How the 52-week high and low affect beta and volatility*

Joost Driessen† Tse-Chun Lin‡ Otto Van Hemert§

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†Tilburg University, PO Box 90153 5000 LE Tilburg, the Netherlands. Email: J.J.A.G.Driessen@uvt.nl.

‡University of Hong Kong, Faculty of Business and Economics, Pokfulam Road, Hong Kong. Email: tsechunlin@hku.hk.

§AQR Capital Management. Email: ovanhemert@gmail.com.

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Abstract

We provide a new perspective on stock price behavior around 52-week highs and lows. Instead of focusing on noisy measurements of abnormal returns (alpha), our main focus is to analyze whether a stock's beta, return volatility and option-implied volatility change (i) when stock prices *approach* their 52-week high or low, and (ii) when stock prices *break through* these highs or lows. We find that betas and volatilities decrease when approaching a high or low, and that volatilities increase after breakthroughs. The effects are economically large and very significant, and consistent across stock and stock-option markets. Among several explanations for our findings, we find most support for the anchoring theory.

JEL classification: G12, G14

Keywords: 52-week high, 52-week low, alpha, beta, volatility, anchoring, prospect theory, investor attention, barrier, support level, resistance level.

1 Introduction

The 52-week high and low stock prices are arguably the most readily available aspects of past stock price behavior.[1] Several researchers have empirically found that hitting the high or low affects trading behavior (Grinblatt and Keloharju, 2001), exercise of (executive) stock options (Heath, Huddart and Lang, 1999, and Poteshman and Serbin, 2003), trading volume (Huddart, Lang and Yetman, 2008), the pricing of mergers and acquisitions (Baker, Pan and Wurgler, 2009), and abnormal returns (Brock, Lakonishok, and LeBaron, 1992, George and Hwang, 2004, and Huddart, Lang and Yetman, 2008). These findings have been supported by a variety of theoretical explanations, including anchoring (Tversky and Kahneman, 1974), prospect theory (Kahneman and Tversky, 1979), and investor attention effects (Barber and Odean, 2008). Despite this attention to 52-week highs and lows, a clear and complete picture about the impact on asset price behavior is lacking. In this paper we shed light on this and investigate the effect of 52-week highs and lows on second moments of stock prices (beta and volatility) and implied stock-option volatilities.

We make three main contributions to the literature. First, we focus on the effect of the highs and lows on the beta of a stock and its (implied) volatility. As is well known (Merton, 1980), second moments of stock returns (beta, volatility) can be measured much more precisely than first moments (abnormal returns). This is important because the existing work on the first moment is inconclusive. For example, Huddart, Lang and Yetman (2008) find positive abnormal returns after hitting the 52-week low, while Brock, Lakonishok and LeBaron (1992) find negative abnormal stock index returns after hitting the past 200-day low. George and Hwang (2004) find negative abnormal returns for stocks trading close to their 52-week low. Hence, even though there is considerable evidence that 52-week highs and lows affect individual trading behavior, it is unclear whether this aggregates to actual effects on the stock price.

Second, while existing work mainly focuses on behavior after hitting a high or low, we study beta and volatility effects both when the stock price approaches 52-week highs and

[1] For example, the Wall Street Journal, Bloomberg, and Yahoo Finance (finance.yahoo.com) report the 52-week high and low for stocks.

lows and after breaking through the high or low. This is an important contribution since the different explanations for the relevance of highs and lows have different implications for the stock price behavior before and after hitting the high or low. As discussed below in more detail, the investor attention hypothesis (see Barber and Odean, 2008, for example) only generates effects after breaking through the high or low, while the anchoring hypothesis also generates price patterns when stock prices approach the 52-week extremes. Further, technical traders believe that 52-week high and low values act as resistance and support levels, respectively, and that breaking through these barriers generates trending stock price behavior (Brock, Lakonishok and LeBaron, 1992). In this case, stock prices would be affected both when approaching the resistance and support levels and after breaking through these levels.

Third, we perform a joint study of stock and stock-option markets. By studying the effects of the 52-week high and low stock prices on stock price volatility and option-implied volatility, we perform a strong consistency and robustness check on our results. Furthermore, we can investigate whether option markets correctly incorporate the patterns observed in the underlying stock volatility. This builds on existing work that investigates behavorial effects in option markets. For example, Han (2008) finds that investor sentiment affects the steepness of the implied volatility skew and Stein (1989), Poteshman (2001), and Goyal and Saretto (2008) find evidence supportive of overreaction of option prices to volatility shocks.

Our empirical analysis uses all stocks listed on NYSE and AMEX from July 1963 to the end of 2008 and option price data from OptionMetrics for a subset of 295 stocks from 1996 to 2008. The empirical strategy is straightforward. For each stock, we run time-series regressions of a market model where the alpha, beta and variance of the returns are allowed to be functions of nearness to the 52-week high or low. Specifically, we include both "approach dummies," which equal one if the stock price is sufficiently close to the 52-week high or low (but hasn't crossed it), and "breakthrough dummies," which equal one on days following the breakthrough. We then focus on the average dummy coefficients across stocks. We control for several variables that are known to affect betas and volatility, including past returns and volatility, and for size, value and momentum factors. We also regress option-implied volatilities on the approach and breakthrough dummies, again controlling for many known determinants of implied volatilities, such as lagged volatilities and the leverage effect.

Our key findings are as follows. First, we find strong evidence that stock prices are affected when they approach the 52-week high. Specifically, a stock's beta decreases by about 0.18 when the stock price is within 3% from the 52-week high. In addition, approaching the 52-week high has a strong effect on volatility. The idiosyncratic stock return variance decreases by about 32% when approaching the 52-week high, controlling for the usual determinants of return variance. We observe a very similar pattern in option markets: the implied stock volatility decreases by about 1 volatility point when approaching the 52-week high (the average implied volatility for stocks in our sample is 43 volatility points). Finally, we find that trading volume of stocks increases significantly when approaching a high or low. All these results are statistically significant and robust to changing the setting in several dimensions. For approaching the 52-week low, we find qualitatively similar results, but the economic magnitudes are much smaller.

Second, we find a strong and significant increase in volatility after breaking through the 52-week high or low. The stock return variance increases by about 46% on the day after breaking through the 52-week high and a stunning 111% after breaking through the 52-week low. The after-breakthrough variance effects last for a few days. Again, we find consistent effects in the option market. Implied stock-option volatilities increase significantly when stock prices break through the 52-week high or low. The effect of breakthroughs on the stock's beta is smaller. Finally, stock trading volume increases by a large amount after breakthroughs, in line with findings of Huddart, Lang and Yetman (2008).

We implement a simple option pricing model with stochastic volatility to assess whether the variance effects in the underlying stock returns are quantitatively consistent with the observed effect on option-implied volatilities. Overall, we find that this is the case. However, we find some evidence that option traders do not anticipate the increase in variance after a potential breakthrough when the stock price is close to the high or low but has not (yet) crossed it.

Finally, we also study the first moment (abnormal returns) both when approaching the

52-week high or low and after breakthroughs. In line with our discussion above, we find less stable and insignificant results in many cases. This supports our view that reliable measurement of abnormal returns is difficult and that much can be learned from studying higher moments and option-implied volatilities.

We discuss the different theories employed to explain existing findings on the effects the 52-week high and low. Overall, our findings give strong support for the anchoring theory of Tversky and Kahneman (1974). We do not find strong evidence in favor or against prospect theory and the attention hypothesis.

The rest of the paper is structured as follows. In section 2 we discuss existing theories for the relevance of the 52-week high and low. In section 3 we describe the data and empirical methodology. Section 4 presents all empirical results. Section 5 concludes.

2 Theoretical background and literature

In this section we discuss the various theories that have been applied to understand the effects of the 52-week high and low on investor behavior and prices.

Anchoring

Tversky and Kahneman (1974) discuss the concept of anchoring and adjustment, which implies that individuals use irrelevant but salient anchors to form beliefs. In the context of financial markets, Baker, Pan and Wurgler (2009) argue that the 52-week high serves as anchor for pricing of mergers and acquisitions. George and Hwang (2004) argue that investors use the 52-week high as an anchor relative to which they evaluate new information: if good news arrives when the stock price is close to the 52-week high, traders are reluctant to bid up the price above the anchor even if the good news would justify this. This implies that the 52-week high acts as a resistance level. In section 3, we use a simulation study to show this implies that both a stock's beta and variance decrease when approaching the resistance level.

Similar effects occur for the 52-week low when bad news arrives, in which case the 52-week low acts as support level, lowering the beta and variance of a stock when approaching the low. A further implication of the anchoring theory is that, eventually, the new information will be incorporated in stock prices, which implies that stock prices are expected to increase after breaking through the resistance level and decrease after breaking through the support level. In addition, disagreement between the behavorial agents and rational agents (subject to limits of arbitrage) may lead to increased trading volume and higher volatility after the breakthrough. Similarly, disagreement between behavorial and rational agents may increase trading volume when approaching the high or low.

Note that the anchoring theory is in line with how technical traders perceive the role of 52-week highs and lows. Indeed, Brock, Lakonishok, and LeBaron (1992) describe how technical traders view the high (low) as a resistance (support) level, and that breaking through this level provides a buy (sell) signal.

Prospect theory

Prospect theory of Kahneman and Tversky (1979) proposes that investors evaluate gains and losses relative to a reference point, with "extra aversion" to losses at the reference point and an S-shaped value function. While in many financial applications the reference point is assumed to be the purchase price, both Heath, Huddart and Lang (1999) and Baker, Pan and Wurgler (2009) argue that the 52-week high could also serve as reference point. In this case, investors may want to hold a stock as long as the stock price is below the reference point, since the value function is convex in this region, and only sell the stock when the stock price crosses the reference point, because the value function is concave above the reference point and because of the additional effect of loss aversion. Hence, this version of prospect theory would imply selling pressure when stock prices break through 52-week highs. As with the anchoring theory, this selling pressure could also lead to increased trading volume and volatility after a breakthrough due to disagreement between prospect-theory agents and rational agents. Turning to the 52-week low, there is no existing work that proposes this as reference point. If it would serve as reference point to prospect theory agents, they would tend to buy a stock when it breaks through the 52-week low, since they become risk seeking in this domain of the value function.

It is less clear that prospect theory generates strong effects when approaching the 52-week high or low, since the the kink at the reference is not crossed.

Attention hypothesis

Barber and Odean (2008) describe the attention hypothesis, which states that individual investors have limited capabilities to track the entire universe of stocks and thus focus on a subset of stocks that grab their attention. They also argue this mainly matters for purchase decisions of individuals, since individuals rarely sell short and thus only sell stocks they already own. Huddart, Lang and Yetman (2008) apply this theory to explain volume and price patterns when stocks break through their 52-week high or low, arguing that such breakthroughs generate attention of individual investors. The attention hypothesis implies increased volume after a breakthrough due to extra purchases of individual investors, and positive subsequent returns due to this buying pressure. The attention hypothesis does not generate any effects when approaching the 52-week high or low.

3 Empirical methodology

We first describe how we measure the 52-week high and low and define approach and breakthrough dummies. Next, we describe the regression methodology to detect price patterns related to the approach and breakthrough dummies. We demonstrate in a simulation exercise the possible effects of resistance and support levels at a 52-week high and low respectively. Finally, we discuss the stock and option data we use.

3.1 Definition of approach and breakthrough dummies

For the approach dummy, we need to set a range where the price level is considered to be close to the 52-week high or low. In the baseline case, the closing price needs to be within a 3% band below the 52-week high or within 3% above the 52-week low. We perform robustness checks on this choice later. Furthermore, we want to rule out situations where the 52-week high or low was set very recently, since in those cases it is unlikely that the high or low represents an anchor or reference point, or grabs the attention of new investors. Specifically, we focus on cases where the 52-week high or low was set at least 30 days ago (i.e. the last breakthrough is at least 30 days ago). To summarize, our key dummy variable for approaching (a) a 52-week high (h), D_t^{ah}, is then equal to one if the following two conditions are satisfied

$$\begin{aligned} (1-\kappa)\max\{P_{t-1},...,P_{t-k}\} &< P_t < \max\{P_{t-1},...,P_{t-k}\} & (1) \\ \arg\max\{P_{t-1},...,P_{t-k}\} &< t-m & (2) \end{aligned}$$

where P_t is the closing price of a stock at time t, k is the number of trading days in the past 52 weeks, $\kappa = 0.03$ and $m = 30$. The dummy for approaching the 52-week low, D_t^{al}, is defined similarly.

The breakthrough dummies D_t^{bl} and D_t^{bl} are equal to one on the *first* day that the closing price is higher (lower) than the 52-week high (low), again only incorporating those cases where the 52-week high or low was set more than 30 days ago.

We rule out stock split or dividend payout events because it is meaningless to compare the pre-event maximum with the post-event price.[2] These two filters are also applied to the other dummy definitions in this paper.

3.2 Regression specifications

In this subsection, we first discuss the benchmark regression, in which the alpha and market beta are functions of a constant and the approach and breakthrough dummies. Next, we explore the effect of these dummy variables on the idiosyncratic return variance. Last, we describe how we analyze the option-implied volatilities. In all cases, our empirical strategy follows a two-step approach. In the first step we run time-series regressions for each stock separately. In a second step we average the relevant regression coefficients across stocks.

3.2.1 Market model regressions

We first focus on the case of approaching a 52-week high or low. We specify a market model where we interact the alpha and beta with the approach dummies and control variables. Specifically, we perform for each stock i the following time-series regression for the excess

[2] We use the variable "Factor to Adjust Price" in the CRSP dataset to rule out stock dividends and splits events when we define our dummies.

return $R_{i,t}$

$$\begin{aligned} R_{i,t} &= \alpha_{0,i} + \alpha_{1,i} D^{ah}_{t-1,i} + \alpha_{2,i} D^{al}_{t-1,i} + \alpha'_{3,i} x_{i,t-1} + \\ &\quad \left(\beta_{0,i} + \beta_{1,i} D^{ah}_{t-1,i} + \beta_{2,i} D^{al}_{t-1,i} + \beta'_{3,i} x_{i,t-1}\right) R_{m,t} + \varepsilon_{i,t} \end{aligned} \tag{3}$$

where $R_{m,t}$ is the excess market return, $\varepsilon_{i,t}$ a zero-mean idiosyncratic shock and $x_{i,t}$ a vector with control variables. Note that in (3) we study whether the return on day t is affected by conditioning variables (approach dummies and controls) observed at the previous day $t-1$. Specifically, we analyze whether the alpha and beta of a stock return on day t depend on whether the stock price was close to the 52-week high or low on the previous day.

For the case of breaking through the 52-week high or low, we perform a similar regression, but now focusing on the return on the day *after* the breakthrough. We thus regress the return on day t on dummy variables capturing whether there was a breakthrough on day $t-1$

$$\begin{aligned} R_{i,t} &= \alpha_{0,i} + \alpha_{1,i} D^{bh}_{t-1,i} + \alpha_{2,i} D^{bl}_{t-1,i} + \alpha'_{3,i} x_{i,t-1} + \\ &\quad \left(\beta_{0,i} + \beta_{1,i} D^{bh}_{t-1,i} + \beta_{2,i} D^{bl}_{t-1,i} + \beta'_{3,i} x_{i,t-1}\right) R_{m,t} + \varepsilon_{i,t} \end{aligned} \tag{4}$$

We are mainly interested in the average effect of the 52-week high and low on price dynamics. Empirically, we then follow a two-step procedure. First, we first run regressions (3) and (4) for each stock separately. In a second step, we calculate the weighted average of the estimated coefficients across stocks. The weight of each stock is based on the number of nonzero dummy observations, so that we have different weights for each dummy variable. Because the precision of the estimates depends on the frequency of observing approaches and breakthroughs, using a weighted average improves the precision of the estimates. We also impose the constraint that only stocks with at least 10 nonzero observations for both dummy variables are included to avoid outliers.[3] We do this separately for regressions (3) and (4).

[3] One might worry that there is a selection effect for this criteria. However, we do not find a significant correlation between the number of dummy observations per stock and the estimated dummy coefficient.

The standard errors for the average coefficients across stocks are based on the variance-covariance matrix of the estimated coefficients from the stock-level time-series regressions. Importantly, we thus do not assume that the estimated coefficients are independent across stocks. Instead, we estimate the variance-covariance matrix of the estimated alphas and betas through the cross-correlations of the error terms $\varepsilon_{i,t}$ of the stock return regressions (3) and (4). The appendix shows a brief derivation for these standard errors.

Finally, in some cases we allow for multiple factors (size, value and momentum) in the regressions (3) and (4).

3.2.2 Idiosyncratic return variance and volume

The second set of regressions focuses on the variance of stock returns. We thus test whether the stock return variance changes when approaching the 52-week high or low or after breaking through the 52-week high or low. We first run regression (3) to obtain the estimated idiosyncratic return, $\widehat{\varepsilon}_{t,i}$, and then run the following regression for each stock using the approach dummies

$$\log(\widehat{\varepsilon}^2_{t,i}) = \theta_{0,i} + \theta_{1,i} D^{ah}_{t-1,i} + \theta_{2,i} D^{al}_{t-1,i} + \theta'_{3,i} x_{i,t} + \eta_{t,i} \qquad (5)$$

A similar regression is estimated for the breakthrough dummies. We focus on the average effect across stocks by averaging the θ-coefficients in the same way as in the previous subsection. Note that we do not focus on the total variance of the stock return since this variance will be affected by a change in the market beta. By looking at the idiosyncratic variance we take out any effects of the beta.

Similar regressions are carried out for the dollar trading volume $V_{t,i}$ of stock i on day t. For the approach case we have

$$\log(1 + V_{t,i}) = \phi_{0,i} + \phi_{1,i} D^{ah}_{t-1,i} + \phi_{2,i} D^{al}_{t-1,i} + \phi'_{3,i} x_{i,t} + \varpi_{t,i} \qquad (6)$$

and the breakthrough regression is performed in similar fashion.

3.2.3 Option-implied volatilities

Our final set of regressions uses implied volatilities of options on the subset of the stocks for which options are traded. On each day, we observe per stock i closing implied volatilities of $K_{i,t}$ options on this stock with different maturities and strike prices, which we denote $IV_{i,k,t}$, for $k = 1, .., K_{i,t}$. We then run the following regression, again per stock,

$$IV_{i,k,t} = \gamma_{0,i} + \gamma_{1,i} D_{i,t} + \gamma'_{2,i} x_{i,t} + \nu_{i,k,t} \qquad (7)$$

where $D_{i,t}$ is the dummy variable of interest, $\nu_{i,k,t}$ is the option-specific error term.[4] Note that in this case, there is no need to lag the dummy variables or controls by one day: our option-implied volatilities are based on closing option prices at day t only. In contrast, the dependent variable in Equations (3) and (4), $R_{i,t}$, is based on closing prices at days $t-1$ and t. We can therefore directly analyze the contemporaneous relation between the option-implied volatilities and the approach dummy variables. Similarly, when performing the breakthrough regressions, we again focus on the contemporaneous relation between the implied volatility and breakthrough variables. Given that a breakthrough is defined as the closing price being higher (lower) than the 52-week high (low), the breakthrough will have happened at some point during the trading day, and we thus analyze the effect of this breakthrough on the closing option prices (or implied volatilities) at the end of that day. However, we also study whether the effects of a breakthrough persist over time, by analyzing the relation between implied volatilities and lagged breakthrough dummy variables. In section 4, we discuss in detail what control variables we put into these regressions. We have multiple options per stock. When calculating standard errors for the regressions involving option-implied volatilities (equation (7)), we cluster all options at the stock level and allow for cross-correlation across stocks in the same way as for the previous regressions (see Appendix).

[4] We perform a separate regression for each dummy variable in order to maximize the number of stocks that can be included in the analysis.

3.3 Simulation study

To illustrate the potential effects of approaching a 52-week high and low on the beta and variance of a stock, we perform a simple simulation exercise. We focus on the approach case and the presence of anchoring effects, because the effect on stock prices in this case has not been studied before.

We mimic our empirical setup by simulating 15 years of daily returns for 2,700 stocks in 100 simulations. The fundamental price of each stock follows a one-factor market model with 1% alpha, unit beta, 8% expected market excess return, 15% market volatility and 30% idiosyncratic volatility per annum. The fundamental price dynamics are not affected by closeness to the 52-week high or low. However, with some positive probability the observed price remains at the level of the previous day if the fundamental price breaks through the 52-week high, which thus is a resistance level. In other words, we try to mimic the anchoring mechanism of George and Hwang (2004), where good news is not (directly) incorporated in the stock price when the stock price is close to the 52-week high.

Specifically, on a given day, the observed price has 25% probability to remain at the same level when the fundamental price breaks through the 52-week high on that day. With 75% probability the observed price does not remain at last day's level, but converges to the fundamental price. For this convergence we consider two alternative assumptions. First, we assume direct and full convergence to the fundamental price in one day (simulation 1). As an alternative, we assume slow convergence over a 10-day period (simulation 2).[5] In addition, we also allow the observed price to remain at the same level for more than one period, but the probability decays over time. Conditional on the observed price remaining at the same level and the fundamental price still being above the resistance level, the probability of the observed price remaining at the same level for the next period is decaying with the inverse of the number of divergence days.

[5] In the slow-convergence case, the observed price has the following process

$$P_{t+1}^O = P_t^O + (P_t^T - P_t^O) * (\frac{c + (10 - c) * u}{10})$$

where c is the number of days after the breakthrough, P_t^O is the observed price at time t, P_t^T is the fundamental price at time t, and u is a random variable with uniform distribution.

The empirical model, i.e. Equation (3) and (5), is applied to estimate the effect of approaching the 52-week high on the alpha, beta, and idiosyncratic return variance. We report the average coefficient across individual stocks using either the number of nonzero dummy observations or the inverse of the coefficient standard errors as weights.

The results for simulations 1 and 2 are in Table 1. In both simulation settings the beta and idiosyncratic variance decrease by a considerable and significant amount, due to the resistance effect of the 52-week high on the observed stock price. The effect on the abnormal return (alpha) is less clear and depends on how quickly the observed price converges to true price. In case of direct convergence (simulation 1), the effect is positive because the price level is corrected on the day when the observed stock price breaks through the high. In case of slow convergence (simulation 2), the alpha dummy is negative because on the breakthrough day, which is the final day that the lagged approach dummy equals one, the stock price does not converge fully to the observed price.

In sum, this simulation exercise shows that anchoring to the 52-week high may temporarily decrease the beta and variance of stock return when the stock price approaches this 52-week high. In addition, the results show that using the second moments is informative since the effect on the first moment (alpha) is ambiguous.

3.4 Data description

We use all stocks listed on NYSE and AMEX from July 1, 1963 to December 31, 2008 from the CRSP dataset. The option data come from OptionMetrics for the period January 1, 1996 to September 30, 2008. For the option analysis, we focus on stocks that (i) are liquid (nonzero trading volume on all days in the sample) and (ii) have option prices available on all days in the sample. Since we focus on short-term effects on prices, we only include options with maturities between 8 and 64 calendar days. In total, this gives 6,448,486 call option prices from 295 stocks.[6]

[6] We focus on call options. Stock options are American, so that put-call parity does not hold exactly. However, given that we focus on short maturities the implied volatilities of put and call options are extremely close.

4 Empirical results

In this section we discuss the empirical evidence on the effect of approaching and breaking through the 52-week high and low on stock and option price dynamics. We start with the effect on the alpha and beta. Subsequently we present the results for the idiosyncratic return variance and volume. Finally, we show the effects for the option-implied volatility.

4.1 Market model regression results

Approaching the 52-week high or low price

In Table 2, Columns 2 and 3, we present the baseline-case result for the market model in case of approaching a 52-week high or low price. In addition to the weighted-average regression coefficient across stocks, we present the median regression coefficient in square brackets and the standard error of the average in parentheses. The standard errors are corrected for the correlation between stocks. We also present significance levels; 1% for ***, 5% for ** and 10% for * respectively. In column 2 we present the results corresponding to the CAPM augmented with 52-week high and low dummies in the alpha and beta, see Equation (3). To preserve space we do not report the average unconditional alpha and beta, $(1/N)\Sigma_i\alpha_{0,i}$ and $(1/N)\Sigma_i\beta_{0,i}$ in Equation (3).

Table 2 shows that the alpha is not significantly affected when approaching the 52-week high or low. In contrast the CAPM beta decreases by 0.18 and 0.06 when approaching the 52-week high and low respectively. This is significant at the 1% significance level and economically meaningful considering that the average stock has a market beta of around 1.0. In column 3, we present results when also including, as independent variables, the return on the Fama and French (1992) small-minus-big market cap (size) and high-minus-low book-value-to-price ratio (value) factor, as well as the Carhart (1997) winner-minus-loser (momentum) factor. Again, to preserve space we do not report coefficients on these additional regressors. The alpha now increases at the 1% significance level when approaching a 52-week low. The median estimate in square brackets is however much smaller, suggesting this result may be sensitive to outliers. The beta decreases significantly and economically meaningful when including the value and size factors, similar to the CAPM result, and has a comparable average and median coefficient.

In Table 3, columns 2, 3 and 4, we show results for approaching a 52-week high or low, Equation (3), while including the past week, month, or year individual stock return as control variables in both the alpha and beta. The specification is motivated by a large body of academic literature documenting price momentum and reversal patterns.[7] As in Table 2, the effect of approaching a 52-week high or low on the alpha is unclear; significant for some cases, but then with a large discrepancy between average and median estimates, raising suspicion of outlier effects. The effect on beta is as before: a significant and economically meaningful decrease when approaching a 52-week high or low. The coefficients on the control variables are significant in most cases as well.

Breaking through the 52-week high or low price

Next we focus on what happens after a breakthrough of a 52-week high or low price. We first note that we have much less statistical power for detecting breakthrough patters, giving rise to higher standard errors, as compared to our analysis of approaching a 52-week high or low. This is a direct consequence of the fact that the number of occasions the breakthrough dummies take the value one is 62,459, about 10 times less than the 590,313 occasions the approach dummies take the value one. The large discrepancy arises from the fact that a stock price can be classified as approaching a 52-week high or low price for several days, but by construction cannot be classified as breaking through a 52-week high or low for two days in a row, since we require that the 52-week high or low was obtained at least 30 days ago, Equation (2).

In Table 2, columns 4 and 5, we present the baseline-case result for the market model in case of breaking through a 52-week high or low price. Notice that the dummies are lagged, so if a 52-week high or low was broken between the close of day t and $t+1$, we analyze the effect on the excess return between the close of day $t+1$ and $t+2$. For the market beta we find that it decreases (increases) after breaking through the 52-week high (low), see column 3. This is robust to controlling for value, size and momentum factors, see Table 2, column 5, as well as to including the past week, month, and year return, see Table 3, columns 5, 6,

[7] Early references on momentum include Jegadeesh and Titman (1993) and Asness (1994).

and 7. However, when restricting the breakthrough dummy to cases where the stock price was within 3% of the 52-week high or low the day before, Table 3, columns 5, 6, and 7, the beta dummy for a 52-week low changes sign. We include this control variable to distinguish cases where the breakthrough happened "suddenly" and cases where the price was already close to the 52-week extreme.

In Table 2, column 4, corresponding to the CAPM specification, Equation (4), we see that the alpha is 0.145% and 0.165% higher after a breakthrough of the 52-week high and low, respectively, both significant at the 1% significance level. On an annualized basis this is a considerable 37% and 42% respectively. However, we estimate that round-trip transaction cost for US stocks vary between 0.10% and 1.00%, mainly depending on size and liquidity, so it is not clear one can profitably trade on this pattern. The results for the alpha remain statistically significant when controlling for the value, size, and momentum factors, see Table 2, column 5, and when controlling for momentum and reversal, see Table 3, columns 5, 6, and 7. The coefficient estimates for the alpha effects do vary somewhat across these specifications however. Also, when restricting the breakthrough dummy to cases the stock price was within 3% of the 52-week high or low the day before, Table 3, columns 5, 6, 7, the alpha dummy for 52-week low is not significant in some cases. Focusing on the cases where the stock price was within 3% of the high or low excludes some of the large breakthroughs (of more than 3%). These results thus suggest that the positive alpha after breaking through the 52-week low mainly captures a price reversal after a large negative shock.

In Table 4 we check the robustness of changes in the CAPM alpha and beta around 52-week high and low prices to (i) using a different definition for when a price is considered to be close to a 52-week high or low, (ii) different methodologies for determining the weights for the reported weighted-average regression coefficients across stocks, and (iii) winsorizing the stock-level regression coefficients used for the reported weighted-average regression coefficients.

4.2 Idiosyncratic return variance and volume results

Idiosyncratic return variance

Next we turn to testing for changes in idiosyncratic return variance when approaching and breaking through a 52-week high or low price, following Equation (5). The dependent variable, idiosyncratic return variance, is obtained from the residual of the market model regression, Equations (3) and (4) without controls, x. It is well known that volatility is time varying, hence it is imperative that we control for the main drivers of volatility and thus that the dummies of interest measure the effect directly attributable to approaching and breaking through the 52-week high or low. To this end we include as control variables, the contemporaneous daily stock return, the lagged realized volatility, and the lagged stock return (split into positive and negative lagged return to allow for an asymmetric relation). The results are presented in Table 5. Idiosyncratic variance decreases when approaching a 52-week high or low and increases after breaking through a 52-week high or low. In each case the result is significant at the 1% level. Economically, the effects are also large. Approaching a high decreases the variance by about -32% ($\exp(-0.392) - 1$), while breakthroughs lead to increases in variance of 46% (high) and 111% (low). Only when approaching a 52-week low is the effect small.

To test for the longevity of the increase in idiosyncratic variance after breaking through a 52-week high or low, in Table 6, column 2, we rerun the regressions of Table 5, column 4, but adding dummies for two to five days after breaking through a 52-week high or low. We can see that the effect tapers off rather quickly: for the 52-week high the dummy coefficient is in fact slightly negative for the second day and beyond, while for the 52-week low the coefficient is still positive for the second day and beyond, but only about a third of the coefficient for day one.

Volume

Alongside in Table 5, we present results for testing the dependence of trading volume on approaching and breaking through 52-week high and low. In addition to the control variables used for the regressions with idiosyncratic return variance as dependent variable, we now also include lagged volume as control variable. Volume is significantly higher both when approaching and breaking through a 52-week high and low. The effect is much larger for after breaking through a 52-week high or low; a factor exp(0.520) = 1.68 for a 52-week high and a factor exp(0.568) = 1.76 for a 52-week low. Again we test for the longevity of the effect, this time in the increase of volume, in Table 6, column 3, by rerunning the regressions of Table 5, column 5, but adding dummies for two to five days after breaking through a 52-week high or low. The increase in volume is most pronounced on the day immediately following the break through and slowly tapers off with only about factor 1.13 and 1.16 increase in volume on day five after the break through for the 52-week high and low, respectively.

In Tables 7 and 8 we check the robustness of changes in the idiosyncratic return variance and volume around 52-week high and low prices to (i) using a different definition for when a price is considered to be close to a 52-week high or low, (ii) different methodologies for determining the weights for the reported weighted-average regression coefficients across stocks, and (iii) winsorizing the stock-level regression coefficients used for the reported weighted-average regression coefficients.

4.3 Option-implied volatilities results

Option-implied volatility

Motivated by the significant effect on idiosyncratic stock return variance when approaching and breaking through a 52-week high or low, we study the price behavior in the option market around a 52-week high or low for the underlying stock. The regression specification is given by Equation (7). The dependent variable is the implied volatility of options, measured in percentage points. In addition to dummies for approaching and breaking through a 52-week high or low, we include several control variables as independent variables. Regarding the option characteristics, we include a dummy for when the option maturity is less than 21 days and a dummy for when the option is close to at-the-money, defined as a strike to spot price ratio between 0.95 and 1.05. As in Table 5, regarding the underlying stock, we include the contemporaneous return, the lagged realized volatility, and the lagged return (split into positive and negative lagged return to allow for an asymmetric relation). Finally, we include the contemporaneous level of the VIX index and the lagged implied volatility (IV) of the stock. For the approach regressions, we use the lagged IV of 22 days ago in order to avoid that the lagged IV picks up part of the effect of being close to the high or low. For the breakthrough regressions, we lag the IV by one day, so that breakthrough dummy coefficients capture the change in IV due to the breakthrough event.

From Table 9 we learn that the implied volatility decreases when approaching a 52-week high or low and increases when breaking through a 52-week high or low, paralleling the result for idiosyncratic return variance. This result is statistically significant and economically meaningful: for example, the increase in implied volatility is greater than a full percentage point for after breaking through a 52-week high or low. In Table 6, column 4, we test for the longevity of the increase in implied volatility following a breakthrough of a 52-week high or low, as we did for idiosyncratic return variance and volume previously, and see that the effect is only there the first two days following the breakthrough. In other words, the increase in implied volatilities is temporary and reverses in a few days. We also check the robustness of changes in the implied volatility around 52-week high and low prices in the last two rows of Tables 7 and 8. The results are qualitatively the same.

4.4 Consistency between stock and option results

The results above reveal strong effects on the stock return variance and option-implied volatilities both before and after breakthroughs. To analyze whether the stock and option results are quantitatively consistent with each other, we implement a simple option pricing model with stochastic volatility. We calibrate this model to capture the variance effects observed in the underlying stock returns, and then assess whether the option price effects generated by this model are similar to the observed option price effects.

In our stochastic volatility model, the stock price follows a continuous-time process

$$dS_t = \mu S_t + \sigma_t S_t dW_t \tag{8}$$

where S_t is the stock price, μ the expected return, σ_t the volatility at time t and dW_t a Brownian motion. There are three regimes for the variance of the stock return σ_t^2: the normal level, the approach level, and the breakthrough level. These variance levels are obtained from the estimates for the beta and idiosyncratic variance in Tables 3 and 5. Specifically, we use that $Var_{t-1}(R_{it}) = \beta_{t-1}^2 Var(R_{m,t}) + Var_{t-1}(\varepsilon_{i,t})$, where β_{t-1} and $Var_{t-1}(\varepsilon_{i,t})$ depend on whether the approach or breakthrough dummies equal one at $t-1$.[8] Each day, the variance regime can switch as a result of movements in the stock price, and we use the historically observed switching frequencies to estimate the switching probabilities.

To keep the model tractable, we assume independence between stock returns and variance changes. Denoting the Black-Scholes price as a function of variance by $BS(\sigma^2)$, Hull and White (1987) show that in case of return-variance independence the option price is given by a risk-neutral expectation of the Black-Scholes price over the average realized variance

$$E_0^Q \left[BS(\frac{1}{T}\int_0^T \sigma_t^2 dt) \right] \tag{9}$$

where T is the maturity date.[9] To implement this equation for our purposes, we simulate daily variance levels according to the regime-switching model, and then calculate model-based call option prices for the typical option in our sample, an ATM call option with 30 calendar days to maturity. We do this for three initial variance levels (normal, approach, and breakthrough). We invert these model-based option prices to implied volatilities so that we can compare how option-implied volatilities (IVs) change conditional upon being in one of three variance states.

We first discuss the case of approaching a high or low. When approaching a high, the option pricing model generates a decrease in the IV equal to −0.72 volatility points, which is close to the estimated decrease (−0.90 volatility points, Table 9). When approaching a low, the model-implied effect is an increase of 0.32 volatility points, while the estimated effect equals −0.40. The model generates a positive effect because the underlying stock variance only decreases marginally when approaching a low, while after a breakthrough the stock variance increases dramatically (Table 5). The option pricing model incorporates the

[8] We also incorporate that after a breakthrough the variance is affected for several days.

[9] Note that the option price is obtained by a risk-neutral expectation over the variance levels. When calibrating the model to underlying stock return variances, we thus assume a zero volatility risk premium. For the short-term high-frequency variance effects that we focus on, this seems a reasonable assumption.

possibility of a breakthrough when the stock price approaches the 52-week low, while it seems that option markets only incorporate the current effect of lower stock variance when the stock price is close to the 52-week low.

For the breakthrough case, the option pricing model generates an increase in IV of 0.26 and 1.34 volatility point for a high and low, respectively, while the actual effects equal 1.12 and 1.16 volatility point in Table 9. Obviously, we do not expect a perfect fit for this analysis given the simplicity of the option pricing model, but the results show that for the breakthrough case there are no major differences between the effects to the stock return variance and option prices.

4.5 Empirical results versus theoretical explanations

Approaching a high or low

As discussed above, we find strong evidence that stock price behavior, option prices and stock volume change when the stock price approaches a 52-week high or low. Specifically, we find a strong decrease in beta, idiosyncratic volatility, and option-implied volatilities. As shown by the simulation in section 3.3, these results are consistent with the anchoring effect leading to what practitioners call a resistance level at the 52-week high and a support level at the 52-week low. When approaching the 52-week high or low the anchor reduces the willingness to bid up or down prices in a direction that would result in a breakthrough and thus decreases the co-movement with the market, as measured by the CAPM beta, and idiosyncratic volatility. We also find an increase in volume when approaching a high or low, which could be the result of disagreement between behavorial agents (subject to the anchoring bias) and rational agents (subject to limits to arbitrage). As discussed in Section 2, prospect theory and the attention hypothesis have no clear predictions for approaching a 52-week high or low and thus are not suited to explain the observed patterns, nor are they falsified by these patterns.

Breaking through a high or low

Our results show that after a breakthrough both idiosyncratic return volatilities and option-implied volatilities increase significantly. We also observe a strong increase in stock trading volume. The increase in variance and volume after breaking through a 52-week high is consistent with all three hypotheses considered. In all three theories (anchoring, prospect theory, and attention hypothesis), a breakthrough generates trading signals for the behavorial agents, which leads to increased trading volume. In addition, disagreement between these behavorial and rational agents may increase volatility, see for example Dumas, Kurshev and Uppal (2007) and Beber, Breedon and Buraschi (2009).

In addition to the volume and volatility effects, we find some evidence for positive abnormal returns after breaking through a high, in line with Huddart, Lang and Yetman (2008). This result would be consistent with both the anchoring theory and attention hypothesis, which both predict that stock prices increase after breaking through a high, while prospect theory predicts a negative alpha in this case. For breaking through the 52-week low we find a significantly positive alpha in some cases, but insignificant alphas in other cases. Hence, we cannot draw strong conclusions on the validity of the different theories in this case. In general, empirical results are more stable and precise for the second moments, in line with the motivation of our paper.

Taking everything together, we find strong evidence that the anchoring theory explains our findings for before and after breakthroughs, while we do not have strong evidence in favor or against the attention hypothesis or prospect theory.

5 Conclusion

In this paper we propose a new way of studying price irregularities when stock prices are close to or breaking through a 52-week high or low price. Instead of focusing on noisy measurements of abnormal returns, we focus on second moments of stock returns (beta, idiosyncratic volatility) and stock-option implied volatilities. In addition, while existing work mainly focuses on (price) behavior after breaking through the 52-week high or low, we study both the stock price behavior when current prices are close to the 52-week high or low, and the behavior after a breakthrough. This provides new insights into the validity of theories that have been put forward to explain the effect of a 52-week high and low. In particular, we find strong evidence that beta, idiosyncratic volatility and option-implied volatility decrease when stock price are close to their 52-week high or low. This is in line with the anchoring hypothesis of Tversky and Kahneman (1974). After breaking through the 52-week high or low, we find a strong increase in stock return volatility and implied volatility.

Even though we focus in this paper on the 52-week high and low, our approach of analyzing second moments around specific events can be applied whenever a researcher is investigating short-term price irregularities.

Appendix

In this appendix we show how to derive the standard error for the weighted average of dummy coefficients across stocks. To illustrate, we only give an example of two stocks. The variance of $\overline{\overline{\beta}}$ can be written as follows

$$\begin{aligned} Var(\overline{\overline{\beta}}) &= Var(\omega_1\hat{\beta}_1 + \omega_2\hat{\beta}_2) \qquad (10) \\ &= \{\omega_1^2 Var(\hat{\beta}_1) + \omega_2^2 Var(\hat{\beta}_2) + 2\omega_1\omega_2 Cov(\hat{\beta}_1, \hat{\beta}_2)\} \\ &= \{\omega_1^2 (X_1'X_1)^{-1} X_1'\hat{\varepsilon}_1\hat{\varepsilon}_1' X_1 (X_1'X_1)^{-1} \\ &\quad + \omega_2^2 (X_2'X_2)^{-1} X_2'\hat{\varepsilon}_2\hat{\varepsilon}_2' X_2 (X_2'X_2)^{-1} \\ &\quad + 2\omega_1\omega_2 (X_1'X_1)^{-1} X_1'\hat{\varepsilon}_1\hat{\varepsilon}_2' X_2 (X_2'X_2)^{-1}\} \end{aligned}$$

where ω_1 and ω_2 are the weights (adding up to one). If we assume that the error term for each stock is *i.i.d.* and the cross-sectional correlation is only contemporaneous, we have

$$\begin{aligned} Var(\overline{\overline{\beta}}) &= \{\omega_1^2 (X_1'X_1)^{-1}\hat{\sigma}_1^2 + \omega_2^2 (X_2'X_2)^{-1}\hat{\sigma}_2^2 \\ &\quad + 2\omega_1\omega_2\hat{\sigma}_{12} (X_1'X_1)^{-1} X_1'X_2 (X_2'X_2)^{-1}\} \end{aligned}$$

Tables

Table 1: Simulation Study: Anchoring Effect of Approaching a 52-week High

This table shows results of the simulation study described in Subsection 3.3, to analyze how anchoring to the 52-week high affects alpha, beta and volatility when approaching the high. We simulate 15 years daily returns for $2,700$ stocks in 100 simulations. The fundamental price of each stock follows a one-factor market model with 1% alpha, unit beta, 8% excess return, 15% market volatility and 30% idiosyncratic volatility per annum. The observed price has 25% probability to remain at last days' level when the true price has broken through the historical high. Conditional on the observed price remaining at the same level and the fundamental price still being above the historical high, the probability of the observed price remaining at the same level is decaying each subsequent day. In the alternative case of a breakthrough, the observed price converges to the fundamental price immediately in Simulation 1. The observed price converges to the fundamental price slowly within 10 following days in Simulation 2. For each simulation we run the market model regression in Equation 3. The first two rows report approach dummy coefficients for the alpha and beta. The last row reports the dummy coefficient of idiosyncratic variance (Equation 5). We report the average coefficient from individual stocks using the square root of number of nonzero approach dummies (NW) or the standard error as weight (SW). We also report the average standard error across 100 simulations for each coefficient (see Appendix for details on the calculation of standard errors).

	Simulation 1		Simulation 2	
	NW	SW	NW	SW
Alpha Historical High (%)	0.013	0.019	−0.032	−0.026
	(0.006)	(0.006)	(0.005)	(0.005)
Beta Historical High	−0.096	−0.094	−0.120	−0.118
	(0.006)	(0.006)	(0.005)	(0.006)
Idio. Volatility	−0.087	−0.083	−0.168	−0.164
	(0.007)	(0.007)	(0.007)	(0.007)

Table 2: Alpha and Beta: Baseline Case

This table shows the results of regression Equations 3 and 4, analyzing whether the alpha and beta are affected when approaching or breaking through the 52-week historical high or low. Columns 2 and 3 show the results when the stock price is approaching the 52-week high and low. Columns 4 and 5 show the results when stock price breaks through the high and low. The estimates are weighted averages of the coefficients for the individual stock-level time-series regressions, where the weight is the square root of number of nonzero approach and breakthrough dummies. Column 2 and 4 show the results using the CAPM alpha and beta. Columns 3 and 5 show the results when adding the size, value, and momentum factors as explanatory variables. We only report the dummy coefficients of interest. The medians of the estimations are shown below between square brackets and the standard errors are in parentheses. Standard errors are corrected for the correlations between stocks. Significance levels are 1% for ***, 5% for ** and 10% for * respectively.

	Approaching		After Breakthrough	
	CAPM	Four Factors	CAPM	Four Factors
Alpha (% daily)				
52-week High	−0.003	* − 0.016	***0.145	***0.110
	[−0.006]	[−0.017]	[0.068]	[0.030]
	(0.006)	(0.009)	(0.021)	(0.020)
52-week Low	0.006	***0.030	***0.165	***0.230
	[0.000]	[0.018]	[0.214]	[0.232]
	(0.007)	(0.010)	(0.026)	(0.024)
Beta				
52-week High	*** − 0.180	*** − 0.141	*** − 0.121	*** − 0.089
	[−0.167]	[−0.134]	[−0.130]	[−0.097]
	(0.014)	(0.013)	(0.030)	(0.029)
52-week Low	*** − 0.063	*** − 0.061	***0.170	***0.134
	[−0.068]	[−0.070]	[0.137]	[0.089]
	(0.012)	(0.010)	(0.020)	(0.019)
Number of Stocks	1789	1789	589	589

Table 3: Alpha and Beta: Controlling for Momentum and Reversal Effects

This table is similar to Table 2, but now adds both $\max(R, 0)$ and $\min(R, 0)$ as control variables in the alpha and beta specification, where R is the past individual stock return measured over either last week, month, or year. The table also reports the result when restricting the breakthrough dummy to cases the stock price was within 3% of the 52-week high or low the day before in the lower part of the each panel. The table reports the (weighted) average of the stock-level coefficient estimates. The medians of the coefficient estimates across stocks are shown below between square brackets and the standard errors are in parentheses. Standard errors are corrected for the correlations between stocks. Significance levels are 1% for ***, 5% for ** and 10% for * respectively.

	Approaching			After Breakthrough		
	Week	Month	Year	Week	Month	Year
Alpha (%)						
52-week High	0.013	***0.043	0.005	***0.175	***0.185	**0.149
	[0.002]	[0.010]	[0.000]	[0.077]	[0.089]	[0.068]
	(0.008)	(0.012)	(0.007)	(0.021)	(0.023)	(0.021)
52-week Low	−0.013	*** − 0.051	0.004	***0.067	***0.099	***0.161
	[−0.010]	[−0.028]	[−0.001]	[0.101]	[0.148]	[0.204]
	(0.010)	(0.014)	(0.011)	(0.025)	(0.027)	(0.025)
52-week High (<3%)				***0.090	***0.086	***0.072
				[0.061]	[0.062]	[0.034]
				(0.024)	(0.025)	(0.023)
52-week Low (>-3%)				0.020	0.037	***0.084
				[−0.009]	[0.018]	[0.068]
				(0.031)	(0.032)	(0.031)
Beta						
52-week High	*** − 0.098	*** − 0.085	*** − 0.080	*** − 0.125	*** − 0.085	*** − 0.092
	[−0.080]	[−0.068]	[−0.066]	[−0.127]	[−0.084]	[−0.107]
	(0.013)	(0.013)	(0.010)	(0.030)	(0.030)	(0.030)
52-week Low	*** − 0.031	*** − 0.038	−0.004	**0.044	***0.068	***0.185
	[−0.037]	[−0.041]	[−0.008]	[0.032]	[0.038]	[0.151]
	(0.009)	(0.010)	(0.009)	(0.020)	(0.020)	(0.020)
52-week High (<3%)				*** − 0.120	** − 0.084	*** − 0.103
				[−0.118]	[−0.079]	[−0.099]
				(0.035)	(0.035)	(0.035)
52-week Low (>-3%)				−0.003	−0.003	***0.093
				[0.030]	[0.006]	[0.099]
				(0.028)	(0.028)	(0.028)

Table 4: Alpha and Beta: Robustness Check

This table shows robustness checks on the results of regression Equations 3 and 4 reported in Table 2 , analyzing whether the alpha and beta are affected when approaching or breaking through the 52-week historical high or low. The definition of closeness to the 52-week extremes used for the approach dummy, kappa, varies: in specification 1 we set kappa equal to 2% while in specification 2 we set kappa equal to 4%. The estimates are a weighted average from regressions ran by individual stocks. We show results where the weight is the number of nonzero approach or breakthrough dummies (NW) or the inverse of standard errors for the dummies from the stock-level regressions (SW). The last two columns show the results when coefficients across stocks are winsorized at 2.5% and 97.5% level. The standard errors are below between parentheses and are corrected for the correlations between stocks (see Appendix). Significance levels are 1% for ***, 5% for ** and 10% for * respectively.

	Approaching				After Breakthrough	
	Original	Original	Winsor.	Winsor.	Original	Windsor.
	Spec 1	Spec 2	Spec 1	Spec 2		
Alpha (%)						
Historical High, NW	*0.018	*0.015	*0.018	*0.014	***0.159	***0.142
	(0.010)	(0.009)	(0.010)	(0.009)	(0.021)	(0.021)
Historical Low, NW	−0.010	** − 0.023	−0.010	** − 0.023	***0.162	***0.162
	(0.013)	(0.010)	(0.013)	(0.010)	(0.026)	(0.026)
Historical High, SW	** − 0.018	−0.010	** − 0.018	−0.010	***0.092	***0.087
	(0.009)	(0.008)	(0.009)	(0.008)	(0.017)	(0.017)
Historical Low, SW	0.016	0.011	0.018	0.010	***0.171	***0.173
	(0.012)	(0.009)	(0.012)	(0.009)	(0.022)	(0.022)
Beta						
Historical High, NW	*** − 0.167	*** − 0.185	*** − 0.167	*** − 0.185	*** − 0.121	*** − 0.119
	(0.015)	(0.014)	(0.015)	(0.014)	(0.030)	(0.030)
Historical Low, NW	*** − 0.056	*** − 0.073	*** − 0.056	*** − 0.073	***0.170	***0.170
	(0.012)	(0.010)	(0.012)	(0.010)	(0.020)	(0.020)
Historical High, SW	*** − 0.153	*** − 0.162	*** − 0.153	*** − 0.162	*** − 0.099	*** − 0.101
	(0.013)	(0.012)	(0.013)	(0.012)	(0.022)	(0.022)
Historical Low, SW	*** − 0.047	*** − 0.068	*** − 0.050	*** − 0.069	***0.159	***0.146
	(0.011)	(0.009)	(0.011)	(0.009)	(0.014)	(0.014)
Number of Stocks	1384	2006	1384	2006	589	

Table 5: Idiosyncratic Variance and Trading Volume

This table shows results of regression Equations 5 and 6, analyzing the effect of approaching and breaking through the 52-week high or low on the idiosyncratic return variance and the log dollar trading volume. The first two columns show the results when the price is approaching the 52-week high and low. The last two columns show the results after the breakthrough. The idiosyncratic variance in columns 1 and 3 is determined using the residuals from a full-fledged regression model which includes approach and breakthrough dummies in both the CAPM alpha and beta (Equations 3 and 4). The lagged standard deviation is calculated using daily returns from $t-44$ to $t-23$. The lagged return is the return from $t-22$ to $t-1$. The lagged volume is the average volume from $t-22$ to $t-1$. The estimates are a weighted average of the coefficients from the stock-level regressions. The weight is the number of nonzero approach or breakthrough dummies. The medians of the coefficients are also shown below between square brackets. The standard errors are between parentheses. Standard errors are corrected for the correlations between stocks. Significance levels are 1% for ***, 5% for ** and 10% for * respectively..

	Approaching		After Breakthrough	
	Idio. Var	Volume	Idio. Var	Volume
52-week High	***−0.392	***0.073	***0.380	***0.520
	[−0.344]	[0.070]	[0.410]	[0.492]
	(0.006)	(0.003)	(0.022)	(0.008)
52-week Low	***−0.029	***0.089	***0.748	***0.568
	[0.009]	[0.094]	[0.751]	[0.552]
	(0.013)	(0.004)	(0.027)	(0.010)
Contemporaneous Return	***1.632	***−0.416	0.118	***0.565
	(0.156)	(0.112)	(0.125)	(0.056)
Lagged Std	***34.03	***−1.222	***35.80	***−1.283
	(0.400)	(0.301)	(0.374)	(0.181)
Positive Lagged Return	***8.449	***0.151	***2.264	***−0.103
	(0.109)	(0.052)	(0.043)	(0.019)
Negative Lagged Return	***−13.80	***−1.167	***−4.972	***−0.406
	(0.128)	(0.049)	(0.056)	(0.025)
Lagged Volume		***0.905		***1.001
		(0.004)		(0.002)
Number of stocks	1789	1644	589	470

Table 6: Effect for the Five Days Following a Breakthrough

This table shows the 5-day effects on idiosyncratic return variance, volume and call option implied volatility after breaking through the 52-week high and low. The control variables are the same as in Tables 5 and 9, but not reported. Significance levels are 1% for ***, 5% for ** and 10% for * respectively.

	Idio. Var	Volume	IV
52-week High			
First Day	$^{***}0.337$	$^{***}0.525$	$^{***}1.124$
	(0.022)	(0.008)	(0.201)
Second Day	$^{***}0.065$	$^{***}0.323$	$^{***}0.962$
	(0.020)	(0.008)	(0.194)
Third Day	0.003	$^{***}0.217$	$^{*}-0.315$
	(0.020)	(0.008)	(0.162)
Fourth Day	−0.021	$^{***}0.164$	−0.173
	(0.020)	(0.008)	(0.181)
Fifth Day	$^{*}-0.031$	$^{***}0.123$	0.199
	(0.019)	(0.008)	(0.182)
52-week Low			
First Day	$^{***}0.744$	$^{***}0.574$	$^{***}1.189$
	(0.028)	(0.010)	(0.398)
Second Day	$^{***}0.315$	$^{***}0.362$	0.338
	(0.025)	(0.010)	(0.331)
Third Day	$^{***}0.281$	$^{***}0.278$	−0.156
	(0.025)	(0.010)	(0.261)
Fourth Day	$^{***}0.250$	$^{***}0.211$	−0.162
	(0.025)	(0.010)	(0.248)
Fifth Day	$^{***}0.188$	$^{***}0.156$	0.154
	(0.024)	(0.010)	(0.313)
Controls	YES	YES	YES

Table 7: Idiosyncratic Variance, Volume, IV: Robustness Check for Approaching Case

This table shows robustness results on the results reported in Tables 5 and 9, analyzing the effect of approaching a 52-week high or low on idiosyncratic volatility, trading volume and implied volatility. The definition of closeness to the 52-week extremes used for the approach dummy, kappa, varies: in specification 1 we set kappa equal to 2% while in specification 2 we set kappa equal to 4%. The estimates are weighted average from regressions ran by individual firms. The estimates are a weighted average from regressions ran by individual stocks. We show results where the weight is the number of nonzero approach or breakthrough dummies (NW) or the inverse of standard errors for the dummies from the stock-level regressions (SW). The last two columns show the results when coefficients across stocks are winsorized at 2.5% and 97.5% level. The standard errors are below between parentheses and are corrected for the correlations between stocks (see Appendix). Significance levels are 1% for ***, 5% for ** and 10% for * respectively.

	Original				Winsorized			
	NW	NW	SW	SW	NW	NW	SW	SW
	Spec 1	Spec 2	Spec 1	Spec 2	Spec 1	Spec 2	Spec 1	Spec 2
Idio. Var								
High	*** − 0.360	*** − 0.401	*** − 0.361	*** − 0.394	*** − 0.357	*** − 0.399	*** − 0.359	*** − 0.392
	(0.008)	(0.005)	(0.012)	(0.008)	(0.008)	(0.005)	(0.012)	(0.008)
Low	−0.012	*** − 0.048	−0.015	*** − 0.049	−0.012	*** − 0.047	−0.015	*** − 0.047
	(0.011)	(0.007)	(0.017)	(0.011)	(0.011)	(0.007)	(0.017)	(0.011)
Volume								
High	***0.094	***0.057	***0.088	***0.053	***0.095	***0.058	***0.088	***0.054
	(0.003)	(0.002)	(0.004)	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)
Low	***0.109	***0.075	***0.107	***0.074	***0.110	***0.076	***0.108	***0.075
	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)	(0.003)	(0.005)	(0.004)
IV								
High	*** − 0.933	*** − 0.961	*** − 0.895	*** − 0.969	*** − 0.943	*** − 0.953	*** − 0.907	*** − 0.959
	(0.091)	(0.060)	(0.096)	(0.064)	(0.091)	(0.060)	(0.096)	(0.064)
Low	*** − 0.557	*** − 0.443	*** − 0.467	*** − 0.379	*** − 0.576	*** − 0.477	*** − 0.487	*** − 0.403
	(0.133)	(0.091)	(0.130)	(0.100)	(0.133)	(0.091)	(0.130)	(0.100)

Table 8: Idiosyncratic Variance, Volume, IV: Robustness Check after Breakthrough

This table shows robustness results on the results reported in Tables 5 and 9, analyzing the effect of breaking through a 52-week high or low on idiosyncratic volatility, trading volume and implied volatility. The estimates are weighted average from regressions ran by individual firms. The estimates are a weighted average from regressions ran by individual stocks. We show results where the weight is the number of nonzero approach or breakthrough dummies (NW) or the inverse of standard errors for the dummies from the stock-level regressions (SW). The last two columns show the results when coefficients across stocks are winsorized at 2.5% and 97.5% level. The standard errors are below between parentheses and are corrected for the correlations between stocks (see Appendix). Significance levels are 1% for ***, 5% for ** and 10% for * respectively.

	Original		Windsorized	
	NW	SW	NW	SW
Idio. Var				
High	***0.380	***0.376	***0.378	***0.375
	(0.022)	(0.024)	(0.022)	(0.024)
Low	***0.748	***0.743	***0.745	***0.739
	(0.027)	(0.030)	(0.027)	(0.030)
Volume				
High	***0.520	***0.502	***0.518	***0.501
	(0.008)	(0.008)	(0.008)	(0.008)
Low	***0.568	***0.556	***0.568	***0.555
	(0.010)	(0.010)	(0.010)	(0.010)
IV				
High	***1.117	***1.099	***1.018	***1.016
	(0.201)	(0.182)	(0.201)	(0.182)
Low	***1.164	***1.127	**1.017	***1.024
	(0.397)	(0.314)	(0.397)	(0.314)

Table 9: Stock-option Implied Volatility

This table shows the results of regression Equation 7, analyzing the effect of approaching and breaking through the 52-week high or low on the implied volatility of stock options, in column 1 to 4 respectively. The short maturity dummy is equal to one if the maturity is less than 21 days. The at-the-money dummy is equal to one if the strike/spot ratio is within 0.95 and 1.05. The lagged standard deviation is calculated using daily returns from $t-44$ to $t-23$. The lagged return is the return from $t-22$ to $t-1$. The lagged implied volatility for approaching and breaking through the 52-week extremes is the implied volatility level on day $t-22$ and $t-1$, respectively. Contemporaneous return is the stock return on day t. The estimates are weighted averages from regressions ran by individual stocks. The weight is the number of nonzero approach or breakthrough dummies. Significance levels are 1% for ***, 5% for ** and 10% for * respectively.

	Approaching		After Breakthrough	
	High	Low	High	Low
52-Week Dummies	$^{***}-0.901$	$^{*}-0.402$	$^{***}1.117$	$^{***}1.164$
	(0.070)	(0.105)	(0.201)	(0.397)
Short Maturity	$^{***}-9.545$	$^{***}-9.604$	$^{***}-8.482$	$^{***}-8.231$
	(0.149)	(0.151)	(0.134)	(0.137)
At-The-Money	$^{***}-0.397$	$^{***}-0.394$	$^{***}-0.543$	$^{***}-0.499$
	(0.050)	(0.051)	(0.052)	(0.052)
Contemporaneous Return	$^{***}5.605$	$^{***}5.579$	$^{***}5.175$	$^{***}4.720$
	(0.027)	(0.027)	(0.026)	(0.028)
Lagged Std	$^{***}0.143$	$^{***}0.143$	$^{***}0.067$	$^{***}0.054$
	(0.005)	(0.005)	(0.004)	(0.005)
Positive Lagged Return	$^{***}0.119$	$^{***}0.116$	$^{***}0.075$	$^{***}0.064$
	(0.006)	(0.006)	(0.004)	(0.005)
Negative Lagged Return	$^{***}-0.499$	$^{***}-0.495$	$^{***}-0.103$	$^{***}-0.083$
	(0.003)	(0.003)	(0.002)	(0.002)
Contemporaneous VIX	$^{***}0.385$	$^{***}0.388$	$^{***}0.123$	$^{***}0.109$
	(0.012)	(0.012)	(0.008)	(0.008)
Lagged Implied Volatility	$^{***}0.394$	$^{***}0.402$	$^{***}0.750$	$^{***}0.813$
	(0.004)	(0.004)	(0.003)	(0.004)
Number of Stocks	281	260	175	75

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