsvirta (1994), the CUSUM and CUSUMSQ tests are advantageous over other parameter constancy tests in that it does not necessitate prior knowledge of the exact structural breakpoints.
[17] For the first 24 months of the sample period beginning July 1965, we assume the regression parameters to be constant.

sentiment index at month t ($PRED_t$) is computed as the predicted value of the BW sentiment index at month t, and the residual sentiment index at month t (RES_t) is computed as the difference between $SENT_t$ and $PRED_t$. Note that since the BW sentiment index, $SENT$, is an orthogonalized sentiment index against six macroeconomic variables, RES is another orthogonalized sentiment index against five further macroeconomic variables.

As in SYY, we classify each month as either a high- or a low-sentiment month based on the median value of the predicted sentiment index, *PRED*. A high- (low-) sentiment month is one in which the value of the predicted sentiment index in the previous month is above (below) the median value of $PRED$ for the whole sample period. Table 2 presents average excess returns (Panel A) and benchmark-adjusted returns (Panel B) of the 11 anomalies' highest-performing deciles (*long leg*), lowest-performing deciles (*short leg*), and long-short portfolios during months following high and low sentiment classified by *PRED*. The benchmark-adjusted returns are returns after adjusting for the Fama and French (1993) three factors. As in SYY, we also consider a strategy based on an aggregation of the 11 anomalies, denoted as "Combination," which equally combines the 11 anomalies within a given month. The results in Table 2 (sorted on *PRED*) are comparable to those in Tables 2 and 3 of SYY (sorted on *SENT*).

The overall results obtained from sorting on *PRED* are similar to those from sorting on *SENT*. In other words, the predicted sentiment index by the five macroeconomic variables provides similar results to those obtained from using the BW sentiment index. Recall that SYY's first hypothesis is that the anomalies should be stronger following high sentiment than following low sentiment. SYY argue that this hypothesis is supported since average (excess and benchmark-adjusted) returns of each of the 11 long-short portfolios are higher following high sentiment than following low sentiment. SYY report that the differences in average returns on the long-short portfolios between months following high and low sentiment ("High-Low") are positive in all 11 anomalies (reported in the last column of Tables 2 and 3 of SYY). Among the 11 individual t-statistics for the difference, eight are statistically significant at the one-tailed 5% level in the case of average excess returns and seven in the case of average benchmark-adjusted returns. When sorting on $PRED$, we obtain similar results. As observed in the last column of Table 2, the differences in average returns on the long-short portfolios between months following high and low sentiment classified by $PRED$ are positive in 10 of the 11 anomalies. Further, the magnitude and the statistical significance of the differences are also similar to those obtained from sorting on $SENT$. Among the 11 individual t-statistics for the difference, eight are statistically significant at the one-tailed 5% level in the case of average excess returns and five in the case of average benchmark-adjusted returns. The difference in the combination strategy is also strongly statistically significant for the case of both excess returns and benchmark-adjusted returns.

Recall also that SYY's second hypothesis is that the returns on the short-leg portfolio of each anomaly should be lower following high sentiment than following low sentiment. This implies that the difference in the average (excess and benchmark-adjusted) returns on the short-leg portfolio between months following high and low sentiment should be negative. SYY report that this difference between months following high and low sentiment classified by $SENT$ is negative in all 11 anomalies and is statistically significant at the (one-tailed) 5% level in 10 of the 11 anomalies for the cases of both excess returns and benchmark-adjusted returns. Similar results are also obtained when sorting on $PRED$. Table 2 shows that the differences in average returns on the short-leg portfolio between months following high and low sentiment classified by $PRED$ are all negative and statistically significant at the 5% level in all 11 anomalies for the cases of excess returns and in 6 of the 11 anomalies for the cases of benchmark-adjusted returns.

SYY's third hypothesis is that investor sentiment should not greatly affect returns on the long-leg portfolio of each anomaly. In other words, the difference in average returns between months following high and low sentiment should be less severe in terms of negative values in the long-leg portfolio than in the short-leg portfolio. As predicted by this hypothesis, SYY report that the differences in average excess returns on the long-leg portfolio between months following high and low sentiment sorted on *SENT* are negative in all 11 anomalies, but only one is statistically significant. When sorting on PRED, we obtain similar results. That is, the differences in average excess returns on the long-leg portfolios between months following high and low sentiment sorted on *PRED* are also negative in all 11 anomalies and are much smaller in absolute value than in the case of the short-leg portfolio. In particular, the differences in average benchmark-adjusted returns are all statistically insignificant and their sign is random in direction.

In summary, the BW sentiment index component predicted by the five macroeconomic variables has as much predictive power for the returns in the anomalies as does the BW sentiment index itself. The top graph in Figure 3 depicts the monthly time-series of *SENT* and *PRED* over the sample period. It shows that these two time-series move quite closely. We compute some statistics to measure the degree of prediction accuracy of the macroeconomic variables for the BW sentiment index in several ways. First, the Spearman correlation coefficient between *SENT* and *PRED* is quite high; it is 0.788 (with p-value of 0.0000). Second, 77.3% of all high-sentiment months classified by *SENT* overlap with those classified by *PRED*. Third, when we estimate a probit regression model of a binary variable representing high-sentiment months classified by *SENT* on a binary variable representing high-sentiment months classified by *PRED*, the slope coefficient estimate is 0.545, with t-statistic of 14.67. These results confirm that the BW sentiment index is closely related to the set of the five macroeconomic variables and that it still contains a significant amount of macro-related variations.

4.2. Anomaly Returns over Investor Sentiment Adjusted for Macroeconomic Variables

The results in the previous section indicate that a substantial portion of the predictive power of the BW sentiment index for the returns in the anomalies is attributed to the component of the index linked to the macroeconomic variables. In this section, we examine whether the component of the BW sentiment index remaining after removing the component linked to the macroeconomic variables has predictive power for the returns in the anomalies. We measure this remaining component using the residual sentiment index, *RES*, from the regression model of equation (1).

Table 3 presents average (excess and benchmark-adjusted) returns of the long-leg, short-leg, and long-short portfolios of the 11 anomalies during months following high and low sentiment classified by *RES*. Overall, the results obtained from sorting on *RES* are quite different from those from sorting on *SENT*. The strong evidence supporting SYY's three hypotheses is no longer found in Table 2. The differences in average excess returns on the long-short portfolio between months following high and low sentiment classified by *RES* are not statistically different from zero for any of the 11 anomalies. The average value of the differences in average excess returns of all 11 anomalies is only 0.13 percent (t-statistic of 0.57). Similar results are found in the differences in average benchmark-adjusted returns. These results do not support SYY's first hypothesis.

Table 3 also shows that when sorting on *RES,* there is no evidence supporting SYY's second and third hypotheses. The differences in average excess returns on the short-leg portfolios are statistically insignificant for all 11 anomalies and are mostly even positive in the 11 anomalies. The differences in average excess returns on the long-leg portfolios are also statistically insignificant. We also find no evidence supporting these hypotheses when using benchmark-adjusted returns. In summary, there is no evidence that the BW sentiment index has predictive power for the returns in the anomalies after adjusting for macroeconomic conditions. In fact, *RES* has no significant relation to the BW sentiment index. The bottom graph in Figure 3 shows the monthly time-series of *SENT* and *RES* over the sample period; it shows no association between the two time series. The Spearman correlation coefficient between *RES* and *SENT* is only -0.005.[18]

4.3. Anomaly Returns Predicted by Macroeconomic Variables

The previous sections show the averages of the actual returns for each anomaly during months classified by the level of the investor sentiment index. In this section, we examine whether the patterns in the returns of the short-leg, long-leg, and long-short portfolios during months following high and low sentiment as anticipated by SYY's hypotheses are also observed in the returns predicted by the macroeconomic variables. We first predict the return of each portfolio in the 11 anomalies in the following predictive regressions:

$$R_{i,t} = \lambda_0 + \lambda_1 X_{t-1} + \varepsilon_{i,t}, \tag{2}$$

$$R_{i,t} = \lambda_0 + \lambda_1 X_{t-1} + \lambda_2 Z_t + \varepsilon_{i,t}, \tag{3}$$

where $R_{i,t}$ is the excess return in month t on the short-leg, long-leg, or long-short portfolio of each anomaly, X_{t-1} is a vector of the one-month lagged five macroeconomic variables, and Z_t is the vector of the Fama-French three factors. The predictive regressions are estimated by rolling over month by month by using the previous 60 monthly observations (a minimum of 24 observations) as in computing *PRED*. The predicted returns in month t are measured as the

[18] By using the contemporaneous values of the 13 macroeconomic variables, Sibley et al. (2016) also report that the power of the BW sentiment index to predict the returns in the anomalies is mainly driven by the business cycle and risk component, while the residual component has little significance in predicting cross-sectional stock returns.

estimates of $\lambda_1 X_{t-1}$ from equations (2) and (3), respectively. The predicted returns from equation (2) are denoted as the predicted excess return, and those from equation (3) are denoted as the predicted benchmark-adjusted returns.

Table 4 presents the average predicted excess returns (Panel A) and benchmark-adjusted returns (Panel B) of the portfolios in the 11 anomalies during months following high and low investor sentiment classified by *PRED*. As predicted by SYY's first hypothesis, the average predicted (excess and benchmark-adjusted) returns of the long-short portfolio are higher following high sentiment than following low sentiment. Specifically, the differences in average predicted returns on the long-short portfolio between months following high and low sentiment are positive in all 11 anomalies and are statistically significant at the (one-tailed) 5% level in 10 and 7 of the 11 anomalies for the cases of excess returns and benchmark-adjusted returns, respectively.

Table 4 also shows that the results using the predicted returns are consistent with the prediction by SYY's second and third hypotheses. The predicted average returns on the short-leg portfolio of each anomaly are lower following high sentiment than following low sentiment. Specifically, the differences in average predicted returns on the short-leg portfolio between months following high and low sentiment are all negative and statistically significant at the 5% level in all 11 anomalies using both excess and benchmark-adjusted returns. However, this phenomenon is hardly observed in the long-leg portfolios. The differences in average predicted returns on the long-leg portfolio between months following high and low sentiment are mostly negative but statistically significant at the 5% level in only six (using excess returns) and three (using benchmark-adjusted returns) of the 11 anomalies, respectively.

Overall, the pattern observed in the actual returns of the anomalies is similarly reproduced in the return predicted by the five macroeconomic variables. The above results again confirm the findings that a substantial portion of the predictive power of the BW sentiment index for the anomalies may be attributed to the component of the index linked to macroeconomic conditions.

4.4. Predictive Regressions

Like SYY, we conduct an alternative analysis to investigate whether the predicted sentiment index, *PRED*, has a predictive relation to the returns of the anomalies as does the BW sentiment index, *SENT*. The alternative analysis is conducted by estimating the following predictive regressions:

$$R_{i,t} = \gamma_0 + \gamma_1 S_{t-1} + \varepsilon_{i,t}, \quad (4)$$

$$R_{i,t} = \gamma_0 + \gamma_1 S_{t-1} + \gamma_2 Z_t + \varepsilon_{i,t}, \quad (5)$$

where $R_{i,t}$ is the excess return in month *t* on the long-leg, short-leg, or long-short portfolio of each anomaly, S_{t-1} is the lagged investor sentiment index, and Z_t is a vector of the Fama-French three factors. We consider three investor sentiment indexes for S_{t-1}; *SENT, PRED*, and *RES*. SYY's hypotheses predict a positive sign of γ_1 for the long-short portfolio (the first hypothesis), a negative sign of γ_1 for the short-leg portfolio (the second hypothesis), and an insignificant value for γ_1 for the long-leg portfolio (the third hypothesis).

Table 5 reports the coefficient estimates ($\hat{\gamma}_1$) on the lagged investor sentiment index variable and the adjusted R^2 of the regression equations (4) and (5) for the 11 anomalies in Panels A and B, respectively. When $SENT$ is used as the sentiment index variable, the results are almost identical to those in SYY's Tables 4 and 5. That is, the estimation results for γ_1 are almost consistent with the prediction by SYY's three hypotheses. When the predicted sentiment, *PRED*, is used as the investor sentiment index variable, we also obtain estimation results for γ_1 similar to those from using *SENT*.[19] The adjusted R^2's using *PRED* are similar to those using *SENT*.

On the other hand, when the residual sentiment index, RES, is used as the sentiment index variable, we find no evidence consistent with the prediction by SYY's hypotheses. That is, the estimates of γ_1 on RES for the long-short portfolios are mostly statistically insignificant but significant at the one-tailed 5% level in only one and in two of the 11 anomalies when not controlling for and controlling for the Fama and French three factors, respectively. Further, the sign of the estimates of γ_1 is almost random in direction for the long-leg, short-leg, and long-short portfolios. These results again confirm that after adjusting for the five macroeconomic variables, the BW sentiment index has no predictive power for the return in the 11 anomalies.

4.5. What Causes the Discrepancy in the Predictive Regression Results from SYY?

The predictive regression results in the previous section on RES is contradictory to those in SYY, although the model settings in both studies are similar. It is necessary, therefore, to clarify what causes the discrepancy in the results between both studies. The predictive regression model SYY used is

$$R_{i,t} = \gamma_0 + \gamma_1 SENT_{t-1} + \gamma_2 Z_t + \sum_{j=1}^{5} m_j X_{jt} + \varepsilon_{i,t}, \quad (6)$$

where $X_{jt}, j = 1, \cdots, 5$, are five macro-variables: the default premium, the term premium, the real interest rate (the monthly difference between the three-month T-bill return and the consumer price

[19] Specifically, the estimates of γ_1 for the long-short portfolio are all positive and statistically significant at the one-tailed 5% level in eight and six of the 11 anomalies when not controlling for (using equation (4)) and controlling for the Fama and French three factors (using equation (5)), respectively. Those for the short-leg portfolio are all negative and are statistically significant at the one-tailed 5% level in eight of the 11 anomalies when controlling for the Fama and French three factors, while those for the long-leg portfolio have random sign and are mostly statistically insignificant.

index inflation rate), inflation, and CAY. These five macroeconomic variables are quite similar to the variables used to control $SENT$ for macroeconomic conditions in this study.[20] The models used in both studies are therefore similar in examining the predictive relation of the investor sentiment index to the anomaly returns. Nonetheless, SYY report in Table 9 that even after controlling for the five macroeconomic variables, the BW investor sentiment index is significantly correlated with the long-short anomaly returns; that is, the estimation results of γ_1 are consistent with their hypotheses. This is contrary to our results showing that the investor sentiment index has no significant predictive relation with the long-short anomaly returns, after controlling for the five macroeconomic variables.

Although the model settings in both studies are similar, the estimation settings are slightly different in two aspects; estimation window and lag of the controlling macroeconomic variables. We first control the BW investor sentiment index for the five macroeconomic variables with one-month lag in the model (1) through the 60-month rolling-window to obtain RES and then estimate the predictive regression model (5) on RES (RES_{t-1}). The reason we use the 60-month rolling-window is that stationarity of the regression coefficients in the model (1) is rejected, as described in Section 4.1. Meanwhile, SYY control the BW investor sentiment index for the five macroeconomic variables with no lag (contemporaneous) in the predictive regression model (6) through the whole-period window.

To examine how sensitive the results are to the estimation window, we repeat our approach by controlling the investor sentiment index for the five macroeconomic variables in the model (1)

[20] These five macroeconomic variables are the same as the variables used to adjust $SENT$ for macroeconomic conditions in this study except that SYY use the three-month T-bill return for the calculation of the real interest rate, while we use the three-month T-bill yield.

through the whole-period window by ignoring nonstationarity of the parameters in the model (1). We obtain two residual investor sentiment indexes, RES' and RES'', according to controlling for the five macroeconomic variables with one-month lag and no lag (contemporaneous) in the model (1), respectively. Table 6 presents the coefficient estimates ($\hat{\gamma}_1$) on RES' and RES'' in the predictive regression model (5), respectively. Contrary to the case of using RES obtained through the 60-month rolling-window (Panel B of Table 5), the estimates of γ_1 for the long-short portfolio are all positive except for one and are statistically significant at the one-tailed 5% level in eight and seven of the 11 anomalies when using RES' and RES'', respectively. These estimates are similar to those of γ_1 on $SENT$ in Table 5, which are the results from not controlling for the macroeconomic variables. The magnitude of the estimates of γ_1 on RES' and RES'' and their statistical significance are quite similar to those in Table 9 of SYY.[21] This indicates that the results of SYY are the ones obtained from inadequately controlling for the macroeconomic variables by ignoring nonstationarity of the parameters.

To further check the effect of the estimation window, we estimate the predictive regression model (6) using the whole-period and 60-month rolling-windows, respectively. Figure 4 plots the monthly time-series of the coefficient estimates of γ_1 over the sample period obtained from using the 60-month rolling-window, when the excess returns on the long-short portfolio of the combination strategy are used. The coefficient estimate of γ_1 from using the whole-period window is constant over the sample period; it is 0.31 (t-statistics of 2.32). As shown in the figure, the rolling-window coefficient estimates are quite volatile and significantly deviated from the constant whole-period coefficient estimate. This dynamic change in the value of γ_1 over time (i.e.,

[21] We also find that the estimates of γ_1 on RES' and RES'' for the long-leg and short-leg portfolios are also similar to those on $SENT$ for these portfolios in Table 5. The results are available upon request.

nonstationary γ_1) causes the discrepancy in the results between the two studies.

Besides the estimation window, another difference between the two studies is in the lag of the macroeconomic variables used in the predictive regressions. The five macroeconomic variables are entered in the predictive regressions contemporaneously in SYY, whereas those variables are entered in the predictive regressions essentially with two-month lags in our study since orthogonalizing the BW sentiment index is performed with the macroeconomic variables with one-month lag. To examine whether this difference in the lag of the macroeconomic variables causes the discrepancy in the results between both studies, we re-estimate the predictive regression model (6) with the same five macroeconomic variables used in SYY with one- and two-month lags, respectively, and report the coefficient estimates on the BW investor sentiment index ($\hat{\gamma}_1$) in Table A1 in the appendix. Whether one- or two-month lagged macroeconomic variables are used, the estimation results of γ_1 are quite similar to those in Table 9 of SYY, which are the results of controlling the contemporaneous macroeconomic variables. Therefore, the difference in the lag of the macroeconomic variables is not a cause of the discrepancy in the results between both studies.

In summary, the discrepancy in the results between this study and SYY is attributed to the difference in the estimation window used in controlling the macroeconomic variables for the BW sentiment index (i.e., whether or not nonstationarity of the parameters is accommodated).

4.6. Using Differently Orthogonalized Investor Sentiment Indexes

To further examine how the predictability of the BW sentiment index for the returns in the anomalies is vulnerable to adjustment for the macroeconomic variables, we construct a new investor sentiment index, denoted as $SENT^{\text{new}}$, by orthogonalizing the Baker and Wurgler (2006) six sentiment proxies to the set of five macroeconomic variables used in this study and then taking their first principal component. We also construct another new investor sentiment index, denoted as $SENT^{\text{new 2}}$, by using the combined 11 macroeconomic variables (the five variables used in this study and the six variables used in Baker and Wurgler (2006)) to orthogonalize the six sentiment proxies and then taking their first principal component.

Table 7 presents average benchmark-adjusted returns of the long-leg, short-leg, and long-short portfolios of the 11 anomalies during months following high and low levels of investor sentiment obtained from sorting on $SENT$ (Panel A), $SENT^{\text{new}}$ (Panel B), and $SENT^{\text{new 2}}$ (Panel C), respectively. We put the results obtained from sorting on $SENT$, which are a replication of Table 3 in SYY, to compare with those from sorting on $SENT^{\text{new}}$ and$SENT^{\text{new2}}$. The results from sorting on $SENT^{\text{new}}$ and $SENT^{\text{new 2}}$ are quite different from those from sorting on the original BW sentiment index, $SENT$. That is, the strong evidence supporting SYY's three hypotheses found in the results from sorting on $SENT$ is hardly found in the results from sorting on $SENT^{\text{new}}$ and $SENT^{\text{new 2}}$. Specifically, when sorting on $SENT^{\text{new}}$, the differences in average benchmark-adjusted returns on the long-short portfolios between months following high and low sentiment are positively statistically significant in only five of the 11 anomalies (compared to seven of the 11 anomalies when sorting on $SENT$) and those on the short-leg portfolios are negatively statistically significant in only six of the 11 anomalies (compared to 10 of the 11 anomalies when sorting on $SENT$) at the one-tailed 5% level. When sorting on $SENT^{\text{new 2}}$, the predictability of the sentiment index for the returns in the 11 anomalies becomes further weakened. That is, only three of the 11 individual t-statistics for the differences are positively and negatively statistically significant at the one-tailed 5% level in the long-short portfolios and in the short-leg portfolios, respectively. Further, the magnitude of the differences in absolute value obtained from sorting on $SENT^{\mathrm{new}}$ and $SENT^{\mathrm{new}\,2}$ is much smaller than that obtained from sorting on $SENT$.

The above results indicate that the predictability of the BW sentiment index for the anomalies reported in SYY could be sensitive to how the influence of macroeconomic conditions is removed from the sentiment proxies.

4.7. An Alternative Sentiment Index - Michigan Sentiment Index

As discussed in the previous section, when we use the BW sentiment index as a measure of investor sentiment, we inevitably confront the issue on the effects of macroeconomic variables on its predictability for the returns in the anomalies. In this section, we use an alternative sentiment index, the Michigan sentiment index, which is less susceptible to this issue. The Michigan sentiment index is a monthly series published by the University of Michigan Surveys of Consumers. Unlike the BW sentiment index, which is constructed from the six sentiment proxies that may be directly influenced by macroeconomic conditions, the Michigan sentiment index is based simply on a survey of 500 randomly selected households. Therefore, the Michigan sentiment index is probably less affected by particular macroeconomic variables and is arguably a pure measure of investor sentiment.

Panel A of Table 8 presents the average benchmark-adjusted returns of the long-leg, short-leg, and long-short portfolios of the 11 anomalies during months following high and low investor sentiment, classified as High or Low based on the median value of the Michigan sentiment index ($MICH$).[22] When sorting on $MICH$, only two individual t-statistics of the 11 anomalies for the

[22] Since the monthly series of the Michigan sentiment index are available from January 1978, our sample period

difference in average return on the long-short portfolio between months following high and low investor sentiment are positively statistically significant at the one-tailed 5 percent level. For the case of the short-leg portfolios, only five individual t-statistics for the difference are negatively statistically significant at the one-tailed 5 percent level. Note that when sorting on the BW sentiment index (*SENT*), seven and ten individual t-statistics for the difference are positively and negatively statistically significant in the case of the long-short portfolios and the short-leg portfolios, respectively. These results indicate that even without adjustment for macroeconomic variables, the SYY hypotheses are hardly supported when using the Michigan sentiment index.

When the Michigan sentiment index is adjusted for the macroeconomic variables, the statistical significance of the results obtained from sorting on $MICH$ is much weakened. We compute two residual Michigan sentiment indexes, RES_{MICH} and RES''_{MICH}. RES_{MICH} is computed as the residual from the predictive regression (1) of $MICH_t$ on a vector of the six macroeconomic variables used in Baker and Wurgler (2006) to orthogonalize the six BW sentiment proxies. RES''_{MICH} is computed similarly to RES_{MICH}, except that the full set of the combined 11 macroeconomic variables (the six variables used in computing RES_{MICH} plus the five variables considered in this paper) are used as predictors in equation (1). When sorting on RES_{MICH} (Panel B), only two (four) of the 11 individual t-statistics for the differences in average returns on the long-short (short-leg) portfolios are statistically significant, respectively. When sorting on RES''_{MICH} (Panel C), none (only one) of the 11 individual t-statistics for the differences in average returns on the long-short (short-leg) portfolios is statistically significant, respectively.

To summarize, the above results indicate that investor sentiment plays a weaker role in

in this analysis is from January 1978 to January 2008.

explaining for the returns in the anomalies than argued in SYY.

5. Can Macroeconomic Risk Explain the Anomaly Returns?

In the previous sections, we show that the predictability of the BW sentiment index for the results in the anomalies is attributed mainly to the sentiment index component linked to the macroeconomic variables. In this section, to examine specifically a pricing ability of the macroeconomic variables in the anomalies, we attempt to identify the risk factors associated with those macroeconomic variables. We also examine whether the risk factors are priced and to what extent they can explain the returns in the anomalies. More importantly, we examine whether the risk factors are more sensitive to the stocks in each short-leg portfolio but less to those in each long-leg portfolio and whether the time-varying premiums of these risk factors are correlated with the BW sentiment index. If this is the case, we can obtain results consistent with the prediction based on SYY's hypotheses, although investor sentiment plays no significant role in explaining the returns in the anomalies.

5.1. Risk Exposure to Macroeconomic Variables

To control for the mutual influence of the five macroeconomic variables, following Petkova (2006), we first estimate a vector autoregressive (VAR) process specification with order of one containing all five variables. We then extract five series of residuals representing innovation or surprise in each macroeconomic variable. This $\mathrm{VAR}(1)$ represents a joint specification of the dynamics of all the five candidate state variables.

To identify the risk factors associated with the five macroeconomic variables, following

Lehmann and Modest (1988), Eckbo, Masulis, and Norli (2000), and Cooper and Priestley (2011), we first construct five factor-mimicking portfolios for innovations in the macroeconomic variables from 40 test assets (ten value-weighted size portfolios, ten value-weighted book-to-market portfolios, ten value-weighted momentum portfolios, and ten equal-weighted asset growth portfolios) as follows.[23] We regress the return of each of the 40 test assets on innovations in the five macroeconomic variables. These 40 contemporaneous time-series regressions produce a (40×5) matrix B of slope coefficients against the five factors. If Ω is the (40×40) covariance matrix of error terms from the 40 time-series regressions, then the weights on the five mimicking portfolios are computed by $w = (B'\Omega^{-1}B)^{-1}B'\Omega^{-1}$, and the mimicking portfolios are given by wR', where R is a (T×40) matrix containing the returns of the 40 test assets. That is, for each factor k, the return in month t of the corresponding mimicking portfolio is computed by multiplying the k-th row of the factor weights w by the vector of returns in month t of the test assets. The mimicking portfolio for a particular factor has unit factor loading (or beta) to the factor and zero factor loading to the remaining factors. We regard these five mimicking portfolios as the risk factors associated with the five macroeconomic variables.

Table 9 presents the factor loadings estimated from monthly multivariate time-series regressions of excess returns of the long-leg (Panel A), short-leg (Panel B), and long-short (Panel C) portfolios of each anomaly on the returns of the five mimicking portfolios. The stocks in the long-leg and short-leg portfolios have mostly negative risk exposures (i.e., factor loadings) on the factors related to cay, term spread, Treasury bill yield, and inflation rate and positive risk exposures on the factor related to default spread. Stocks in the short-leg portfolios generally have

[23] The size, book-to-market, and momentum portfolios are taken from Kenneth French's website (http://mba.tuck. dartmouth.edu/pages/faculty/ken.french/).

greater risk exposures in absolute value on the five factors than do the stocks in the long-leg portfolios.[24] Specifically, as a summary statistic, factor loading estimates of the returns of the long-leg vs. short-log portfolios in the combination strategy on the five factors are -0.29 vs. -0.48 for cay, -1.06 vs. -1.63 for term spread, 0.99 vs. 1.59 for default spread, -0.53 vs. -0.86 for Treasury bill yield, and -0.35 vs. -0.52 for inflation rate. These results indicate that the risk factors associated with the macroeconomic variables tend to be more sensitive to the stocks in each short-leg portfolio but less to those in each long-leg portfolio. Thus, the factor loadings of the returns in the long-short portfolios of the anomalies (i.e., the spreads in factor loading) are in general positive for the factors related to cay, term spread, Treasury bill yield, and inflation rate and negative for the factor related to default spread.

5.2. Explaining the Returns in the Anomalies with Macroeconomic Factors

In this section, we examine to what extent the spread in the factor loadings between the short-leg and long-leg portfolios in each anomaly can explain the spread in average returns between those portfolios. In other words, we examine the extent to which the spread in (realized) average return between the short-leg and long-leg portfolios can be explained by the spread in expected return computed as the product of the factor loadings of these portfolios on the factors and the risk premium estimates associated with the factors.

To do this, we first estimate the risk premiums associated with the five factors within the Fama and MacBeth (1973) two-pass methodology. Specifically, in the first-pass, factor loadings

[24] We also obtain a similar pattern in the factor loadings across the long-leg and short-leg portfolios when innovations in the five macroeconomic variables are used as regressors, instead of using the returns of the factor-mimicking portfolios. The results are available upon request.

(or betas) are estimated from monthly time-series regressions of returns of test assets on returns of the five mimicking portfolios by using the 60-month rolling-window and the full sample, respectively. In the second-pass, for each month we estimate the regression coefficients (γ's) in the cross-sectional regression (CSR) of returns of test assets on the five factor loadings estimated in the first-pass. We use the same 40 portfolios as test assets used for constructing the mimicking portfolios: ten value-weighted size portfolios, ten value-weighted book-to-market portfolios, ten value-weighted momentum portfolios, and ten equal-weighted asset growth portfolios. The time-series averages of the month-by-month CSR coefficient estimates are the estimates of the risk premiums.

Table 10 presents the risk premium estimates associated with the five factors for the period from August 1965 to January 2008. Note that when the predictive betas with the 60-month rolling-window are used in the CSR as regressors, we use the same beta estimates for the first 60 months of the sample period. The risk premium estimates are mostly statistically significant at the traditional significance level, whether the predictive betas with the 60-month rolling-window or the full-sample betas are used.[25] For example, when the predictive betas with the 60-month rolling-window are used, the risk premium estimates are 0.09 percent (t-statistic of 1.77) for cay, 0.12 percent (t-statistic of 1.84) for term spread, -0.08 percent (t-statistic of -3.39) for default spread, -0.31 percent (t-statistic of -2.95) for Treasury bill yield, and 0.09 percent (t-statistic of 2.13) for inflation rate.[26] The average adjusted R^2 of the CSRs is 0.466, which is comparable to

[25] We also use the extending-window sample to estimate factor loadings that always starts in August 1965 (the first month of the sample period). However, the results of the risk premium estimates are qualitatively similar to those obtained from using the beta estimates with a 60-month rolling-window and the full sample.

[26] The t-statistics of the risk premium estimates are Shanken (1992)-corrected. Note that Shanken (1992) provides an errors-in-variables (EIV) correction for standard errors of the risk premium estimates, while Kim (1995, 1997) provides an EIV-correction for the risk premium estimates themselves.

other studies.[27] These results indicate that the factors related to the macroeconomic variables are mostly priced. Note that the intercept estimates in the CSRs are quite large and statistically significant. This means that while the factors can explain a substantial portion of the cross-sectional spread in the average returns of the test assets, those factors may be insufficient to fully explain the cross-section of average returns of the test assets.

The next step is to compute the expected returns of the long-leg and short-leg portfolios implied by the risk factors related to the macroeconomic variables and compare the expected returns with the (realized) average returns of the portfolios in each anomaly. The expected return of the portfolio is the time-series average of the products of the risk premium estimates and the factor loadings in month t, computed as

$$\mathrm{E}(R_t) = \hat{\gamma}_{\text{cay},t}\hat{\beta}_{\text{cay},t} + \hat{\gamma}_{\text{term,t}}\hat{\beta}_{\text{term},t} + \hat{\gamma}_{\text{default},t}\hat{\beta}_{\text{default},t} + \hat{\gamma}_{\text{T-bill},t}\hat{\beta}_{\text{T-bill},t} + \hat{\gamma}_{\text{inflation},t}\hat{\beta}_{\text{inflation},t}, \quad (6)$$

where $\hat{\gamma}_{\cdot t}$'s are the risk premium estimates from the month-by-month CSR in month t and $\hat{\beta}_{\cdot t}$'s are the factor loading estimates obtained from time-series regressions of returns of the (long-leg or short-leg) portfolio on returns of the five mimicking portfolios. Then, we take the difference in the expected return between the long-leg and short-leg portfolios in each anomaly as the expected return spread. The (realized) average return spread is obtained as the difference in average return between the long-leg and short-leg portfolios in each anomaly.

Given the risk premium estimates in Table 10 and the full-sample factor loading estimates of the long-short portfolios in Table 9, we anticipate a substantial positive amount of the expected return spread in each anomaly, since both the risk premium and factor loading estimates of the

[27] For example, Cooper and Priestley (2011) estimate the risk premiums for the factors associated with the Chen, Roll, and Ross (1986) macroeconomic variables by using the similar test portfolios in the CSR to ours and report the average adjusted R^2 of 0.48.

long-short portfolios in the anomalies have in general the same sign for the five factors except for Treasury bill yield.

Table 11 compares the average return spread and the expected return spread in each anomaly. The expected returns are computed each month by multiplying the risk premium estimates by the factor loading estimates obtained from the 60-month rolling window. The expected return spread implied from the five macroeconomic factors are positive in all the 11 anomalies. The difference between the expected and average return spreads is statistically insignificant at the 5 percent level in four among the 11 anomalies (failure probability, Ohlson's O-score, composite equity issuance, and gross profitability premium). For example, the expected return spread across the long-leg and short-leg portfolios in failure probability is 0.58 percent per month, while the average return spread across the same portfolios is 0.95 percent per month. The t-statistic for the null hypothesis of no difference between the average and expected return spreads in this anomaly is 0.09. The fraction of the average return spread in failure probability accounted for by its expected return spread is 61 percent. The average faction of the average return spread accounted for by the expected return spread in the above-mentioned four anomalies is 59 percent. This indicates that a large portion of the return of the long-short portfolio in these anomalies is attributed to the expected return implied by risk exposures to the five macroeconomic variables.

Meanwhile, the difference between the expected and average return spreads in the other seven anomalies (net stock issuance, total accrual, net operating assets, momentum, asset growth, ROA, and investment-to-asset) is statistically significant at the 5 percent level. The average fraction of the average return spread accounted for by the expected return spread in these seven anomalies is 21 percent. This indicates that although the null hypotheses of no difference between the average and expected return spreads are rejected for these seven anomalies, the average return spreads of these anomalies are still moderately accounted for by their expected return spread.

The above result also indicates that the model cannot fully explain the average return spreads in the above-mentioned seven anomalies by the expected return spreads implied by the five macroeconomic factors. However, this does not necessarily mean that the returns of the long-short portfolios in these anomalies are not attributed to macroeconomic conditions, since risk exposures to macroeconomic variables other than the five used in this study may satisfactorily account for the returns. For example, using the five Chen, Roll, and Ross (1986) (CRR) macroeconomic factors (growth in industrial production, unexpected inflation, change in expected inflation, term spread, and default spread) and a methodology similar to ours, Cooper and Priestley (2011) report that the average return spreads in two anomalies (asset growth and investment-to-asset) not satisfactorily accounted for by the five macroeconomic factors used in this study are largely accounted for by their expected return spreads implied by the CRR factors.[28]

From the above results, we argue that, in general, the returns of the long-short portfolio in the anomalies can be substantially accounted for by their expected returns implied from a pricing kernel containing factors associated with macroeconomic variables.

5.3. Is the Investor Sentiment Index Correlated with Risk Premiums?

If a risk factor is more sensitive to the returns in each short leg but less sensitive to the returns in each long leg and the premium of the factor varies over time in a manner correlated with the sentiment index, the results obtained could be consistent with the prediction of SYY's hypotheses,

[28] Cooper and Priestley (2011) report that the factions of the average return spread accounted for by the expected return spread in the two anomalies (asset growth and investment-to-asset), are 69 percent and 55 percent, respectively.

whether or not investor sentiment plays a role in explaining the returns in the anomalies. As shown in Table 9, the risk exposure of stocks on the five factors are, in absolute value, generally greater in the short-leg portfolios than in the long-leg portfolios. In this section, we examine whether the BW sentiment index exhibits a correlation with the variations in risk premiums of the factors associated with the five macroeconomic variables.

In Panel A of Table 12, we present the estimation results of contemporaneous time-series regressions of the BW sentiment index on the five monthly risk premium estimates. From the table, the BW sentiment index is quite correlated with the risk premium estimates. For example, when the risk premium estimates obtained from using the full-sample betas are used as regressors, the coefficient estimates on the five risk premium estimates are 0.12 (t-statistic of 3.03) for cay, -0.04 (t-statistic of -0.72) for term spread, 0.14 (t-statistic of 2.72) for default spread, -0.03 (t-statistic of -0.84) for Treasury bill rate, and -0.12 (t-statistic of -2.30) for inflation rates. The coefficient estimates for cay, default spread, and inflation rates are statistically significant at the 5 percent level. The intercept estimate is statistically insignificant. Further, the p-value for an F-test for the null hypothesis that all slope coefficients are zero is less than 0.001; this indicates that the null hypothesis is strongly rejected. When the risk premium estimates obtained from using the 60-month rolling-window predictive betas are used, the results are quite similar.

On the other hand, when the Michigan sentiment index is regressed on the five risk premium estimates, we obtain quite different results. The estimation results (Panel B of Table 12) show that none of the slope coefficient estimates is statistically significant. However, the intercept estimate is strongly statistically significant (with a t-statistic of 131.74) and the adjusted R^2 is -0.009. These results indicate that the Michigan sentiment index is completely uncorrelated with the risk premium estimates. Note that when sorting on the Michigan sentiment index, we find the results hardly supporting SYY's hypotheses (see Table 8).

Based on the above results, we argue that SYY's results consistent with the prediction by their hypotheses is a consequence of the BW sentiment index co-varying with the risk premiums of the factors associated with the macroeconomic variables.

6. Conclusions

Recently, SYY provided empirical results consistent with their hypotheses on the role of investor sentiment in the degree of mispricing (in particular, overpricing) in a variety of asset pricing anomalies and argued that sentiment-related overpricing is the primary source of the profitable opportunities in the anomalies, particularly in short-leg portfolios. As a measure of market-wide investor sentiment, SYY used the investor sentiment index constructed by Baker and Wurgler (2006). However, SYY's results might be mixed with the effect of macroeconomic conditions, because the sentiment index they used might still contain a link to some macroeconomic variables. We therefore need to re-examine the role of investor sentiment in explaining the returns in the anomalies after controlling for such a link and then examine to what extent the returns in the anomalies can be accounted for by the risk factors associated with the macroeconomic variables.

When we use the sentiment index predicted by a set of macroeconomic variables, results consistent with SYY's hypotheses are obtained. However, when we remove the effect of the macroeconomic variables from the sentiment index, we no longer obtain results consistent with their hypotheses. As a next step, we examine the pricing ability of the macroeconomic variables in the anomalies. We find that the risk factors associated with the macroeconomic variables are mostly priced and that a large portion of the average return spread across the long-leg and short-leg portfolios in the anomalies is, in general, accounted for by their expected return spread implied by the risk factors. More importantly, we find that the risk factors tend to be more sensitive to the return in each short-leg portfolio but less sensitive to the return in each long-leg portfolio and that the BW sentiment index is significantly correlated with the risk premium estimates of those factors.

The above results indicate that the BW sentiment index used in SYY still contains components of macroeconomic conditions, and a substantial amount of the predictability of the BW sentiment index for the returns in the anomalies reported in SYY is attributed to the sentiment index co-varying with the risk premiums of the factors associated with the macroeconomic variables. Overall, our results indicate that SYY's results might be a consequence of the use of an inadequately constructed sentiment index in that it is still mixed with the effects of macroeconomic conditions. Overall, our results indicate that SYY's results might be a consequence of the use of an inadequately constructed sentiment index in that it is still mixed with the effects of macroeconomic conditions. We therefore assert that our empirical evidence supports a risk-based explanation rather than a sentiment-based explanation for the returns in the anomalies. However, we do not assert that investor sentiment plays little role in the mispricing of stocks in the anomalies, since our empirical evidence is not strong enough to solidly rule out a sentiment-based explanation and the argument of sentiment-driven mispricing, combined with that by Miller (1977) regarding impediments to short selling, is still legitimate.

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Table 1 Correlation Coefficients between the Investor Sentiment Index and Macroeconomic Variables

Panel A presents the Spearman contemporaneous correlation coefficients among the Baker and Wurgler (2006) investor sentiment index (*SENT*) and the macroeconomic variables. "cay" is the Lettau and Ludvigson (2001) consumption-wealth ratio. "T-bill yield" is the three-month Treasury bill yield. Numbers in square brackets indicate p-values. Panel B presents the Spearman correlation coefficients between *SENT* and the one-month-lagged macroeconomic variables. ***, **, and * refer to statistical significance at the 1%, 5%, and 10% levels, respectively. The sample period is July 1965 to December 2007.

	cay	Term spread	Default spread	T-bill yield	Inflation
	Panel A. Contemporaneous correlation coefficients				
Term spread	0.269***				
	[0.000]				
Default spread	-0.083*	0.220***			
	[0.060]	[0.000]			
T-bill yield	0.152***	-0.482***	0.383***		
	[0.001]	[0.000]	[0.000]		
Inflation	-0.215***	-0.342***	0.172***	0.450***	
	[0.000]	[0.000]	[0.000]	[0.000]	
SENT	0.203***	-0.089**	0.182***	0.312***	-0.057
	[0.000]	[0.045]	[0.000]	[0.000]	[0.203]
	Panel B. Correlation coefficients of the investor sentiment index (SENT) with lagged macroeconomic variables				
SENT	0.200***	-0.102**	0.171***	0.318***	-0.050
	[0.000]	[0.022]	[0.000]	[0.000]	[0.261]

Table 2 Average Returns of the Anomalies during Months Following High- and Low-Sentiment Sorted on the Predicted Sentiment

This table presents average excess and benchmark-adjusted returns of the anomalies' highest-performing deciles (*long leg*), lowest-performing deciles (*short leg*), and long-short portfolios during months following high and low levels of investor sentiment, classified as HIGH or LOW based on the median level of the predicted sentiment index (*PRED*). The predicted sentiment index at month t is computed as the fitted (predicted) value from the following time-series regression model: $SENT_t = \theta_0 + \theta_1 X_{t-1} + \varepsilon_t$, where $SENT_t$ is the Baker and Wurgler (2006) investor sentiment index at month t and X_{t-1} is a vector of the one-month lagged five macroeconomic variables (cay, term spread, default spread, three-month Treasury-bill yield, and inflation rate). The parameters are estimated by rolling over month by month using the previous 60 monthly observations available up to month t-1. The benchmark-adjusted returns are returns after adjusting for the Fama-French three factors. "Combination" is a strategy that equally combines the 11 anomalies within a given month. The sample period covers August 1965 to January 2008, except for anomaly (i), where the data period begins December 1974, and anomaly (ii) and (x), for which the sample period begins January 1972. Numbers in parentheses indicate White's (1980) heteroskedasticity-adjusted *t*-statistics.

Anomaly	Long leg			Short leg			Long−Short		
	High	Low	High-Low	High	Low	High-Low	High	Low	High-Low
				Panel A: Excess returns					
Failure probability	0.63 (1.70)	1.25 (4.31)	-0.62 (-1.31)	-1.04 (-1.41)	1.05 (1.91)	-2.09 (-2.27)	1.67 (2.82)	0.21 (0.47)	1.47 (1.99)
Ohlson's O	0.05 (0.13)	1.00 (3.95)	-0.94 (-2.04)	-1.13 (-1.90)	0.80 (1.87)	-1.93 (-2.63)	1.18 (3.08)	0.20 (0.65)	0.99 (2.00)
Net stock issuance	0.33 (1.09)	1.06 (4.70)	-0.73 (-1.92)	-0.65 (-1.61)	0.79 (2.84)	-1.44 (-2.93)	0.99 (4.95)	0.27 (1.93)	0.71 (2.91)
Composite equity issuance	0.28 (1.01)	0.97 (4.24)	-0.69 (-1.93)	-0.48 (-1.16)	0.89 (2.99)	-1.37 (-2.69)	0.76 (2.75)	0.08 (0.47)	0.68 (2.12)
Total accrual	0.06 (0.13)	1.38 (4.13)	-1.31 (-2.33)	-0.99 (-1.86)	1.26 (3.35)	-2.25 (-3.45)	1.05 (3.51)	0.12 (0.52)	0.94 (2.51)
Net operating assets	0.35 (0.93)	1.07 (3.71)	-0.71 (-1.50)	-0.79 (-1.83)	0.90 (3.07)	-1.69 (-3.24)	1.14 (4.85)	0.16 (0.94)	0.98 (3.35)
Momentum	0.45 (0.99)	1.76 (5.04)	-1.30 (-2.25)	-1.37 (-2.26)	0.47 (1.14)	-1.83 (-2.51)	1.82 (3.86)	1.29 (4.01)	0.53 (0.93)
Gross profitability premium	0.23 (0.67)	1.15 (4.46)	-0.92 (-2.15)	-0.12 (-0.34)	0.69 (2.80)	-0.81 (-1.89)	0.35 (1.46)	0.45 (2.04)	-0.10 (-0.32)
Asset growth	0.63 (1.60)	1.38 (3.96)	-0.76 (-1.44)	-0.89 (-1.88)	0.98 (3.02)	-1.87 (-3.25)	1.52 (5.51)	0.40 (1.78)	1.11 (3.12)
ROA	0.18 (0.46)	1.12 (3.93)	-0.93 (-1.90)	-1.10 (-1.77)	0.47 (1.07)	-1.57 (-2.07)	1.29 (3.01)	0.65 (1.89)	0.64 (1.16)
Investment to asset	0.30 (0.79)	1.52 (4.74)	-1.22 (-2.48)	-0.72 (-1.65)	1.02 (3.25)	-1.74 (-3.25)	1.01 (4.90)	0.50 (2.47)	0.52 (1.79)
Combination	0.27 (0.80)	1.24 (4.90)	-0.97 (-2.32)	-0.87 (-1.94)	0.84 (2.72)	-1.72 (-3.14)	1.14 (6.06)	0.40 (3.48)	0.74 (3.37)
				Panel B: Benchmark-adjusted returns					
Failure probability	0.37 (1.94)	0.39 (3.13)	-0.02 (-0.08)	-1.54 (-3.98)	-0.78 (-2.46)	-0.76 (-1.56)	1.91 (3.97)	1.17 (3.18)	0.74 (1.26)
Ohlson's O	0.19 (1.89)	0.22 (2.93)	-0.03 (-0.22)	-1.19 (-4.91)	-0.66 (-3.81)	-0.53 (-1.81)	1.37 (5.65)	0.87 (4.46)	0.50 (1.63)
Net stock issuance	0.18 (2.16)	0.21 (3.59)	-0.03 (-0.32)	-0.67 (-3.98)	-0.27 (-2.46)	-0.40 (-1.97)	0.85 (4.73)	0.48 (3.75)	0.37 (1.67)
Composite equity issuance	-0.06 (-0.53)	0.11 (1.12)	-0.17 (-1.14)	-0.57 (-3.03)	-0.26 (-2.58)	-0.31 (-1.44)	0.51 (2.21)	0.37 (2.64)	0.14 (0.51)
Total accrual	0.23 (1.02)	0.28 (1.71)	-0.04 (-0.15)	-0.70 (-2.76)	0.01 (0.07)	-0.71 (-2.45)	0.93 (3.04)	0.27 (1.23)	0.67 (1.83)
Net operating assets	0.37 (2.25)	0.11 (0.83)	0.26 (1.28)	-0.79 (-4.32)	-0.25 (-2.04)	-0.54 (-2.45)	1.16 (4.89)	0.35 (1.98)	0.80 (2.74)
Momentum	0.68 (3.44)	0.58 (3.55)	0.10 (0.40)	-1.29 (-3.29)	-1.00 (-4.43)	-0.29 (-0.63)	1.97 (3.79)	1.58 (4.84)	0.39 (0.63)
Gross profitability premium	0.41 (2.77)	0.44 (3.78)	-0.03 (-0.19)	-0.25 (-1.46)	-0.23 (-1.76)	-0.02 (-0.10)	0.65 (2.78)	0.67 (3.36)	-0.01 (-0.05)
Asset growth	0.39 (2.20)	0.04 (0.27)	0.34 (1.49)	-0.73 (-3.79)	-0.17 (-1.40)	-0.56 (-2.45)	1.12 (4.25)	0.21 (1.09)	0.91 (2.82)
ROA	0.40 (3.01)	0.35 (3.18)	0.04 (0.25)	-0.97 (-2.98)	-0.82 (-3.32)	-0.15 (-0.37)	1.37 (3.89)	1.18 (4.05)	0.19 (0.43)
Investment to asset	0.07 (0.40)	0.26 (2.07)	-0.20 (-0.97)	-0.65 (-3.63)	-0.10 (-0.76)	-0.54 (-2.42)	0.71 (3.47)	0.37 (2.03)	0.35 (1.32)
Combination	0.27 (5.19)	0.27 (5.75)	0.00 (0.04)	-0.80 (-5.46)	-0.40 (-4.45)	-0.39 (-2.25)	1.07 (6.95)	0.68 (6.42)	0.39 (2.10)

Table 3 Average Returns of the Anomalies during Months Following High- and Low-Sentiment Sorted on the Residual Sentiment

This table presents average excess and benchmark-adjusted returns of the anomalies' highest-performing deciles (*long leg*), lowest-performing deciles (*short leg*), and long-short portfolios during months following high and low levels of investor sentiment, classified as HIGH or LOW based on the median level of the residual sentiment index (*RES*) which is computed as the residual from the following time-series regression model: $SENT_t = \theta_0 + \theta_1 X_{t-1} + \varepsilon_t$, where $SENT_t$ is the Baker and Wurgler (2006) investor sentiment index and X_{t-1} is a vector of the one-month lagged five macroeconomic variables (cay, term spread, default spread, three-month Treasury-bill yield, and inflation rate). The parameters are estimated by rolling over month by month using the previous 60 monthly observations available up to month t-1. The benchmark-adjusted returns are returns after adjusting for the Fama-French three factors. Numbers in parentheses indicate heteroskedasticity-adjusted *t*-statistics of White (1980).

Anomaly	Long leg			Short leg			Long−Short		
	High	Low	High-Low	High	Low	High-Low	High	Low	High-Low
Panel A: Excess returns									
Failure probability	1.19 (3.78)	0.68 (1.93)	0.50 (1.06)	0.17 (0.25)	-0.19 (-0.31)	0.36 (0.39)	1.02 (1.73)	0.87 (1.95)	0.14 (0.19)
Ohlson's O	0.80 (2.46)	0.24 (0.70)	0.56 (1.19)	0.18 (0.33)	-0.55 (-1.07)	0.73 (0.98)	0.62 (1.72)	0.79 (2.29)	-0.17 (-0.34)
Net stock issuance	0.88 (3.46)	0.51 (1.81)	0.37 (0.96)	0.11 (0.33)	0.03 (0.07)	0.08 (0.17)	0.77 (4.37)	0.49 (2.84)	0.28 (1.15)
Composite equity issuance	0.68 (2.81)	0.56 (2.12)	0.13 (0.36)	0.29 (0.87)	0.12 (0.31)	0.16 (0.32)	0.40 (1.90)	0.44 (1.79)	-0.04 (-0.12)
Total accrual	1.14 (2.78)	0.30 (0.77)	0.84 (1.48)	0.61 (1.31)	-0.34 (-0.73)	0.95 (1.44)	0.53 (1.92)	0.64 (2.50)	-0.11 (-0.30)
Net operating assets	0.82 (2.46)	0.60 (1.76)	0.22 (0.46)	0.16 (0.45)	-0.04 (-0.11)	0.20 (0.39)	0.66 (3.40)	0.64 (2.89)	0.01 (0.05)
Momentum	1.42 (3.27)	0.79 (2.05)	0.64 (1.10)	-0.24 (-0.47)	-0.67 (-1.25)	0.43 (0.59)	1.66 (3.96)	1.46 (3.74)	0.21 (0.36)
Gross profitability premium	0.85 (3.09)	0.52 (1.58)	0.33 (0.77)	0.25 (0.83)	0.32 (1.05)	-0.07 (-0.16)	0.60 (2.63)	0.20 (0.86)	0.40 (1.24)
Asset growth	1.28 (3.76)	0.72 (1.81)	0.56 (1.07)	0.19 (0.49)	-0.11 (-0.26)	0.30 (0.52)	1.09 (3.95)	0.83 (3.60)	0.26 (0.72)
ROA	0.83 (2.40)	0.46 (1.27)	0.37 (0.74)	-0.45 (-0.77)	-0.23 (-0.46)	-0.23 (-0.29)	1.28 (2.92)	0.69 (2.01)	0.60 (1.07)
Investment to asset	1.07 (3.23)	0.74 (2.01)	0.33 (0.67)	0.36 (1.03)	-0.05 (-0.13)	0.41 (0.76)	0.72 (3.53)	0.79 (3.85)	-0.08(-0.27)
Combination	0.96 (3.36)	0.55 (1.77)	0.41 (0.97)	0.13 (0.34)	-0.16 (-0.39)	0.28 (0.51)	0.83 (5.13)	0.71 (4.64)	0.13 (0.57)
Panel B: Benchmark-adjusted returns									
Failure probability	0.46 (2.82)	0.29 (1.97)	0.17 (0.81)	-1.43 (-3.70)	-0.90 (-2.81)	-0.53 (-1.09)	1.90 (4.04)	1.19 (3.09)	0.71 (1.19)
Ohlson's O	0.23 (2.51)	0.18 (2.09)	0.05 (0.42)	-1.03 (-4.63)	-0.83 (-4.01)	-0.20 (-0.67)	1.26 (5.44)	1.00 (4.60)	0.26 (0.80)
Net stock issuance	0.27 (3.72)	0.12 (1.70)	0.16 (1.58)	-0.62 (-4.18)	-0.32 (-2.53)	-0.30 (-1.60)	0.90 (5.62)	0.44 (2.96)	0.46 (2.17)
Composite equity issuance	0.01 (0.10)	0.03 (0.30)	-0.02 (-0.15)	-0.53 (-3.46)	-0.30 (-2.14)	-0.23 (-1.16)	0.54 (2.88)	0.33 (1.80)	0.21 (0.82)
Total accrual	0.42 (2.02)	0.09 (0.53)	0.32 (1.23)	-0.19 (-0.81)	-0.50 (-2.69)	0.30 (1.03)	0.61 (2.17)	0.59 (2.35)	0.02 (0.05)
Net operating assets	0.18 (1.18)	0.30 (2.02)	-0.12 (-0.60)	-0.64 (-4.07)	-0.39 (-2.78)	-0.25 (-1.21)	0.82 (4.13)	0.69 (3.16)	0.12 (0.43)
Momentum	0.64 (3.52)	0.62 (3.54)	0.03 (0.11)	-1.27 (-3.81)	-1.03 (-3.71)	-0.24 (-0.58)	1.91 (4.32)	1.64 (4.29)	0.27 (0.48)
Gross profitability premium	0.44 (3.27)	0.41 (3.07)	0.03 (0.16)	-0.41 (-2.56)	-0.06 (-0.45)	-0.35 (-1.62)	0.85 (3.77)	0.47 (2.22)	0.38 (1.22)
Asset growth	0.26 (1.59)	0.17 (0.97)	0.09 (0.40)	-0.55 (-3.37)	-0.35 (-2.37)	-0.20 (-0.93)	0.81 (3.46)	0.52 (2.40)	0.29 (0.96)
ROA	0.29 (2.27)	0.46 (3.94)	-0.16 (-0.96)	-1.48 (-4.83)	-0.35 (-1.28)	-1.13 (-2.79)	1.77 (5.10)	0.81 (2.59)	0.96 (2.06)
Investment to asset	0.12 (0.85)	0.21 (1.43)	-0.09 (-0.45)	-0.41 (-2.47)	-0.35 (-2.32)	-0.06 (-0.26)	0.53 (2.76)	0.56 (2.80)	-0.03 (-0.12)
Combination	0.29 (5.72)	0.25 (4.97)	0.04 (0.59)	-0.74 (-5.57)	-0.46 (-4.33)	-0.27 (-1.61)	1.03 (7.23)	0.72 (6.06)	0.31 (1.72)

Table 4 Returns of the Anomalies Predicted by Macroeconomic Variables during Months Following High- and Low-Sentiment

This table presents the predicted average returns of the 11 anomalies by the macroeconomic variables from the following predictive regressions:

Eqn (1): $R_{i,t} = \lambda_0 + \lambda_1 X_{t-1} + \varepsilon_{i,t}$, and Eqn (2): $R_{i,t} = \lambda_0 + \lambda_1 X_{t-1} + \lambda_2 Z_t + \varepsilon_{i,t}$, where $R_{i,t}$ is the excess return in month *t* on the long-leg, short-leg, or the difference (long-short) of each anomaly, X_{t-1} is a vector of the one-month lagged five macroeconomic variables (cay, term spread, default spread, three-month Treasury-bill yield, and inflation rate), and Z_t is the vector of the Fama-French three factors. The predictive regressions are estimated by rolling over month by month using the previous 60 monthly observations available up to month t-1. The predicted returns are measured as the estimates of $\lambda_1 X_{t-1}$ from equations (1) and (2), respectively. The predicted returns from equation (1) are denoted as the predicted excess returns (Panel A), and those from equation (2) are denoted as the predicted benchmark-adjusted returns (Panel B). The predicted returns are then classified as HIGH or LOW based on the median level of predicted sentiment which is computed as $\hat{\theta}_1 X_{t-1}$ from the following time-series regression model: $SENT_t = \theta_0 + \theta_1 X_{t-1} + \varepsilon_t$, where $SENT_t$ is the Baker and Wurgler (2006) investor sentiment index. The parameters are estimated by rolling over month by month using the previous 60 monthly observations available up to month t-1. Numbers in parentheses indicate heteroskedasticity-adjusted t-statistics of White (1980). The sample period is August 1965 to January 2008.

Anomaly	Long leg			Short leg			Long-Short		
	High	Low	High-Low	High	Low	High-Low	High	Low	High-Low
Panel A: Predicted excess returns by the macroeconomic variables									
Failure probability	1.00 (5.23)	1.11 (6.76)	-0.11 (-0.42)	0.35 (0.92)	1.52 (4.31)	-1.17 (-2.24)	0.65 (2.29)	-0.41 (-1.55)	1.06 (2.73)
Ohlson's O	0.59 (2.73)	0.94 (5.63)	-0.36 (-1.30)	0.07 (0.20)	1.06 (3.60)	-0.99 (-2.15)	0.52 (2.18)	-0.11 (-0.61)	0.63 (2.09)
Net stock issuance	0.68 (4.38)	1.12 (8.35)	-0.43 (-2.11)	-0.17 (-0.76)	0.94 (5.21)	-1.11 (-3.85)	0.85 (7.65)	0.18 (2.01)	0.67 (4.74)
Composite equity issuance	0.65 (4.91)	1.02 (8.12)	-0.37 (-2.03)	-0.10 (-0.48)	1.09 (5.30)	-1.19 (-4.02)	0.75 (5.31)	-0.07 (-0.58)	0.82 (4.47)
Total accrual	0.75 (3.25)	1.72 (9.17)	-0.97 (-3.25)	-0.43 (-1.55)	1.42 (6.28)	-1.85 (-5.18)	1.18 (8.23)	0.30 (2.55)	0.88 (4.79)
Net operating assets	0.80 (4.18)	1.15 (6.81)	-0.34 (-1.34)	-0.38 (-1.84)	0.89 (4.44)	-1.27 (-4.43)	1.18(10.87)	0.26 (2.60)	0.93 (6.32)
Momentum	1.20 (4.15)	1.84 (8.97)	-0.64 (-1.81)	-0.87 (-3.40)	1.21 (4.06)	-2.08 (-5.29)	2.07 (9.46)	0.63 (2.72)	1.44 (4.53)
Gross profitability premium	0.49 (2.76)	1.15 (7.62)	-0.66 (-2.81)	0.30 (1.72)	0.98 (6.27)	-0.68 (-2.88)	0.19 (1.43)	0.17 (1.65)	0.02 (0.11)
Asset growth	1.48 (7.14)	1.65 (8.25)	-0.17 (-0.59)	-0.64 (-2.73)	0.87 (4.21)	-1.51 (-4.83)	2.12(13.63)	0.78 (6.36)	1.34 (6.76)
ROA	0.74 (3.47)	0.65 (4.30)	0.08 (0.32)	0.10 (0.29)	0.91 (3.17)	-0.81 (-1.78)	0.63 (2.90)	-0.25 (-1.34)	0.89 (3.07)
Investment to asset	0.86 (4.19)	1.80 (9.93)	-0.94 (-3.42)	-0.44 (-2.11)	0.89 (4.68)	-1.33 (-4.70)	1.31(11.45)	0.91 (9.57)	0.40 (2.67)
Combination	0.77 (4.32)	1.37 (9.04)	-0.60 (-2.56)	-0.30 (-1.31)	1.12 (5.30)	-1.42 (-4.57)	1.07(13.70)	0.25 (3.04)	0.82 (7.35)
Panel B: Predicted benchmark-adjusted returns by the macroeconomic variables									
Failure probability	0.26 (3.62)	0.47 (6.53)	-0.22 (-2.13)	-1.24 (-6.83)	-0.33 (-2.22)	-0.91 (-3.89)	1.50 (7.34)	0.80 (4.50)	0.70 (2.57)
Ohlson's O	0.19 (4.19)	0.28 (6.20)	-0.10 (-1.52)	-0.97 (-7.54)	-0.41 (-3.56)	-0.56 (-3.22)	1.16 (8.65)	0.70 (5.44)	0.46 (2.49)
Net stock issuance	0.23 (5.77)	0.27 (7.96)	-0.04 (-0.71)	-0.43 (-6.44)	-0.26 (-4.35)	-0.17 (-1.95)	0.67 (8.06)	0.53 (7.68)	0.14 (1.27)
Composite equity issuance	-0.06(-0.96)	0.13 (2.54)	-0.19 (-2.33)	-0.39 (-5.95)	-0.14 (-2.03)	-0.25 (-2.70)	0.33 (3.58)	0.26 (3.00)	0.06 (0.49)
Total accrual	0.47 (4.60)	0.32 (3.41)	0.15 (1.06)	-0.66 (-6.60)	-0.15 (-2.29)	-0.51 (-4.21)	1.13 (8.35)	0.48 (4.24)	0.65 (3.72)
Net operating assets	0.18 (2.53)	0.20 (3.31)	-0.02 (-0.20)	-0.69 (-8.72)	-0.48 (-6.32)	-0.20 (-1.83)	0.86 (8.80)	0.68 (7.32)	0.18 (1.35)
Momentum	0.69 (6.74)	0.32 (3.67)	0.37 (2.79)	-1.42(-10.45)	-0.56 (-3.90)	-0.87 (-4.39)	2.11(10.25)	0.87 (4.32)	1.24 (4.29)
Gross profitability premium	0.31 (3.49)	0.35 (7.24)	-0.04 (-0.43)	-0.41 (-5.39)	-0.01 (-0.15)	-0.41 (-4.21)	0.72 (6.14)	0.36 (4.49)	0.36 (2.55)
Asset growth	0.56 (5.70)	0.27 (3.86)	0.29 (2.38)	-0.77(-10.52)	-0.47 (-7.36)	-0.30 (-3.13)	1.33(10.91)	0.74 (6.93)	0.59 (3.65)
ROA	0.38 (5.75)	0.07 (1.23)	0.31 (3.60)	-1.06 (-7.67)	-0.59 (-5.05)	-0.48 (-2.64)	1.44 (9.78)	0.65 (5.19)	0.79 (4.06)
Investment to asset	0.21 (2.47)	0.46 (9.19)	-0.25 (-2.48)	-0.63 (-8.27)	-0.34 (-5.01)	-0.29 (-2.81)	0.84 (7.81)	0.80(10.01)	0.04 (0.31)
Combination	0.31(10.95)	0.28(14.19)	0.04 (1.03)	-0.75(-12.75)	-0.32 (-6.30)	-0.43 (-5.47)	1.06(15.41)	0.60(10.85)	0.46 (5.23)

Table 5 Predictive Regressions of Anomalies on Investor Sentiment Proxies

This table reports the coefficient estimates ($\hat{\gamma}_1$) on the investor sentiment proxy variables and the adjusted R^2 in the following predictive regression: $R_{i,t} = \gamma_0 + \gamma_1 S_{t-1} + \varepsilon_{i,t}$, and $R_{i,t} = \gamma_0 + \gamma_1 S_{t-1} + \gamma_2 Z_t + \varepsilon_{i,t}$, where $R_{i,t}$ is the excess return in month *t* on the long-leg, short-leg, or long-short portfolio of each anomaly, S_{t-1} is the investor sentiment proxy variable, and Z_t is the vector of the Fama-French three factors. The investor sentiment indexes considered are the Baker and Wurgler (2006) investor sentiment index (*SENT*), the predicted sentiment index (*PRED*) by the five macroeconomic variables (cay, term spread, default spread, three-month Treasury-bill yield, and inflation rate), and the residual sentiment index (*RES*) adjusted for the five macroeconomic variables. Numbers in parentheses indicate White's (1980) heteroskedasticity-adjusted t-statistics, and numbers in brackets indicate adjusted R^2.

Anomaly	Investor sentiment proxy variables (S_{t-1})								
	$SENT$			$PRED$			RES		
	Long	Short	Long-Short	Long	Short	Long-Short	Long	Short	Long-Short
Panel A: Model: $R_{i,t} = \gamma_0 + \gamma_1 S_{t-1} + \varepsilon_{i,t}$									
Failure probability	-0.43	-1.80	1.37	-0.32	-1.46	1.14	-0.41	-1.40	0.99
	(-1.74)	(-2.99)	(2.59)	(-1.32)	(-2.82)	(2.55)	(-0.84)	(-1.25)	(1.13)
	[0.004]	[0.030]	[0.027]	[0.001]	[0.017]	[0.016]	[0.000]	[0.004]	[0.002]
Ohlson's O	-0.24	-1.09	0.85	-0.58	-1.40	0.82	0.61	0.45	0.16
	(-0.8)	(-2.31)	(2.95)	(-2.24)	(-3.48)	(3.09)	(1.10)	(0.56)	(0.31)
	[0.000]	[0.014]	[0.020]	[0.009]	[0.023]	[0.017]	[0.004]	[-0.001]	[-0.002]
Net Stock Issuance	-0.28	-0.84	0.55	-0.39	-0.90	0.51	0.29	0.25	0.04
	(-1.38)	(-2.92)	(3.93)	(-2.08)	(-3.62)	(4.07)	(0.75)	(0.49)	(0.15)
	[0.002]	[0.020]	[0.038]	[0.007]	[0.025]	[0.034]	[0.000]	[-0.001]	[-0.002]
Composite Equity Issuance	-0.21	-0.68	0.47	-0.27	-0.83	0.56	0.16	0.42	-0.26
	(-2.38)	(-1.12)	(2.68)	(-1.42)	(-3.11)	(3.53)	(0.50)	(0.86)	(-0.94)
	[0.001]	[0.012]	[0.015]	[0.003]	[0.019]	[0.023]	[-0.001]	[0.000]	[0.00]
Total Accrual	-0.59	-0.96	0.37	-0.88	-1.26	0.39	0.76	0.83	-0.07
	(-1.82)	(-2.49)	(1.77)	(-3.18)	(-3.85)	(2.13)	(1.43)	(1.25)	(-0.19)
	[0.006]	[0.015]	[0.006]	[0.018]	[0.028]	[0.007]	[0.004]	[0.003]	[-0.002]
Net Operating Assets	-0.34	-0.83	0.49	-0.47	-0.91	0.44	0.36	0.29	0.07
	(-1.29)	(-2.76)	(3.50)	(-2.17)	(-3.46)	(3.19)	(0.74)	(0.56)	(0.27)
	[0.002]	[0.018]	[0.020]	[0.006]	[0.023]	[0.016]	[0.000]	[-0.001]	[-0.002]
Momentum	-0.69	-1.02	0.33	-0.97	-1.06	0.09	0.76	0.21	0.55
	(-2.38)	(-2.41)	(1.07)	(-3.75)	(-3.05)	(0.35)	(1.59)	(0.30)	(1.08)
	[0.009]	[0.013]	[0.001]	[0.021]	[0.015]	[-0.002]	[0.004]	[-0.002]	[0.001]
Gross Profitability Premium	-0.22	-0.54	0.32	-0.48	-0.43	-0.05	0.65	-0.21	0.86
	(-0.94)	(-2.21)	(1.81)	(-2.43)	(-2.12)	(-0.29)	(1.37)	(-0.46)	(2.26)
	[0.000]	[0.010]	[0.006]	[0.008]	[0.006]	[-0.002]	[0.006]	[-0.001]	[0.022]
Asset growth	-0.48	-0.91	0.44	-0.63	-1.11	0.48	0.42	0.56	-0.14
	(-1.68)	(-2.66)	(2.16)	(-2.49)	(-3.75)	(2.75)	(0.85)	(0.89)	(-0.44)
	[0.004]	[0.017]	[0.010]	[0.01]	[0.028]	[0.013]	[0.000]	[0.001]	[-0.001]
ROA	-0.20	-1.14	0.94	-0.54	-1.17	0.64	0.60	-0.07	0.67
	(-0.66)	(-2.35)	(2.79)	(-1.98)	(-3.07)	(2.35)	(1.14)	(-0.09)	(1.21)
	[-0.001]	[0.015]	[0.020]	[0.006]	[0.015]	[0.007]	[0.003]	[-0.002]	[0.003]
Investment to Asset	-0.70	-0.77	0.07	-0.82	-0.99	0.17	0.35	0.61	-0.25
	(-2.46)	(-2.51)	(0.49)	(-3.17)	(-3.60)	(1.29)	(0.76)	(1.05)	(-1.00)
	[0.014]	[0.014]	[-0.002]	[0.02]	[0.025]	[0.001]	[0.000]	[0.002]	[0.001]
Combination	-0.43	-0.93	0.50	-0.60	-1.01	0.41	0.47	0.31	0.16
	(-1.85)	(-2.90)	(3.79)	(-2.95)	(-3.72)	(3.81)	(1.14)	(0.55)	(0.73)
	[0.006]	[0.020]	[0.037]	[0.015]	[0.026]	[0.026]	[0.002]	[-0.001]	[0.000]

Anomaly	Investor sentiment proxy variables (S_{t-1})								
	$SENT$			$PRED$			RES		
	Long	Short	Long-Short	Long	Short	Long-Short	Long	Short	Long-Short
	Panel B: Model: $R_{i,t} = \gamma_0 + \gamma_1 S_{t-1} + \gamma_2(\text{FF 3 factors})_t + \varepsilon_{i,t}$								
Failure probability	-0.02	-0.93	0.91	0.03	-0.59	0.62	-0.13	-1.17	1.04
	(-0.13)	(-2.79)	(2.15)	(0.21)	(-1.96)	(1.64)	(-0.46)	(-2.05)	(1.52)
	[0.789]	[0.723]	[0.360]	[0.789]	[0.717]	[0.352]	[0.789]	[0.718]	[0.353]
Ohlson's O	0.06	-0.53	0.59	-0.02	-0.45	0.43	0.15	-0.21	0.36
	(0.85)	(-2.65)	(3.03)	(-0.23)	(-2.72)	(2.60)	(1.05)	(-0.57)	(1.01)
	[0.932]	[0.841]	[0.607]	[0.932]	[0.84]	[0.602]	[0.932]	[0.837]	[0.598]
Net Stock Issuance	0.00	-0.39	0.39	-0.02	-0.31	0.29	0.06	-0.16	0.22
	(0.07)	(-3.60)	(3.38)	(-0.33)	(-3.29)	(2.62)	(0.56)	(-0.84)	(1.08)
	[0.931]	[0.856]	[0.263]	[0.931]	[0.854]	[0.254]	[0.931]	[0.851]	[0.246]
Composite Equity Issuance	0.02	-0.21	0.23	0.00	-0.21	0.22	0.03	0.02	0.01
	(0.23)	(-1.92)	(1.76)	(0.02)	(-2.12)	(1.78)	(0.25)	(0.14)	(0.07)
	[0.844]	[0.823]	[0.371]	[0.823]	[0.844]	[0.371]	[0.823]	[0.843]	[0.367]
Total Accrual	-0.02	-0.27	0.24	-0.11	-0.32	0.21	0.22	0.15	0.07
	(-0.13)	(-1.55)	(1.22)	(-0.76)	(-2.22)	(1.19)	(0.98)	(0.47)	(0.19)
	[0.779]	[0.807]	[0.067]	[0.78]	[0.808]	[0.066]	[0.78]	[0.806]	[0.064]
Net Operating Assets	0.07	-0.32	0.39	0.08	-0.24	0.31	-0.02	-0.17	0.15
	(0.70)	(-2.82)	(2.88)	(0.81)	(-2.27)	(2.31)	(-0.11)	(-0.97)	(0.65)
	[0.818]	[0.848]	[0.074]	[0.818]	[0.846]	[0.069]	[0.818]	[0.845]	[0.061]
Momentum	-0.04	-0.30	0.26	-0.10	-0.10	0.01	0.14	-0.45	0.58
	(-0.32)	(-1.12)	(0.76)	(-0.82)	(-0.44)	(0.02)	(0.6)	(-1.35)	(1.25)
	[0.821]	[0.670]	[0.021]	[0.821]	[0.669]	[0.019]	[0.821]	[0.67]	[0.022]
Gross Profitability Premium	0.14	-0.21	0.34	0.01	0.01	0.00	0.28	-0.49	0.78
	(1.41)	(-1.63)	(1.96)	(0.14)	(0.12)	(0.01)	(1.59)	(-2.00)	(2.23)
	[0.816]	[0.758]	[0.113]	[0.816]	[0.757]	[0.104]	[0.817]	[0.761]	[0.123]
Asset growth	0.06	-0.35	0.41	0.05	-0.35	0.40	0.01	0.01	0.00
	(0.59)	(-2.87)	(2.73)	(0.53)	(-3.32)	(2.82)	(0.04)	(0.05)	(-0.01)
	[0.806]	[0.866]	[0.279]	[0.806]	[0.866]	[0.279]	[0.805]	[0.863]	[0.269]
ROA	0.13	-0.58	0.71	0.07	-0.22	0.29	0.12	-0.75	0.87
	(1.39)	(-2.50)	(2.67)	(0.87)	(-1.03)	(1.23)	(0.75)	(-1.80)	(1.88)
	[0.886]	[0.730]	[0.321]	[0.885]	[0.726]	[0.31]	[0.885]	[0.729]	[0.318]
Investment to Asset	-0.22	-0.24	0.03	-0.20	-0.29	0.08	-0.02	0.11	-0.14
	(-2.11)	(-2.24)	(0.22)	(-2.07)	(-3.01)	(0.75)	(-0.15)	(0.61)	(-0.63)
	[0.845]	[0.843]	[0.169]	[0.845]	[0.844]	[0.17]	[0.844]	[0.842]	[0.17]
Combination	0.00	-0.32	0.32	-0.03	-0.20	0.17	0.09	-0.25	0.34
	(0.07)	(-3.00)	(2.99)	(-1.00)	(-2.31)	(1.78)	(1.38)	(-1.48)	(1.86)
	[0.972]	[0.909]	[0.341]	[0.972]	[0.907]	[0.329]	[0.973]	[0.907]	[0.333]

Table 6 Predictive Regressions of the Anomaly Returns on the Residual Investor Sentiment Proxies Estimated by the Whole-Period Window

This table reports the coefficient estimates ($\hat{\gamma}_1$) on the residual investor sentiment proxy variables in the following predictive regression: $R_{i,t} = \gamma_0 + \gamma_1 RES_{t-1} + \gamma_2 Z_t + \varepsilon_{i,t}$, where $R_{i,t}$ is the excess return in month t on the long-leg, short-leg, or long-short portfolio of each anomaly, RES_{t-1} is the residual investor sentiment proxy variable, and Z_t is the vector of the Fama-French three factors. Two residual investor sentiment proxy variables, RES' and RES'', are obtained by regressing the Baker and Wugler (2006) investor sentiment index ($SENT$) on the one-month lagged and contemporaneous five macroeconomic variables (cay, term spread, default spread, three-month Treasury-bill yield, and inflation rate), respectively, by using the whole-period sample. Numbers in parentheses indicate White's (1980) heteroskedasticity-adjusted t-statistics, and numbers in brackets indicate adjusted R^2.

Anomaly	RES'			RES''		
	Long	Short	Long-short	Long	Short	Long-short
	Model: $R_{i,t} = \gamma_0 + \gamma_1 RES_{t-1} + \gamma_2(\text{FF 3 factors})_t + \varepsilon_{i,t}$					
Failure probability	0.07	-1.11	**1.18**	0.04	-1.20	**1.24**
	(0.34)	(-2.66)	**(2.19)**	(0.19)	(-2.86)	**(2.30)**
	[0.789]	[0.723]	**[0.363]**	[0.789]	[0.725]	**[0.365]**
Ohlson's O	0.07	-0.55	**0.61**	0.08	-0.52	**0.60**
	(0.82)	(-2.12)	**(2.42)**	(0.92)	(-2.05)	**(2.41)**
	[0.932]	[0.84]	**[0.605]**	[0.932]	[0.84]	**[0.605]**
Net Stock Issuance	-0.02	-0.48	**0.46**	0.01	-0.45	**0.45**
	(-0.33)	(-3.80)	**(3.38)**	(0.09)	(-3.58)	**(3.37)**
	[0.931]	[0.857]	**[0.265]**	[0.931]	[0.856]	**[0.265]**
Composite Equity Issuance	0.03	-0.19	**0.22**	0.05	-0.18	0.22
	(0.39)	(-1.75)	**(1.65)**	(0.58)	(-1.57)	(1.60)
	[0.823]	[0.843]	**[0.37]**	[0.823]	[0.843]	[0.37]
Total Accrual	0.03	-0.19	0.22	0.01	-0.26	0.28
	(0.15)	(-0.91)	(0.89)	(0.06)	(-1.28)	(1.17)
	[0.779]	[0.807]	[0.066]	[0.779]	[0.807]	[0.067]
Net Operating Assets	0.05	-0.31	**0.36**	0.05	-0.32	**0.36**
	(0.46)	(-2.35)	**(2.3)**	(0.41)	(-2.34)	**(2.31)**
	[0.818]	[0.847]	**[0.069]**	[0.818]	[0.847]	**[0.069]**
Momentum	0.05	-0.18	0.22	0.07	-0.19	0.26
	(0.35)	(-0.57)	(0.58)	(0.52)	(-0.59)	(0.65)
	[0.821]	[0.669]	[0.02]	[0.821]	[0.669]	[0.02]
Gross Profitability Premium	0.12	-0.28	**0.40**	0.07	-0.27	**0.34**
	(1.10)	(-1.90)	**(1.96)**	(0.65)	(-1.89)	**(1.72)**
	[0.816]	[0.759]	**[0.114]**	[0.816]	[0.759]	**[0.111]**
Asset growth	0.02	-0.37	**0.39**	-0.02	-0.36	**0.35**
	(0.19)	(-2.59)	**(2.29)**	(-0.17)	(-2.55)	**(2.03)**
	[0.805]	[0.866]	**[0.276]**	[0.805]	[0.865]	**[0.275]**
ROA	0.05	-0.73	**0.78**	0.07	-0.87	**0.94**
	(0.42)	(-2.44)	**(2.24)**	(0.57)	(-3.11)	**(2.85)**
	[0.885]	[0.731]	**[0.32]**	[0.885]	[0.733]	**[0.325]**
Investment to Asset	-0.28	-0.20	-0.08	-0.30	-0.21	-0.09
	(-2.45)	(-1.66)	(-0.59)	(-2.69)	(-1.71)	(-0.66)
	[0.846]	[0.842]	[0.17]	[0.846]	[0.842]	[0.17]
Combination	0.00	-0.32	**0.32**	-0.01	-0.34	**0.33**
	(-0.02)	(-2.48)	**(2.40)**	(-0.18)	(-2.62)	**(2.54)**
	[0.972]	[0.908]	**[0.337]**	[0.972]	[0.909]	**[0.339]**

Table 7 Anomalies during Months Following High- and Low-Sentiment Sorted on Three Sentiment Indexes

This table presents average benchmark-adjusted returns of the anomalies' highest-performing deciles (*long leg*), lowest-performing deciles (*short leg*), and long-short portfolios during months following high and low levels of investor sentiment, classified as HIGH or LOW based on the median level of each of the three sentiment indexes. The three sentiment indexes are constructed by estimating the first principal component of the six Baker and Wurgler (2006) (BW) sentiment proxies orthogonalized by a set of the six macroeconomic variables used by BW (growth in industrial production; growth in consumption of each of durables, nondurables, and services; growth in employment; and a dummy variable for NBER recessions), a set of the five macroeconomic variables used in this paper (cay, term spread, default spread, three-month Treasury-bill yield, and inflation rate), and a full set of the combined 11 macroeconomic variables, respectively. These three sentiment indexes are denoted as $SENT$, $SENT^{\text{new}}$, and $SENT^{\text{new 2}}$, respectively. The benchmark-adjusted returns are those after adjusting for the Fama-French three factors. Numbers in parentheses indicate White's (1980) heteroskedasticity-adjusted t-statistics. The sample period is August 1965 to January 2008.

Anomaly	Long-leg portfolios			Short-leg portfolios			Long-Short		
	High	Low	High-Low	High	Low	High-Low	High	Low	High-Low
				Panel A: Sorting on $SENT$					
Failure probability	0.43 (2.52)	0.33 (2.33)	0.10 (0.44)	-1.65 (-4.33)	-0.58 (-1.81)	-1.07 (-2.19)	2.08 (4.45)	0.91 (2.39)	1.17 (1.95)
Ohlson's O	0.25 (2.70)	0.16 (2.09)	0.09 (0.72)	-1.24 (-5.29)	-0.60 (-3.23)	-0.64 (-2.16)	1.49 (6.13)	0.76 (3.77)	0.73 (2.32)
Net stock issuance	0.28 (3.68)	0.11 (1.68)	0.17 (1.69)	-0.80 (-4.86)	-0.12 (-1.09)	-0.68 (-3.42)	1.08 (6.19)	0.23 (1.79)	0.85 (3.90)
Composite equity issuance	0.08 (0.69)	-0.03 (-0.31)	0.11 (0.72)	-0.64 (-3.62)	-0.17 (-1.57)	-0.47 (-2.26)	0.72 (3.40)	0.14 (0.89)	0.58 (2.23)
Total accrual	0.19 (0.85)	0.34 (2.13)	-0.14 (-0.53)	-0.70 (-2.88)	0.02 (0.15)	-0.73 (-2.53)	0.89 (3.02)	0.31 (1.33)	0.58 (1.60)
Net operating assets	0.22 (1.36)	0.27 (2.04)	-0.05 (-0.24)	-0.87 (-4.94)	-0.15 (-1.25)	-0.72 (-3.40)	1.09 (4.78)	0.42 (2.20)	0.67 (2.30)
Momentum	0.66 (3.64)	0.60 (3.46)	0.06 (0.23)	-1.51 (-4.03)	-0.76 (-3.22)	-0.75 (-1.69)	2.17 (4.46)	1.36 (3.87)	0.81 (1.35)
Gross profitability premium	0.46 (3.17)	0.41 (3.25)	0.05 (0.26)	-0.40 (-2.43)	-0.06 (-0.47)	-0.33 (-1.59)	0.85 (3.77)	0.47 (2.23)	0.38 (1.24)
Asset growth	0.37 (2.23)	0.07 (0.38)	0.30 (1.29)	-0.82 (-4.48)	-0.06 (-0.48)	-0.76 (-3.43)	1.18 (4.81)	0.13 (0.60)	1.05 (3.35)
ROA	0.49 (4.01)	0.27 (2.26)	0.23 (1.35)	-1.26 (-3.98)	-0.51 (-2.01)	-0.75 (-1.88)	1.75 (5.00)	0.78 (2.66)	0.97 (2.16)
Investment to asset	0.01 (0.09)	0.32 (2.53)	-0.31 (-1.57)	-0.73 (-4.31)	-0.01 (-0.07)	-0.72 (-3.34)	0.74 (3.75)	0.33 (1.76)	0.41 (1.54)
Combination	0.30 (5.62)	0.26 (5.40)	0.04 (0.62)	-0.92 (-6.46)	-0.26 (-2.95)	-0.66 (-3.89)	1.22 (7.92)	0.52 (5.01)	0.70 (3.74)

Anomaly	Long-leg portfolios			Short-leg portfolios			Long-Short		
	High	Low	High-Low	High	Low	High-Low	High	Low	High-Low
Panel B: Sorting on $SENT^{\text{new}}$									
Failure probability	0.40 (2.19)	0.36 (2.50)	0.04 (0.16)	-1.49 (-3.88)	-0.81 (-2.55)	-0.68 (-1.40)	1.89 (3.99)	1.17 (3.12)	0.72 (1.21)
Ohlson's O	0.26 (2.85)	0.15 (1.70)	0.11 (0.87)	-1.09 (-4.86)	-0.77 (-3.81)	-0.32 (-1.06)	1.34 (5.85)	0.92 (4.23)	0.43 (1.36)
Net stock issuance	0.20 (2.54)	0.19 (2.85)	0.01 (0.06)	-0.93 (-5.94)	-0.02 (-0.13)	-0.91 (-4.69)	1.13 (6.84)	0.21 (1.49)	0.92 (4.32)
Composite equity issuance	0.07 (0.66)	-0.03 (-0.28)	0.10 (0.69)	-0.65 (-3.67)	-0.19 (-1.60)	-0.46 (-2.18)	0.72 (3.50)	0.16 (0.96)	0.56 (2.18)
Total accrual	0.19 (0.84)	0.32 (1.86)	-0.13 (-0.47)	-0.51 (-2.06)	-0.19 (-1.08)	-0.32 (-1.11)	0.70 (2.39)	0.51 (2.07)	0.19 (0.51)
Net operating assets	0.26 (1.66)	0.21 (1.56)	0.05 (0.26)	-0.91 (-5.04)	-0.13 (-1.06)	-0.78 (-3.52)	1.17 (5.22)	0.34 (1.77)	0.83 (2.86)
Momentum	0.53 (2.79)	0.72 (4.18)	-0.19 (-0.72)	-1.25 (-3.27)	-1.05 (-4.28)	-0.20 (-0.43)	1.78 (3.56)	1.77 (4.95)	0.01 (0.02)
Gross profitability premium	0.54 (3.83)	0.31 (2.46)	0.23 (1.22)	-0.30 (-1.79)	-0.18 (-1.28)	-0.12 (-0.54)	0.83 (3.59)	0.49 (2.33)	0.34 (1.09)
Asset growth	0.17 (1.01)	0.26 (1.51)	-0.09 (-0.40)	-0.87 (-4.78)	-0.03 (-0.25)	-0.84 (-3.77)	1.04 (4.07)	0.29 (1.42)	0.75 (2.30)
ROA	0.38 (3.18)	0.37 (2.99)	0.02 (0.10)	-1.26 (-4.09)	-0.55 (-2.09)	-0.71 (-1.82)	1.64 (4.82)	0.91 (3.03)	0.73 (1.61)
Investment to asset	0.06 (0.39)	0.26 (1.96)	-0.20 (-1.02)	-0.74 (-4.15)	-0.01 (-0.11)	-0.73 (-3.24)	0.80 (4.04)	0.28 (1.48)	0.52 (1.99)
Combination	0.27 (5.15)	0.27 (5.79)	0.00 (-0.06)	-0.87 (-5.99)	-0.33 (-3.63)	-0.54 (-3.12)	1.14 (7.47)	0.61 (5.71)	0.54 (2.88)
Panel C: Soring on $SENT^{\text{new }2}$									
Failure probability	0.37 (2.10)	0.39 (2.72)	-0.02 (-0.10)	-1.28 (-3.45)	-1.04 (-3.11)	-0.24 (-0.49)	1.65 (3.61)	1.43 (3.64)	0.22 (0.37)
Ohlson's O	0.28 (3.19)	0.12 (1.40)	0.16 (1.28)	-0.98 (-4.31)	-0.88 (-4.47)	-0.10 (-0.34)	1.26 (5.36)	1.00 (4.75)	0.26 (0.83)
Net stock issuance	0.18 (2.42)	0.21 (2.94)	-0.03 (-0.29)	-0.71 (-4.37)	-0.24 (-1.98)	-0.47 (-2.32)	0.89 (5.31)	0.45 (3.11)	0.44 (2.01)
Composite equity issuance	0.12 (1.09)	-0.08 (-0.72)	0.20 (1.32)	-0.55 (-3.20)	-0.29 (-2.24)	-0.26 (-1.20)	0.67 (3.33)	0.21 (1.22)	0.46 (1.75)
Total accrual	0.13 (0.60)	0.38 (2.11)	-0.25 (-0.89)	-0.30 (-1.25)	-0.39 (-2.15)	0.08 (0.28)	0.43 (1.56)	0.77 (2.97)	-0.33 (-0.90)
Net operating assets	0.29 (1.88)	0.19 (1.33)	0.10 (0.47)	-0.73 (-4.14)	-0.31 (-2.40)	-0.41 (-1.87)	1.01 (4.83)	0.50 (2.40)	0.51 (1.75)
Momentum	0.59 (3.14)	0.67 (3.78)	-0.08 (-0.31)	-1.18 (-3.15)	-1.12 (-4.35)	-0.06 (-0.13)	1.77 (3.59)	1.78 (4.85)	-0.02 (-0.03)
Gross profitability premium	0.48 (3.46)	0.36 (2.90)	0.12 (0.63)	-0.31 (-1.96)	-0.16 (-1.12)	-0.15 (-0.72)	0.80 (3.55)	0.53 (2.46)	0.27 (0.88)
Asset growth	0.12 (0.74)	0.31 (1.77)	-0.18 (-0.78)	-0.67 (-3.66)	-0.24 (-1.72)	-0.43 (-1.89)	0.79 (3.16)	0.54 (2.54)	0.25 (0.77)
ROA	0.38 (3.07)	0.37 (3.10)	0.01 (0.06)	-1.16 (-3.77)	-0.64 (-2.41)	-0.52 (-1.31)	1.54 (4.56)	1.01 (3.31)	0.53 (1.19)
Investment to asset	-0.02 (-0.14)	0.34 (2.46)	-0.37 (-1.80)	-0.53 (-3.05)	-0.23 (-1.56)	-0.30 (-1.35)	0.51 (2.68)	0.57 (2.87)	-0.06 (-0.24)
Combination	0.25 (4.85)	0.29 (6.08)	-0.04 (-0.56)	-0.73 (-5.18)	-0.48 (-4.68)	-0.25 (-1.41)	0.98 (6.65)	0.77 (6.65)	0.21 (1.11)

Table 8 Anomalies during Months Following High- and Low-Sentiment Sorted on Michigan Sentiment Indexes

This table presents average benchmark-adjusted returns of the anomalies' highest-performing deciles (*long leg*), lowest-performing deciles (*short leg*), and long-short portfolios during months following high and low levels of investor sentiment, classified as HIGH or LOW based on the median level of each of the three sentiment indexes; $MICH$ is the Michigan sentiment index, and RES_{MICH} is computed as the residual from the following time-series regression model: $MICH_t = \theta_0 + \theta_1 X_{t-1} + \varepsilon_t$, where $MICH_t$ is the Michigan sentiment index and X_{t-1} is a vector of the one-month lagged six macroeconomic variables used in Baker and Wurgler (2006) (BW) to orthogonalize the six BW sentiment proxies (growth in industrial production; growth in durables, nondurables, and services consumption; growth in employment; and a dummy variable for NBER recessions). The parameters are estimated by rolling over month by month using the previous 60 monthly observations available up to month t-1. RES''_{MICH} is computed similarly to RES_{MICH} except that a full set of the combined 11 macroeconomic variables (the six variables used in computing RES_{MICH} plus the five variables used in this paper - cay, term spread, default spread, three-month Treasury-bill yield, and inflation rate) are included in X_{t-1} in the predictive regression. The benchmark-adjusted returns are those after adjusting for the Fama-French three factors. Numbers in parentheses indicate White's (1980) heteroskedasticity-adjusted t-statistics. The sample period is January 1978 to January 2008.

Anomaly	Long-leg portfolios			Short-leg portfolios			Long-Short		
	High	Low	High-Low	High	Low	High-Low	High	Low	High-Low
				Panel A: Sorting on $MICH$					
Failure probability	0.58 (3.06)	0.07 (0.51)	0.51 (2.10)	-1.46 (-3.61)	-1.05 (-2.84)	-0.41 (-0.75)	2.04 (4.11)	1.12 (2.50)	0.92 (1.38)
Ohlson's O	0.29 (3.05)	0.17 (1.89)	0.12 (0.94)	-0.80 (-3.42)	-0.89 (-4.45)	0.09 (0.30)	1.09 (4.43)	1.06 (4.93)	0.03 (0.09)
Net stock issuance	0.26 (3.04)	0.20 (2.81)	0.06 (0.56)	-0.82 (-4.19)	-0.13 (-0.88)	-0.69 (-2.77)	1.08 (5.22)	0.33 (1.88)	0.75 (2.75)
Composite equity issuance	0.02 (0.15)	0.08 (0.55)	-0.06 (-0.31)	-0.65 (-3.27)	-0.10 (-0.52)	-0.55 (-1.96)	0.66 (2.85)	0.18 (0.72)	0.49 (1.48)
Total accrual	0.42 (1.50)	0.42 (2.26)	-0.01 (-0.02)	-1.05 (-3.74)	-0.04 (-0.22)	-1.00 (-2.92)	1.46 (4.57)	0.47 (1.84)	1.00 (2.48)
Net operating assets	0.17 (0.90)	0.27 (1.40)	-0.11 (-0.42)	-0.92 (-4.18)	-0.30 (-1.75)	-0.62 (-2.21)	1.08 (4.03)	0.57 (2.21)	0.51 (1.41)
Momentum	0.60 (2.87)	0.43 (2.11)	0.17 (0.57)	-1.73 (-3.62)	-0.79 (-2.11)	-0.93 (-1.53)	2.33 (3.84)	1.23 (2.47)	1.10 (1.39)
Gross profitability premium	0.58 (4.00)	0.22 (1.35)	0.36 (1.67)	-0.30 (-1.70)	-0.25 (-1.31)	-0.05 (-0.21)	0.88 (3.38)	0.47 (1.93)	0.41 (1.16)
Asset growth	0.12 (0.62)	0.45 (1.85)	-0.33 (-1.12)	-0.82 (-3.55)	-0.18 (-1.10)	-0.64 (-2.23)	0.94 (2.96)	0.63 (2.26)	0.31 (0.74)
ROA	0.61 (4.62)	0.34 (2.70)	0.28 (1.57)	-0.81 (-2.46)	-0.92 (-2.96)	0.11 (0.25)	1.42 (3.90)	1.26 (3.55)	0.16 (0.33)
Investment to asset	0.04 (0.23)	0.34 (1.95)	-0.30 (-1.23)	-0.59 (-2.79)	-0.22 (-1.22)	-0.37 (-1.31)	0.63 (2.78)	0.57 (2.30)	0.06 (0.20)
Combination	0.34 (5.55)	0.27 (4.47)	0.06 (0.76)	-0.90 (-4.91)	-0.44 (-3.31)	-0.46 (-1.98)	1.24 (6.44)	0.72 (4.74)	0.52 (2.12)

Anomaly	Long-leg portfolios			Short-leg portfolios			Long-Short		
	High	Low	High-Low	High	Low	High-Low	High	Low	High-Low
				Panel B: Sorting on RES_{MICH}					
Failure probability	0.25 (1.74)	0.41 (2.36)	-0.16 (-0.73)	-1.47 (-4.01)	-1.05 (-2.67)	-0.42 (-0.79)	1.72 (4.06)	1.46 (2.92)	0.26 (0.41)
Ohlson's O	0.27 (2.89)	0.20 (2.15)	0.07 (0.59)	-0.91 (-3.92)	-0.77 (-3.87)	-0.14 (-0.47)	1.18 (4.76)	0.97 (4.58)	0.22 (0.67)
Net stock issuance	0.23 (3.15)	0.23 (2.84)	0.00 (0.00)	-0.62 (-3.53)	-0.34 (-2.12)	-0.28 (-1.19)	0.85 (4.25)	0.58 (3.18)	0.28 (1.04)
Composite equity issuance	-0.05 (-0.35)	0.14 (1.04)	-0.19 (-1.02)	-0.56 (-2.91)	-0.19 (-1.07)	-0.37 (-1.43)	0.52 (2.12)	0.33 (1.47)	0.18 (0.57)
Total accrual	0.57 (2.78)	0.27 (1.09)	0.31 (1.02)	-0.91 (-3.56)	-0.20 (-0.86)	-0.71 (-2.09)	1.48 (4.73)	0.47 (1.76)	1.01 (2.52)
Net operating assets	0.32 (1.79)	0.12 (0.60)	0.20 (0.80)	-0.88 (-4.74)	-0.34 (-1.80)	-0.54 (-2.14)	1.20 (4.51)	0.46 (1.84)	0.74 (2.13)
Momentum	0.38 (1.99)	0.65 (3.15)	-0.27 (-1.01)	-1.77 (-4.79)	-0.76 (-1.70)	-1.01 (-1.84)	2.16 (4.52)	1.41 (2.49)	0.74 (1.07)
Gross profitability premium	0.44 (3.14)	0.36 (2.17)	0.08 (0.36)	-0.25 (-1.38)	-0.30 (-1.64)	0.04 (0.18)	0.70 (2.75)	0.66 (2.63)	0.03 (0.09)
Asset growth	0.03 (0.14)	0.54 (2.38)	-0.51 (-1.73)	-0.80 (-3.93)	-0.21 (-1.20)	-0.58 (-2.26)	0.83 (2.82)	0.75 (2.59)	0.07 (0.19)
ROA	0.60 (4.57)	0.36 (2.80)	0.24 (1.36)	-0.86 (-2.60)	-0.87 (-2.82)	0.01 (0.02)	1.46 (3.91)	1.23 (3.47)	0.23 (0.46)
Investment to asset	-0.01 (-0.08)	0.40 (2.33)	-0.41 (-1.76)	-0.77 (-4.07)	-0.05 (-0.28)	-0.71 (-2.81)	0.76 (3.25)	0.45 (1.88)	0.31 (0.97)
Combination	0.28 (4.28)	0.33 (5.89)	-0.06 (-0.70)	-0.89 (-5.67)	-0.46 (-3.00)	-0.43 (-1.99)	1.17 (6.44)	0.80 (5.14)	0.37 (1.61)
				Panel C: Sorting on RES''_{MICH}					
Failure probability	0.32 (2.26)	0.35(1.93)	-0.03 (-0.16)	-1.76 (-4.94)	-0.76 (-1.92)	-1.01 (-1.95)	2.08 (5.11)	1.11 (2.17)	0.97 (1.54)
Ohlson's O	0.29 (3.15)	0.18(1.94)	0.10 (0.83)	-0.74 (-3.28)	-0.94 (-4.55)	0.19 (0.63)	1.03 (4.17)	1.12 (5.20)	-0.09(-0.27)
Net stock issuance	0.29 (3.85)	0.17(2.20)	0.12 (1.16)	-0.56 (-3.32)	-0.41 (-2.41)	-0.15 (-0.64)	0.85 (4.54)	0.58 (3.02)	0.27 (1.04)
Composite equity issuance	0.04 (0.30)	0.06(0.41)	-0.02 (-0.09)	-0.58 (-3.21)	-0.18 (-0.95)	-0.39 (-1.57)	0.61 (2.78)	0.24 (0.97)	0.38 (1.22)
Total accrual	0.45 (2.35)	0.39(1.49)	0.07 (0.23)	-0.72 (-3.08)	-0.39 (-1.51)	-0.33 (-0.98)	1.17 (4.14)	0.78 (2.57)	0.40 (0.99)
Net operating assets	0.18 (1.01)	0.25(1.33)	-0.07 (-0.29)	-0.79 (-4.42)	-0.44 (-2.23)	-0.35 (-1.39)	0.97 (3.62)	0.69 (2.77)	0.28 (0.80)
Momentum	0.43 (2.19)	0.61(2.97)	-0.18 (-0.66)	-1.74 (-4.95)	-0.80 (-1.73)	-0.94 (-1.71)	2.17 (4.67)	1.41 (2.43)	0.76 (1.10)
Gross profitability premium	0.49 (3.13)	0.31(2.08)	0.18 (0.87)	-0.41 (-2.41)	-0.14 (-0.75)	-0.26 (-1.07)	0.90 (3.96)	0.46 (1.75)	0.45 (1.34)
Asset growth	0.04 (0.23)	0.52(2.23)	-0.48 (-1.65)	-0.54 (-2.78)	-0.47 (-2.50)	-0.07 (-0.29)	0.59 (2.19)	0.99 (3.25)	-0.40(-1.06)
ROA	0.57 (4.52)	0.38(2.90)	0.19 (1.08)	-0.96 (-2.84)	-0.77 (-2.57)	-0.19 (-0.43)	1.53 (4.20)	1.15 (3.22)	0.38 (0.77)
Investment to asset	0.14 (0.81)	0.25(1.36)	-0.11 (-0.48)	-0.40 (-2.14)	-0.43 (-2.17)	0.03 (0.11)	0.53 (2.35)	0.67 (2.76)	-0.14(-0.45)
Combination	0.30 (5.08)	0.32(4.93)	-0.02 (-0.24)	-0.84 (-5.52)	-0.52 (-3.27)	-0.32 (-1.48)	1.13 (6.78)	0.83 (4.94)	0.30 (1.30)

Table 9 Loadings on Mimicking Portfolios of Innovations in Macroeconomic Variables

This table presents factor loadings (or betas) estimated from monthly multivariate time-series regressions of excess returns of the long-leg, short-leg, and long-short portfolios on returns of the five mimicking portfolios for innovations in the five macroeconomic variables (cay, term spread, default spread, three-month Treasury-bill yield, and inflation rate). The residuals from the VAR(1) model including the five macroeconomic variables are regarded as the innovations. Numbers in parentheses indicate White's (1980) heteroskedasticity-adjusted t-statistics.

Anomaly	cay ($\hat{\beta}_{cay}$)	Term spread ($\hat{\beta}_{\text{term}}$)	Default sprd ($\hat{\beta}_{\text{default}}$)	T-bill yield ($\hat{\beta}_{\text{T-bill}}$)	Inflation rate ($\hat{\beta}_{\text{inflation}}$)
			Panel A: Long-leg portfolio		
Failure probability	-0.41 (-1.20)	-0.07 (-0.14)	0.46 (0.69)	0.15 (0.45)	-0.23 (-0.50)
Ohlson's O	-0.24 (-0.59)	-1.12 (-1.54)	1.15 (1.82)	-0.32 (-0.82)	0.09 (0.20)
Net stock issuance	-0.15 (-0.53)	-1.18 (-2.87)	1.09 (2.33)	-0.54 (-2.22)	-0.31 (-0.93)
Composite equity issuance	0.11 (0.44)	-0.60 (-1.63)	0.66 (1.44)	-0.39 (-1.76)	-0.29 (-0.91)
Total accrual	-0.03 (-0.06)	-1.93 (-2.44)	1.35 (1.62)	-0.89 (-1.92)	-0.30 (-0.64)
Net operating assets	-0.49 (-1.18)	-1.82 (-3.00)	1.02 (1.61)	-0.88 (-2.46)	-0.41 (-0.98)
Momentum	-0.67 (-1.48)	-0.29 (-0.36)	0.01 (0.01)	-0.16 (-0.35)	-0.23 (-0.42)
Gross profitability premium	-0.53 (-1.42)	-1.12 (-2.14)	1.25 (2.33)	-0.48 (-1.57)	-0.50 (-1.43)
Asset growth	-0.44 (-1.15)	-1.10 (-1.90)	1.27 (1.96)	-0.75 (-2.28)	-0.81 (-1.69)
ROA	-0.28 (-0.70)	-0.86 (-1.21)	1.42 (2.09)	-0.26 (-0.64)	-0.12 (-0.26)
Investment to asset	-0.10 (-0.28)	-1.21 (-2.15)	1.30 (2.19)	-0.77 (-2.37)	-0.59 (-1.38)
Combination	-0.29 (-0.85)	-1.06 (-2.10)	0.99 (1.84)	-0.53 (-1.80)	-0.35 (-0.94)
			Panel B: Short-leg portfolio		
Failure probability	-1.06 (-1.36)	-1.62 (-1.04)	0.61 (0.37)	-0.84 (-0.94)	-1.09 (-1.19)
Ohlson's O	-0.46 (-0.76)	-1.00 (-0.75)	0.69 (0.60)	-0.49 (-0.69)	-0.48 (-0.66)
Net stock issuance	-0.53 (-1.30)	-1.40 (-1.86)	1.73 (2.72)	-0.76 (-1.87)	-0.51 (-1.25)
Composite equity issuance	-0.56 (-1.50)	-1.59 (-2.77)	1.90 (2.99)	-1.00 (-3.02)	-0.54 (-1.34)
Total accrual	-0.38 (-0.74)	-2.26 (-2.44)	2.04 (2.29)	-1.12 (-2.17)	-0.41 (-0.73)
Net operating assets	-0.38 (-0.91)	-1.46 (-2.22)	1.83 (2.65)	-0.72 (-1.92)	-0.58 (-1.39)
Momentum	-0.46 (-0.76)	-2.97 (-2.67)	3.20 (2.87)	-1.74 (-2.68)	-1.00 (-1.63)
Gross profitability premium	-0.48 (-1.24)	-1.31 (-2.33)	0.54 (0.87)	-0.44 (-1.41)	-0.24 (-0.69)
Asset growth	-0.43 (-0.83)	-1.84 (-2.29)	1.96 (2.50)	-0.90 (-2.01)	-0.49 (-1.00)
ROA	-0.63 (-1.07)	-0.82 (-0.63)	0.92 (0.76)	-0.22 (-0.30)	-0.33 (-0.47)
Investment to asset	-0.22 (-0.52)	-1.31 (-2.04)	1.74 (2.58)	-0.65 (-1.76)	-0.34 (-0.73)
Combination	-0.48 (-1.06)	-1.63 (-1.99)	1.59 (2.09)	-0.86 (-1.90)	-0.52 (-1.10)
			Panel C: Long-Short portfolio		
Failure probability	0.65 (0.95)	1.55 (1.12)	-0.15 (-0.10)	0.99 (1.25)	0.86 (1.18)
Ohlson's O	0.23 (0.53)	-0.12 (-0.16)	0.46 (0.63)	0.17 (0.39)	0.57 (1.25)
Net stock issuance	0.38 (1.76)	0.22 (0.45)	-0.63 (-1.81)	0.21 (0.82)	0.21 (0.99)
Composite equity issuance	0.67 (2.72)	0.99 (2.07)	-1.24 (-2.91)	0.61 (2.32)	0.25 (1.04)
Total accrual	0.35 (1.05)	0.33 (0.68)	-0.69 (-1.31)	0.23 (0.85)	0.10 (0.35)
Net operating assets	-0.11 (-0.46)	-0.36 (-1.03)	-0.81 (-2.02)	-0.16 (-0.80)	0.17 (0.68)
Momentum	-0.21 (-0.48)	2.68 (3.10)	-3.19 (-3.28)	1.57 (2.95)	0.77 (1.56)
Gross profitability premium	-0.06 (-0.21)	0.19 (0.51)	0.71 (1.61)	-0.04 (-0.18)	-0.26 (-1.00)
Asset growth	-0.01 (-0.04)	0.74 (1.25)	-0.69 (-1.29)	0.15 (0.47)	-0.32 (-0.95)
ROA	0.35 (0.79)	-0.04 (-0.05)	0.49 (0.58)	-0.04 (-0.09)	0.21 (0.45)
Investment to asset	0.12 (0.57)	0.10 (0.31)	-0.44 (-1.19)	-0.12 (-0.65)	-0.25 (-1.04)
Combination	0.19 (0.92)	0.57 (1.39)	-0.60 (-1.71)	0.33 (1.45)	0.17 (0.93)

Table 10 Risk Premium Estimates on the Macroeconomic Factors

This table presents the estimates of risk premiums using the Fama and MacBeth (1973) two-pass method for mimicking portfolios for innovations in the five macroeconomic variables (cay, term spread, default spread, three-month Treasury-bill yield, and inflation rate). In the first-pass, factor loadings (or betas) are estimated from monthly time-series regressions of returns of test assets on returns of the five mimicking portfolios using the 60-month rolling-window and the full sample, respectively. In the second-pass, for each month we estimate the regression coefficients (γ's) in the cross-sectional regression of returns of test assets on factor loadings estimated in the first-pass. The test assets include 40 portfolios: ten value-weighted size portfolios, ten value-weighted book-to-market portfolios, ten value-weighted momentum portfolios, and ten equal-weighted asset growth portfolios. The risk premium estimates of the five mimicking portfolios are time-series averages of the month-by-month coefficient estimates of the second-pass cross-sectional regressions. The intercepts and risk premiums are in percentage per month. The Shanken (1992)-corrected t-statistics are reported in parentheses. The sample period is August 1965 to January 2008.

Sample used to estimate betas in the 1st pass	Intercept	cay	Term spread	Default spread	T-bill yield	Inflation rate	Adj $\bar{R}^2$
	$\hat{\gamma}_0$	$\hat{\gamma}_{cay}$	$\hat{\gamma}_{\text{term}}$	$\hat{\gamma}_{\text{default}}$	$\hat{\gamma}_{\text{T-bill}}$	$\hat{\gamma}_{\text{inflation}}$	
60-month rolling window	1.19	0.09	0.12	-0.08	-0.31	0.09	0.466
	(5.41)	(1.77)	(1.84)	(-3.39)	(-2.95)	(2.13)	
Whole period	1.39	0.28	0.10	-0.13	-0.22	0.01	0.442
	(5.95)	(5.07)	(1.25)	(-3.44)	(-1.80)	(0.17)	

Table 11 Realized Returns versus Expected Returns

This table compares the average return spread ($\bar{R}_L - \bar{R}_S$) and the expected return spread ($\mathrm{E}(R_L) - \mathrm{E}(R_S)$) between the long-leg and short-leg portfolios of each anomaly, where $\bar{R}_L$ and $\mathrm{E}(R_L)$ ($\bar{R}_S$ and $\mathrm{E}(R_S)$) are the realized average return and the expected return of the long-leg (short-leg) portfolio, respectively. The expected return of the portfolio is the time-series average of monthly expected returns computed as $\mathrm{E}(R_t) = \hat{\gamma}_{\text{cay},t} \cdot \hat{\beta}_{\text{cay},t} + \hat{\gamma}_{\text{term},t} \cdot \hat{\beta}_{\text{term},t} + \hat{\gamma}_{\text{default},t} \cdot \hat{\beta}_{\text{default},t} + \hat{\gamma}_{\text{T-bill},t} \cdot \hat{\beta}_{\text{T-bill},t} + \hat{\gamma}_{\text{inflation},t} \cdot \hat{\beta}_{\text{inflation},t}$, where $\hat{\gamma}_{\cdot t}$'s are the risk premium estimates obtained from the cross-sectional regression (CSR) in month t and $\hat{\beta}_{\cdot t}$ are the factor loadings estimated from time-series regressions of returns of the portfolio on returns of the five mimicking portfolios using the 60-month returns available up to month t. "t-stat" indicates t-statistic for the null H_0: $\mathrm{E}(R_L) - \mathrm{E}(R_S) = \bar{R}_L - \bar{R}_S$. Numbers in parentheses indicate t-statistic. The sample period is August 1965 to January 2008.

Anomaly	Realized return	Expected return implied from the macroeconomic factors		
	$\bar{R}_L - \bar{R}_S$	$\mathrm{E}(R_L)$-$\mathrm{E}(R_S)$	$\frac{\mathrm{E}(R_L) - \mathrm{E}(R_S)}{\bar{R}_L - \bar{R}_S}$	t-stat
Failure probability	0.95 (2.54)	0.58 (2.92)	0.61	0.90
Ohlson's O	0.70 (2.83)	0.15 (1.02)	0.22	1.85
Net stock issuance	0.63 (5.11)	0.18 (2.96)	0.29	3.33
Composite equity issuance	0.42 (2.59)	0.43 (4.38)	1.03	-0.07
Total accrual	0.58 (3.11)	0.15 (1.28)	0.26	1.99
Net operating assets	0.65 (4.41)	0.07 (0.91)	0.11	3.44
Momentum	1.56 (5.44)	0.60 (2.80)	0.39	2.80
Gross profitability premium	0.40 (2.45)	0.20 (2.58)	0.49	1.16
Asset growth	0.96 (5.33)	0.06 (0.51)	0.06	4.30
ROA	0.98 (3.53)	0.26 (1.62)	0.26	2.26
Investment to asset	0.75 (5.22)	0.07 (1.17)	0.10	4.34
Combination	0.77 (6.90)	0.20 (3.73)	0.26	4.84

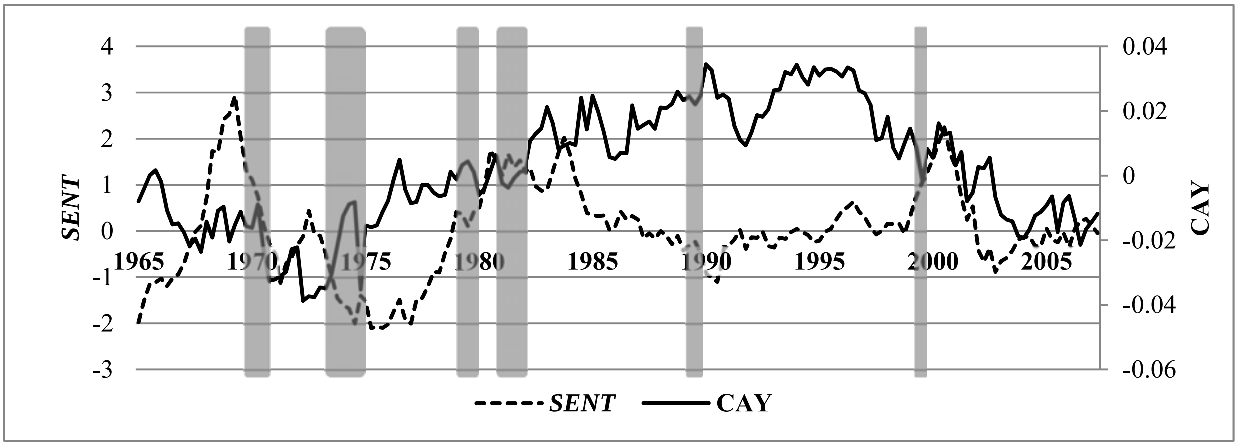
Table 12 Regression of the Investor Sentiment Index on the Risk Premium Estimates

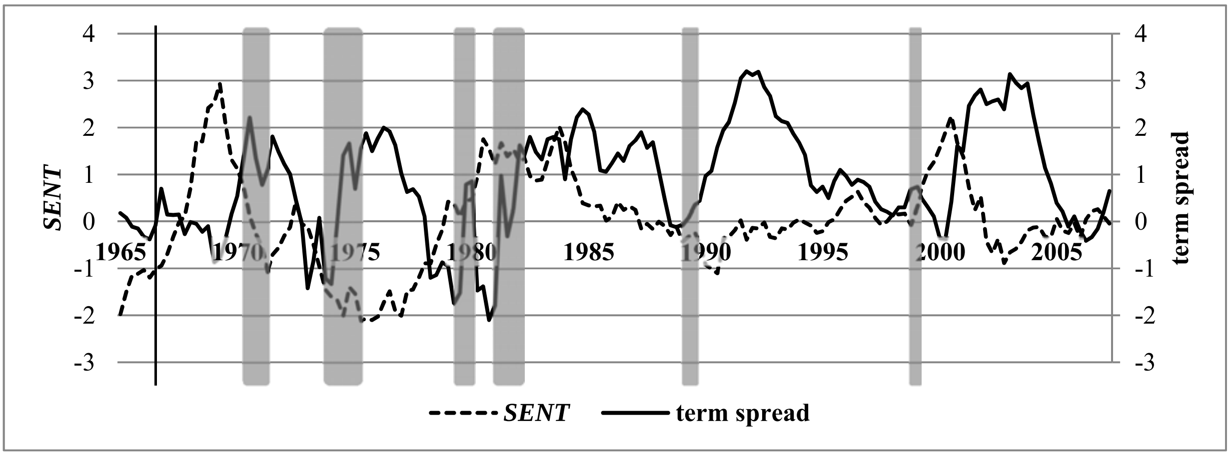
This table presents the coefficient estimates of contemporaneous time-series regressions of the Baker and Wurgler (2006) sentiment index (Panel A) or the Michigan sentiment index (Panel B) on the monthly risk premium estimates for the five macroeconomic variables. The risk premium estimates are obtained from the month-by-month cross-sectional regression of excess returns of 40 test assets on beta estimates of the factor-mimicking portfolios for innovations in the five macroeconomic variables within the Fama and MacBeth (1973) two-pass framework. Beta estimates are obtained from monthly time-series regressions of returns of test assets on returns of the five mimicking portfolios using the 60-month rolling-window and the full sample, respectively. The sample periods for the Baker and Wurgler sentiment index and the Michigan sentiment index are August 1965 to January 2008 and January 1978 to January 2008, respectively. Numbers in parentheses indicate t-statistics. The last column reports p-values of F-tests for the null hypothesis that all slope coefficients equal zero.

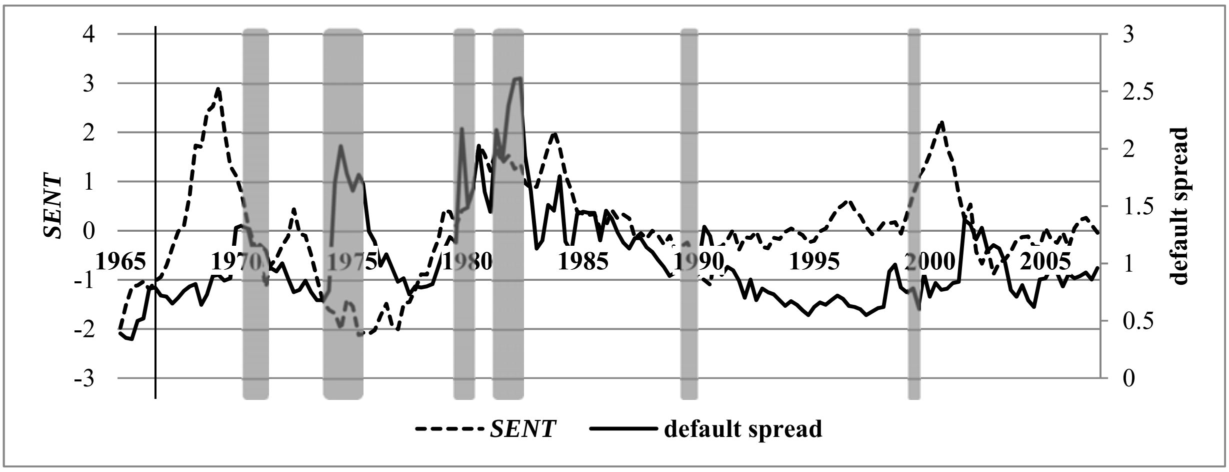
Sample used to estimate betas in the 1st pass	Explanatory variables: Intercept	Risk premium estimates for: cay	Term spread	Default spread	T-bill yield	Inflation rate	Adj R^2	p-value (F-test)
	Panel A: Y-variable = Baker and Wurgler sentiment index							
60-mon rolling window	-0.05	0.11	-0.02	0.10	-0.03	-0.12		
	(-1.18)	(2.99)	(-0.42)	(1.88)	(-0.98)	(-2.51)	[0.029]	0.001
Whole period	-0.02	0.12	-0.04	0.14	-0.03	-0.12		
	(-0.39)	(3.03)	(-0.72)	(2.72)	(-0.84)	(-2.30)	[0.030]	0.001
	Panel B: Y-variable = Michigan sentiment index							
60-mon rolling window	87.9	0.51	-0.09	0.51	0.03	0.05		
	(131.74)	(0.95)	(-0.11)	(0.67)	(0.07)	(0.06)	[-0.009]	0.878
Whole period	87.89	0.53	-0.09	0.51	0.03	0.00		
	(131.90)	(0.98)	(-0.12)	(0.67)	(0.06)	(0.00)	[-0.009]	0.878

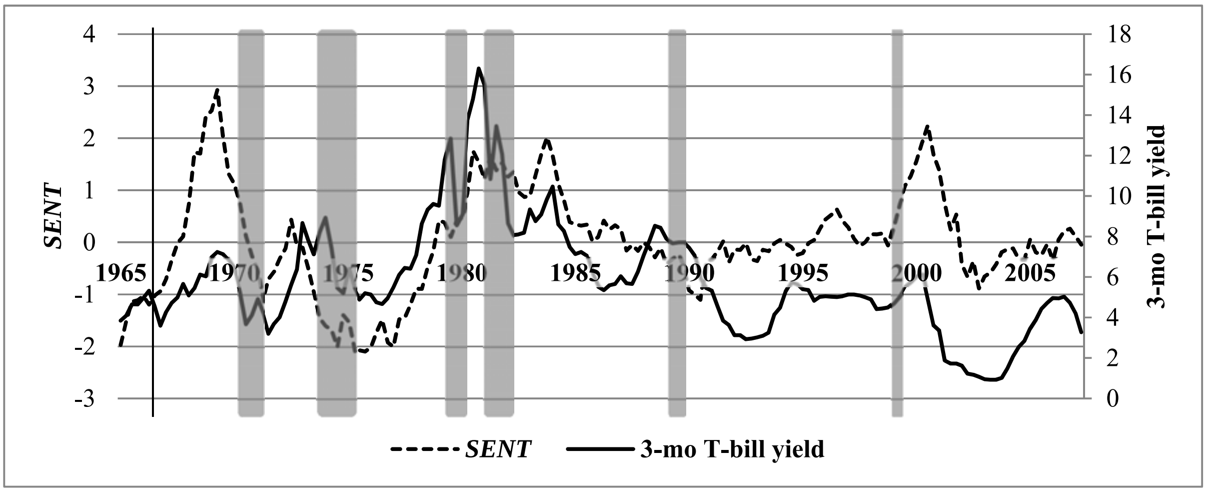
Figure 1 Time-series Patterns of the Investor Sentiment Index and Macroeconomic Variables

These figures depict the quarterly time-series patterns of the Baker and Wurgler (2006) investor sentiment index (*SENT*) against each of the five macroeconomic variables (cay, term spread, default spread, 3-month Treasury bill yield, and inflation rate). Gray bars indicate the NBER recession periods.

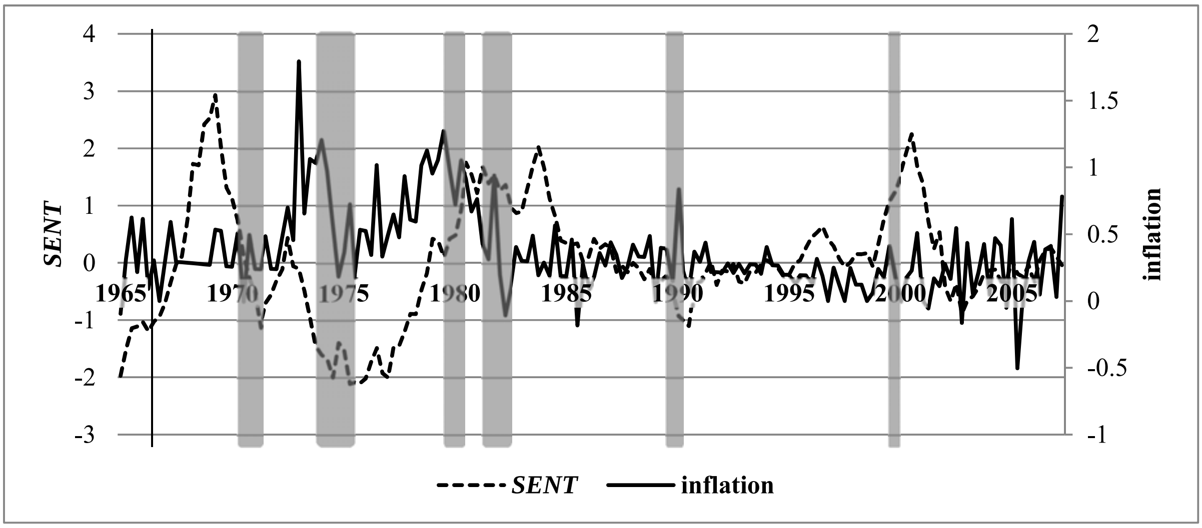








SENT
3-mo T-bill yield
1965
1970
1975
1980
1985
1990
1995
2000
2005
4
3
2
1
0
-1
-2
-3
18
16
14
12
10
8
6
4
2
0
SENT
3-mo T-bill yield



SENT
inflation
1965
1970
1975
1980
1985
1990
1995
2000
2005
4
3
2
1
0
-1
-2
-3
2
1.5
1
0.5
0
-0.5
-1
SENT
inflation

Figure 2. Squared Cumulative Sums of Residual Investor Sentiment Index

This figure shows the time-series pattern of the squared cumulative sums (CUSUMSQ) of the recursive residuals from the following regression model: $SENT_t = \theta_0 + \theta_1 X_{t-1} + \varepsilon_t$, where $SENT_t$ is the Baker and Wurgler (2006) investor sentiment index and X_{t-1} is a vector of the five lagged macroeconomic variables (cay, term spread, default spread, 3-month Treasury-bill yield, and inflation rate). The upper and lower straight line indicate the upper and lower bound of a 95 percent confidence band, respectively.

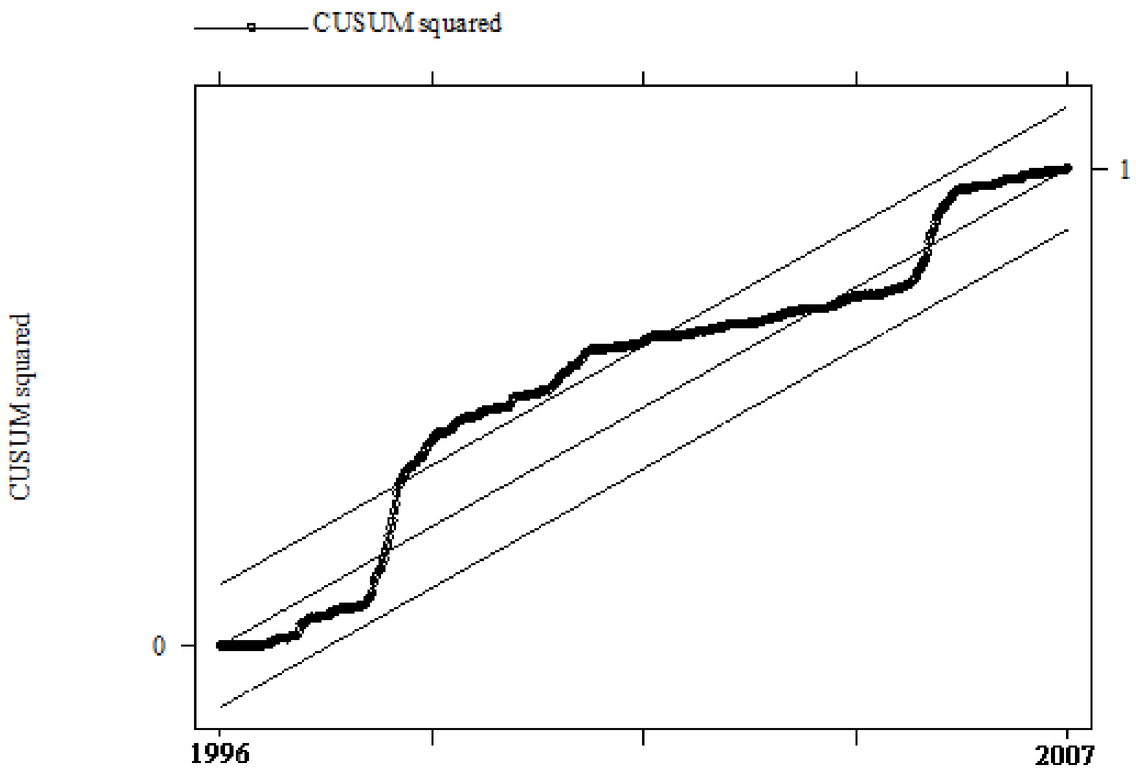
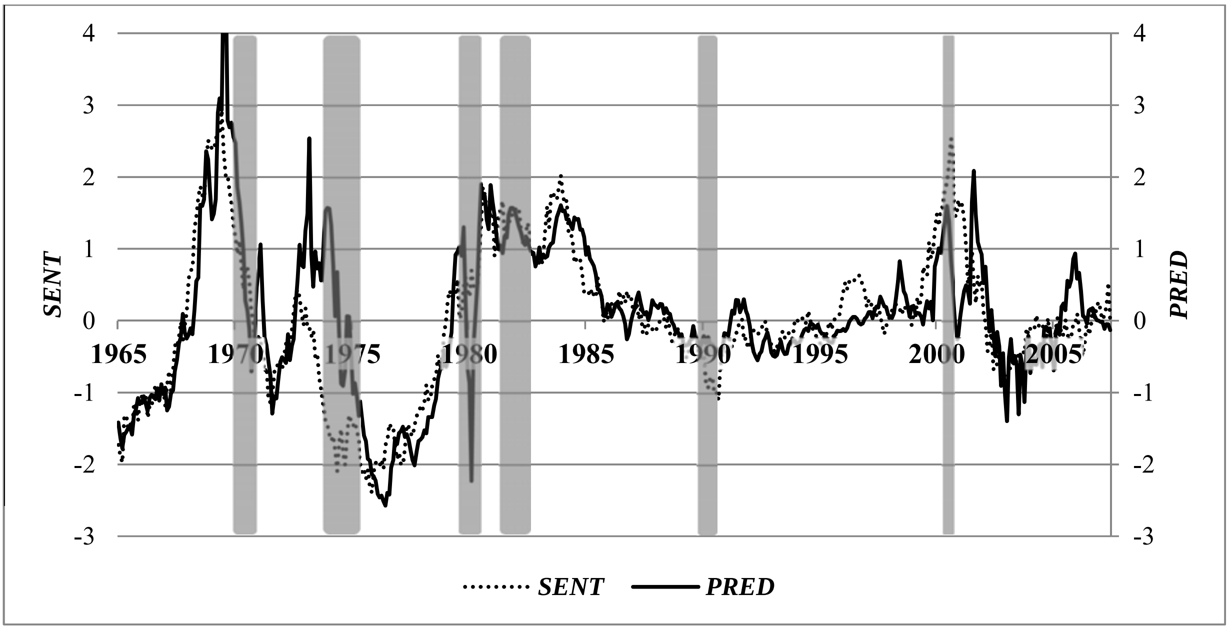


Figure 3 Investor Sentiment versus Predicted and Residual Investor Sentiment

These figures depict the monthly time-series patterns of the Baker and Wurgler (2006) investor sentiment index (*SENT*), the predicted sentiment index (*PRED*), and the residual sentiment index. $PRED_t$ is computed as $\hat{\theta}_1 X_{t-1}$ from the following time-series regression model: $SENT_t = \theta_0 + \theta_1 X_{t-1} + \varepsilon_t$, where $SENT_t$ is the Baker and Wurgler (2006) investor sentiment index and X_{t-1} is a vector of the one-month lagged five macroeconomic variables (cay, term spread, default spread, 3-month Treasury-bill yield, and inflation rate). The parameters are estimated by rolling over month by month by using the previous 60 observations (a minimum of 24 observations) available up to month t-1. RES_t is computed as the difference between $SENT_t$ and $PRED_t$. Gray bars indicate the NBER recession periods.



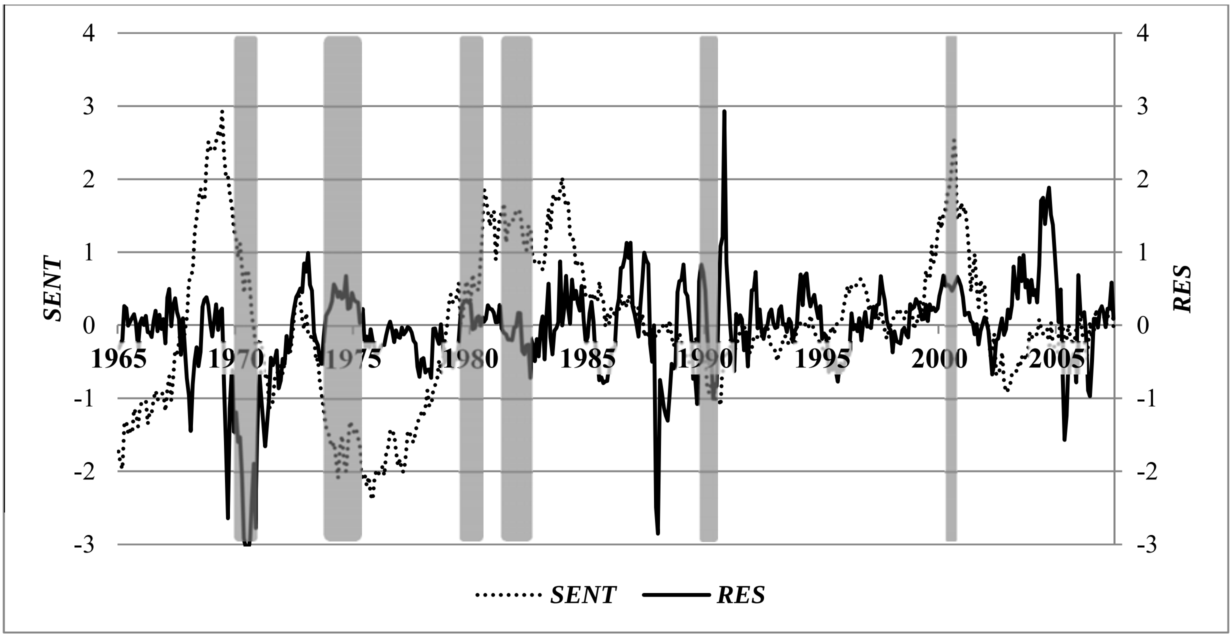


Figure 4. Coefficient Estimates on the Investor Sentiment Index: Rolling versus Whole-period Approach

This figure presents the monthly time-series patterns of the coefficient estimates from the following model:

$$R_{i,t} = \gamma_0 + \gamma_1 SENT_{t-1} + \gamma_2 X_t + \gamma_3 Z_t + \varepsilon_{i,t} \ ,$$

where $R_{i,t}$ is the excess return in month *t* on the long-short portfolio of the combination strategy, X_t is a vector of the five macroeconomic variables (cay, term spread, default spread, 3-month Treasury-bill yield, and inflation rate), and Z_t is the vector of Fama-French 3 Factors. The coefficients are estimated using the whole-period and 60-month rolling-windows, respectively.

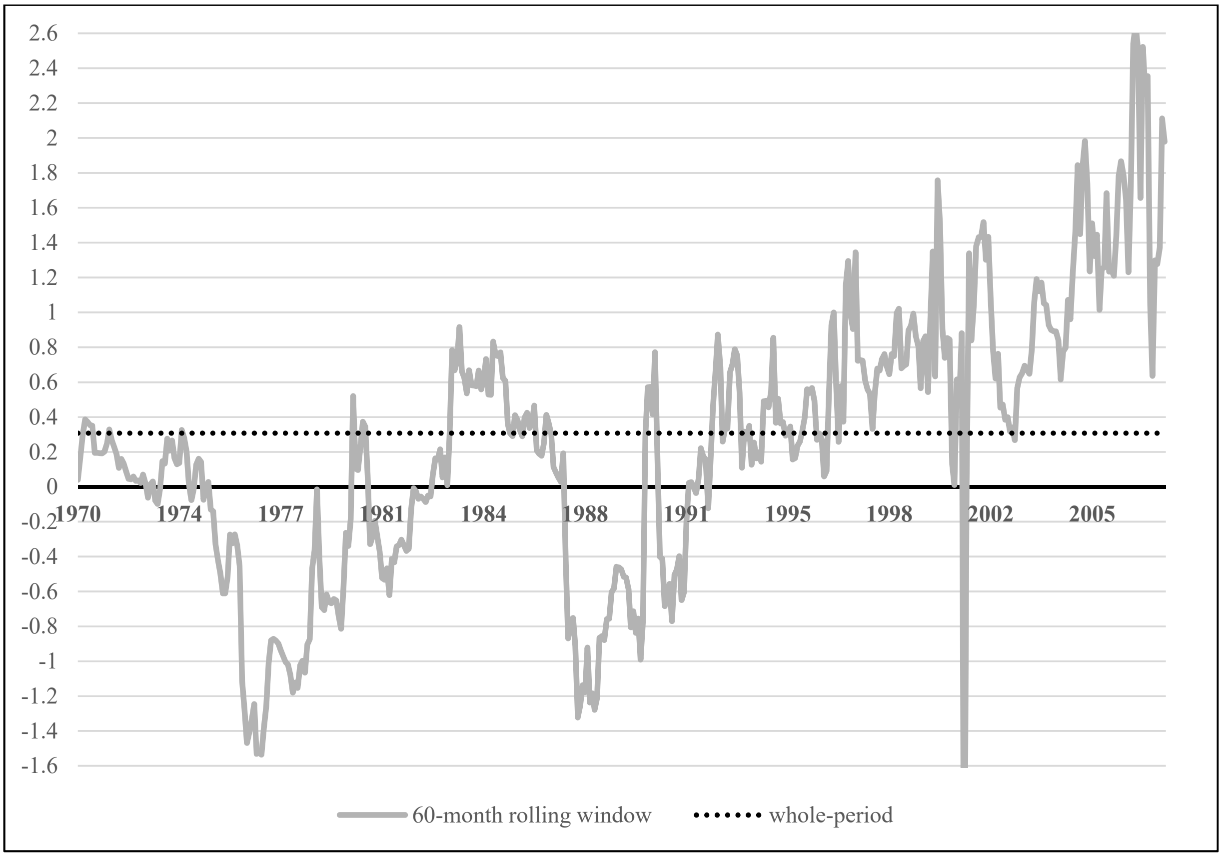


Table A1 Predictive Regressions of the Anomaly Returns on the Investor Sentiment and One- and Two-Month-Lagged Macroeconomic Variables

This table presents the coefficient estimates on the Baker and Wurgler (2006) investor sentiment index ($\hat{\gamma}_1$) from the following predictive regression models containing the five macroeconomic variables with one- and two-month lags, respectively:

$$R_{i,t} = \gamma_0 + \gamma_1 SENT_{t-1} + \gamma_2 Z_t + \sum_{j=1}^{5} m_j X_{j,t-1} + \varepsilon_{i,t},$$

$$R_{i,t} = \gamma_0 + \gamma_1 SENT_{t-1} + \gamma_2 Z_t + \sum_{j=1}^{5} m_j X_{j,t-2} + \varepsilon_{i,t},$$

where $R_{i,t}$ is the excess return in month *t* on the long-leg, short-leg, and long-short portfolio of the anomalies, $SENT$ is the Baker and Wurgler (2006) sentiment index, Z_t is the vector of Fama-French 3 Factors, and $X_{j,t-m}, j = 1, \cdots, 5$, are five macro-variables (cay, term spread, default spread, 3-month Treasury-bill yield, and inflation rate) with m-month lag. The coefficients are estimated using the whole-period sample same as in Table 9 of SYY (2012). Numbers in parentheses indicate White's (1980) heteroskedasticity-adjusted *t*-statistics.

Anomaly	Long	Short	Long-Short	Long	Short	Long-Short
	Using the **one-month lagged** five macroeconomic variables			Using the **two-month lagged** five macroeconomic variables		
Failure probability	0.03(0.13)	-1.20(-2.92)	1.22(2.34)	0.06(0.31)	-1.10(-2.70)	1.16(2.22)
Ohlson's O	0.08(0.99)	-0.53(-2.08)	0.61(2.47)	0.07(0.86)	-0.57(-2.23)	0.64(2.55)
Net stock issuance	0.00(0.05)	-0.45(-3.62)	0.46(3.42)	-0.02(-0.35)	-0.48(-3.84)	0.46(3.42)
Composite equity issuance	0.04(0.53)	-0.18(-1.63)	0.22(1.62)	0.03(0.36)	-0.20(-1.77)	0.22(1.66)
Total accrual	0.02(0.08)	-0.26(-1.28)	0.28(1.20)	0.03(0.17)	-0.18(-0.89)	0.21(0.89)
Net operating assets	0.05(0.44)	-0.32(-2.36)	0.37(2.37)	0.05(0.49)	-0.31(-2.34)	0.36(2.31)
Momentum	0.08(0.57)	-0.19(-0.60)	0.27(0.67)	0.05(0.39)	-0.18(-0.57)	0.23(0.59)
Gross profitability premium	0.07(0.61)	-0.27(-1.90)	0.34(1.71)	0.12(1.07)	-0.28(-1.91)	0.40(1.96)
Asset growth	-0.02(-0.24)	-0.36(-2.55)	0.34(1.99)	0.01(0.13)	-0.37(-2.58)	0.38(2.25)
ROA	0.03(0.26)	-0.92(-3.35)	0.95(2.95)	0.01(0.09)	-0.77(-2.61)	0.78(2.27)
Investment to asset	-0.31(-2.75)	-0.21(-1.72)	-0.09(-0.68)	-0.28(-2.50)	-0.20(-1.63)	-0.08(-0.61)
Combination	-0.01(-0.20)	-0.34(-2.65)	0.33(2.56)	-0.00(-0.04)	-0.32(-2.50)	0.32(2.42)