

## 1. Introduction

The classic capital asset pricing model (CAPM) theorizes a positive linear relation between expected returns and asset betas—bearing high (low) betas is awarded by high (low) returns (Sharpe, 1964), which is, however, nullified by Fama and French (1992) showing that betas are unrelated to returns.<sup>1</sup> Subsequent studies probe explanations in various aspects such as market frictions, misspecification of systematic risk, and inefficiency of market proxies (see, Roll and Ross, 1994; Jagannathan and Wang, 1996; Brennan et al., 2012; Frazzini and Pedersen, 2014). From a behavioral approach, Antoniou et al. (2016) discuss the time-varying beta-return relation, or the security market line (SML), conditional on different levels of individual investor sentiment (i.e., bullishness or bearishness). In particular, Antoniou et al. (2016) argue that individual investors are unsophisticated, so they would trade more over bullish than bearish periods (see, also, Grinblatt and Keloharju, 2001; Lamont and Thaler, 2003). Since the elevated trading does not equally influence all stocks but concentrates on high-beta stocks (Barber and Odean, 2000 & 2001), high-beta stocks tend to be overpriced in times of market euphoria, leading to low returns and then the collapse of the CAPM; by contrast, the CAPM would hold over gloomy periods when individual investors stay on the sidelines, which is supported by their empirical results. Extending the market risk (i.e., beta) to a larger set of macro-related risk (such as consumption growth and innovations in inflation), Shen et al. (2017) evidence that stocks with high exposure tend to earn high returns over bearish periods rather than over bullish periods. At the market level, Yu and Yuan (2011) explore the mean-variance relation and obtain the same empirical finding that a high level of individual investors' participation over high sentiment periods undermines the risk-return tradeoff over low sentiment periods in the US stock market, which is widely confirmed in European stock markets (Wang, 2018a).

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<sup>1</sup> Mixed results of the risk-return tradeoff are also presented in some other earlier studies, such as Fama and MacBeth (1973) and Haugen and Heins (1975).

In one recent paper, DeVault et al. (2019) uncover that in contrast to theoretical models that institutional investors are free from irrational trading, they, rather than individual investors, are more likely to be sentiment traders driving the sentiment-induced mispricing, due to common institutional investment styles such as risk management, reputational concerns, momentum trading, and herding. Applying this argument into the context of the mean-variance relation, Wang (2018b) document that institutional investors' higher participation over the optimistic periods would distort the positive mean-variance relation exhibited over the pessimistic periods, confirming that institutional investors can also be sentiment traders (for global evidence, see, Wang and Duxbury, 2019). However, evidence of the role of institutional investor sentiment in the beta-return relation at the stock level is scant, retarding a profound understanding of the validity of the CAPM and the SML as suggested in Antoniou et al. (2016).

Note, also, that Jacobs (2016), Altanlar et al. (2018), Cai et al. (2018), and Wang et al. (2019) demonstrate that some financial anomalies are at least as strong, and sometimes stronger, in developed markets than emerging markets: a phenomenon that Cai et al. (2018) refer to as the global anomaly puzzle. If an analysis of the influence of institutional investor sentiment on the beta-return relation further confirms them to be sentiment traders as shown in DeVault et al. (2019), the global anomaly puzzle could be explained from the perspective of institutional investors given their higher participation in developed markets.

To this end, we investigate the role of institutional investor sentiment in determination of the beta-return relation. We hypothesize that if institutional investors are sentiment traders as suggested by DeVault et al. (2019), the risk-return tradeoff would be undermined when they are bullish while would be observed when they are bearish. In other words, an upward-sloping (downward-sloping) SML could be revealed over bearish (bullish) periods.<sup>2</sup> Empirical results

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<sup>2</sup> For extant literature studying the time-varying SML based on different settings, see, Cohen et al. (2005), Frazzini and Pedersen (2014), and Hong and Sraer (2016).

exhibit a flat beta-return relation over the 46-year entire sample, corroborating the findings of Fama and French (1992). Notably, separating the entire sample into neutral, bullish, and bearish subsamples based on institutional investor sentiment, we, as expected, report a flat SML over neutral periods, a slightly negative SML over bullish periods, while an evidently positive SML over bearish periods, all of which are robust when employing different beta measures.

This paper adds to the growing sentiment literature by assessing the rationality of institutional investors in terms of their impact on the beta-return relation and suggests them to be sentiment traders as well. Also, our paper complements discussions on the time-varying SML from the perspective of institutional investor sentiment and assures that the positive SML holds over bearish periods but not bullish periods. Finally, confirming institutional investors to be sentiment traders, our paper provides an explanation to the global anomaly puzzle.

The remaining of the paper proceeds as follows. Section 2 presents data on stock betas and institutional investor sentiment, followed by empirical results and discussions in Section 3. Section 4 concludes.

## **2. Data**

### **2.1 Beta**

Stock betas are sourced from the WRDS Beta Suite providing stocks' loading on various risk factors.<sup>3</sup> Following Fama and French (1992), we choose a rolling five-year estimation window for monthly betas. Stock betas are estimated from three models including the CAPM (Sharpe, 1964), the three-factor model (Fama and French, 1993), and the four-factor model (Carhart, 1997). Recall that at the market level, the presented mean-variance relation is subject to the choice of volatility models (Ghysels et al., 2005; Yu and Yuan, 2011), implying that at the

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<sup>3</sup> See, <https://wrds-web.wharton.upenn.edu/wrds/ds/wrdsbeta/index.cfm?navId=428> for more details about the WRDS Beta Suite.

stock level, the beta-return relation may also depend on different beta models. Therefore, our adoption of three beta models facilitates to ensure the robustness of the reported beta-return relation.

## 2.2 Institutional investor sentiment and sample separation

We collect institutional investor sentiment data from Investors Intelligence (II) constructing weekly investor sentiment from current or retired professionals who classify themselves as bullish, bearish, or neutral (Brown and Cliff, 2004). According to the II, the normal sentiment level is 20% neutral (*Neutral*), 45% bulls (*Bull*), and 35% bears (*Bear*), meaning that institutional investors are on average bullish when *Bull* exceeds 45%, bearish when *Bear* exceeds 35%, and neutral otherwise. Compared with the prior literature splitting the entire sample into bullish and bearish periods (Yu and Yuan, 2011; Wang, 2018a), the criterion of the II generating three subsamples including bullish, bearish, and neutral is more precise and in line with the reality.

Following Yu and Yuan (2011) and Wang (2018b), we separate the entire sample as follows. One period needs to be at least one-year long to avoid frequent conversions between regimes. The annual *Bull* and *Bear* in calendar year  $T$  is computed by averaging the weekly *Bull* and *Bear* within the calendar year  $T$ . The next calendar year  $T + 1$  is grouped into bullish if *Bull* is over 45%, bearish if *Bear* is over 35%, and neutral otherwise.

One concern related to our sample separation is that although three subsamples are generated based on institutional investor sentiment II, we appear not to effectively disentangle the influence of individual investor sentiment. To elucidate, if institutional investor sentiment and individual investor sentiment exhibit a synchronous trend, our separation may not exclusively reflect the impact of institutional investor sentiment on the beta-return relation. Table 1 reports correlations between four commonly-used individual investor sentiment measures including

consumer confidence of the Conference Board, consumer sentiment of the University of Michigan, and raw and orthogonalized BW sentiment index from Baker and Wurgler (2006) and *Bull*. Since high (low) values of these four individual investor sentiment measures indicate high (low) investor sentiment, consistent with *Bull*, a high (low) correlation suggests a high (low) level of synchronicity. The reported correlations, ranging from  $-0.122$  (Raw BW) to  $0.332$  (Michigan), are not high, ensuring that our separation is mainly driven by institutional investor sentiment.

**Table 1.** Correlations between institutional and individual investor sentiment.

|             | Conference Board              | Michigan                      | Raw BW                           | Orthogonalized BW                |
|-------------|-------------------------------|-------------------------------|----------------------------------|----------------------------------|
| <i>Bull</i> | 0.141<br>(0.001) <sup>a</sup> | 0.332<br>(0.000) <sup>a</sup> | $-0.122$<br>(0.039) <sup>b</sup> | $-0.106$<br>(0.013) <sup>b</sup> |

This table presents correlations between four widely-adopted individual investor sentiment measures including consumer confidence of the Conference Board, consumer sentiment of the University of Michigan, and raw and orthogonalized BW sentiment index from Baker and Wurgler (2006) and *Bull*. <sup>a</sup> and <sup>b</sup> represent statistical significance at the 1% and 5% level, respectively.

Table 2 reports that the averages of *Bull*, *Bear*, and *Neutral* from 1970 to 2015 are 45.25%, 31.03%, and 23.72%, respectively. In our 46-year sample, we have 24 bullish, 14 bearish, and 8 neutral years. Figure 1 illustrates historical movement of *Bull*, *Bear*, and *Neutral*, showing that institutional investor sentiment fluctuates around the normal level, but can much depart from it in some conditions.

**Table 2.** Summary statistics of the II, 1970–2015.

|                | $\mu$ (%) | $\sigma$ (%) | <i>Max.</i> (%) | <i>Min.</i> (%) | Number of years |
|----------------|-----------|--------------|-----------------|-----------------|-----------------|
| <i>Bull</i>    | 45.25     | 9.91         | 84.40           | 16.30           | 24              |
| <i>Bear</i>    | 31.03     | 9.21         | 48.70           | 11.80           | 14              |
| <i>Neutral</i> | 23.72     | 8.14         | 54.70           | 0.00            | 8               |

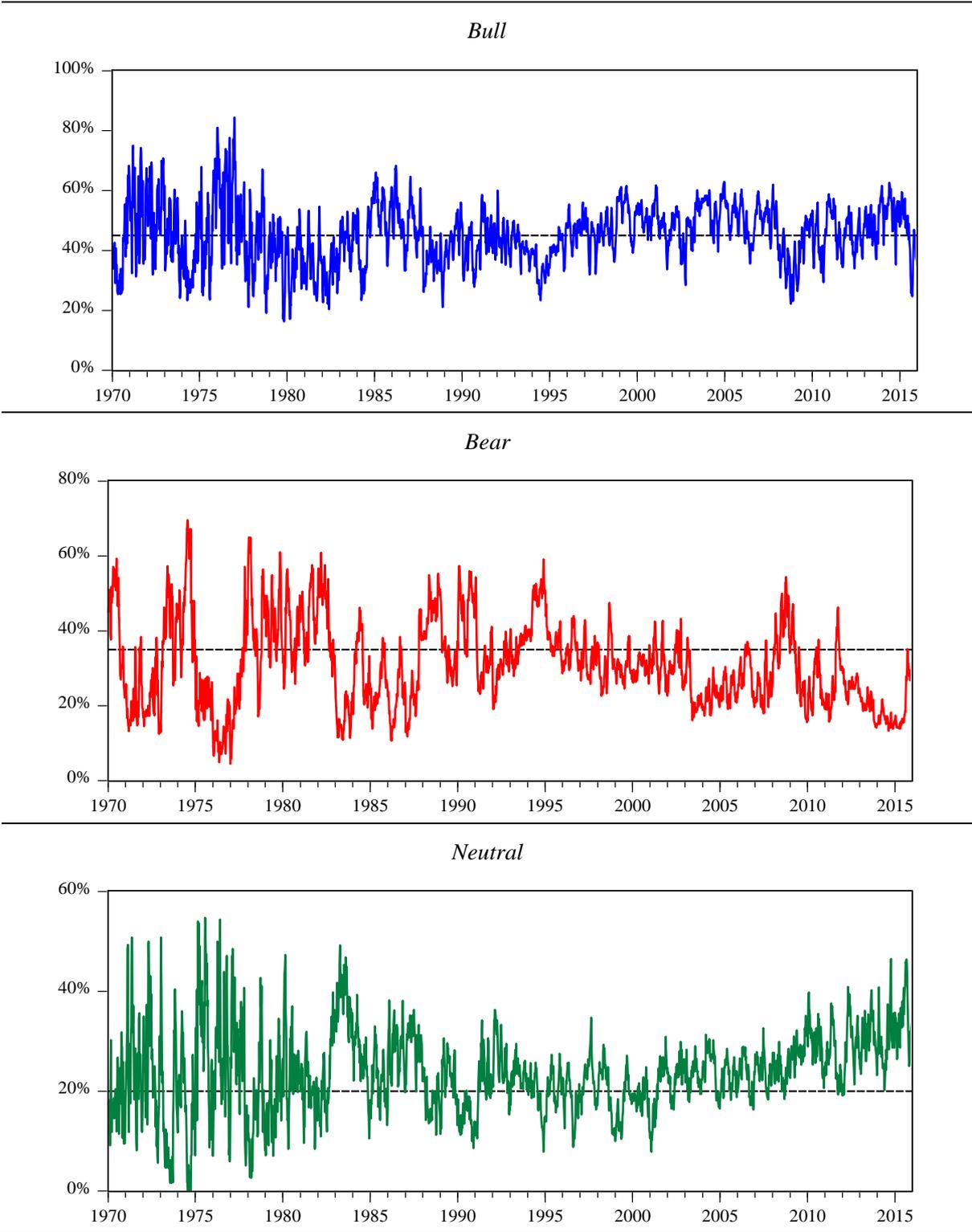
This table shows summary statistics of *Bull*, *Bear*, and *Neutral*. In particular, we report the mean ( $\mu$ ), the standard deviation ( $\sigma$ ), the maximum value (*Max.*), the minimum value (*Min.*), along with the number of years in each subsample.

### 3. Empirical results

#### 3.1 Portfolio analyses

Table 3 reports average returns of beta-sorted portfolios. While highest-beta stocks tend to have higher returns than lowest-beta stocks over the entire sample periods, the difference (0.07%) is trivial and insignificant. The separation between bullish, bearish, and neutral subsamples reveals some interesting findings. Stock returns increase with betas over bearish periods, as predicted by the CAPM. Specifically, the average monthly returns of the lowest- and highest-beta stocks are 2.50% and 3.20%, respectively, which generates an annual return spread of nearly 9% with a  $p$ -value smaller than 5%. However, the CAPM does not hold over bullish periods in that highest-beta stocks yield significantly lower returns than lowest-beta stocks. Also, there is no significant difference in returns of highest- and lowest-beta stocks over neutral periods. Consistent with Table 3, Figure 2 presents an evidently upward-sloping SML, a slightly downward-sloping SML, and a flat SML over bearish, bullish, and neutral periods, indicative of positive, negative, and flat beta-return relations, accordingly.

**Figure 1.** Historical *Bull*, *Bear*, and *Neutral* weekly movement, 1970–2015.



This figure illustrates the historical *Bull*, *Bear*, and *Neutral* weekly movement. The dashed horizontal line in each graph denotes the norm level, i.e., 45% for *Bull*, 35% for *Bear*, and 20% for *Neutral*.

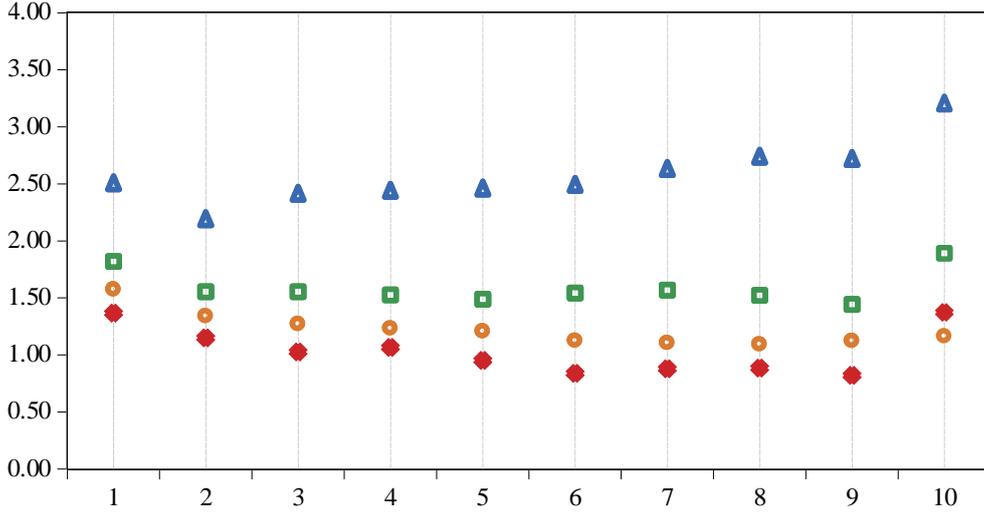
**Table 3.** Average returns of beta-sorted portfolios.

|   | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 10 – 1             |
|---|------|------|------|------|------|------|------|------|------|------|--------------------|
| <i>Panel A Entire sample</i>                            |      |      |      |      |      |      |      |      |      |      |                    |
| Entire ( $n = 552$ )                                    | 1.82 | 1.55 | 1.55 | 1.53 | 1.49 | 1.54 | 1.57 | 1.52 | 1.44 | 1.89 | 0.07               |
| <i>Panel B Neutral, bullish, and bearish subsamples</i> |      |      |      |      |      |      |      |      |      |      |                    |
| Bullish ( $n = 288$ )                                   | 1.57 | 1.34 | 1.27 | 1.23 | 1.21 | 1.12 | 1.10 | 1.09 | 1.12 | 1.16 | -0.41 <sup>c</sup> |
| Bearish ( $n = 168$ )                                   | 2.50 | 2.18 | 2.41 | 2.43 | 2.45 | 2.48 | 2.62 | 2.73 | 2.71 | 3.20 | 0.70 <sup>b</sup>  |
| Neutral ( $n = 96$ )                                    | 1.37 | 1.15 | 1.03 | 1.07 | 0.95 | 0.84 | 0.88 | 0.88 | 0.82 | 1.37 | 0.01               |

This table reports returns of beta-sorted portfolios over the entire sample as well as bullish, bearish, and neutral periods. Returns (in %) are computed as the average monthly returns of each beta portfolio. Highest-beta stocks are grouped into the highest numbered decile (i.e., 10) while lowest-beta stocks are grouped into the lowest numbered decile (i.e., 1). In the last column (10 – 1), we compute return differences between the highest-beta and lowest-beta portfolios.

<sup>b</sup> and <sup>c</sup> represent statistical significance at the 5% and 10% level, respectively.

**Figure 2.** Graphical illustration: average returns of beta-sorted portfolios.



This figure plots the beta-return relation over the entire sample as well as bullish, bearish, and neutral periods. Returns (in %) are computed as the average monthly returns of each beta portfolio. Highest-beta stocks are grouped into the highest numbered decile (i.e., 10) while lowest-beta stocks are grouped into the lowest numbered decile (i.e., 1). Squares, circles, triangles, and crosses represent entire, bullish, bearish, and neutral periods, respectively.

### 3.2 Regression analyses

To test the beta-return relation, we estimate,

$$R_{i,t} = \alpha + \beta Beta_{i,t} + \gamma \Psi_t + \varepsilon_{i,t}. \quad (1)$$

where  $R_{i,t}$  is the return of stock  $i$  in month  $t$  and  $Beta_{i,t}$  is the beta of stock  $i$  in month  $t$ . In addition, we control market factors ( $MKT_t$ ), size factors ( $SMB_t$ ), book-to-market factors ( $HML_t$ ), and momentum factors ( $MOM_t$ ) in matrix  $\Psi_t$ . To distinguish beta-return relations over neutral, bullish, and bearish periods, we employ,

$$R_{i,t} = \alpha_1 + \alpha_2 D_{1,t} + \alpha_3 D_{2,t} + \beta_1 Beta_{i,t} + \beta_2 Beta_{i,t} D_{1,t} + \beta_3 Beta_{i,t} D_{2,t} + \gamma_1 \Psi_t + \gamma_2 \Psi_t D_{1,t} + \gamma_3 \Psi_t D_{2,t} + \varepsilon_{i,t}. \quad (2)$$

where  $D_{1,t}$  is unit for bullish periods and zero otherwise;  $D_{2,t}$  is unit for bearish periods and zero otherwise. Thus,  $\beta_1$ ,  $\beta_1 + \beta_2$ , and  $\beta_1 + \beta_3$  are the beta-return relations over neutral, bullish, and

bearish periods, accordingly. As hypothesized, in the context that institutional investors are sentiment traders (DeVault et al., 2019), their elevated trading over bullish periods tends to distort the positive beta-return relation, leading  $\beta_1 + \beta_2$  not to be significantly positive, while the risk-return tradeoff should be discovered over bearish periods, i.e., a significantly positive  $\beta_1 + \beta_3$ .

Table 4 presents the heterogeneity in the beta-return relation across different institutional investor sentiment regimes. Over neutral periods, the beta-return relation appears to be flat given the rather low-magnitude and insignificant estimations across all three beta models, varying from  $-0.062$  (four-factor model) to  $-0.013$  (CAPM). We find the risk-return tradeoff over bearish periods and such relation is quite strong in terms of magnitude and significance, ranging from  $0.978$  (four-factor model) and  $1.012$  (three-factor model). However, the positive SML crashes over bullish periods. As per the four-factor model, a 1% increase (decrease) in stock betas would bring about a 0.978% increase (decrease) in expected returns over bearish periods, while a same amount would lead to a marginal and insignificant 0.193% decrease (increase) in expected returns over bullish periods. In general, our results confirm a positive SML developed in traditional financial theories to hold over bearish periods but a negative SML over bullish periods. The regression results largely reflect results in Subsection 3.1.

Results of the entire sample are supposed to be a net outcome of bullish, bearish, and neutral periods. Although we have a pronouncedly positive SML over bearish periods, due to the smaller number of bearish years (14 years, see, Table 2), the entire sample presents a weakly positive SML.

**Table 4.** Excess stock returns against betas.

|   | CAPM (I) |                      | Three-factor (II) |                      | Four-factor (III) |                      |
|---|----------|----------------------|-------------------|----------------------|-------------------|----------------------|
| <i>Panel A Entire sample</i>                            |          |                      |                   |                      |                   |                      |
| $\beta$   | 0.261    | (0.338)              | 0.163             | (0.512)              | 0.147             | (0.534)              |
| <i>Panel B Neutral, bullish, and bearish subsamples</i> |          |                      |                   |                      |                   |                      |
| $\beta_1$   | -0.013   | (0.984)              | -0.051            | (0.937)              | -0.062            | (0.923)              |
| $\beta_1 + \beta_2$                                     | -0.205   | (0.574)              | -0.184            | (0.607)              | -0.193            | (0.587)              |
| $\beta_1 + \beta_3$                                     | 1.011    | (0.013) <sup>b</sup> | 1.012             | (0.010) <sup>a</sup> | 0.978             | (0.012) <sup>b</sup> |

This table presents results of beta-return relations over the entire sample (Panel A) along with over neutral, bullish, and bearish periods (Panel B) from Eq. (1) and (2). For the purpose of robustness checks, stock betas are obtained from the CAPM (Column I), three-factor model (Column II), and the four-factor model (Column III). *P*-values are based on robust and clustered standard errors.

<sup>a</sup> and <sup>b</sup> represent statistical significance at the 1% and 5% level, respectively.

#### 4. Conclusion

Consistent with our hypothesis, we document that the risk-return tradeoff, i.e., the positive SML, would be undermined by increased presence and trading of institutional investors over bullish periods, but would be discovered over bearish periods when they stay along the sidelines. Our results provide support to DeVault et al. (2019) evidencing that institutional investors are sentiment traders, and extend Antoniou et al. (2016) documenting the role of individual investor sentiment in determination of the beta-return relation to institutional investor sentiment. Also, our finding of the sentiment institutional investors provides an alternative explanation for the rising global anomaly puzzle showing that some market anomalies are at least as strong, and sometimes stronger, in developed markets than emerging markets due to institutional investors' higher participation in developed markets.

This paper also implies another future research avenue. Like DeVault et al. (2019), our empirical analyses are in the US stock market only. It is, however, intuitive that institutional investors are different across markets because of different cultural dimensions and market integrity (Schmeling, 2009). Therefore, a further study on a wider global sample incorporating multiple markets, especially both developed and emerging markets, is needed to complement

this literature. In addition, the enlarged global dataset providing out-of-US evidence is necessary in surveying market anomalies (Griffin et al., 2003; Ang et al., 2009). We leave it to future studies.

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