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Market Dynamics and Momentum Profits

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Abstract

Recent evidence indicates that momentum profits are sensitive to market conditions. We find that the profits are higher when the markets continue in the same state than when they transition to a different state. These findings support Daniel, Hirshleifer, and Subrahmanyam (1998), who suggest that investor overconfidence is higher when the markets continue in the same state (UP or DOWN) than when they reverse, predicting higher momentum profits in the former. In contrast, our evidence following DOWN markets is not consistent with the other competing models for the market-state conditional momentum profits.

I. Introduction

It is well known that stocks exhibit momentum profits over the medium term (e.g., Jegadeesh and Titman (1993)), but there is substantial debate about the source of the profits.[1] Cooper, Gutierrez, and Hameed (CGH) (2004) report that the profits are in fact confined to periods following UP markets. They argue that their evidence is more consistent with the behavioral models of Daniel, Hirshleifer, and Subrahmanyam (DHS) (1998) and Hong and Stein (HS) (1999) than with the rational asset pricing models. More recently, Sagi and Seasholes (SS) (2007) present a rational asset pricing model that is also consistent with the evidence in CGH, suggesting that this evidence can no longer discriminate between behavioral and rational explanations for momentum profits.

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[1]While some studies suggest that momentum profits can be understood in a rational equilibrium framework (e.g., Conrad and Kaul (1998), Johnson (2002), Chordia and Shivakumar (2002), (2006), and Sagi and Seasholes (2007)), others point to behavioral biases (e.g., Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), Hong and Stein (1999), and Daniel and Titman (1999), (2006)).

CGH's (2004) study also reveals that momentum profits increase in past market performance up to the median level and then decline beyond the median market performance. They argue that this is because extremely high market performance coincides with the ending of the overreaction phase and the beginning of the correctional reversal phase, noting that "the onset of reversals would of course diminish the momentum profits." This suggests that momentum profits should be higher when the markets continue in UP states than when they reverse.

We empirically investigate the effects of market reversals on momentum profits, in light of the asymmetric momentum profits following UP versus DOWN markets. That is, are the reversal effects present following UP markets (where momentum profits exist) but not DOWN markets (where these profits do not exist)? If market reversals reduce momentum profits following both market states, then the lack of profits following DOWN markets must be due to the offsetting of the losses when the market reverses to UP states against the profits when they continue in the DOWN state. This is important, since existing literature suggests that momentum profits do not exist following DOWN markets. In addition, we examine whether the effects of market reversals on momentum profits offer any discriminatory evidence among the competing behavioral and rational asset pricing models for the market-state conditional momentum profits.

The DHS (1998), HS (1999), and SS (2007) models make specific predictions about the effects of market continuations and market transitions on momentum profits. In the DHS model, investor overconfidence induced by confirming market movements (buys followed by UP markets or sells followed by DOWN markets) drives momentum profits. In particular, overconfidence during UP markets stems from price appreciations following buys. This predicts that momentum profits should be higher when the markets continue in the UP state than when they transition to DOWN states. Similarly, overconfidence during DOWN markets is due to price declines following sells. This suggests that momentum profits should be higher when the markets continue in the DOWN state than when they transition to UP states. Thus, the model predicts that momentum profits should be higher when the markets continue in the same state than when they transition to a different state.

The HS (1999) model indicates that increased wealth reduces investors' risk aversion, which leads to higher momentum profits following UP markets. As a result of the positive effect of UP markets on wealth, the model suggests that subsequent UP markets should deliver higher momentum profits than subsequent DOWN markets for any given past market state. In the SS (2007) model, higher growth options in UP markets lead to higher return autocorrelations, resulting in higher momentum profits following these markets. This, too, indicates that, conditional on the past market state, momentum profits should be higher when the subsequent market is UP than when it is DOWN. Thus, the HS and SS models predict higher momentum profits when the markets continue in UP states than when they transition to DOWN states, but lower momentum profits when they continue in DOWN states than when they transition to UP states.

Similar to CGH (2004), we define 2 states for the past market performance: "UP" is when the past 12-month Center for Research in Security Prices (CRSP) value-weighted (VW) return is nonnegative, and "DOWN" is when the past

12-month CRSP VW return is negative. In addition, we classify the profits following UP markets into 2 groups: i) the CRSP VW return in the subsequent month is nonnegative (i.e., the markets continue in the UP state), or ii) the CRSP VW return in the subsequent month is negative (i.e., the markets transition to a DOWN state). Analogously, we classify the profits, or lack of them, following DOWN states into 2 groups: i) the markets continue in the DOWN state, or ii) they transition to UP states.

Our results show that, following UP markets, the mean momentum profit decreases from 2.09% per month when the markets continue in UP states to –0.01% when they transition to DOWN states. These results are consistent with the effects of market transitions on momentum profits, and they suggest that the profits following UP markets are due to the profits when the markets continue in the UP state. Following DOWN markets, the mean momentum profit declines from 3.53% per month when the markets continue in the same state to –2.54% when they transition to UP states. Thus, market-transition effects are ubiquitous, and they decrease momentum profits following UP as well as DOWN markets. The finding that momentum profits are large and significant when the markets continue in DOWN states is unexpected, since prior research suggests that profits do not exist following DOWN markets (e.g., CGH (2004)). Our results shed new light on the lack of momentum profits following DOWN states, indicating that this is due to the offsetting effects of the profits when the markets continue in the DOWN state against the losses when they transition to UP states. Thus, momentum profits exist not only when the markets continue in UP states, but also when the markets continue in DOWN states.

Our findings make at least 2 important contributions to the vast momentum literature. First, they present new evidence on the dynamics of the markets and momentum profits, shedding light on the existence of momentum profits following UP markets but not following DOWN markets. Second, while the result following UP markets is consistent with the competing models for the market-state conditional momentum profits (the DHS (1998), HS (1999), and SS (2007) models), the result following DOWN markets is only consistent with the DHS model. Thus, our results discriminate among the competing theories for the market-state momentum profits and point to investor overconfidence and biased self-attribution as psychological biases that underpin momentum profits.

The rest of the paper is organized as follows. Section II briefly discusses the 3 competing models for the market-state conditional momentum profits and summarizes the testable hypotheses. Section III presents the data and initial evidence, and Section IV explores the potential explanations. Section V examines robustness and other considerations, and Section VI concludes.

II. Testable Hypotheses

Three models provide alternative explanations for the higher momentum profits following UP markets than following DOWN markets: the DHS (1998), HS (1999), and SS (2007) models. These models make specific predictions about the relation between market dynamics and momentum profits. The DHS model

suggests that the arrival of confirming news increases overconfidence, while disconfirming news dampens it, albeit to a lesser extent due to biased self-attribution. In the model, a public signal confirms a trade if they have the same signs ("buy" followed by a positive signal or "sell" followed by a negative signal). Thus, "buys" followed by positive signals (price appreciations) drive overconfidence during UP markets. This indicates that overconfidence should be higher when the markets continue in UP states than when they transition to DOWN states, since price slowdowns at the onsets of DOWN markets do not confirm "buys." Accordingly, momentum profits should be higher when the markets continue in UP states than when they transition to DOWN states.

In DOWN markets, "sells" followed by negative public signals (price declines) drive investor overconfidence.[2] This suggests that overconfidence should be higher when the markets continue in DOWN states than when they transition to UP states, since inceptions of UP markets do not confirm "sells." This predicts that momentum profits should be higher when the markets continue in DOWN states than when they transition to UP states. Thus, the DHS (1998) model predicts higher momentum profits when the markets continue in the same state than when they transition to a different state.

HS (1999) present a behavioral model that assumes that private information diffuses slowly over time, resulting in a positive serial correlation in returns. This attracts the attention of momentum traders, whose trading activity results in an eventual overreaction to the news. Lower risk aversion on the part of the momentum traders leads to greater delayed overreaction, which increases momentum profits. Consequently, CGH (2004) argue that increases in investors' aggregate wealth during UP markets reduce their risk aversion, and this results in higher momentum profits following UP markets than following DOWN markets.

We extend CGH's (2004) argument to market continuations in the same state versus transitions to a different state. Specifically, conditional on past market performance, momentum profits should be higher, or at least not lower, when the subsequent market is UP than when it is DOWN, since UP markets have positive impacts on investors' aggregate wealth, while DOWN markets have adverse effects on it.[3] Consequently, the HS (1999) model predicts higher momentum profits when the markets continue in UP states than when they transition to DOWN states. Likewise, the model suggests that momentum profits should be higher when the markets transition from DOWN markets to UP markets than when they continue in the DOWN state.

[2]CGH (2004) argue that investor overconfidence is higher following UP markets than following DOWN markets, since investors, in the aggregate, are long in the markets. This, however, does not imply that overconfidence is nonexistent during DOWN markets. In fact, DHS ((1998), p. 1856) clearly indicate that negative public news after "sell" also gives rise to investor overconfidence. Thus, while overconfidence may be higher during UP markets, the DHS model suggests that it also exists during DOWN markets, especially when the markets continue in the DOWN state.

[3]While short sellers' wealth may increase when the markets continue in DOWN states, this effect is unlikely to dominate investors' aggregate wealth for the following reasons: i) Investors, in the aggregate, are long in the market, ii) short sellers' profits occur at the expense of their counterparts, and iii) short sellers may not be parties in all trades. Thus, the aggregate wealth is likely to decline when the markets continue in DOWN states.

In the SS (2007) model, growth options increase the sensitivity of a firm's value to these options, making the firm riskier. To the extent that the increased risk has a systematic component, the firm's return autocorrelation will increase with these growth options. UP markets have higher growth options, which increase return autocorrelation, resulting in higher momentum profits following these markets. By extension, conditional on past market performance, return autocorrelations and momentum profits should be higher, or at least not lower, when the subsequent markets are UP than when they are DOWN. Thus, the SS model predicts higher momentum profits when the markets continue in UP states than when they transition to DOWN states. Furthermore, the model suggests that momentum profits should be lower when the markets continue in DOWN states than when they transition to UP states.

Table 1 presents the predictions of the DHS (1998), HS (1999), and SS (2007) models for the 4 different market dynamics: (UP, UP), (UP, DOWN), (DOWN, UP), and (DOWN, DOWN). These predictions summarize the main hypotheses we test. (UP, UP) occurs when the past 12-month CRSP VW return is nonnegative and the subsequent month's return is also nonnegative, and (UP, DOWN) is when the subsequent month's return is negative. (DOWN, DOWN) and (DOWN, UP) are similarly defined. As Table 1 shows, all 3 models predict higher momentum profits in (UP, UP) than in (UP, DOWN). However, the HS and SS models predict higher momentum profits in (DOWN, UP) than in (DOWN, DOWN), while the DHS model predicts higher profits in (DOWN, DOWN) than in (DOWN, UP).

TABLE 1

Predictions of Momentum Profits under Different Market Dynamics

Table 1 presents the predictions for momentum profits from the DHS (Daniel, Hirshleifer, and Subrahmanyam (1998)), the HS (Hong and Stein (1999)), and the SS (Sagi and Seasholes (2007)) models under different market dynamics. (UP, UP) is when the past 12-month CRSP value-weighted return is nonnegative and the subsequent month's return is also nonnegative, and (UP, DOWN) is when the subsequent month's return is negative. (DOWN, DOWN) and (DOWN, UP) are similarly defined.

	Market Dynamics			
Models	(UP, UP)	(UP, DOWN)	(DOWN, DOWN)	(DOWN, UP)
DHS	High	Low	High	Low
HS	High	Low	Low	High
SS	High	Low	Low	High

III. Data and Initial Evidence

A. Portfolio Construction

The sample consists of all stocks in the CRSP database from January 1927 through December 2005 (covering 948 months). Monthly returns, stock prices, outstanding shares, and CRSP VW index returns are extracted from the CRSP data set. As in CGH (2004), we exclude stocks whose prices are below $1 at the beginning of the holding period and skip a month between the portfolio formation and the holding periods to minimize microstructure-induced biases. A total of 24,036 firms are studied over the sample period.

At the beginning of each month $(t+1)$, the past market is classified as an UP (DOWN) market if the past 12-month return of the CRSP VW index is nonnegative (negative). This results in 699 UP markets and 249 DOWN markets. CGH (2004) suggest that momentum profits are robust to this definition of the market, and it yields more DOWN markets than definitions based on longer windows. Furthermore, we classify month $t+1$ as UP (DOWN) if the CRSP VW return in that month is nonnegative (negative). Thus, (UP, UP) captures market continuations in UP states and (UP, DOWN) represents a transition to DOWN states. Continuations in DOWN states, (DOWN, DOWN), and transitions to UP states, (DOWN, UP), are similarly defined. The markets continue in UP states in 453 out of the 699 UP markets, and they continue in DOWN states in 114 out of the 249 DOWN markets.

At the beginning of each month, the firms are sorted into deciles based on their returns from month $t-5$ to $t-1$, skipping month t. The losers are assigned to portfolio P1, the winners to P10, and these portfolios are held for the next 6 months (from months $t+1$ through $t+6$). Similar to Jegadeesh and Titman (2001), a momentum decile portfolio in any month holds stocks ranked in that decile from all the previous 6 ranking months. Each monthly cohort is assigned an equal weight in the portfolio. We analyze the VW returns of these portfolios to reduce the effects of small stocks.

To assess the effects of the well-known common risk factors, the Fama and French (FF) (1993) αs or risk-adjusted profits are also formed as

$$(1) \qquad p_t^{\text{adj}} = p_t - \hat{\beta}_1 \text{RMRF}_t - \hat{\beta}_2 \text{SMB}_t - \hat{\beta}_3 \text{HML}_t,$$

where p_t is the raw profit from portfolio P10 – P1 for month t, RMRF is the excess of the VW market return over the 1-month T-bill rate, SMB is the small-minus-big risk premium, HML is the high book-to-market minus the low book-to-market risk premium, and $\hat{\beta}_i$ $(i = 1, 2, 3)$ is the estimated loading from a regression of the time series of raw profits on the risk premiums and a constant.[4] FF (1996) note that their model does not capture short-run momentum and is, therefore, unlikely to impact the results. Nevertheless, the 3-factor αs are computed for completeness. Estimating the capital asset pricing model (CAPM) by solely using the RMRF factor delivers results that lie between the raw and the FF (1993) 3-factor estimates (results in CGH (2004) are the same). Thus, these single-factor adjustments do not convey any new information and, as such, are not tabulated.

Finally, Chordia and Shivakumar (2002) argue that variations in macroeconomic factors (business cycles) can explain momentum profits. To ensure that our results are not due to business cycles, we adjust the stock returns for the macroeconomic factors and compute the momentum profits based on these adjusted returns.[5] The macroeconomic factor-adjusted return is estimated as follows:

$$(2) \quad r_{i,t}^{\text{adj}} = r_{i,t} - \hat{\alpha}_0 - \hat{\alpha}_1 \text{DIV}_{t-1} - \hat{\alpha}_2 \text{DEF}_{t-1} - \hat{\alpha}_3 \text{TERM}_{t-1} - \hat{\alpha}_4 \text{YLD}_{t-1},$$

[4] See FF (1993) for full descriptions of the risk premiums. The time series of these risk premiums are obtained from: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[5] We thank the referee for suggesting this test.

where $r_{i,t}$ is the return of stock i in month t, DIV_{t-1} is the lagged dividend yield of the CRSP VW index, DEF_{t-1} is the lagged yield spread between Baa- and Aaa-rated bonds, $TERM_{t-1}$ is the lagged yield spread between the 10-year T-bonds and the 6-month T-bills, YLD_{t-1} is the lagged yield on a T-bill with 3 months to maturity, and $\hat{\alpha}_i$s ($i = 0, 1, 2, 3, 4$) are estimated each month for each stock from a regression of the previous 60 months' returns on the macroeconomic factors. DIV_{t-1} is obtained from the CRSP database, while the other macroeconomic factors are obtained from the Federal Reserve Board.[6]

B. Market Dynamics and Momentum Profits

Table 2 presents the mean momentum profits classified by the past market state as well as the subsequent market state. Irrespective of the past market state, the mean returns for all the decile portfolios are positive when the subsequent markets are UP, and they are all negative (even for the winners) when the subsequent markets are DOWN. This is consistent with the arrival of good fundamental news when the subsequent markets are UP and bad news when they are DOWN, which validates the classification that (UP, UP) and (DOWN, DOWN) represent continuations in the same direction, while (UP, DOWN) and (DOWN, UP) capture market reversals.

Panel A of Table 2 presents the results following UP markets. These results show that the mean momentum profit is 2.09% per month (t-value = 8.98) when the subsequent market is also UP, and it is –0.01% (t-value = –0.09) when the subsequent market is DOWN. A test of the difference in momentum profits (2.10%) is statistically significant (t-value = 6.03). The FF (1993) α estimates and the macroeconomic adjusted profits deliver the same conclusions.[7] This suggests that momentum profits are higher when the markets continue in UP states than when they transition to DOWN states, consistent with the effects of market reversals on momentum profits. Furthermore, the results indicate that momentum profits following UP markets stem from the profits when the markets continue to advance. Thus, the models that explain the higher momentum profits following UP markets must also account for the higher profits when the markets continue in UP states than when they transition to DOWN states.

Following DOWN markets (Panel B of Table 2), the mean momentum profit is 3.53% per month (t-value = 5.96) when the markets continue in DOWN states and it is –2.54% (t-value = –3.11) when they transition to UP states.[8] The difference in momentum profits (–6.07%) is statistically significant (t-value = $-$ 6.26). The conclusions from the FF (1993) 3-factor model and the macroeconomic model are the same. Again, momentum profits are higher when the markets continue in the same state than when they transition to a different state. The large momentum

[6]See the Federal Reserve Board Web site: http://www.federalreserve.gov/releases/.

[7]CGH (2004) also report that the macroeconomic factors are unable to account for the market-state conditional momentum profits.

[8]The mean momentum profits following UP and DOWN markets are 1.32% and 0.20% per month, respectively. Using evidence from 1929 through 1995, CGH (2004) report momentum profits of 1.04% following UP markets and –0.08% following DOWN markets (see their Table IV).

TABLE 2

Market Dynamics and Momentum Profits

Table 2 presents the holding as well as the formation period returns for CRSP stocks whose prices are at least $1 at the beginning of the holding period from January 1927 through December 2005. The market is classified each month as an UP (DOWN) market if the CRSP VW return in the prior 12 months is nonnegative (negative). In addition, the subsequent month is classified as UP (DOWN) if the CRSP VW return in that month is nonnegative (negative). At the beginning of each month ($t+1$), the stocks are sorted by their returns in months $t-5$ to $t-1$, skipping month t, and the winners are assigned to P10 and the losers to P1. Each portfolio is held for the next 6 months. The raw momentum profits, the Fama-French (FF) (1993) α estimates, and the macroeconomic-adjusted profits are reported along with their t-values (in parentheses). Returns for portfolios P3–P8 are not reported for brevity.

	Subsequent UP Markets		Subsequent DOWN Markets		
Portfolio	Holding Period (A)	Formation Period	Holding Period (B)	Formation Period	(A) – (B)
Panel A. Past UP Markets					
P1	3.24	–4.65	–4.71	–4.74	
P2	3.17	–1.95	–3.59	–2.01	
P9	4.49	6.24	–3.96	6.51	
P10	5.33	10.67	–4.72	11.10	
P10 – P1	2.09		–0.01		2.10
	(8.98)		(–0.09)		(6.03)
FF α for P10 – P1	2.48		0.35		2.13
	(11.51)		(1.13)		(5.88)
Macro-adj. P10 – P1	2.03		–0.06		2.09
	(9.05)		(–0.22)		(5.72)
No. of months	453		246		
Panel B. Past DOWN Markets					
P1	8.03	–8.52	–9.02	–9.35	
P2	7.38	–5.35	–7.24	–5.94	
P9	4.96	3.23	–4.98	3.10	
P10	5.48	6.82	–5.49	6.93	
P10 – P1	–2.54		3.53		–6.07
	(–3.11)		(5.96)		(–6.26)
FF α for P10 – P1	–1.73		4.27		–6.00
	(–2.38)		(6.31)		(–5.92)
Macro-adj. P10 – P1	–2.01		3.60		–5.61
	(–2.97)		(6.92)		(–6.14)
No. of months	135		114		

profit in continuing DOWN markets is particularly noteworthy since prior studies indicate that momentum profits are nonexistent following DOWN markets. In fact, we find that the lack of momentum profits following DOWN markets is due to the offsetting of the profits when the markets continue in the DOWN state against the losses when they transition to UP states.[9] Thus, the models that explain the lack of momentum profits following DOWN markets must account for the higher momentum profits when the markets continue in DOWN states than when they transition to UP states.

Finally, as alluded to earlier, the returns of all the decile momentum portfolios are higher in subsequent UP markets than in subsequent DOWN markets. This has specific implications for the strength of the winners' versus the losers' return reversals following each market state. In particular, following UP markets, the

[9]While the profits when the markets continue in DOWN states are higher in absolute value than the losses when they transition to UP states, the higher number of transitions to UP states implies higher weights for the losses, resulting in the disappearance of the profits.

losers' returns decrease when the markets reverse to DOWN states and, therefore, the winners' returns must decrease faster for momentum profits to be lower when the markets reverse. As seen in Panel A of Table 2, the mean return for winners declines from 5.33% in (UP, UP) to –4.72% in (UP, DOWN), a decrease of 10.05%, while the corresponding decrease for losers is 7.95%. Thus, following UP markets, the lower momentum profits when the markets transition to DOWN states are driven by stronger return reversals for the winners than for the losers.

By the same logic, following DOWN markets, the winners' returns increase when the markets reverse to UP states, and hence the losers' returns must increase faster for momentum profits to be lower when the markets reverse. The results in Panel B of Table 2 show that the losers' mean return increases from –9.02% in (DOWN, DOWN) to 8.03% in (DOWN, UP), an increase of 17.05%, while the corresponding increase for winners is 10.97%. Thus, following DOWN markets, the lower momentum profits when the markets transition to UP states stem from stronger return reversals for the losers than for the winners. In sum, following UP markets, the winners' returns display stronger reversals in market transitions to DOWN states, whereas following DOWN markets, the losers' returns display stronger reversals in transitions to UP states.

IV. Potential Explanations

Three models provide explanations for the higher momentum profits following UP markets than following DOWN markets: the DHS (1998), HS (1999), and SS (2007) models. We examine the explanations from these models in light of the new evidence from the relation between the market dynamics and momentum profits.

The behavioral model of DHS (1998) makes predictions that are consistent with our empirical findings. First, as discussed in Section II, the model predicts that momentum profits should be higher when the markets continue in the same state than when they transition to a different state, exactly as our results show.

Second, the DHS (1998) model suggests that overconfidence about winners drives momentum profits following UP markets, since confirming news after "buys" (price appreciation) is strongest among the winners. The higher overconfidence for these stocks indicates that inceptions of DOWN markets, which are associated with disconfirmatory news for "buys," should impact the winners more than the losers. Consequently, the onsets of DOWN markets should reduce the winners' returns more than the losers' returns. Thus, the DHS model is also consistent with the fact that, following UP markets, the lower momentum profits when the markets transition to DOWN states are due to more severe return reversals for the winners than the losers.

Unlike UP markets, loser stocks drive overconfidence in DOWN markets, since confirming news for "sells" (price declines) is strongest among the losers. This suggests that inceptions of UP markets should adversely affect overconfidence more for the losers than for the winners. As a result, price recoveries for the losers should be stronger than those for the winners. Again, this is consistent with our findings that, following DOWN markets, the lower momentum profits

when the markets transition to UP states stem from stronger return reversals for the losers than the winners.

From discussions in Section II, the HS (1999) model predicts that momentum profits should be higher in (UP, UP) than in (UP, DOWN). This is in line with our evidence following UP markets. The model also indicates that momentum profits should be higher, or at least not lower, in (DOWN, UP) than in (DOWN, DOWN). Our results following DOWN markets show that momentum profits are indeed higher when the markets continue in the DOWN state than when they transition to UP states, contradicting the model's prediction.

Finally, we see from Section II that the SS (2007) model predicts that momentum profits should be higher in (UP, UP) than in (UP, DOWN). Again, this is consistent with our evidence following UP markets. However, similar to the HS (1999) model, the SS model's prediction that momentum profits should be higher, or at least not lower, in (DOWN, UP) than in (DOWN, DOWN) is not supported by the significantly higher momentum profits when markets continue in DOWN states than when they reverse.

In summary, our evidence following UP markets supports the predictions of the 3 models for the market-state conditional momentum profits. However, the evidence following DOWN markets is more consistent with the DHS (1998) model than the HS (1999) or SS (2007) model. Although both the DHS and HS models appeal to behavioral biases to explain the existence of momentum profits, there is a fundamental difference in the psychological biases that generate the profits in the 2 models. Specifically, momentum profits in the DHS model are the result of continual overreaction to private news in the light of confirming public news due to overconfidence and biased self-attribution. The HS model, on the other hand, derives momentum profits from underreaction to private news by the "news watchers" and subsequent overreaction to the news caused by momentum traders. Thus, the evidence from the relation between the market dynamics and momentum profits supports the continual overreaction to private news explanation for momentum profits.

V. Robustness Checks

A. Past Market Performance

It is possible that the subsequent market conditions relate to the level of past market performance. CGH (2004) report that momentum profits increase with past market performance and then decrease with it after the median market performance. Thus, a link between the past and the subsequent market performance would influence our results. To preclude this possibility, we compute the mean monthly CRSP VW return in the past 12 months. These means are 1.81%, 1.71%, –0.93%, and –1.29% for (UP, UP), (UP, DOWN), (DOWN, UP), and (DOWN, DOWN) states, respectively, and the overall median is 1.13%. If our results are driven by the past market performance, (DOWN, UP) momentum profits should be higher than (UP, UP) profits, while (DOWN, UP) profits should be higher than (DOWN, DOWN) profits. Our evidence is exactly the contrary, suggesting that our results are not driven by the past market performance.

B. Past Return Momentum

It is also possible that sorting on the subsequent market performance inadvertently sorts on past return momentum. In particular, market continuations could be associated with higher past return momentum and, hence, the higher profits for these states. If this is the case, the spread between the winners and the losers in the formation period will be higher when the markets continue in the same state than when they transition to a different state. To examine this, we report the formation period returns for the momentum portfolios. The results in Table 2 show that the formation-period return momentums are not higher when the markets continue in UP states than when they transition to DOWN states. Specifically, the formation-period spread between the winners and the losers' mean returns in (UP, UP) states (15.32%) is not higher than the corresponding spread in (UP, DOWN) states (15.84%). Thus, there is no evidence that our results are driven by stronger past return momentum when the markets continue in the same state.

C. Market Definition

We examine the robustness of our results to the past market performance by defining the past market as UP (DOWN) if the 3-year CRSP VW return is nonnegative (negative). This definition reduces our sample period to January 1929 through December 2005 (total of 924 months). The results, which are not tabulated for brevity, are consistent with our main findings, though defining past markets over this longer horizon reduces the effects of market reversals on momentum profits.

D. Short-Run Return Autocorrelations

It is well known that stocks display negative return autocorrelations at monthly intervals (e.g., Jegadeesh (1990)), and hence it is possible that this affects the results, especially in situations where momentum profits reverse, as in the case of (DOWN, UP) states. However, this is unlikely because we skip the returns in the immediate past month in forming the momentum portfolios, making it improbable that the portfolios inadvertently sort on the past month's returns. Also, we compute the average returns in the immediate past months, and the results, which are not tabulated but available from the authors, show that the past months' returns are unrelated to momentum profits even for the (DOWN, UP) markets.

E. International Robustness

Using information from Datastream for January 1985–December 2005, we examine whether momentum profits are higher when the markets continue in the same state than when they transition to a different state in non-U.S. markets. We find that the results do not hold internationally. For instance, in Japan, the mean momentum profit in (UP, UP) is –3.45% (t-value = –3.26) versus 0.83% (t-value = 2.12) in (UP, DOWN), and the mean profit in (DOWN, DOWN) is

1.10% (t-value = 2.10) versus 1.99% (t-value = 2.69) in (DOWN, UP) states.[10] In fact, momentum profits exist following DOWN markets (1.57%; t-value = 3.03) but not following UP markets (–1.22%; t-value = –2.43), suggesting that the market-state conditional momentum profits documented in the U.S. are not necessarily global.[11]

We find that market-state conditional momentum profits are more consistent with behavioral explanations. This indicates that investor behavior heterogeneity is a source for the cross-country differences in the relation between market dynamics and momentum profits. An examination of such differences is beyond the scope of this paper but is certainly an interesting topic for future research.

F. Predictive Models

Our main findings are ex post in nature. To generate similar results on an ex ante basis requires a model that can accurately predict market movements (i.e., UPs and DOWNs). Our search for such a model includes time-series regressions, GARCH-in-mean models, and trends in daily market returns. The potential predictors we consider include: i) macroeconomic variables such as gross national product (GNP), industrial production, term structure, and credit spread; ii) stock market variables such as index price-to-earnings (P/E) ratio and dividend yield; and iii) the Baker and Wurgler (2007) investor sentiment index.[12] We also include the changes in these variables in our models.

Unfortunately, the accuracy rate of most of these predictive models is only around 50%. The errors in predicting the market movements contaminate the classification of markets into continuing versus transitioning states, making it difficult to discern the effects of market transitions on the momentum profits on an ex ante basis. For instance, the results from our best predictive model, which are untabulated for brevity, indicate that momentum profits are not statistically different between the predicted market continuations and transitions. In particular, the mean momentum profit in continuing UP markets is not statistically higher than the profit in transitions to DOWN markets (difference = 0.79%; t-value = 1.35). Similarly, the mean momentum profit in continuing DOWN markets is not statistically higher than the profit in transitions to UP markets (difference = 0.85%; t-value = 0.78).[13] In contrast, based on the actual market movements for the same period,

[10]For the same period in the U.S., the mean momentum profit is 2.15% (t-value = 6.05) higher when the markets continue in UP states than when they transition to DOWN states, and it is 6.19% (t-value = 5.28) higher when the markets continue in DOWN states than when they transition to UP states.

[11]Other studies have also reported differences in the nature of momentum profits in the U.S. versus other countries. For instance, Antoniou, Lam, and Paudyal (2007) report that momentum profits are positive and significant during both expansionary and contractionary periods in the 3 European countries they studied (U.K., Germany, and France), contradicting Chordia and Shivakumar's (2002) finding that momentum profits are positive during expansionary periods and insignificant during recessions in the U.S.

[12]We thank Jeffrey Wurgler for making the investor sentiment index available on his Web site: http://pages.stern.nyu.edu/~jwurgler/.

[13]Our best model is a logit regression model with market direction as the dependent variable and the significant 1st, 3rd, 6th, 12th, and 36th lags of all the macroeconomic, market, and sentiment variables along with their corresponding lagged changes as the explanatory variables. This specification

the mean momentum profit in continuing UP markets is 2.29% (t-value = 4.17) higher than the profit in transitions to DOWN markets, and the profit in continuing DOWN markets is 6.14% (t-value = 5.23) higher than the profit in transitions to UP markets.

G. Other Checks

To further ensure that our results are not influenced by low-priced stocks (Harris (1994) discusses the effects of low-priced stocks) and/or small stocks, we screen out stocks whose prices are below \$5 or whose capitalizations are below the lowest decile of the NYSE/AMEX capitalization breakpoint at the beginning of the holding period (e.g., Jegadeesh and Titman (2001)). The results from these tests, which are not tabulated, are qualitatively the same as the reported results. This is not surprising, since our earlier tests are based on stocks whose prices are at least \$1, and the returns of the portfolios are VW.

VI. Conclusion

Recent evidence suggests that momentum profits exist following UP markets but not following DOWN markets. Furthermore, momentum profits decline with high past market performance. CGH (2004) attribute this to the onset of correctional market reversal when market performance is high, suggesting that market transitions reduce momentum profits. We study the effects of market transitions on momentum profits following both UP and DOWN markets and find that these effects are ubiquitous. This new evidence sheds light on the existence of momentum profits following UP markets and the lack of profits following DOWN markets, as well as discriminating among the competing models for the market-state conditional momentum profits.

Following UP markets, momentum profits are higher when the markets continue in the UP state than when they transition to DOWN states, suggesting that the profits following UP markets are mainly due to the profits when the markets continue. Following DOWN markets, we document both large momentum profits when the markets continue in DOWN states and large losses when markets transition to UP states. Prior studies have found that momentum profits are nonexistent following DOWN markets. Our results show that such a lack of profits is due to the offsetting effects of the profits when the markets continue in the DOWN states against the losses when they reverse to UP states.

Existing literature provides 3 explanations for the higher momentum profits following UP markets than following DOWN markets: the DHS (1998), HS (1999), and SS (2007) models. We examine the implications of these models in light of our new evidence from the relation between market dynamics and momentum profits. The DHS model predicts that momentum profits should be higher when markets continue in the same state than when they transition to a different

achieves an accurate rate of 48% to 80% for the 4 different market states. The inclusion of the sentiment variable, which is only available from January 1966, limits the regression to only the 2nd half of our sample period.

state. This is because market continuations boost overconfidence, while reversals dampen it. In contrast, both HS and SS models predict that, conditional on the past market state, momentum profits should be higher, or at least not lower, in subsequent UP markets than in subsequent DOWN markets, since UP markets are associated with higher investor wealth (HS) or higher growth options (SS).

Our findings following UP markets are therefore consistent with all 3 models. However, following DOWN markets, the higher momentum profits when the markets continue in the same state than when they reverse are more consistent with the DHS (1998) model than with the 2 alternative theories. Thus, our evidence discriminates among the competing models for the market-state conditional momentum profits. The support for the DHS model lends credence to a particular behavioral bias, continuous overreaction to private information in the face of confirming news, as a source of momentum profits.

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