Capital Gain Overhang and risk-return trade-off: An international study

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Abstract

This paper examines the risk-return relation under the impact of investors' price reference points in international markets. Follow Grinblatt and Han (2005) and Wang, Yan and Yu (2017), we calculate the capital gain overhang (*CGO*) to measure the psychological evaluation of past returns. Using the double sorting methodology, we find that a negative risk-return trade-off generally exists in international markets when *CGO* value is low, and further Fama-MacBeth procedure results confirm our findings. The *CGO* effect is found to be more prominent in less developed, less transparent, and less legally protected markets. It is stronger in markets with collectivistic, higher power distanced, and feminine cultures. The evidence also indicates that the price reference effect is more pronounced when the market is in crisis condition. In addition, the *CGO* effect on risk-return relation reverses as the holding period becomes longer.

JEL Classification: G14, G15, G40

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1. Introduction

In recent years, prospect theory has been used to explain how investors may allocate money to a stock based on their mental evaluation of the stock's past return distribution. The theory was first proposed in Kahneman and Tversky (1979) and extended in Tversky and Kahneman (1992). The theory, based on its S-shaped utility function, differs from traditional utility theory in three useful implications: (1) investors evaluate outcomes not based on wealth levels, but based on their perception of gains and losses relative to a reference point (reference-dependent preferences); (2) Investors are more sensitive to losses than to same-magnitude gains (loss aversion); (3) Due to concavity of the utility function when there is a gain and convexity of the function when there is a loss, investors tend to be risk-averse in times of gains and risk-seeking in times of losses.

Based on this theory, researchers have explored many market phenomena, such as the disposition effect (investors tend to sell winners sooner than they should have and hold on to losers longer than they should have, e.g. in Frazzini 2006; Li and Yang, 2013; Dacey and Zielonka, 2008; Grinblatt and Han, 2005), negative-feedback trading strategy (investors buy stocks when prices declined and sell stocks when prices rose, e.g. in Yao and Li, 2013; Huang, Liu, and Yin, 2019), equity premium puzzle (stocks generally earn a much higher risk premium than what the traditional risk measures can explain, e.g. in Benartzi and Thaler, 1995; Barberis and Huang, 2006), and insignificant or even negative risk-return trade-off relationship (the risk-return relationship is not significantly positive as traditional asset pricing theory predicts, e.g. in Ang et al, 2006, 2009; Frazzini and Pedersen, 2014; Baker, Bradley and Wurgler, 2011; Qu, Liu, & He, 2019). In this paper, we extend the research by Wang, Yan and Yu (2017) to explore the risk-return trade-off relationship more in-depth and in an international context.

In recent years, studies have used different measures of the prospect theory reference point to investigate the impact of prospect theory value on risk-return relation after controlling for various risk measures in a cross-sectional setting. For example, Barberis, Mukherjee and Wang (2016) find that stocks with higher prospect theory value tend to earn a lower subsequent return as investors buy into these stocks while stocks with lower prospect theory value tend to earn a higher subsequent return as investors have less demand for these stocks and these stocks tend to be underpriced. The prospect theory value used is from Tversky and Kahneman (1992) and depends on parameter estimates from experimental data in this same paper. However, the psychological evaluation of the past return distribution could also be measured as the so-called Capital Gain Overhang (*CGO*). This measure was first introduced by Grinblatt and Han (2005) and later used in Wang, Yan and Yu (2017) to study the risk-return trade-off relationship. Intuitively, this measure shows how much a stock price is above the reference price point formed based on weighted historical prices. The *CGO* measure is easily constructed (more details in Section 3) and imposes different weights on prices that are more recent vs. prices that are farther away in the past. It is also intuitive as explained above, so we adopt the *CGO* measure in this study as a proxy for the prospect theory value. Wang, Yan and Yu (2017) argue that for stocks that have negative *CGO* meaning capital loss relative to the reference price, investors may become more risk seeking and hold the stocks longer than they should have (disposition effect). This could result in a negative risk-return relationship as subsequent returns would be low for this type of high-risk investment. On the other hand, for stocks that have positive *CGO* meaning capital gain, investors may be risk averse and tend to sell the stocks quicker, therefore resulting in a positive risk-return relationship.

This study follows Wang, Yan and Yu (2017) and further investigates the positive or negative risk-return trade-off relationship in the following aspects. First, we extend the study to twenty-two developed markets and eighteen emerging markets. The findings of Wang, Yan and Yu (2017) are found to hold in many of these international markets, which is also consistent with Barberis, Mukherjee and Wang (2016). The double sorts give us very consistent results for all international markets. When *CGO* is high, the higher the *Beta* risk, the higher the excess returns. When *CGO* is lower, this risk-return relation becomes insignificant and even turns negative in some cases.

Second, we adopt the Fama-McBeth method to conduct cross-sectional regression analysis. We find that for our whole sample of international markets, *CGO* has a positive moderating effect on the risk-return relation, i.e. the higher the *CGO* is, the more positive and significant the risk-return relation is. The *CGO* moderating effect is significant even after controlling for widely used pricing factors such as firm-level market value, price-to-book ratio, trading volume, past 52-weeks max/min returns, lagged returns, and return momentum, etc. or market-level Fama-French factors. In addition, the results are further compared between the developed market group and the emerging markets group, and we find that the results are more pronounced in emerging markets group.

Third, this study explores this risk-return relation anomaly for markets with different characteristics such as capital market development, corporate transparency, legal protection, and cultural dimensions. The purpose is to find out whether these different market characteristics will mitigate or reinforce the moderating effect of *CGO* on risk-return relationship. We find that the *CGO* effect is stronger in less developed, less transparent, and less legally protected markets. It is also stronger in markets with collectivistic, higher power distanced, feminine, uncertainty avoiding, short-time oriented and restrained cultures. These cross-country determinants help explain the moderating effect of *CGO* on the risk-return relationship.

Fourth, to examine the *CGO*'s impact on the risk-return relationship in different regimes, we take out two subsamples: one termed crisis period representing the global financial crisis period (from July

2007 to July 2009) and the post-crisis tranquil period (from July 2009 to Dec 2017). During the global financial crisis period, investors might ignore their own private information and follow other investors to trade (such as herding behavior[1]). This behavior could magnify the effect of *CGO* on the risk-return trade-off. We find that the *CGO* effect on risk-return trade-off is more pronounced during the financial crisis period.

Lastly, we extend the test from weekly risk-return trade-off to monthly, quarterly, and semi-annual time horizon. We find that the impact of *CGO* on the risk-return trade-off reverses signs in all three time horizons, especially for developed markets. This suggests in the medium- to long-run, when *CGO* is negative, the risk-return relationship is positive and strong while this relationship becomes weaker when *CGO* is positive.

The rest of the paper is organized as follows. In Section 2, we develop hypotheses tested in this paper. Section 3 discusses models and statistical methods used. Section 4 explains the data sample and summary statistics. Section 5 presents risk-return trade-off results based on double sorted portfolios. Section 6 shows the Fama-McBeth regression results and robustness tests, and Section 7 concludes the paper.

2. Literature review and hypotheses development

The traditional CAPM or asset pricing models assume investors are rational and pricing factors such as beta, size, price-to-book ratio, momentum, etc. could be used to explain cross-sectional stock returns (for example, Fama and French, 1993; Carhart, 1997). Under the rational models, the risk-return relationship should be positive, in other words, the higher the risk, the higher the excess return.

[1] (Chiang and Zheng 2010)

However, empirical studies do not always find positive relationship and sometimes even find significantly negative risk-return relationship. Behavioral finance literature argues that investors are not always rational, therefore exhibiting certain cognitive biases or misperceptions when making financial decisions (Ritter, 2003; Oechssler et al, 2009). One of these cognitive biases is described in Grinblatt and Han (2005) as investors subject to prospect theory (Kahneman and Tversky, 1979) and mental accounting (Thaler, 1980) tend to be more risk loving for stocks that have a paper loss while be more risk averse for stocks that have a paper gain. This may explain why the risk-return relationship is not always positive. We follow Wang, Yan and Yu (2017) to use *CGO* as a measure of prospect theory value and test the following hypothesis:

H1: Stocks with higher prospect theory value exhibit positive risk-return relationship while stocks with lower prospect theory value exhibit weaker and even negative risk-return relationship.

Other than the prospect theory value measured by *CGO*, there are other cross-country factors in local market that could potentially affect the cognitive abilities and behavior of investors in the country, therefore affecting the *CGO* effect on the cross-sectional risk-return relationship. We classify these factors into four groups: capital market development, financial transparency, legal protection and cultural dimensions.

In the more developed capital markets, there are generally more experienced investors, especially institutional investors, who usually have less cognitive biases than retail investors due to more advanced investing techniques and skills in collecting information and analysis (e.g. Lai et al., 2013). This means capital development will likely mitigate the *CGO* effect on the risk-return relationship.

Market development, financial transparency, and legal protection are usually correlated in a market. More developed markets usually come with more financial transparency and better legal protection, both of which are important for investors' acquisition of information and perception of risk (Linciano, et al., 2018; Wang et al., 2011, Avgouleas et al., 2008). Investors who have less information about fundamentals of the firm are more likely to have biases and use heuristics in investment decision making process (Tversky and Kahneman, 1974). According to Wang et al. (2017), the *CGO* effect on risk-return relationship could be caused by slower information flows and investors' underreaction to news. In general, firms with low corporate transparency (less financial transparency and legal protection) are more affected by investor sentiment than are firms with high corporate transparency (Firth, et al., 2015). Therefore, we have the following hypotheses:

H2: The less developed a capital market is, the stronger the moderating effect of CGO on risk-return relationship.

H3: The less corporate transparency, the stronger the *moderating effect of CGO on risk-return relationship.*

H4: The less investor protection, the stronger the *moderating effect of CGO on risk-return relationship.*

Other than the above-mentioned market or system design related factors, the psychology literature has an extensive literature on how cross-country cultural differences could help explain the information content of the stock markets around the world (Nguyen and Truong, 2013) or stock prices/returns themselves (Afego, 2018). As defined by Hofstede (2011), "Culture is the collective programming of the mind that distinguishes the members of one group or category of people from others" and in this study, it distinguishes the collective mind set of investors with different cultural background.

Cultural differences are measured using Hofstede (2011) six cultural dimensions: Power Distance (*PDI*), Individualism/collectivism (*IDV*), Masculinity/Femininity (*MAS*), Uncertainty Avoidance

(*UAI*), Long/Short Term Orientation (*LTO*) and Indulgence/Restraint (*IVR*). In higher power-distanced (*PDI*) and uncertainty avoiding (*UAI*) markets, investor sentiment is more restricted by government regulations and rules, therefore investors tend to rely more on past price information of the stock (Wang et al., 2021). Investors also tend to herd more after others because of information asymmetry (Zarzeski, 1996; Beckmann et al., 2008). Then past price information will be more often used as reference for trading, indicating a stronger CGO effect. On the other hand, in more individualistic (*IDV*), masculine (*MAS*), long-term oriented (*LTO*), and indulgent (*IVR*) markets, investors tend to be more competitive and independent, and they rely more on analysis of their own rather than past price information of the stock (Chui et al., 2010; Beckmann et al., 2008; Aggarwal et al., 2012; Hofstede, 2011; Hammerich, 2019; Wang et al., 2021). When investors make trading decisions without mainly relying on past price information, the reference- dependent preference (RDP) and the disposition effect would play a less important role in stock's risk-return relationship, as explained on the *CGO* effect by Wang et al., (2017).

Therefore, we argue that the higher the *IDV*, *MAS*, *LTO* and *IVR* values, the less likely investors will rely on past price information, and as a result, the weaker the moderating effect of *CGO* on risk-return relationship. On contrary, the higher the *PDI* and *UAI* value, the more likely investors will rely on just past price information, strengthening the *CGO* effect.

H5A: The more individualistic, masculine, long-term oriented and self-indulgent a society/culture is, the weaker the moderating effect of CGO on risk-return relationship.

H5B: The higher power distanced and more uncertainty avoiding a society/culture is, the stronger the moderating effect of CGO on risk-return relationship.

It has been well documented in the literature that during the crisis, investors tend to herd more in the global stock markets due to reasons such as information asymmetry, investor experience/training, etc.

(e.g. Chiang and Zheng, 2010; Venezia et al., 2011; Mobarek et al., 2014). Therefore, individual investors are more likely to follow the others' trading pattern and to rely on past price information such as *CGO*. As past price information plays a more important role in trading behavior during crisis, we expect that the *CGO* effect on risk-return relationship is stronger during financial crisis periods compared to during tranquil periods.

H6: The moderating effect of CGO on risk-return relationship is strengthened during financial crisis periods.

The long-term moderating effect of *CGO* on risk-return relation can be different from short term effect. Argued in Barberis et al., (2001), the prospect theory predicts long-term reversal of stock returns due to time-varying risk aversion. When there is a price increase, risk aversion of investors goes lower as price gain will cushion any subsequent loss. This will further push up prices and lower subsequent returns. When there is a price decrease, risk aversion increases, which will push down price and increase subsequent returns. In the long term, the impact of *CGO* will be weaker or even reversed. Empirical evidence also shows that a stock's long-term return tends to have a negative correlation with investors' trading decisions if the stock is persistently overbought or oversold (Dasgupta et, al. 2011). Therefore, if investors make trading decisions with the prospect theory value (*CGO*) of a company, not the company's fundamentals, the *CGO* effect on risk-return relation could be weakened or even reversed in a long run. As our sample and main tests are based on weekly data, we expect that the *CGO* effect is gradually weakened if we test the risk-return relationship in monthly, quarterly, or semi-annual time frame.

H7: The moderating effect of CGO on risk-return relationship is weakened or reversed in a longer time frame.

3. Estimation models and research methodology

Following Grinblatt and Han (2005) and Wang, Yan and Yu (2017), we adopt the turnover-based measure to calculate the price reference point. Specifically, for each week t, the reference price for each individual stock is calculated as the following:

$$RP_t = \frac{1}{k}\sum_{n=1}^{T}\left(V_{t-n}\prod_{\tau=1}^{n-1}(1 - V_{t-n+\tau})\right)P_{t-n} \tag{1}$$

where V_t is the stock's trading volume turnover in week t, T is 104 weeks,[2] the number of weeks in the previous two years, and k is a constant that makes the weights on past prices sum to one. The trading volume turnover is calculated as weekly trading volume divided by the total number of shares outstanding for the stock. According to Grinblatt and Han (2005), the weight on stock price at time *t-n* is the probability that the share purchased at week *t-n* has not been traded. The capital gain overhang (*CGO*) at week *t* is computed as the percentage difference between the market price and the reference price:

$$CGO_t = \frac{P_t - RP_t}{P_t} \tag{2}$$

To avoid the micro-structure issue from daily or high frequency data and the less prominent behavioral effect from low frequency data, we use twenty years daily data to form the weekly *CGO* values for each stock. Following Barberis, Mukherjee, and Wang (2016), we write the regression equation below to test investors' risk-return relationship under prospect theory/disposition effect in each individual international market or market group:

$$R_{i,t+1} = country_i + b_1 CGO_{i,t} + b_2 Risk_{i,t} + b_3 Risk_{i,t} \times CGO_{i,t} + \sum_{j=4}^{N} b_j Z_{i,t} + \varepsilon_{i,t+1} \tag{3}$$

[2] Wang, Yan and Yu (2017) use 260 weeks (5 years) data to compute the reference price, but for international markets, especially many emerging markets, the data are much shorter than those in the U.S. market, so we use 104 weeks (2 years) instead. However, the results are similar when we test some markets using a longer period of data (260 weeks).

The above Equation (3) is estimated by Fama-McBeth regression in our empirical analysis, and according to our hypotheses a positive coefficient (b_3) is indicative of the existence of prospect theory/mental accounting investors in the market. Stock and stock index returns are calculated as $R_{t+1} = 100 \times (\log(P_{t+1}) - \log(P_t))$, where P_t denotes either the individual stock price or the stock market index at time *t*, and since we calculate weekly returns, the prices are all Wednesday closing stock prices.[3] All returns in our estimations are excess returns over the short term (1-month or 3-month, depends on data availability) domestic interest rate. We use *Beta* as the risk measure, and it is the coefficient of the weekly CAPM regression in the past 104 weeks with a minimum of two years of data. $Z_{i,t}$ represents a vector of control variables, including firm's size, price-to-book ratio, trading volume turnover, lagged return, return momentum, return reversal, past 52 weeks' high and low price, etc. $country_i$ is a dummy variable controlling for fixed effects for country *i*.The definition of these variables can be found in Appendix I.

[Appendix I]

4. Data description

Stock data for all markets are collected from Thomson *Datastream*. The data consist of pricing information and fundamental variables for individual stocks and stock market indexes. At individual stock level, the following variables are collected for this study: stock price, trading volume turnover, market capitalization, and price-to-book ratio. At market level, we collect the market price index and domestic short-term interest rate[4] (risk-free rate). As noted by Ince and Porter (2006), there are issues regarding data coverage, classification, and integrity for international markets in the *Datastream*

[3] We adopt Wednesday closing price to calculate stock returns according to the conventional way to calculate weekly returns (Chordia and Swaminathan, (2000); Gutierrez and Kelley (2008)).
[4] Depends on the data availability, either 1-month or 3-month domestic interest rate is used.

International data. In addition, according to Brennan, Huh, and Subrahmanyam (2011), extreme values in returns/trading volumes may cause illiquidity issues and affect the validity of the model. Therefore, to compile the data, we set a firm's observations to be missing if its stock returns and trading volumes on Wednesdays are in the extreme top or bottom 1% of the cross-section in each market. To fix the massive stale data problem, we follow Ince and Porter (2006) and drop observations with security prices and trading volumes that have zero variance for more than one week during the periods.[5] Moreover, 20 or more stocks are required for each market in each month to ensure meaningful analysis, and therefore even though we collect data from July 1997 to December 2017 for all markets, the actual starting date for each company varies in our sample and emerging/smaller markets tend to have shorter sample periods.

The whole dataset includes 22 developed markets[6] and 18 emerging markets.[7] Besides the whole sample, we also conduct analysis based on the developed markets group and the emerging market group to explore different impact of *CGO* on risk-return relation.

[Table 1]

Table 1 provides summary statistics of major variables for each market.[8] The results show that in our sample for developed markets, the U.S. has most firms and number of observations, followed by Japan and Canada; for emerging markets, China has most firms and number of observations, followed by India. In developed markets, Portugal firms have the highest

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[5] We use weekly data for empirical analysis and daily data for some of the cleaning rules.

[6] 22 developed markets include Australia (AU), Belgium (BG), Canada (CA), Denmark (DK), Finland (FN), France (FR), Germany (BD), Greece (GR), Hong Kong (HK), Israel (IS), Italy (IT), Japan (JP), Netherlands (NL), New Zealand (NZ), Norway (NW), Portugal (PT), Singapore (SG), Spain (ES), Sweden (SD), Switzerland (SW), United Kingdom (UK), and the U.S. (US).

[7] 18 Emerging markets include Argentina (AR), Brazil (BR), China (CN), Egypt (EG), Hungary (HN), India (IN), Indonesia (ID), Korea (KO), Malaysia (MY), Mexico (MX), Philippines (PH), Poland (PO), Romania (RM), Russia (RS), Saudi Arabia (SR), South Africa (SA), Taiwan (TA), and Turkey (TK).

[8] The definition for each variable can be found in Appendix I.

average weekly return (0.75%) and Italy has the lowest average weekly return (0.11%). In emerging markets, Indian firms have the highest average weekly return (1.02%) and Saudi Arabia has the lowest average weekly return (0.12%). In general, developed markets have higher average returns than emerging markets. The average capital gain overhang is negative for most markets except for the U.S. and Argentina, indicating that for most international markets the weekly stock prices are on average lower than the reference prices. Average *Beta*s are around 1 for most markets. The average price-to-book ratio for firms ranges from 1.52 (Japan) to 9.14 (Canada) for developed markets, and from 0.68 (Hungary) to 27.36 (Brazil) for emerging markets. This shows valuations in emerging markets vary more as compared to developed markets.

5. Portfolio analysis

5.1. CGO single sorted and Double sorted portfolios

Panel A of Table 2 reports variable statistics for single-sorted equally weighted portfolios based on the *CGO* value, with P1 group having lowest *CGO* while P5 group having highest *CGO*. Specifically, Panel A1 shows excess returns and CAPM alphas for *CGO* portfolios, and it is evident that both returns are positively correlated with firm's *CGO* values, suggesting higher *CGO* groups tend to have higher returns. Panel A2 shows other firm characteristics across *CGO* quintiles. In general, high *CGO* stocks tend to have lower *Beta* and higher momentum, but have mixed relation with size, Book-to-Market, and trading volume. The results are consistent with those in Wang et al. (2017).

Double sorting is a simple way to compare the portfolio returns based on two variables of our interest. In this section, we are interested in comparing portfolio returns that are formed based on stocks' *Beta* risk and *CGO*. At the beginning of each month, we sort all common stocks based on their lagged *CGO* (value at the end of last month) for each market group and put them into five *CGO* groups with

*CGO*5 being the group that has the highest *CGO* and *CGO*1 being the group that has the lowest *CGO*. Then within each *CGO* group, stocks are sorted based on their lagged *Beta* (value at the end of last month) and further put into five *Beta* groups with *Beta*5 having highest *Beta* and *Beta*1 having lowest *Beta*. The portfolios P1 to P5 are then held for one month. We calculate the equally weighted[9] weekly excess returns based on portfolios' return on each Wednesday of the month. The return differences between *Beta*5 (P5) and *Beta*1 (P1) groups within each *CGO* group are reported in Panel B of Table 2.

[Table 2]

The results in Table 2 Panel B show that the excess portfolio returns are significantly higher in high *Beta* groups for all *CGO5* groups in the whole sample, all developed markets sample, and all emerging markets sample [10]. This suggests that when *CGO* is high, positive risk-return relationship holds for all samples. However, when *CGO* is low, this positive relationship no longer holds. It either becomes insignificant (for whole sample and developed markets) or turns significantly negative (for emerging markets). It is also observed that the lower the *CGO*, the weaker the risk-return relationship. For example, in all developed markets, when *CGO* is high (i.e. prior capital gains), the excess returns for high-beta stocks are 41 basis points higher than those for low-beta stocks per week; when *CGO* is low (i.e. prior capital losses), the difference is only 24 basis points and not statistically significant, hence the positive risk-return relationship becomes weaker as *CGO* becomes lower. For all emerging

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[9] We also conducted empirical analysis with value-weighted portfolio returns. Since the results are similar to those from equally weighted portfolios and to save space, the results are not reported but are available upon request.

[10] We also did double sorting for individual markets, and the results show that 77% (17 out of 22) of developed markets and 83% (15 out of 18) emerging markets show similar pattern with those market groups. i.e. When *CGO* is low, the positive risk-return relationship becomes weaker or even turns negative as *CGO* becomes lower. There are some variations of the *CGO* effect across the markets in our sample, and in general it is more pronounced in emerging markets. In some large developed markets, such as France and Germany, however, the effect is not that significant. It could be attributed to a country's cultural background, rather than its development level as we test is in Section 6.2.4. To save space, the results for individual markets are not reported, but they are available upon request.

markets, when *CGO* is high, the high-beta stocks have weekly excess returns about 39 basis points higher; when *CGO* is low, the low-beta stocks have weekly excess returns about 29 basis points higher and risk-return relationship becomes negative. This finding is consistent with Wang, et al. (2017) and suggests that the U.S. evidence could be generalized to international markets. When *CGO* is low, investors tend to delay selling the stocks and become more risk-seeking, therefore leading to insignificant or negative risk-return relationship. Furthermore, the *CGO* impact on risk-return relationship is more profound in emerging markets than in developed markets group.

5.2. Robustness tests

To validate our results, following Ang, Hodrick, Xing, and Zhang (2006) and Wang, Yan and Yu (2017), we calculate firm's idiosyncratic return volatility as an alternative measure of risk, which is the standard deviation of the residual values from the time-series CAPM model.[11] We then replace the *Beta* risk with the idiosyncratic return volatility measure and repeat the double sorting procedure. Results are reported in Appendix II. The results are consistent with those in Table 2 Panel B. For high *CGO* stocks, the risk-return relationship is positive and significant for all market groups, but for low *CGO* stocks, the relationship becomes less significant for all market and developed market groups and even turns negative for all emerging markets group. It suggests that our results are robust across two different measures of risk proxy. To save space, we shall only adopt *Beta* risk as the risk measure in the following regression analysis.

Besides *CGO*, studies also document other price-based reference points for investors, such as purchase price (Shefrin and Statman, 1985), adjusted purchase price (Arkes et al. 2008), historical maximum and minimum prices (Kaustia, 2004), 52-week high/low prices (George and Hwang, 2004),

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[11] $R_{i,t} = b_0 + b_1 R_{M,t} + \varepsilon_{i,t}$, where $R_{i,t}$ is stock *i* 's weekly excess return on week *t* , and $R_{M,t}$, is the market return on date *t*. The model is estimated each stock each week in the data set using the weekly return from the previous year (52 weeks).

and a combination of above (Riley, Summers, and Duxbury 2020). The findings of the above literature also suggest that investors tend to sell their stocks when stock price exceeds the reference point. To further validate our findings from the test of *CGO* grouping and stocks' risk-return trade-off relationship, we re-do double sorting with a stock's relative price to its past 52-week high/low.

Following the same methodology as in Section 5.1, we sort all common stocks based on the price relative to their 52-week high/low for each market group and divide them into five reference price (*REF*) groups with *REF*1 being the group in which stock prices are close to or lower than their past 52-week high and *REF5* being the group in which stock prices are close to or higher than their past 52-week low. Within each *REF* group, stocks are sorted based on their lagged *Beta* and further put into five *Beta* groups where *Beta*5 has highest *Beta* and *Beta*1 has lowest *Beta*. The portfolios are then held for one month and the equally weighted weekly excess return and the return difference between *Beta*1 and *Beta*5 groups within each *REF* group are reported in Appendix III.

The results are also consistent with what we report in Table 2 Panel B, in that the positive risk-return trade-off holds for all three market groups when the reference price is high (*REF*5), where the excess return difference between high *Beta* stock portfolios and low *Beta* stock portfolios is positive and significant. On the other hand, the risk-turn trade-off turns negative for all three market groups when the reference price is low (*REF*1). The results confirm our findings that the risk-return trade-off relation is affected by investors' gain or loss relative to a reference price.

6. Regression analysis

Although the double sorting method provides a simple way to see the risk-return relation with a moderating factor, it also has some drawbacks and cannot go beyond two factors. If we need to incorporate three or more factors of interest, double sorting can no longer help. It also cannot report the specific coefficients for certain independent variables of interest such that we do not know the magnitude of the impact. In this section, we further explore *CGO*'s impact on risk-return relation after we control for a series of pricing factors. The empirical analyses are conducted using Fama-MacBeth regressions, and the results are presented as follows. First, we run the regression of excess stock returns on *CGO*, *Beta*, the interaction term between *CGO* and *Beta*, and a series of control variables for all market groups in our sample. Next, we classify the markets based on different country-level characteristics and compare the *CGO* effect on risk-return relation for different types of markets. We also test the risk-return relation with *CGO* as the moderator under different market conditions and compare investors' behavior between tranquil and crisis periods. Lastly, we examine the longer-term effect of *CGO* on risk-return relation with monthly, quarterly, and semi-annual returns.

6.1. Fama-Macbeth regression on stock returns

According to the prospect theory and the findings from Grinblatt and Han (2005) and Wang, Yan and Yu (2017), prospect theory (PT)/ Mental accounting (MA) investors tend to be more risk averse when the capital overhang (*CGO*) is positive and more risk taking when the *CGO* is negative, so the risk-return relation under a positive *CGO* would be positive and under a negative *CGO* could be insignificant or even negative. Therefore, we should observe a positive and significant coefficient for the interaction term between *CGO* and *Beta* if PT/MA investors widely exist in the market (*Hypothesis 1* in Section 2).

We adopt two-step Fama-MacBeth procedure as the main technique in our empirical analysis. The coefficients of regressions represent the average cross-sectional response to excess returns.[12]

The first model tested is a reduced model derived from Equation (3):

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[12] To validate our findings, we also test the same set of regressions with the GLM (generalized linear model) procedure. The main results, especially the coefficients of the key variables are consistent with those from the Fama-Macbeth regression analysis. The results are available upon request.

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + \varepsilon_{i,t+1} \tag{4}$$

In this model, no other control variables are included in the regression except for the main variables: *CGO*, *Beta*, and the interaction term between *CGO* and *Beta*.

The reduced model provides evidence on how the risk-return relation is affected by *CGO* values in international markets. However, stock excess returns are affected by other pricing factors as well. Fama and French (1993, 2012) suggest firm characteristic variables such as firm size and book-to-market ratio can explain variances of stock returns. George and Hwang (2004) find that past 52-week high/low return improves the forecasting power of for future returns. Amihud's (2002) find that liquidity is associated with cross-sectional and time-series stock returns. Daniel and Titman (1997) argue that return momentum and past returns are significantly correlated with stock returns. Therefore, following Barberis, Mukherjee, and Wang (2016), among others, we include these widely used pricing factors in our model and re-write the regression equation as the following extended model in equation (5) and full model in equation (6):

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 LogMV_{i,t} + b_5 PTBV_{i,t} + \varepsilon_{i,t+1} \tag{5}$$

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 LogMV_{i,t} + b_5 PTBV_{i,t} + b_6 TO_{i,t} + b_7 Max_{i,t} + b_8 Min_{i,t} + b_9 R_{i,t} + b_{10} Mom_{i,t} + \varepsilon_{i,t+1} \tag{6}$$

where $LogMV_{i,t}$ is the log of firm size, $PTBV_{i,t}$ is the market value divided by the book value of equity at the end of last fiscal year, $TO_{i,t}$ is the trading volume turnover that measures a company's liquidity, $Max_{i,t}$ and $Min_{i,t}$ are the last 52 weeks' highest and lowest stock returns respectively, $R_{i,t}$ is the lagged stock return, and $Mom_{i,t}$ is the cumulative return from month *t-12* to *t-1*.[13] To test if there is a

[13] See Appendix I for detailed definitions of the variables.

difference of the *CGO* impact on risk-return relation between developed markets and emerging markets, we also include a three-way interaction term of the emerging market dummy and the *CGO-Beta* interaction term.

The regression results for the whole sample, developed, and emerging market groups are reported in Table 3. [14] The results for Equation (4), (5), and (6) are reported in Panels A, B, and C, respectively.

[Table 3]

The coefficients for *CGO* are all positive and significant, but the coefficients for *Beta* are mostly negative and significant for all market groups. Note that the signs of coefficients for *CGO* and *Beta* do not represent their relationship with excess returns solely, as the interaction term between *CGO* and *Beta* is also included in the regressions.

Our key variable to test the prospect theory effect is the interaction term between *CGO* and *Beta*. Not surprisingly, the coefficients for the interaction term are positive and significant for all market groups and are very consistent even after we include all control variables. [15] The results confirm our *Hypothesis 1* that investors with prospect theory behavior generally exist in international markets, where the risk-return relation is dependent on the stock's *CGO* value; i.e. under a positive *CGO*, the risk-return relation is positive while under a negative *CGO*, the risk-return relation is negative. They are also consistent with the findings of Wang, Yan and Yu (2017) in the U.S. market and Qu, Liu, and He (2019) in the Chinese stock market.

For other pricing factors, *MV* and *PTBV* are positively correlated with stock excess returns; *TO* has a mixed relationship with stock excess returns and is only significant for emerging market group; *Max*

[14] We also did all the regressions for individual markets. Most individual market results are consistent with their corresponding market group. To save space, we shall only report the results from market groups. The individual market regression results are available upon requests.

[15] Although the significance level is slightly lower as we include more control variables.

and *Min* are mostly negatively correlated with stock excess returns, indicating possible return reversals; the lagged return variable and the momentum variable are significantly positively correlated with stock excess returns for all market groups. The signs and significance level of the coefficients are mostly consistent with previous studies.[16] The results suggest that although the widely used pricing factors are mostly significant in explaining the stock returns, they don't alter the significant impact of *CGO* on risk-return relation.

It is also interesting to note that in the last column for all three regressions, the *emerging dummy* - *CGO-Beta* three-way interaction term is significantly positively associated with excess stock returns, confirming our previous finding that the *CGO* impact on risk-return relation is more pronounced for emerging markets.

6.2. Cross-country comparison

In previous section, we mainly test the *CGO* effect for the whole sample (or as groups for developed/emerging markets). However, investors from different markets might have different views on reference prices when they make investment decisions and the information accessibility from capital market is also different. Therefore, the *CGO* effect on risk-return relation could also be different for markets with different characteristics. To further investigate this issue, we measure markets' characteristics from the following four aspects: capital market development (CMD), corporate transparency (CT), investor protection (IP), and cultural dimensions (CD). As deduced in Hypotheses *H2*, *H3*, and *H4*, we expect that the *CGO* effect is stronger in markets that are less developed and have poorer corporate transparency and investor protection. From Hypotheses *H5A* and *H5B*, we expect that markets with more individualism, masculinity, long-term orientation and

[16] For example, Barberis et al. 2016

indulgence tend to have a weaker CGO effect, while markets with more power distance and uncertainty avoidance tend to have a stronger CGO effect.

To conduct empirical tests, we create a dummy variable $Proxy\_Dummy$ that equals one when a proxy measure of the market characteristic is above the median value of all markets and zero when it is below the median.[17] We then multiply the $Proxy\_Dummy$ with the interaction term *CGO* x *Beta* and incorporate this triple interaction variable into Equation (7) and rewrite as the following:

$$R_{i,t+1} = country_i + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 Proxy\_Dummy_{i,t} + b_5 Beta_{i,t} \times CGO_{i,t} \times Proxy\_Dummy_j + b_6 LogMV_{i,t} + b_7 PTBV_{i,t} + b_8 TO_{i,t} + b_9 Max_{i,t} + b_{10} Min_{i,t} + b_{11} R_{i,t} + b_{12} Mom_{i,t} + \varepsilon_{i,t+1} \quad (7)$$

All variables are defined as before, and the regression results are reported in Table 4. To save space, only the five key variables (*CGO*, *Beta*, *CGO**Beta*, $Proxy\_Dummy$, and *CGO**Beta**Proxy_dummy*) are reported.

[Table 4]

6.2.1 Capital market development

The proxies we use for capital market development are: the ratio of market capitalization over GDP (*market capitalization*), the number of listed firms over total population (*companies*), and the ratio of market turnover over market capitalization (*market turnover ratio*).[18] The estimates of regressions from Equation (7) with these three proxies are reported in Panel A of Table 4.

The results show that the three-way interaction term $Beta_{i,t} \times CGO_{i,t} \times Proxy\_Dummy$ is negatively and significantly associated with stock excess returns when *market capitalization* and

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[17] For example, when Market Capitalization Index is used as a proxy for capital market development, the median value of the index is 55.56 (see appendix I for data sources) for all 40 markets (22 developed markets and 18 emerging markets). The *proxy_dummy* is set to one for the 20 markets that have a Market Capitalization Index value higher than 55.56, and zero for the rest 20 markets that have a Market Capitalization Index value lower than 55.56.
[18] The variable definition and source of data can be found in Appendix I.

market turnover ratio are used as the proxy dummy variable and is not significantly associated with stock excess returns when *companies* is used as the proxy dummy variable. This suggests that for those markets with higher market development level, the *CGO* effect on risk-return relation is weaker than for those markets with lower market development level. This finding is consistent with our *Hypothesis 2* (*H2*) that the less developed a capital market is, the stronger the moderating effect of *CGO* on risk-return relationship.

6.2.2 Corporate transparency

The proxies for corporate transparency include the adoption of International Financial Reporting Standards (*IFRS*), the number of circulated newspapers (*Newspapers*), and the corporate transparency index (*Transparency*) (Bushman et al., 2004; Firth, et al., 2014).[19] The estimates of regressions from Equation (7) with these three proxies are reported in Panel B of Table 4.

The results show that the three-way interaction term $Beta_{i,t} \times CGO_{i,t} \times Proxy\_Dummy$ is negatively associated with stock excess returns for all three proxies, but the coefficient is only significant for the *IFRS* dummy, suggesting that for those markets with higher corporate transparency, the *CGO* effect on risk-return relation is weaker than for those markets with lower corporate transparency, especially when corporate transparency is measured by the adoption of *IFRS*. This finding is consistent with our *Hypothesis 3* (*H3*) that the less corporate transparency, the stronger the moderating effect of *CGO* on risk-return relationship.

6.2.3 Investor protection

[19] The variable definition and source of data can be found in Appendix I.

The proxies for investor protection include the *rule of law* index, the *property rights* index, and the *law and order* index (Bushman et al., 2004; Avgouleas et al., 2008).[20] The estimates of regressions from Equation (7) with these three proxies are reported in Panel C of Table 4.

The results show that the three-way interaction term $Beta_{i,t} \times CGO_{i,t} \times Proxy\_Dummy$ is negatively and significantly associated with stock excess returns when *rule of law* and *property rights* are used as the proxy dummy variable and is not significant associated with stock excess returns when *Law and Order* is used as the proxy dummy variable, suggesting that for those markets with worse investor protection, the *CGO* effect on risk-return relation is stronger than for those markets with better investor protection level. This finding is consistent with our *Hypothesis 4* (*H4*) that the less legal protection, the stronger the moderating effect of *CGO* on risk-return relationship.

6.2.4 Cultural dimension

Following Hofstede (2011)'s research on cultural dimensions, we adopt the following cultural dimension proxies:[21] Individualism (*IDV*), Power Distance (*PDI*), Masculinity (*MAS*), Uncertainty Avoidance (*UAI*), Long-term orientation (*LTO*), and Indulgence (*IVR*). The estimates of regressions from Equation (7) with these six proxies are reported in Panel D of Table 4.

The results show that the three-way interaction term $Beta_{i,t} \times CGO_{i,t} \times Proxy\_Dummy$ is negatively associated with stock excess returns when *IDV* , *MAS*, *LTO* or *IVR* is used as the proxy dummy variable, but are only significant when *IDV* and *MAS* are used. The term is positively associated with stock excess returns when *PDI* or *UAI* is used as the proxy dummy variable, but it is only significant for *PDI*. This suggests that the *CGO* effect is stronger in markets with collectivistic,

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[20] The variable definition and source of data can be found in Appendix I.
[21] For details, please visit https://geerthofstede.com/culture-geert-hofstede-gert-jan-hofstede/6d-model-of-national-culture/. The variable definition and source of data can be found in Appendix I.

higher power distanced, and feminine cultures. The findings are consistent with our *Hypothesis 5* (*H5A* and *H5B*) that the higher the *IDV* and *MAS* and the lower the *PDI*, the weaker the moderating effect of *CGO* on risk-return relationship.

6.3. Stock returns under different market conditions

In this section, we present the empirical results for an updated regression model to test if there is a difference in the *CGO* impact on risk-return relation between tranquil and crisis periods. During a crisis period, investors usually face large losses and tend to have more behavioral anomalies during crisis periods.[22] The crisis period is defined as the period from July 2007 to July 2009, when the subprime mortgage crisis spread into a global financial crisis. During this period, the global stock markets suffered greatly and S&P500 lost about half its value over this period of time. The tranquil period is from August 2009 (the end of the global financial crisis) till the end of our sample December 2017. We then test Equation (6) separately for the tranquil period and the crisis period:

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 LogMV_{i,t} + b_5 PTBV_{i,t} + b_6 TO_{i,t} + b_7 Max_{i,t} + b_8 Min_{i,t} + b_9 R_{i,t} + b_{10} Mom_{i,t} + \varepsilon_{i,t+1} \quad (6)$$

To save space, only the coefficients of the three main variables for the whole sample, developed and emerging market groups in tranquil period are reported in Panel A of Table 5 and those in crisis period are reported in Panel B of Table 5.

[Table 5]

Consistent with previous results in Table 3, the coefficients of the interaction term between *CGO* and *Beta* are all positive. However, it is significant for all three market groups in the crisis period, but it is only significant for the whole sample in the tranquil period. Furthermore, coefficient of the

[22] Some investors could be overly risk-averse resulting in under-investment in risky assets (Filbeck et al. 2017).

interaction term is much larger in the emerging markets group than in the developed markets group during the crisis period. The results suggest that the *CGO* effect on risk-return relation is more pronounced during crisis period than during tranquil period, especially in emerging markets group. When investors face market uncertainty and information asymmetry, they might make investment decisions more based on their own psychological price benchmark rather than fundamentals of the company.[23]

6.4. Long term effect of CGO on risk-return trade-off

Investors' trading preferences may change in different time frames. Ben-David and Hirshleifer (2012) find that investors are less likely to buy or sell for small gains or losses, but more likely to buy or sell as the absolute value of gain/loss increases, and they call this trading response a V-shaped relation to profit. The V-shaped relation, however, becomes flattened as the holding period of the stock becomes longer. In this section, we extend previous tests that use weekly returns as the dependent variable to monthly, quarterly, and semi-annual returns and investigate how the risk-return trade-off is affected by *CGO* over a longer time frame in international stock markets. We rewrite Equation (6) as:

$$R'_{i,t+1} = country_i + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 LogMV_{i,t} + b_5 PTBV_{i,t} + b_6 TO_{i,t} + b_7 Max_{i,t} + b_8 Min_{i,t} + b_9 R_{i,t} + b_{10} Mom_{i,t} + \varepsilon_{i,t+1} \quad (8)$$

where $R'_{i,t+1}$ represents next monthly, quarterly, or semi-annual stock returns for next time period. We then re-run the regression for the whole sample as well as the developed markets group, and the emerging market group. The results are reported in Table 6.

[Table 6]

[23] For example, herding with other investors (Chiang and Zheng, 2010).

Panel A of Table 6 shows the results from monthly return, Panel B shows the results from quarterly return, and Panel C shows the results from semi-annual return.[24] There are a few differences when we compare the results in Table 6 with those in Table 3 where weekly return is the dependent variable. First, the coefficients for *CGO* become insignificant (except for the developed market group in Panel A, and for the emerging market group in Panel C, both are marginal significant). Second, the coefficients of the interaction term (*CGO* x *Beta*) turn negative for most groups in all three panels, although they are only significant in Panel A for the whole sample and developed markets group. It indicates that higher *CGO* stocks tend to earn lower stock returns over a long run, and the reversal of the *CGO* effect is at the strongest level after a month. This is consistent with our argument that investors tend to sell high *CGO* stocks over time, resulting in lower stock returns. Third, the coefficients of the interaction term *CGO* x *Beta* are larger in absolute value when we use longer term future returns as the dependent variable. It might suggest that in a long run the *CGO* effect weakens or reverses on the risk-return relation, and the longer the time frame the more reversal of the *CGO* effect.[25] The results are consistent with the findings from Ben-David and Hirshleifer (2012) that investors tend to overturn their trading decisions in a long run.

6.5. Robustness check

6.5.1 Market-level pricing factors

Aside from the firm-level pricing factors we have employed in the tests above, stock excess returns can be affected by market pricing factors as well. Fama and French (1992, 1993) propose a three-factor model to explain the variation of cross-sectional stock returns and argue that small size stocks and high book-to-market stocks have return premiums over large and low book-to-market stocks.

[24] To save space, we shall only report the coefficients for the three key variables: *CGO*, *Beta*, and *CGO*Beta*. The coefficients of other control variables are similar to previous tables, and the full results are available upon requests.
[25] It is also possible that the excess returns become larger for a longer holding period, so all coefficients become larger.

This model has been widely used in empirical asset pricing studies. Jegadeesh and Titman (1993) and Carhart (1997) find that buying past winning and selling past losing stocks generates significant positive returns, so the momentum factor is often used together with the Fama-French factors. As stock market momentum might be caused by investors' overreaction to short term information (De Bondt and Thaler, 1985, 1987), stock returns can also experience a long-term reversal. Therefore, we include the above market pricing variables and form an alternative model to test risk-return relation with the *CGO* as the moderator:

$$R_{i,t+1} = country_i + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 SMB_{mkt,t} + b_5 HML_{mkt,t} + b_6 MOM_{mkt,t} + b_7 REV_{mkt,t} + \varepsilon_{i,t+1} \quad (9)$$

where *SMB*, *HML*, *MOM*, and *REV* are the corresponding market pricing factors small minus big, high minus low, short term momentum winner minus loser, and long-term reversal winner minus loser,[26] and the estimation results of Equation (9) for all market groups are reported in Table 7.

[Table 7]

The results in Table 7 are consistent with those in Table 3. The signs for coefficients of *CGO* are mostly positive and significant and the coefficients of *Beta* are mostly negative and significant. The coefficients for the interaction term between *Beta* and *CGO* are all positive and significant, indicating that with lower or negative *CGO* the risk-return relation could turn negative. The pricing factors, *SMB*, *HML*, *MOM*, and *REV* are significant for the whole markets group, but less significant for the emerging markets group. The signs of the coefficients are consistent with previous studies.[27] The

[26] See Appendix IV for definition of the variables.

[27] For example, the signs for the coefficients of *SMB* and *HML* are positive and significant for most market groups, indicating that there are small and high book-to-market stock returns premiums.

results suggest that by using an alternative model that controls for market-level pricing factors, the *CGO* effect on risk-return relation is still consistent with our main findings.

6.5.2 Prospect theory value

In Barberis, Mukherjee, and Wang (2016), an alternative prospect theory variable (TK) is used to measure a stock's past returns distribution. Investors evaluate this TK value mentally as reference for their future investments. The main finding of the paper shows that the TK value of a stock's historical return distribution is negatively related to the stock's subsequent return. In the table showing international evidence, this paper reports that creating a long-short portfolio by buying (shorting) stocks in the lowest (highest) TK quintile could generate a positive and significant Alpha in over 50% of the forty-six international markets in their sample.

In this section, we divide all markets in our sample into two groups based on the signs and significance level of Alpha when forming long-short portfolios based on the TK value. One group of markets have positive and significant Alpha when creating a long-short portfolio by buying (shorting) stocks in the lowest (highest) TK quintile and the other group of markets have insignificant Alpha.[28] We then run Equation (6) for these two groups separately and the results are reported in Table 8. [29]

[Table 8]

The results show that the coefficient of the interaction term between *CGO* and *Beta* is positively and significantly correlated with stock excess returns in group 1 (markets that have positive and significant Alpha when creating a long-short portfolio by buying (shorting) stocks in the lowest (highest) prospect theory value quintile), but the coefficient is not significant for group 2 (markets

[28] We thank Dr. Baolian Wang for providing the detailed international market result.
[29] To save space, we shall only report the coefficients for the three key variables: *CGO*, *Beta*, and *CGO*x*Beta*. The coefficients of other control variables are similar to previous tables, and the full results are available upon requests.

that have insignificant Alpha). This suggests that the *CGO* effect on risk-return relation is stronger in markets where investors are more likely to use the TK value to make their investment decisions, which is consistent with Barberis, Mukherjee, and Wang (2016).

6.5.3 Disposition effect

Another possible explanation of the *CGO* effect on risk-return relation is the disposition effect, which argues that investors have a greater propensity to sell stocks trading at a paper gain rather than those trading at paper loss (Barberis and Xiong, 2009). The disposition effect of investors' trading behavior could be explained by the prospect theory developed by Kahneman and Tversky (1979) and Tversky and Kahneman (1992), and it could induce mispricing[30] that results in similar risk-return relation as the *CGO* effect. However, because *CGO* measures investors' risk preference based on a reference point, not mispricing, the *CGO* effect is different from the disposition-effect induced mispricing.

Nonetheless, to differentiate the *CGO* effect from the disposition-effect induced mispricing, we follow An (2016) to create the V-shaped Net Selling Propensity (*VNSP*), which measures investors' propensity to sell a security when the magnitude of their gains or losses on this security increase, as a proxy for the disposition-effect induced mispricing. We then follow Wang et al. (2017) and incorporate *VNSP* and its interaction term with *Beta* into our Fama-MacBeth regression model (6) as the following:

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 VNSP_{i,t} + b_5 Beta_{i,t} \times VNSP_{i,t} + b_6 LogMV_{i,t} + b_7 PTBV_{i,t} + b_8 TO_{i,t} + b_9 Max_{i,t} + b_{10} Min_{i,t} + b_{11} R_{i,t} + b_{12} Mom_{i,t} + \varepsilon_{i,t+1} \quad (10)$$

where *VNSP* is calculated as in An (2016), and all other variables are defined as before. The results of Equation (10) are reported in Table 9. Although the disposition-effect induced mispricing (*VNSP*)

[30] Higher risk stocks are underpriced, and lower risk stocks are overpriced.

and its interaction with *Beta* are mostly significant, the *CGO* effect still holds, especially for the emerging markets group.

7. Conclusion

This study examines the risk-return relation from a behavioral finance perspective. The traditional asset pricing theory states that investors earn higher returns by taking higher risks. However, many empirical studies have found the opposite (for example, Fama and French, 1992; Ang et al, 2006, 2009; Frazzini and Pedersen, 2014; Baker, Bradley and Wurgler, 2011). To investigate this anomaly, many have given different explanations such as various measures of risk, benchmarking, etc. This study explores this anomaly in an international context from the prospect theory point of view following Wang, Yan and Yu (2017). Prospect theory argues that investors become more risk seeking when the stock price is below a certain reference price and become risk averse when the stock price is above the reference point (Tversky and Kahneman, 1992). As investors become more risk seeking, they tend to hold the risky stocks for too long, resulting in lower subsequent returns. As investors become risk averse, the positive risk-return relationship remains.

To measure the prospect theory value, we follow Grinblatt and Han (2005) and Wang, et al. (2017) and use the capital gain overhang (*CGO*), which is defined as how much the stock price is above or below the reference price point (calculated as trading volume weighted average historical prices). We first use firm-level data in 40 markets (22 developed and 18 emerging markets) to form portfolios based on *Beta* and *CGO* (double sorting) to get preliminary results and find that in higher *CGO* groups, the positive risk-return relation remains in all market groups including the developed markets and emerging markets sub-groups; in lower *CGO* groups, however, the relation is much weaker and is even negative for the emerging markets group. When we use the 52-week high/low price to replace

CGO as the reference point or to use the idiosyncratic volatility risk to replace *Beta* risk as the risk measure, the results remain.

We then use the Fama-MacBeth regression model to investigate the moderating role of *CGO* in the risk-return trade-off. This method brings similar results as the double sorting method even after controlling for some widely used pricing factors such as firm market value, price-to-book ratio, trading volume, past 52 weeks max/min returns, lagged returns, and return momentum, etc. Although the *CGO* effect tends to be more pronounced in emerging markets group than in advanced markets group. When we replace those firm-level pricing factors with market-level pricing factors such as the Fama-French factors, momentum, and long-term reversal variables, the results remain. The next question arises: will the *CGO* effect be stronger for certain markets? If yes, what country characteristics make the *CGO* effect stronger? By including a set of dummy variables proxying for a market's capital development, corporate transparency, investor protection, and cultural dimension measures in the regression, we find that the *CGO* effect is stronger in less developed, less transparent, and less legally protected markets. It is also stronger in markets with collectivistic, higher power distanced, and feminine cultures.

Our results are also comparable to the international evidence found by Barberis, Mukherjee and Wang (2016) that the *CGO* effect is stronger for markets where investors are more likely to use the prospective theory (TK) value as their reference price for trading. Furthermore, after controlling for the disposition-effect induced mispricing (*VNSP*, (An, 2016)) and its interaction with *Beta*, we find the *CGO* effect still holds, especially for the emerging markets group.

The difference in investor behavior during crisis periods is also examined. During the global financial crisis from July 2007 to July 2009, the *CGO* effect on the risk-return relationship is stronger for the whole sample, developed markets group, and emerging markets group. This evidence is consistent with the findings in the literature that when investors face market uncertainty and information asymmetry, they might make investment decisions more based their own psychological price benchmark rather than fundamentals of the company. In addition, the *CGO* effect on risk-return relation reverses as the holding period becomes longer in one month, one quarter, or one half-year.

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Table 1. Descriptive statistics

Panel A. Summary statistics

This table presents summary statistics for 40 markets included in our sample. Markets (Column 1) are classified into 22 developed and 18 emerging markets and seven regions based on geographic proximity. Columns 2 to 4 list, respectively, the beginning, the number of companies, and the number of stock-week observations for each market. Columns 5–11 list the time-series average value of the following variables: (1) *Return* is calculated as $R_t = (\log(P_t) - \log(P_{t-1})) \times 100$, where P_t denotes either the individual stock price or the stock market index; (2) *CGO* at week t is computed from Equation (2): $CGO_t = \frac{P_{t-1} - RP_t}{P_{t-1}}$, where P_{t-1} is the price of stock at week *t-1*, and RP_t is reference price computed from Equation (1): $RP_t = \frac{1}{k}\sum_{n=1}^{T}(V_{t-n}\prod_{\tau=1}^{n-1}(1 - V_{t-n+\tau}))P_{t-n}$, where V_t is week t's turnover in the stock, T is the number of weeks in the previous two years, and k is a constant that makes the weights on past prices sum to one; (3) *Beta* is the coefficient of the weekly CAPM regression in the past 104 weeks with a minimum of two years of data; (4) *Size* is the market capitalization in millions domestic currency; (5) *Price-to-Book ratio* is the ratio of market capitalization to the book equity of the fiscal year ending; (6) *Momentum* is the holding period return for month *t-12* to *t-1*; (7) Trading volume is the number of shares for each stock traded for the week in thousands. All data are collected from Thomson Datastream. Values are calculated from twenty years weekly data ranging from 7/1997 to 12/2017 and the data consists of 22 developed markets and 18 emerging markets.[31]

	Beginning date	Number of stocks	Number of observations	Return (%)	*CGO*	Beta	Size (in million $)	Price-to-Book ratio	Momentum (%)	Trading Volume (in Thousand)
				Developed Markets						
North America										
Canada	Aug 6, 1997	2536	1,044,976	0.37%	-0.34	1.05	1018.10	9.14	-2.53%	246.57
US (NYSE)	Aug 6, 1997	3474	2,392,164	0.25%	0.01	0.99	8795.05	6.46	4.19%	4133.57
Europe										
Belgium	Aug 6, 1997	312	138,359	0.23%	-0.15	1.33	2093.89	1.75	-0.30%	75.81
Denmark	Aug 6, 1997	336	148,191	0.23%	-0.34	1.13	1157.25	2.25	-2.09%	654.10
Finland	Aug 6, 1997	238	121,657	0.22%	-0.15	1.42	1636.73	2.62	0.44%	510.12
France	Aug 6, 1997	1929	703,196	0.35%	-0.21	0.96	2424.72	2.67	-1.79%	270.09
Germany	Aug 6, 1997	1305	805,636	0.55%	-0.37	1.10	2833.02	4.11	-4.00%	217.65
Greece	Aug 6, 1997	407	237,198	0.26%	-0.71	0.94	1895.37	2.97	-8.76%	124.69

[31] The 22 developed markets are: Australia (AU), Belgium (BG), Canada (CA), Denmark (DK), Finland (FN), France (FR), Germany (BD), Greece (GR), Hong Kong (HK), Israel (IS), Italy (IT), Japan (JP), Netherlands (NL), New Zealand (NZ), Norway (NW), Portugal (PT), Singapore (SG), Spain (ES), Sweden (SD), Switzerland (SW), United Kingdom (UK), and the U.S. (US); the 18 Emerging markets are: Argentina (AR), Brazil (BR), China (CN), Egypt (EG), Hungary (HN), India (IN), Indonesia (ID), Korea (KO), Malaysia (MY), Mexico (MX), Philippines (PH), Poland (PO), Romania (RM), Russia (RS), Saudi Arabia (SR), South Africa (SA), Taiwan (TA), and Turkey (TK).

Italy	Aug 6, 1997	317	187,701	0.11%	-0.26	1.04	2527.40	2.28	-5.09%	2505.96
Netherlands	Aug 6, 1997	301	141,872	0.14%	-0.52	0.97	4424.57	7.58	-4.20%	1087.15
Norway	Aug 6, 1997	508	168,553	0.23%	-0.33	0.85	880.12	2.34	-8.02%	713.65
Portugal	Aug 6, 1997	170	50,314	0.75%	-0.25	1.29	1351.14	1.96	-2.57%	1496.32
Spain	Aug 6, 1997	186	95,626	0.16%	-0.19	0.47	5345.53	2.59	0.12%	2950.24
Sweden	Aug 6, 1997	579	252,493	0.35%	-0.28	1.00	1360.98	3.68	0.61%	782.24
Switzerland	Aug 6, 1997	248	187,733	0.18%	-0.09	0.99	6406.22	3.10	2.51%	394.51
UK	Aug 6, 1997	1393	670,773	0.30%	-0.24	1.08	3028.63	3.72	-1.64%	2531.01
Asia-Pacific										
Australia	Aug 6, 1997	1926	837,772	0.52%	-0.60	0.49	872.20	3.42	-9.12%	995.64
Hong Kong	Aug 6, 1997	1479	771,963	0.36%	-0.58	0.99	1511.82	3.28	-3.26%	7225.90
Israel	Aug 6, 1997	929	397,723	0.72%	-0.59	0.94	348.58	1.97	-0.03%	583.21
Japan	Aug 6, 1997	2848	2,230,297	0.24%	-0.12	0.99	1533.66	1.52	0.20%	7847.30
New Zealand	Aug 6, 1997	308	97,920	0.19%	-0.10	1.59	440.87	2.09	-0.44%	435.66
Singapore	Aug 6, 1997	558	319,029	0.29%	-0.34	1.02	1053.38	1.71	-3.41%	2411.16
Emerging Markets										
East Asia										
China	Aug 6, 1997	3,265	1,570,143	0.27%	-0.10	1.02	1567.61	4.12	6.56%	12713.00
Indonesia	Aug 6, 1997	646	251,936	0.67%	-0.19	0.76	547.30	2.08	5.18%	15363.21
Korea	Aug 6, 1997	1,227	658,103	0.41%	-0.13	0.88	911.01	1.85	1.85%	437.77
Malaysia	Aug 6, 1997	801	564,732	0.22%	-0.18	1.00	361.70	1.32	-2.23%	1244.10
Philippines	Aug 6, 1997	263	137,147	0.64%	-0.20	1.28	663.08	24.60	4.81%	9958.70
Taiwan	Aug 6, 1997	905	690,568	0.13%	-0.17	0.98	889.73	1.58	-0.84%	4353.81
Europe										
Hungary	Aug 6, 1997	40	20,898	0.40%	-0.19	1.16	727.47	0.68	-4.11%	271.44
Poland	Aug 6, 1997	838	310,298	0.37%	-0.21	1.41	268.30	1.84	-5.36%	125.03
Romania	Nov 24, 1997	138	60,277	0.84%	-0.24	0.53	168.39	1.07	11.04%	1825.38
Russia	Aug 6, 1997	374	91,693	0.49%	-0.15	2.02	2149.44	14.69	4.01%	989.99
Turkey	Aug 6, 1997	374	257,106	0.51%	-0.04	1.00	121.28	1.70	11.87%	2732.77
Latin America										
Argentina	Aug 6, 1997	73	43,280	0.77%	0.03	0.89	47.81	4.15	19.81%	246.14
Brazil	Aug 6, 1997	203	92,145	0.39%	-0.17	0.98	1388.95	27.36	-1.31%	186.64
Mexico	Aug 6, 1997	151	67,406	0.37%	-0.04	0.90	2148.39	1.98	6.21%	3730.90
West Asia and Africa										
Egypt	Aug 6, 1997	162	94,130	0.36%	-0.14	0.96	148.37	2.03	1.75%	1255.96
India	Aug 6, 1997	3,101	1,153,151	1.02%	-0.55	0.90	623.08	2.66	5.61%	55.02
Saudi Arabia	Aug 6, 1997	180	84,838	0.12%	-0.06	1.03	3154.29	3.18	-4.39%	1798.90
South Africa	Aug 6, 1997	309	172,669	0.54%	-0.06	-4.71	1099.54	4.42	5.85%	855.72

Table 2. Single-sorted and Double-Sorted Portfolio

At the beginning of each month, we sort all common stocks based on lagged *CGO* for each market or market group and divide the stocks into five *CGO* groups (*CGO*1 is the lowest).[32] Panel A shows the results of single sort and Panel B shows the results of double sort.

Panel A1 reports the time-series averages of the weekly equally weighted excess returns for five portfolios sorted by capital gains overhang (*CGO*), the difference in the excess returns between the high- and low-*CGO* portfolios (P5-P1), the intercepts (alpha) of the CAPM regression, and the corresponding t -statistics. Panel A2 reports the time-series averages of other variables of interests based on the five *CGO* portfolios.

Panel A1: Five CGO portfolio returns for all markets

Portfolio	**Return**	**CAPM-α**
P1	0.1022	-0.0196
t-stat	(1.28)	(-0.86)
P2	0.1508**	-0.0284***
t-stat	(2.17)	(-2.92)
P3	0.3629***	0.0387
t-stat	(4.59)	(1.05)
P4	0.4359***	-0.0046
t-stat	(6.72)	(-0.31)
P5	0.6184***	0.0447***
t-stat	(9.62)	(3.28)
P5-P1	0.5162***	0.0644**
t-stat	(5.03)	(2.41)

Panel A2: Five CGO portfolio characteristics for all markets

Portfolio	**CGO**	**Beta**	**LOG(MV)**	**BM**	**Momentum**	**Trading Volume (in Millions)**
P1	-1.3782	1.1214	6.5541	0.7609	-13.97%	0.9977
P2	-0.2605	0.9966	7.5206	0.7538	-5.14%	1.9838
P3	-0.0665	0.9910	7.6407	0.7348	0.47%	3.1213
P4	0.0668	0.6454	7.4400	0.7120	4.29%	5.3595
P5	0.2616	0.9811	6.9696	0.6666	10.59%	0.6131
P5-P1	1.6398***	-0.1403	0.4155***	-0.0943***	19.36%***	-0.3846
t-stat	(49.47)	(0.92)	(12.71)	(15.27)	(17.48)	(0.70)

[32] The extreme bottom 1% stock return and trading volume values by the end of each month in each market are dropped.

In Panel B, within each of the *CGO* groups, excess stock returns are further divided into five portfolios based on lagged Beta (*Beta*1 is the lowest), the risk proxy.[33] The portfolio is then held for one week and we report the equally weighted excess returns[34] in the following table for high Beta portfolio (P5) and low beta portfolio (P1) and the difference in excess returns between the two portfolios. The results are based on 22 developed markets and 18 emerging markets.[35] Two market groups are formed besides the whole sample: All developed markets ("All dev" 22 developed markets), all emerging markets ("All emg" 18 emerging markets). The sample covers 20 years monthly data ranging from 7/1997 to 12/2017. The t-statistics are calculated based on Newey-West (1987) adjusted standard errors.

Panel B: Double sorts based on *CGO* and *Beta*

	Whole sample			All dev			All emg		
	CGO1	*CGO3*	*CGO5*	*CGO1*	*CGO3*	*CGO5*	*CGO1*	*CGO3*	*CGO5*
Beta1	0.2119	0.3234	0.5864	0.3172	0.3634	0.7269	0.2690	0.4388	0.7491
Beta5	0.4018	0.7745	0.9018	0.5581	2.1661	1.1319	-0.0223	0.4001	1.1386
P5-P1	0.1899	0.4511	0.3154	0.2409	1.8026	0.4050	-0.2913	-0.0387	0.3895
T-stat	1.05	1.80*	2.59***	0.97	1.74*	5.15***	-6.45***	-0.92	8.11***

[33] The extreme bottom 1% stock return and trading volume values by the end of each month in each market are dropped.

[34] We also conducted empirical analysis with value-weighted portfolio returns. Since the results are similar to those from equally-weighted portfolios and to save space, the results are not reported but are available upon request.

[35] 22 developed markets: Australia (AU), Belgium (BG), Canada (CA), Denmark (DK), Finland (FN), France (FR), Germany (BD), Greece (GR), Hong Kong (HK), Israel (IS), Italy (IT), Japan (JP), Netherlands (NL), New Zealand (NZ), Norway (NW), Portugal (PT), Singapore (SG), Spain (ES), Sweden (SD), Switzerland (SW), United Kingdom (UK), and the U.S. (US); and the 18 Emerging markets are: Argentina (AR), Brazil (BR), China (CN), Egypt (EG), Hungary (HN), India (IN), Indonesia (ID), Korea (KO), Malaysia (MY), Mexico (MX), Philippines (PH), Poland (PO), Romania (RM), Russia (RS), Saudi Arabia (SR), South Africa (SA), Taiwan (TA), and Turkey (TK).

Table 3. Fama-MacBeth regression results with *CGO* and interaction effects on stock returns

This table reports the estimation results from the following equations for whole sample and all three market groups:

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + \varepsilon_{i,t+1} \quad (4)$$

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 LogMV_{i,t} + b_5 PTBV_{i,t} + \varepsilon_{i,t+1} \quad (5)$$

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 LogMV_{i,t} + b_5 PTBV_{i,t} + b_6 TO_{i,t} + b_7 Max_{i,t} + b_8 Min_{i,t} + b_9 R_{i,t} + b_{10} Mom_{i,t} + \varepsilon_{i,t+1} \quad (6)$$

The above equations are estimated by Fama-MacBeth regression (the time-series average of coefficients for cross-sectional regression at weekly basis). The dependent variable is weekly percentage excess return in week *t+1*. $CGO_{i,t}$ is the weekly capital gain overhang for each stock calculated by Equation (1). $Beta_{i,t}$ is the risk measure, and it is the coefficient of the weekly CAPM regression in the past 104 weeks with a minimum of two years of data. $LogMV_{i,t}$ is the log of size. $PTBV_{i,t}$ is the market value divided by the book value of equity at the end of last fiscal year. $TO_{i,t}$ is the trading volume turnover. $Max_{i,t}$ and $Min_{i,t}$ are the last 52 weeks highest stock return and lowest stock return. $R_{i,t}$ is the lagged stock return, and $Mom_{i,t}$ is the cumulative return from month *t-12* to *t-1*. The dummy variable in the triple interaction term "*Dummy* × *CGO* × *Beta*" is the emerging market dummy. $country_i$ is the dummy variables controlling for fixed effects.[36] Two market groups are formed besides the whole sample: all developed markets and all emerging markets. The sample covers 20 years monthly data ranging from 7/1997 to 12/2017. The *t*-statistics are in parentheses, ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

[36] The results for the fixed effect dummy are not reported due to space limit.

Panel A. Basic model

	Whole sample	**Developed markets**	**Emerging markets**	**Whole sample with Emerging market dummy**
Intercept	0.1222***	0.1161**	0.1744***	0.1339***
	(2.65)	(2.53)	(2.96)	(3.32)
CGO	0.0684***	0.0460***	0.1662***	0.0641***
	(6.18)	(4.37)	(4.74)	(5.64)
Beta	-0.0444***	-0.0612***	-0.0541***	-0.0531**
	(-3.40)	(-3.84)	(-2.69)	(-2.51)
CGO × Beta	0.0404***	0.0346***	0.1050***	0.0224**
	(4.72)	(4.32)	(3.13)	(2.39)
Dummy × CGO × Beta				0.1606***
				(5.37)
R-Squared	0.0112	0.0152	0.0174	0.0174

Panel B. Extended model

	Whole sample	**Developed markets**	**Emerging markets**	**Whole sample with Emerging market dummy**
Intercept	-0.1577***	-0.1872***	-0.1567*	-0.1538***
	(-2.70)	(-3.10)	(-1.76)	(-2.64)
CGO	0.0591***	0.0363***	0.1702***	0.0542***
	(5.33)	(3.73)	(4.18)	(5.03)
Beta	-0.0586***	-0.0805***	-0.0314	-0.0584***
	(-3.95)	(-4.61)	(-1.29)	(-3.90)
CGO × Beta	0.0368***	0.0297***	0.1081***	0.0222**
	(3.95)	(3.46)	(2.79)	(2.28)
LogMV	0.0387***	0.0428***	0.0396***	0.0388***
	(6.34)	(5.78)	(4.36)	(6.36)
PTBV	0.0009***	0.0011***	0.0091***	0.0009***
	(2.81)	(2.71)	(3.08)	(2.78)
Dummy × CGO × Beta				0.1770***
				(5.19)
R-Squared	0.0174	0.0281	0.0280	0.0200

Panel C. Full model

	Whole sample	**Developed markets**	**Emerging markets**	**Whole sample with Emerging market dummy**
Intercept	-0.0633	-0.0462	0.0547	-0.0601
	(-0.99)	(-0.69)	(0.58)	(-0.95)
CGO	0.0471***	0.0327***	0.1247***	0.0433***
	(3.74)	(3.20)	(2.76)	(3.56)
Beta	-0.0814***	-0.0953***	-0.1440***	-0.0819***
	(-3.89)	(-4.22)	(-4.34)	(-3.90)
CGO × Beta	0.0444***	0.0254**	0.1120**	0.0259**
	(3.65)	(2.52)	(2.57)	(2.17)
LogMV	0.0332***	0.0348***	0.0195**	0.0333***
	(5.22)	(4.56)	(2.17)	(5.25)
PTBV	0.0011***	0.0014***	0.0049	0.0011***
	(3.09)	(2.70)	(1.15)	(3.04)
TO	-0.0276	-0.0497	4.5524***	-0.0289
	(-0.22)	(-0.34)	(12.67)	(-0.23)
Max	-0.0102***	-0.0087***	-0.0198***	-0.0101***
	(-13.76)	(-12.22)	(-13.03)	(-13.91)
Min	-0.0013	0.0043**	-0.0020	-0.0014
	(-0.65)	(2.39)	(-0.66)	(-0.70)
R_t	0.1902***	0.1844***	0.2038***	0.1902***
	(15.81)	(13.06)	(12.87)	(15.90)
Mom	0.0022***	0.0024***	0.0010***	0.0022***
	(7.56)	(8.49)	(2.68)	(7.57)
Dummy × CGO × Beta				0.1962***
				(5.39)
R-Squared	0.0356	0.0464	0.0699	0.0381

Table 4. *CGO* effect for markets with different characteristics

This table reports the estimation results from the following regression equation: [37]

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 Beta_{i,t} \times CGO_{i,t} \times Proxy\_Dummy_j + b_5 LogMV_{i,t} + b_6 PTBV_{i,t} + b_7 TO_{i,t} + b_8 Max_{i,t} + b_9 Min_{i,t} + b_{10} R_{i,t} + b_{11} Mom_{i,t} + \varepsilon_{i,t+1} \quad (7)$$

The above equations are estimated by Fama-MacBeth regression (the time-series average of coefficients for cross-sectional regression at weekly basis). The dependent variable is weekly percentage excess return in week *t+1*. $CGO_{i,t}$ is the weekly capital gain overhang for each stock calculated by Equation (1). $Beta_{i,t}$ is the risk measure, and it is the coefficient of the weekly CAPM regression in the past 104 weeks with a minimum of two years of data. $LogMV_{i,t}$ is the log of size. $PTBV_{i,t}$ is the market value divided by the book value of equity at the end of last fiscal year. $TO_{i,t}$ is the trading volume turnover. $Max_{i,t}$ and $Min_{i,t}$ are the last 52 weeks highest stock return and lowest stock return. $R_{i,t}$ is the lagged stock return, and $Mom_{i,t}$ is the cumulative return from month *t-12* to *t-1*. $country_i$ is the dummy variables controlling for fixed effects.[38] The dummy variable $Proxy\_Dummy_j$ represents 15 different country-level proxies[39]. It equals to one when a proxy value is above the median value, and zero otherwise. The results are based on 22 developed markets and 18 emerging markets.[40] The sample covers 20 years monthly data ranging from 7/1997 to 12/2017. The *t*-statistics are in parentheses, ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

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[37] To save space, we shall only report the coefficients for the four key variables: *CGO*, *Beta*, *CGO*Beta*, and *CGO*Beta*Proxy_dummy*. The coefficients of other control variables are similar to previous tables, and the full results are available upon requests.

[38] The results for the fixed effect dummy are not reported due to space limit.

[39] The 15 indexes are: Market Capitalization, Market Turnover Ratio, Companies, Transparency, Newspapers, IFRS, Rule of Law, Property Rights, Law and Order, PDI, IDV, MAS, UAI, LTO, and IVR. Please see Appendix I for definition of the index variables and sources of the data.

[40] 22 developed markets: Australia (AU), Belgium (BG), Canada (CA), Denmark (DK), Finland (FN), France (FR), Germany (BD), Greece (GR), Hong Kong (HK), Israel (IS), Italy (IT), Japan (JP), Netherlands (NL), New Zealand (NZ), Norway (NW), Portugal (PT), Singapore (SG), Spain (ES), Sweden (SD), Switzerland (SW), United Kingdom (UK), and the U.S. (US); and the 18 Emerging markets are: Argentina (AR), Brazil (BR), China (CN), Egypt (EG), Hungary (HN), India (IN), Indonesia (ID), Korea (KO), Malaysia (MY), Mexico (MX), Philippines (PH), Poland (PO), Romania (RM), Russia (RS), Saudi Arabia (SR), South Africa (SA), Taiwan (TA), and Turkey (TK).

Panel A. Capital market development

	Dummy 1 (Market Capitalization)	**Dummy 2 (Market Turnover Ratio)**	**Dummy 3 (Companies)**
Intercept	0.0004	-0.0502	-0.0093
	(0.01)	(-0.67)	(-0.13)
CGO	0.0266**	0.0283***	0.0384***
	(2.23)	(2.67)	(3.15)
Beta	-0.0811***	-0.0809***	-0.0802***
	(-3.86)	(-3.88)	(-3.84)
CGO × *Beta*	0.1899***	0.0790***	0.0509**
	(6.92)	(4.34)	(2.21)
Dummy	-0.0733*	0.0410	-0.0474
	(-1.77)	(1.13)	(-1.46)
CGO × *Beta* ×*Proxy_Dummy*	-0.1656***	-0.0418**	-0.0108
	(-5.69)	(-2.35)	(-0.43)
R-Squared	0.0464	0.0434	0.0423

Panel B. Corporate transparency

	Dummy 4 (Transparency)	**Dummy 5 (Newspapers)**	**Model 6 (IFRS)**
Intercept	-0.0609	-0.0365	-0.0784
	(-0.96)	(-0.51)	(-0.80)
CGO	0.0332***	0.0313***	0.0434***
	(2.76)	(2.75)	(3.51)
Beta	-0.0751***	-0.0846***	-0.0784***
	(-3.62)	(-4.10)	(-3.75)
CGO × *Beta*	0.0689***	0.0564***	0.1457***
	(3.71)	(3.54)	(4.16)
Proxy_Dummy	0.0421	-0.0057	0.0212
	(1.12)	(-0.17)	(0.33)
CGO × *Beta* ×*Proxy_Dummy*	-0.0252	-0.0237	-0.1036***
	(-1.35)	(-1.42)	(-2.85)
R-Squared	0.0468	0.0474	0.0455

Panel C. Investor protection

	Dummy 7 (Rule of Law)	**Dummy 8 (Property Rights)**	**Dummy 9 (Law and Order)**
Intercept	-0.0220	-0.0514	-0.0510
	(-0.29)	(-0.70)	(-0.76)
CGO	0.0286**	0.0384***	0.0427***
	(2.51)	(3.18)	(3.35)
Beta	-0.0823***	-0.0785***	-0.0777***
	(-3.89)	(-3.74)	(-3.73)
CGO × Beta	0.1691***	0.1633***	0.0719***
	(4.27)	(4.35)	(4.07)
Proxy_Dummy	-0.0119	-0.0173	-0.0169
	(-0.26)	(-0.41)	(-0.51)
CGO × Beta ×Proxy_Dummy	-0.1392***	-0.1329***	-0.0295
	(-3.36)	(-3.37)	(-1.57)
R-Squared	0.0488	0.0458	0.0419

Panel D. Cultural dimension

	Dummy 10 (PDI)	**Dummy 11 (IDV)**	**Dummy 12 (MAS)**	**Dummy 13 (UAI)**	**Dummy 14 (LTO)**	**Dummy 15 (IVR)**
Intercept	-0.0345	-0.2423***	-0.0347	-0.0440	-0.0352	-0.1242**
	(-0.60)	(-3.46)	(-0.52)	(-0.70)	(-0.53)	(-2.06)
CGO	0.0485***	0.0473***	0.0470***	0.0523***	0.0463***	0.0517***
	(4.45)	(4.40)	(4.47)	(4.78)	(3.52)	(3.80)
Beta	-0.0887***	-0.0879***	-0.0895***	-0.0919***	-0.0782***	-0.0787***
	(-4.05)	(-3.98)	(-4.07)	(-4.22)	(-3.73)	(-3.73)
CGO × Beta	0.0234*	0.0683***	0.0652***	0.0342***	0.0550***	0.0520***
	(1.68)	(4.51)	(4.60)	(3.16)	(3.11)	(3.25)
Proxy_Dummy	-0.0204	0.1713***	-0.0598	-0.0840**	-0.0756***	0.0708**
	(-0.54)	(4.16)	(-1.55)	(-2.27)	(-2.60)	(2.45)
CGO × Beta ×Proxy_Dummy	0.0479***	-0.0561***	-0.0290**	0.0147	-0.0157	-0.0268
	(2.78)	(-3.16)	(-2.04)	(0.67)	(-0.89)	(-1.54)
R-Squared	0.0464	0.0457	0.0455	0.0455	0.0405	0.0407

Table 5. *CGO* effect under different market conditions

This table reports the estimation results from the following equation for whole sample and two market groups in different market conditions. The crisis period is defined as date between 07/2007 and 07/2009, and the tranquil period is defined as date between 08/2009 and 12/2017:

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 LogMV_{i,t} + b_5 PTBV_{i,t} + b_6 TO_{i,t} + b_7 Max_{i,t} + b_8 Min_{i,t} + b_9 R_{i,t} + b_{10} Mom_{i,t} + \varepsilon_{i,t+1} \quad (6)$$

The above equations are estimated by Fama-MacBeth regression (the time-series average of coefficients for cross-sectional regression at weekly basis). The dependent variable is weekly percentage excess return in week *t+1*. $CGO_{i,t}$ is the weekly capital gain overhang for each stock calculated by Equation (1). $Beta_{i,t}$ is the risk measure, and it is the coefficient of the weekly CAPM regression in the past 104 weeks with a minimum of two years of data. $LogMV_{i,t}$ is the log of size. $PTBV_{i,t}$ is the market value divided by the book value of equity at the end of last fiscal year. $TO_{i,t}$ is the trading volume turnover. $Max_{i,t}$ and $Min_{i,t}$ are the last 52 weeks highest stock return and lowest stock return. $R_{i,t}$ is the lagged stock return, and $Mom_{i,t}$ is the cumulative return from month *t-12* to *t-1*. $country_i$ is the dummy variables controlling for fixed effects.[41] Two market groups are formed besides the whole sample: all developed markets and all emerging markets. The sample covers 20 years monthly data ranging from 7/1997 to 12/2017. The *t*-statistics are in parentheses, ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Panel A. Tranquil period

	Whole sample	**Developed markets**	**Emerging markets**
Intercept	0.1806	0.2300*	0.1175
	(1.41)	(1.69)	(0.77)
CGO	0.0557*	0.0311	0.2540*
	(1.76)	(1.07)	(1.89)
Beta	-0.0160	-0.0132	-0.1393
	(-0.25)	(-0.20)	(-1.54)
CGO × Beta	0.0840**	0.0515	0.0178
	(2.30)	(1.63)	(0.14)
R-Squared	0.0585	0.0682	0.1049

Panel B. Crisis period

	Whole sample	**Developed markets**	**Emerging markets**
Intercept	-0.8549***	-0.7716***	-0.4981*
	(-4.11)	(-4.04)	(-1.66)
CGO	-0.0787	-0.0116	-0.0151
	(-1.00)	(-0.28)	(-0.10)
Beta	0.0046	-0.2079	0.0804
	(0.03)	(-1.03)	(0.51)
CGO × Beta	0.2143**	0.0939**	0.2985**
	(2.44)	(2.04)	(2.14)
R-Squared	0.0527	0.0684	0.0742

[41] The results for the fixed effect dummy are not reported due to space limit.

Table 6. Long term effect of *CGO* on risk-return trade-off

This table reports the estimation results from the following equation for whole sample and two market groups: [42]

$$R'_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 LogMV_{i,t} + b_5 PTBV_{i,t} + b_6 TO_{i,t} + b_7 Max_{i,t} + b_8 Min_{i,t} + b_9 R_{i,t} + b_{10} Mom_{i,t} + \varepsilon_{i,t+1} \quad (8)$$

The regression is for all three international market groups. The above Equation 9 is estimated by Fama-MacBeth regression (the time-series average of coefficients for cross-sectional regression at weekly basis), where $R'_{i,t+1}$ represents monthly, quarterly, or semi-annually stock returns for next time period. $CGO_{i,t}$ is the weekly capital gain overhang for each stock calculated by Equation (1). $Beta_{i,t}$ is the risk measure, and it is the coefficient of the weekly CAPM regression in the past 104 weeks with a minimum of two years of data. $LogMV_{i,t}$ is the log of size. $PTBV_{i,t}$ is the market value divided by the book value of equity at the end of last fiscal year. $TO_{i,t}$ is the trading volume turnover. $Max_{i,t}$ and $Min_{i,t}$ are the last 52 weeks highest stock return and lowest stock return. $R_{i,t}$ is the lagged stock return, and $Mom_{i,t}$ is the cumulative return from month *t-12* to *t-1*. $country_i$ is the dummy variables controlling for fixed effects.[43] Two market groups are formed besides the whole sample: all developed markets and all emerging markets. The sample covers 20 years monthly data ranging from 7/1997 to 12/2017. The *t*-statistics are in parentheses, ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Panel A. Monthly return

	Whole sample	**Developed markets**	**Emerging markets**
Intercept	1.4388***	1.5763***	1.8064***
	(5.48)	(5.67)	(4.53)
CGO	0.0962	0.0876*	0.1358
	(1.64)	(1.94)	(0.74)
Beta	-0.1641*	-0.1785*	-0.3253**
	(-1.77)	(-1.79)	(-2.11)
CGO × *Beta*	-0.1016*	-0.0868*	-0.2233
	(-1.72)	(-1.65)	(-1.31)
R-Squared	0.0439	0.056	0.0677

[42] To save space, we shall only report the coefficients for the three key variables: *CGO*, *Beta*, and *CGO*x*Beta*. The coefficients of other control variables are similar to previous tables, and the full results are available upon requests.
[43] The results for the fixed effect dummy are not reported due to space limit.

Panel B. Quarterly return

	Whole sample	**Developed markets**	**Emerging markets**
Intercept	4.2427***	4.1877***	5.5056***
	(6.61)	(6.38)	(5.77)
CGO	0.0696	0.1590	-0.5081
	(0.51)	(1.32)	(-1.27)
Beta	-0.3503*	-0.2056	-0.6438*
	(-1.71)	(-0.88)	(-1.94)
CGO × *Beta*	-0.1092	-0.1122	0.3249
	(-0.92)	(-0.98)	(0.93)
R-Squared	0.0449	0.0581	0.0675

Panel C. Semi-annual return

	Whole sample	**Developed markets**	**Emerging markets**
Intercept	8.6993***	8.0460***	12.2528***
	(8.25)	(7.60)	(8.54)
CGO	0.0116	0.2547	-1.1380*
	(0.06)	(1.58)	(-1.88)
Beta	-0.5026	-0.1202	-1.2436**
	(-1.58)	(-0.34)	(-2.52)
CGO × *Beta*	-0.1612	-0.1395	0.8153
	(-0.74)	(-0.64)	(1.54)
R-Squared	0.0440	0.0573	0.0591

Table 7. *CGO* effect with market-level pricing factors

This table reports the estimation results from the following equation for whole sample and two market groups:

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 SMB_{mkt,t} + b_5 HML_{mkt,t} + b_6 MOM_{mkt,t} + b_7 REV_{mkt,t} + \varepsilon_{i,t+1} \quad (9)$$

The above equation is estimated by Fama-MacBeth regression (the time-series average of coefficients for cross-sectional regression at weekly basis). The dependent variable is weekly percentage excess return in week *t+1*. $CGO_{i,t}$ is the weekly capital gain overhang for each stock calculated by Equation (1). $Beta_{i,t}$ is the risk measure, and it is the coefficient of the weekly CAPM regression in the past 104 weeks with a minimum of two years of data. *SMB* and *HML* represent the size factor and the value factor that are calculated as the return difference between the small size stock portfolio and the large size stock portfolio, and between the high book-to-market (B/M) equity stock portfolio and the low B/M stock portfolio, respectively. *MOM* is the return difference between winner and loser stock portfolios for month *t-12* to *t-1*, and *REV* is the return difference between winner and loser stock portfolios from month *t-36* to *t-12*. To distinguish from firm-level pricing factors, we add a subscript "mkt" to these market-level variables. We form *SMB*, *HML*, *MOM*, and *REV* portfolios according to Fama and French (1993, 2012, and 2015).[44] $country_i$ is the dummy variables controlling for fixed effects.[45] Two market groups are formed besides the whole sample: all developed markets and all emerging markets. The sample covers 20 years monthly data ranging from 7/1997 to 12/2017. The *t*-statistics are in parentheses, ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

	Whole sample	**Developed markets**	**Emerging markets**
Intercept	0.0748	0.0997**	0.0504
	(1.51)	(2.06)	(0.36)
CGO	0.0443***	0.0280***	0.0122
	(4.37)	(3.06)	(0.33)
Beta	-0.0430***	-0.0617***	-0.0322
	(-2.86)	(-3.65)	(-1.30)
CGO × *Beta*	0.0446***	0.0378***	0.1300***
	(5.04)	(4.56)	(3.51)
SMB	0.1102***	0.0883***	0.1850
	(7.01)	(4.42)	(1.01)
HML	0.0362**	0.0274	0.0512
	(2.54)	(1.49)	(0.30)
MOM	-0.1065***	-0.1322***	-0.1742
	(-3.80)	(-4.94)	(-0.68)
REV	-0.1081***	-0.0716***	-0.1779*
	(-5.56)	(-3.02)	(-1.84)
R-Squared	0.0284	0.0280	0.0702

[44] For detailed information on data and Fama-French portfolio formation, please refer to Section 4 and the Appendix I.
[45] The results for the fixed effect dummy are not reported due to space limit.

Table 8. Robustness test based on prospect theory value

This table reports the estimation results from the following equation: [46]

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 LogMV_{i,t} + b_5 PTBV_{i,t} + b_6 TO_{i,t} + b_7 Max_{i,t} + b_8 Min_{i,t} + b_9 R_{i,t} + b_{10} Mom_{i,t} + \varepsilon_{i,t+1} \quad (6)$$

The above equations are estimated by Fama-MacBeth regression (the time-series average of coefficients for cross-sectional regression at weekly basis). The dependent variable is weekly percentage excess return in week *t+1*. $CGO_{i,t}$ is the weekly capital gain overhang for each stock calculated by Equation (1). $Beta_{i,t}$ is the risk measure, and it is the coefficient of the weekly CAPM regression in the past 104 weeks with a minimum of two years of data. $LogMV_{i,t}$ is the log of size. $PTBV_{i,t}$ is the market value divided by the book value of equity at the end of last fiscal year. $TO_{i,t}$ is the trading volume turnover. $Max_{i,t}$ and $Min_{i,t}$ are the last 52 weeks highest stock return and lowest stock return. $R_{i,t}$ is the lagged stock return, and $Mom_{i,t}$ is the cumulative return from month *t-12* to *t-1*. $country_i$ is the dummy variables controlling for fixed effects.[47] The whole sample is divided into two groups according to Barberis et al. (2016) results, where group 1 markets have positive and significant Alpha when creating a long-short portfolio by buying (shorting) stocks in the lowest (highest) prospect theory value quintile and group 2 markets have insignificant Alpha. The sample covers 20 years' monthly data ranging from 7/1997 to 12/2017. The *t*-statistics are in parentheses, ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

	Group 1	**Group 2**
Intercept	-0.1586**	-0.2668***
	(-2.54)	(-5.26)
CGO	0.0973***	0.0124
	(5.02)	(1.18)
Beta	-0.0644***	-0.0531***
	(-2.60)	(-2.89)
CGO × *Beta*	0.0626***	0.0025
	(3.42)	(0.23)
R-Squared	0.0472	0.2075

[46] To save space, we shall only report the coefficients for the four key variables: *CGO*, *Beta*, *CGO*x*Beta*, and *CGO*x*Beta*x*Proxy_dummy*. The coefficients of other control variables are similar to previous tables, and the full results are available upon requests.

[47] The results for the fixed effect dummy are not reported due to space limit.

Table 9. Fama-MacBeth regression controlling for the V-shaped disposition effect

This table reports the estimation results from the following equation for whole sample and two market groups: [48]

$$R_{i,t+1} = country_i + b_0 + b_1 CGO_{i,t} + b_2 Beta_{i,t} + b_3 Beta_{i,t} \times CGO_{i,t} + b_4 VNSP_{i,t} + b_5 Beta_{i,t} \times VNSP_{i,t} + b_6 LogMV_{i,t} + b_7 PTBV_{i,t} + b_8 TO_{i,t} + b_9 Max_{i,t} + b_{10} Min_{i,t} + b_{11} R_{i,t} + b_{12} Mom_{i,t} + \varepsilon_{i,t+1} \quad (10)$$

The above equations are estimated by Fama-MacBeth regression (the time-series average of coefficients for cross-sectional regression at weekly basis). The dependent variable is weekly percentage excess return in week *t+1*. $CGO_{i,t}$ is the weekly capital gain overhang for each stock calculated by Equation (1). $Beta_{i,t}$ is the risk measure, and it is the coefficient of the weekly CAPM regression in the past 104 weeks with a minimum of two years of data. $LogMV_{i,t}$ is the log of size. $PTBV_{i,t}$ is the market value divided by the book value of equity at the end of last fiscal year. $TO_{i,t}$ is the trading volume turnover. $Max_{i,t}$ and $Min_{i,t}$ are the last 52 weeks highest stock return and lowest stock return. $R_{i,t-1}$ is the lagged stock return, and $Mom_{i,t}$ is the cumulative return from month *t-12* to *t-1*. $country_i$ is the dummy variables controlling for fixed effects.[49] $VNSP_{i,t}$ is the V-shaped net selling propensity (*VNSP*), which measures the V-shaped disposition effect calculated based on An (2016). Two market groups are formed besides the whole sample: all developed markets and all emerging markets. The sample covers 20 years' monthly data ranging from 7/1997 to 12/2017. The *t*-statistics are in parentheses, ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

	Whole sample	**Developed markets**	**Emerging markets**
Intercept	0.2593***	0.1436**	0.4792***
	(3.74)	(2.00)	(4.13)
CGO	0.1421***	0.0916***	0.0652
	(10.23)	(7.26)	(1.36)
Beta	-0.0502*	-0.1059***	0.0124
	(-1.79)	(-3.57)	(0.16)
CGO × *Beta*	0.0352**	0.0159	0.1243***
	(2.38)	(1.09)	(2.65)
VNSP	-0.7241***	-0.4335***	-0.9653***
	(-14.78)	(-9.70)	(-7.34)
VNSP × *Beta*	-0.0798*	0.0194	-0.2924**
	(-1.66)	(0.39)	(-2.33)
R-Squared	0.0381	0.0478	0.0734

[48] To save space, we shall only report the coefficients for the four key variables: *CGO*, *Beta*, *CGO*x*Beta*, *VNSP, and VNSP*x*Beta*. The coefficients of other control variables are similar to previous tables, and the full results are available upon requests.
[49] The results for the fixed effect dummy are not reported due to space limit.

Appendix I

This Appendix describes the control variables used in our analysis.

Variable	Definition	Source
CGO	Capital Gain Overhang	Calculated from Equation (1) and (2)
Beta	Firm Beta	The coefficient of the weekly CAPM regression in the past 104 weeks with a minimum of two years of data
LogMV	Logged firm market value	Market value, Datastream
PTBV	Firm Price-to-Book ratio	Price-to-Book ratio data, Datastream
TO	Trading Volume Turnover	The number of shares traded on a particular day, Datastream
Max	Past 52 weeks highest price	Stock price data collected from Datastream
Min	Past 52 weeks lowest price	Stock price data collected from Datastream
R_t	Lagged one month return	Stock price data collected from Datastream
Return Momentum (*Mom*)	Holding period return from -12 month to -1 month	Stock price data collected from Datastream
Long Term Reversal (*Rev*)	Holding period return from -36 month to -12 month	Stock price data collected from Datastream
Market Capitalization (% of GDP)	Share price times the number of shares outstanding	https://data.worldbank.org/indicator/CM.MKT.LCAP.GD.ZS
Market Turnover Ratio	Ratio of the value of total shares traded to average real market capitalization	https://datacatalog.worldbank.org/stock-market-turnover-ratio
Companies	Companies which have shares listed on an exchange at the end of the year	https://data.worldbank.org/indicator/CM.MKT.LDOM.NO
Transparency	Extent to which investors are protected through disclosure of ownership and financial information	https://data.worldbank.org/indicator/IC.BUS.DISC.XQ
Newspapers	Total average circulation of daily newspapers	https://data.un.org/Data.aspx?q=circulation&d=UNESCO&f=series%3aC_N_500036

International Financial Reporting Standards (IFRS)	Use of IFRS as the primary GAAP	https://www.iasplus.com/en/resources/ifrs-topics/use-of-ifrs
Rule of law	Extent to which countries adhere to the rule of law	https://worldjusticeproject.org/our-work/research-and-data/wjp-rule-law-index-2020/current-historical-data
Property Rights	Assessment of the ability of individuals to accumulate property, secured by state-enforced laws	https://www.heritage.org/index/explore?view=by-region-country-year&u=637550448911561626
Law and Order	Measures how secure the population feels (self-reported)	https://news.gallup.com/poll/267788/gallup-law-and-order-research-center.aspx
PDI	Hofstede's cultural dimensions: Power Distance Index	https://geerthofstede.com/research-and-vsm/dimension-data-matrix/
IDV	Hofstede's cultural dimensions: Individualism Index	https://geerthofstede.com/research-and-vsm/dimension-data-matrix/
MAS	Hofstede's cultural dimensions: Masculinity Index	https://geerthofstede.com/research-and-vsm/dimension-data-matrix/
UAI	Hofstede's cultural dimensions: Uncertainty Avoidance Index	https://geerthofstede.com/research-and-vsm/dimension-data-matrix/
LTO	Hofstede's cultural dimensions: Long-term Orientation Index	https://geerthofstede.com/research-and-vsm/dimension-data-matrix/
IND	Hofstede's cultural dimensions: Indulgence Index	https://geerthofstede.com/research-and-vsm/dimension-data-matrix/
Prospect Theory Value (TK)	The prospect theory value of a stock’s historical return distribution	Prospect Theory and Stock Returns: An Empirical Test (Barberis, Mukherjee, and Wang, 2016)

Appendix II. Double-Sorted Portfolio returns using firms' idiosyncratic volatility risk as the risk proxy

At the beginning of each month, we sort all common stocks based on lagged *CGO* for each market or market group and divide the stocks into five *CGO* groups (*CGO*1 is the lowest); then within each of the *CGO* groups, excess stock returns are further divided into five portfolios based on firms' idiosyncratic volatility[50] as the risk proxy.[51] The portfolio is then held for one week and we report the equally-weighted excess returns[52] for P1 (lowest *Beta*) and P5 (highest *Beta*) and their difference in the following table. The results are based on 22 developed markets and 18 emerging markets. [53] Two market groups are formed besides the whole sample: All developed markets ("All dev" 22 developed markets), all emerging markets ("All emg" 18 emerging markets). The sample covers 20 years monthly data ranging from 7/1997 to 12/2017. The t-statistics are calculated based on Newey-West (1987) adjusted standard errors.

	Whole sample			All developed markets			All emerging markets		
	CGO1	*CGO3*	*CGO5*	*CGO1*	*CGO3*	*CGO5*	*CGO1*	*CGO3*	*CGO5*
Beta1	-0.0671	-0.0872	-0.1129	-0.1008	-0.1254	-0.1171	0.0166	-0.0172	-0.1438
Beta5	0.1682	0.2417	0.2348	0.2217	0.5183	0.3189	-0.1187	-0.0172	0.2093
P5-P1	0.2353	0.3289	0.3477	0.3225	0.6437	0.4359	-0.1353	0.0001	0.3531
T-stat	2.03**	2.17**	6.79***	2.14**	2.52**	6.57***	-2.00**	0.00	5.09***

[50] Calculated as the standard deviation of the residuals from the CAPM model using weekly excess returns in the past year.
[51] The extreme bottom 1% stock return and trading volume values by the end of each month in each market are dropped.
[52] We also conducted empirical analysis with value-weighted portfolio returns. Since the results are similar to those from equally-weighted portfolios and to save space, the results are not reported but are available upon request.
[53] 22 developed markets: Australia (AU), Belgium (BG), Canada (CA), Denmark (DK), Finland (FN), France (FR), Germany (BD), Greece (GR), Hong Kong (HK), Israel (IS), Italy (IT), Japan (JP), Netherlands (NL), New Zealand (NZ), Norway (NW), Portugal (PT), Singapore (SG), Spain (ES), Sweden (SD), Switzerland (SW), United Kingdom (UK), and the U.S. (US); and the 18 Emerging markets are: Argentina (AR), Brazil (BR), China (CN), Egypt (EG), Hungary (HN), India (IN), Indonesia (ID), Korea (KO), Malaysia (MY), Mexico (MX), Philippines (PH), Poland (PO), Romania (RM), Russia (RS), Saudi Arabia (SR), South Africa (SA), Taiwan (TA), and Turkey (TK).

Appendix III. Double-Sorted Portfolio returns using 52-week high/low as the reference point

At the beginning of each month, we sort all common stocks based on their prices relative to 52-week high/low prices (*REF*) for each market group and divide the stocks into five *REF* groups (*REF*5 is the high relative price group, close or higher than 52-week high; *REF*5 is the low relative price group, close or lower than 52-week low); then within each of the *REF* groups, excess stock returns are further divided into five portfolios based on lagged Beta (*Beta*5 is the highest), the risk proxy.[54] The portfolio is then held for one month and we report the equally-weighted weekly excess returns in the following table. The results are based on 22 developed markets and 18 emerging markets.[55] Two market groups are formed besides the whole sample: All developed markets ("All dev" 22 developed markets), all emerging markets ("All emg" 18 emerging markets). The sample covers 20 years monthly data ranging from 7/1997 to 12/2017. The t-statistics are calculated based on Newey-West (1987) adjusted standard errors.

	Whole sample			All developed markets			All emerging markets		
	REF1	*REF3*	*REF5*	*REF1*	*REF3*	*REF5*	*REF1*	*REF3*	*REF5*
Beta1	0.3593	0.4744	0.6260	0.3632	0.4449	0.5125	0.3526	0.5462	0.7481
Beta5	0.0138	0.3355	0.9990	0.0990	0.3496	0.9901	0.0624	0.3858	1.3791
P5-P1	-0.3456	-0.1388	0.3730	-0.2642	-0.0953	0.4776	-0.2902	-0.1603	0.6309
T-stat	-42.30***	-8.73***	31.75***	-40.97***	-6.91***	49.85***	-31.22***	-7.96***	37.15***

[54] The extreme bottom 1% stock return and trading volume values by the end of each month in each market are dropped.

[55] 22 developed markets: Australia (AU), Belgium (BG), Canada (CA), Denmark (DK), Finland (FN), France (FR), Germany (BD), Greece (GR), Hong Kong (HK), Israel (IS), Italy (IT), Japan (JP), Netherlands (NL), New Zealand (NZ), Norway (NW), Portugal (PT), Singapore (SG), Spain (ES), Sweden (SD), Switzerland (SW), United Kingdom (UK), and the U.S. (US); and the 18 Emerging markets are: Argentina (AR), Brazil (BR), China (CN), Egypt (EG), Hungary (HN), India (IN), Indonesia (ID), Korea (KO), Malaysia (MY), Mexico (MX), Philippines (PH), Poland (PO), Romania (RM), Russia (RS), Saudi Arabia (SR), South Africa (SA), Taiwan (TA), and Turkey (TK).

Appendix IV. Construction of size, B/M, momentum, and long-term reversal factors

This table illustrate how stocks are sorted to form portfolios. For each market, the size factor $SMB_{mkt,t}$ is the average return on the three small stock portfolios minus the average return on the three large stock portfolios (2 X 3 sorts). The value factors $HML_{mkt,t}$ (same for $MOM_{mkt,t}$ and $REV_{mkt,t}$ variables) are calculated as the average return on the two high B/M portfolios minus the average return on the two low B/M portfolios (2 X 3 sorts). The factors are $SMB_{mkt,t}$ (small minus big), $HML_{mkt,t}$ (high minus low B/M), $MOM_{mkt,t}$ (winner minus loser), and $REV_{mkt,t}$ (winner minus loser).

Sort	Breakpoints	Factors and their components
2X3 sorts on Size and B/M, or Size and MOM, or Size and REV	Size: 50% median	$SMB_{B/M}= (S_H+S_N+S_L)/3-(B_H+B_N+B_L)/3$
		$SMB_{MOM}= (S_W+S_N+S_L)/3-(B_H+B_N+B_L)/3$
		$SMB_{REV}= (S_W+S_N+S_L)/3-(B_H+B_N+B_L)/3$
		$SMB_{mkt} = (SMB_{B/M} +SMB_{MOM} +SMB_{REV})/3$
	B/M: 30th and 70th percentiles	$HML_{mkt} = (S_H+B_H)/2-(S_L+B_L)/2=[(S_H-S_L)+(B_H-B_L)]/2$
	MOM: 30th and 70th percentiles	$MOM_{mkt} = (S_W+B_W)/2-(S_L+B_L)/2=[(S_W-S_L)+(B_W-B_L)]/2$
	REV: 30th and 70th percentiles	$REV_{mkt} = (S_W+B_W)/2-(S_L+B_L)/2=[(S_W-S_L)+(B_W-B_L)]/2$