The effect of short-term return reversals on momentum profits

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Abstract

The authors investigate the effect of a short-term stock return reversal on the term structure of momentum profits in the Korean stock market following Goyal and Wahal (2015). Their empirical findings show that the term structure of momentum is more pronounced when a return reversal lasts up to two months but is substantially weakened when past performance over the last two months is not taken into account for portfolio formation. Their evidence suggests that the term structure of momentum profitability arises primarily from a carryover of the return reversal from the previous two months.

Keywords Momentum profit, Short-term return reversals, Echo effect

Paper type Research paper

1. Introduction

This study examines the term structure of momentum profits reported by Novy-Marx (2012) in the Korean stock market. Jegadeesh and Titman (1993, JT hereafter) find that past returns can predict future returns: the strategy of buying past winners and selling past losers generates significantly positive profits. Since then, various studies have documented that momentum, defined as the tendency of winners to win and losers to lose, exists in stock prices. Indeed, the momentum phenomenon is prevalent and robust in different countries, asset classes and sample periods (Rouwenhorst, 1998; Jegadeesh and Titman, 2001; Chui *et al.*, 2010; Fama and French, 2012; Asness *et al.*, 2013).

However, the profitability of the momentum strategy remains controversial in the Korean stock market. While most studies conducted in the late 1990s argue that no momentum exists in the Korean stock market (Kho, 1997; Kim and Eom, 1997), more recent studies find that the significance of JT momentum profits depends on firm characteristics and sample periods (Chung and Kim, 2002; Eom, 2013) [1]. Chung and Kim (2002) investigate stock samples from 1998 to 2001 and find that the momentum phenomenon exists depending on the size of the company and holding period of portfolios. Eom (2013) investigates both the KOSPI and the KOSDAQ markets over 1980–2009 and shows that momentum profits are more significant in the 2000s. Kim (2012), Jang (2017) and Kim and Lee (2018) also find that momentum profits have become more significant in the Korean stock market [2].

Jang (2017) investigates the term structure of momentum profitability in the Korean stock market according to Novy-Marx (2012). She finds that momentum profits are primarily driven by returns over the intermediate (past t–12 to t–7 months) rather than the recent (past t–6 to t–2 months) horizon. This finding is puzzling because it is inconsistent with the

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traditional view of momentum that stock prices continue moving in the same direction. "Echo," rather than momentum, thus seems to exist in Korean stock returns, consistent with the previous US-based results of Goyal and Wahal (2015).

In this study, we investigate the underlying cause of the echo effect in the Korean stock market. Our conjecture is that a return reversal over two months induces the difference in profits between strategies based on intermediate-horizon performance and recent performance. The conventional momentum strategy measures past performance over the preceding months, skipping the most recent month to avoid market microstructure effects, including a one-month return reversal [3]. Thus, the one-month reversal effect cannot contaminate the profitability of the conventional momentum strategy. However, if the return reversal occurs over a period of months, the reversal will affect the profitability of the momentum strategy, which might erode momentum profits.

Several studies have consistently reported that a short-term return reversal exists in the Korean stock market (Yun and Cho, 2006; Kim and Song, 2013; Kang and Jeong, 2018). The reversal can be explained by several theories, among which the widely accepted explanation is based on compensation for providing liquidity. Campbell *et al.* (1993) present a model in which liquidity providers absorb the excess supply of a stock at a lower price and expect a positive return. Their model implies that a subsequent reversal in the stock price reflects the premium required by liquidity providers. An alternative explanation of short-term reversals is that they are associated with investor overreaction (Lehmann, 1990). The overreaction and subsequent correction of prices can lead to the return reversal.

We hypothesize that the difference in profits between intermediate return-based and recent return-based momentum strategies, that is, the term structure of momentum, arises because of a carryover from a short-term reversal from months before portfolio formation. Based on a large sample spanning 1999–2021, we provide the supporting evidence for the hypothesis. First, we observe a term structure of momentum profits in the Korean stock market, consistent with Novy-Marx (2012) and Jang (2017). Specifically, the intermediate return-based strategy constructed 12 to seven months before outperforms the recent return-based strategy constructed six to two months before. The magnitude of the difference in returns from the two strategies is as high as 0.615% per month based on the five-factor alpha. Second, we find that the term structure of momentum profits is more prominent when a return reversal occurs over two months. The difference in profits between the intermediate return- and recent return-based strategies is greater when the reversal strategy suggested by Nagel (2012) earns positive returns, which suggests that the reversal drives the term structure of momentum. Lastly, but most importantly, we find that the term structure of momentum weakens when we exclude the most recent two months for the recent return definitions. This implies that the return difference between the intermediate return- and recent return-based strategies is primarily driven by the underperformance of the former, which is due to the inclusion of the second month in recent return portfolios. Overall, our findings strongly support the hypothesis that the term structure of momentum profits is a manifestation of the short-term (two-month) return reversal effect.

This study contributes to the literature as follows. First, we provide a convincing explanation for the term structure of the momentum and echo effects in the Korean stock market. This is primarily driven by a return reversal occurring over two months. Second, we provide practical implications for the design of more profitable trading strategies. A stock selection criterion that excludes the performance of the most recent two months can significantly improve the profitability of a momentum strategy. Lastly, we confirm that the echo effect exists in the Korean stock market like the US market based on a large sample covering 1999–2021. By expanding the sample to the latest period in which COVID-19 has affected the global financial market, we also contribute to the existing literature.

The remainder of this paper is organized as follows. Section 2 explains the data source and methodology, and Section 3 examines momentum profits and their term structure. Section 4 investigates whether the term structure is related to a short-term return reversal. Section 5 concludes.

2. Data and methodology

To examine the term structure of momentum returns, we employ the conventional momentum strategy suggested by JT. Specifically, at the end of month *t*, we sort stocks based on $pret_{(p,\ q)}$, denoting the cumulative returns from months $t–p$ to $t–q$ (inclusive), and construct a long-short strategy by buying stocks in the top quintile and selling stocks in the bottom quintile. Hereafter, we denote the long-short strategy based on $pret_{(p,\ q)}$ as "the $pret_{(p,\ q)}$ strategy."

Our sample consists of all the firms listed on the Korea Stock Exchange from January 1999 to February 2021. We obtain market and accounting data from DataGuide and KIS-VALUE. To be included in our sample, a stock must have at least 14 days in the month. We exclude stocks priced below 500 Korean won at the end of the previous month. The final sample includes, on average, 658 firms per month.

Table 1 presents the summary statistics for the variables of interest, including the mean, standard deviation and 5th, 25th, 50th, 75th and 95th percentiles. *return* is a stock's monthly return, *SIZE* is the natural logarithm of market capitalization and *BM* is the book-to-market ratio. *OP* is the operating profitability ratio calculated by dividing EBIT by the book value to equity, and *INV* is asset growth computed following Fama and French (2015). *IVOL* is the idiosyncratic volatility estimated as the standard deviation of the residuals obtained from a regression of daily excess stock returns based on Fama and French's (2015) five-factor model over a one-month window. *ILLIQ* is the natural logarithm of Amihud's (2002) illiquidity measure computed as the absolute daily return divided by the daily dollar trading volume, averaged over all the trading days in a month.

			Percentile				
	Mean	Std. Dev	5%	25%	50%	75%	95%
return	1.68	12.90	−13.84	−5.23	0.16	6.53	21.39
$pret_{(12,\ 2)}$	19.63	52.95	−34.33	−10.58	8.73	35.81	106.52
$pret_{(12,\ 7)}$	10.55	34.86	−27.24	−9.38	4.20	22.12	67.45
$pret_{(6,\ 2)}$	9.00	32.02	−25.37	−8.84	3.41	19.55	59.62
SIZE	25.94	1.66	23.81	24.73	25.58	26.87	29.18
BM	1.55	1.17	0.29	0.74	1.28	2.06	3.66
OP	0.18	1.24	−0.16	0.01	0.06	0.13	0.45
INV	0.09	0.30	−0.14	−0.01	0.05	0.14	0.41
IVOL	2.67	1.37	1.13	1.77	2.37	3.20	5.26
ILLIQ	−17.15	2.52	−21.33	−18.82	−17.09	−15.60	−12.91

Note(s): This table reports the mean, standard deviation and percentiles for the variables of interest. *return* is the monthly return of individual stocks, and $pret_{(p,\ q)}$ is the cumulative return over months $t–p$ to $t–q$ (inclusive). *OP* is the operating profitability ratio calculated by dividing EBIT by the book value to equity, and *INV* is asset growth computed following Fama and French (2015). *IVOL* is the idiosyncratic volatility estimated as the standard deviation of the residuals obtained from a regression of daily excess stock returns on the Fama and French's (2015) five factors over a one-month window. *ILLIQ* is the natural logarithm of Amihud's (2002) illiquidity measure computed as the absolute daily return divided by the daily dollar trading volume, averaged over all the trading days in a month. All the returns and *IVOL* are reported in percentage

Table 1.
Summary statistics

First, we examine the term structure of momentum using Fama–MacBeth (1973) regression, as in Novy-Marx (2012)

$$r_{i,t} = a + b_1\, pret_{(p_1,\, q_1)_{i,t}} + b_2\, pret_{(p_2,\, q_2)_{i,t}} + c' z_{i,t-1} + \varepsilon_{i,t} \tag{1}$$

where $r_{i,t}$ is the rate of return of stock i in month t. $pret_{(p_1,\, q_1)}$ and $pret_{(p_2,\, q_2)}$, respectively, refer to the cumulative intermediate-horizon returns and recent-horizon returns. z is a set of control variables. In the most general specification, $z_{i,t-1}$ includes size (*SIZE*), the book-to-market ratio (*BM*), operating profitability (*OP*), investment (*INV*), illiquidity (*ILLIQ*), idiosyncratic volatility (*IVOL*) and a one-month reversal (r_{-1}) [4]. The positive and significant coefficient of $pret_{(p_i,\, q_i)}$ implies that the momentum strategy based on $pret_{(p_i,\, q_i)}$ is profitable. Our main interest is in the difference between the $pret_{(p_1,\, q_1)}$ and $pret_{(p_2,\, q_2)}$ slopes. This difference implies the presence of the term structure of momentum. In particular, a lower slope of $pret_{(p_2,\, q_2)}$ indicates the inferior performance of momentum strategies based on recent past returns.

Next, we examine which months contribute to (or erode) the profitability of momentum strategies. We run the full-term structure regressions suggested by Jegadeesh (1990):

$$r_{i,t} = a + \sum_{k=1}^{K} b_k r_{i,t-k} + \sum_{l=1}^{L} c_l z_{i,t-1} + \varepsilon_{i,t} \tag{2}$$

where $r_{i,t}$ is the rate of return of stock i in month t. z is a set of control variables. The b_k is interpreted as the return responses at various lags of k. If b_k is significantly negative, it indicates that the return in month $t-k$ reverses in month t. For example, if a return reversal carries over two months, b_2 is negative and significant.

Finally, we examine whether the term structure of momentum is more pronounced in the presence of return reversals using the following time-series regression:

$$r_t^{dif} = \alpha + \beta H_t + \gamma' f_t + \varepsilon_t \tag{3}$$

where r_t^{dif} is the difference in returns between the $pret_{(p_1,\, q_1)}$ and $pret_{(p_2,\, q_2)}$ strategies. f_t is a vector of the risk factors of the CAPM, Fama and French (1993) three-factor and Fama and French (2015) five-factor models in month t. H_t is a dummy variable equal to 1 if the reversal strategy suggested by Nagel (2012) generates a positive return and 0 otherwise; hence, H is an indicator of the presence of return reversals. The reversal strategy involves assigning the portfolio weights $w_{i,t}$ to stock i at time t based on the past return of stock i ($r_{i,t-k}$) relative to the returns on the equal-weighted market portfolio ($r_{m,t-k}$):

$$w_{i,t} = -\left(\frac{1}{2}\sum_{i=1}^{N}\left|r_{i,t-k} - r_{m,t-k}\right|\right)^{-1}\left(r_{i,t-k} - r_{m,t-k}\right) \tag{4}$$

where N is the number of stocks in month t. In Equation (4), the weight implies buying stocks whose returns are less than the market return in month $t-k$ and selling stocks whose returns are greater than the market return in month $t-k$. Thus, the higher the reversal strategy returns, the stronger is the return reversal from months $t-k$ to t [5]. In Equation (3), the coefficients of interest are α, the intercept, and β, the slope of the reversal dummy. The insignificant α indicates that the term structure of momentum disappears in the absence of a short-term return reversal. The significant and positive β implies that the term structure is more prominent in the presence of a return reversal.

3. Term structure of momentum profits

Table 2 shows the average monthly returns for the long-short portfolios for the momentum strategy based on different past performances [6]. Columns (1), (2) and (3) show the returns

Table 2.
Term structure of momentum profits: portfolio sorts

	$pret_{(12,2)}$ (1)	$pret_{(12,7)}$ (2)	$pret_{(6,2)}$ (3)	$pret_{(12,7)}–pret_{(6,2)}$ (4)
Raw returns	0.276	0.525**	−0.042	0.567*
	(0.85)	(2.11)	(−0.14)	(1.94)
CAPM alpha	0.491	0.635**	0.185	0.45*
	(1.52)	(2.54)	(0.66)	(1.66)
FF3 alpha	0.319	0.541**	−0.015	0.556*
	(0.96)	(2.09)	(−0.05)	(1.83)
FF5 alpha	0.285	0.531**	−0.084	0.615**
	(0.85)	(2.05)	(−0.28)	(2.01)

Note(s): This table shows the monthly raw and risk-adjusted returns for the $pret_{(12,2)}$, $pret_{(12,7)}$ and $pret_{(6,2)}$ strategies and the difference in returns between the $pret_{(12,7)}$ and $pret_{(6,2)}$ strategies. We report the raw returns and alphas from the CAPM, three-factor model and five-factor model. The $pret_{(p,q)}$ strategy refers to the momentum strategy constructed each month by buying winners and selling losers, which are defined as the top and bottom quintiles of cumulative returns over months *t–p* to *t–q* (inclusive). All the returns are reported in percentage. Numbers in parentheses are the *t*-statistics calculated using the Newey and West's (1987) robust standard errors. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively

based on $pret_{(12,2)}$, $pret_{(12,7)}$ and $pret_{(6,2)}$, respectively. Column (4), labeled "$pret_{(12,7)}–pret_{(6,2)}$," shows the difference in returns between the two long-short portfolios based on $pret_{(12,7)}$ and $pret_{(6,2)}$. We report the raw returns and alphas from the CAPM, three-factor model and five-factor model [7].

First, we find that the conventional momentum strategy, based on $pret_{(12,2)}$, does not generate positive returns, consistent with previous studies finding no price momentum in the Korean stock market (Chung and Kim, 2002; Ahn and Lee, 2004; Park and Jee, 2006; Chui *et al.*, 2010). The strategy based on recent past returns also does not earn significant profits; indeed, it is even negative. The five-factor alpha of $pret_{(6,2)}$ is −0.084% (*t*-statistic = −0.28). However, the strategy based on the intermediate past returns exhibits different results. The $pret_{(12,7)}$ strategy generates a positive five-factor alpha of 0.531% (*t*-statistic = 2.05). Accordingly, momentum strategies formed on $pret_{(12,7)}$ outperform strategies formed on $pret_{(6,2)}$ by 0.615% per month with a *t*-statistic of 2.01. The superior profitability of intermediate strategies implies that momentum strategies have the term structure of returns in the Korean market like the US market. Our finding confirms Jang (2017) for our extended sample, which includes recent years.

Figure 1 plots the trends of the cumulative returns of the momentum strategies based on intermediate-horizon and recent past performance, respectively. Consistent with the earlier results, the $pret_{(12,7)}$ strategy (solid line) generates significantly higher cumulative returns than the $pret_{(6,2)}$ strategy (dashed line) over the sample period. Specifically, an investor investing 1 Korean won in the first month of the sample period would have earned 3.11 Korean won with the $pret_{(12,7)}$ strategy and 0.67 Korean won with the $pret_{(6,2)}$ strategy.

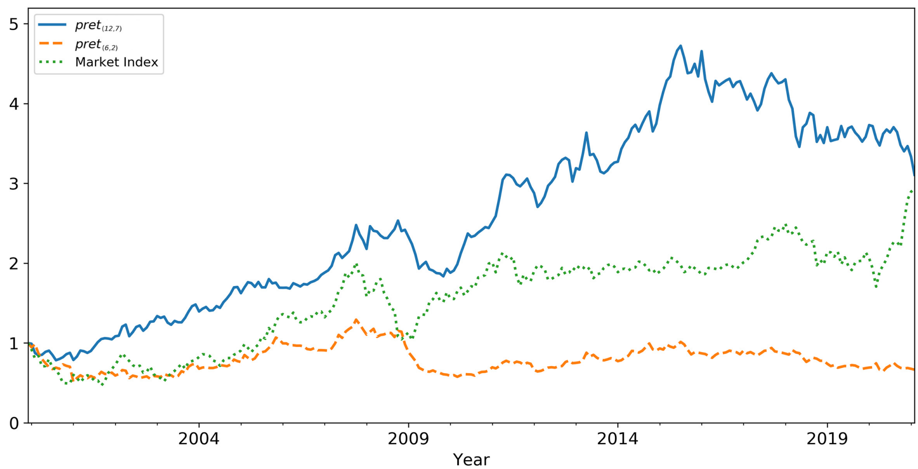
Figure 2 presents the momentum profits across holding periods. We construct the long-short momentum portfolio and hold the portfolio over subsequent K ($K = 1, 3, \ldots, 24$) months using JT's overlapping approach. The blue and red bars represent the five-factor alphas of the $pret_{(12,7)}$ and $pret_{(6,2)}$ strategies, respectively, and the asterisk above the bar represents statistical significance. First, the profits of the $pret_{(12,7)}$ strategy decrease with the holding period. The profits are statistically positive with one- and three-month holding periods but become not significant with holding periods longer than six months [8]. On the contrary, we find no evidence of a decreasing pattern with the $pret_{(6,2)}$ strategy; indeed, this strategy generates even higher returns with three-, six- and nine-month holding periods than with a one-month holding period, although they are insignificant. A possible explanation is that profits from the intermediate-horizon strategy carry over to profits from the recent return-based strategy as the holding periods increase because we revise the weight on $1/K$ of the momentum portfolio in any month [9].

Table 3 reports the estimation results of the Fama–MacBeth (1973) regression of Equation (1). Columns (1) and (2) show that while the coefficient of $pret_{(12,7)}$ is 0.733% and statistically significant at the 1% level, the coefficient of $pret_{(6,2)}$ is not significant. Our primary interest is in the difference between the $pret_{(12,7)}$ and $pret_{(6,2)}$ coefficients. The difference, reported in Column (3), is 0.475% (t-statistic = 1.98), positive and significant at the 5% level. Columns (4)–(6) report the results when we use risk-adjusted returns as the dependent variable in Equation (1) [10]. Consistently, the coefficient of $pret_{(12,7)}$ is significantly positive, whereas that of $pret_{(6,2)}$ is insignificant. The difference between the coefficients of $pret_{(12,7)}$ and $pret_{(6,2)}$ is significant and positive.

The estimated coefficients of the control variables are consistent with our expectations: the price reverses at monthly horizons (Jegadeesh, 1990; Lehmann, 1990; Yun and Cho, 2006), high idiosyncratic volatility is associated with lower subsequent returns (Ang *et al.*, 2006; Kang *et al.*, 2014a) and firms with more aggressive investment earn lower average returns (Aharoni *et al.*, 2013). On the contrary, we find that the illiquidity effect (Amihud, 2002) and profitability effect (Novy-Marx, 2012; Fama and French, 2015) are insignificant in the Korean market unlike in the US market.

4. Term structure of momentum profits and short-term return reversal

To investigate which months contribute to or erode the profitability of momentum strategies, we run the cross-sectional regressions in Equation (2). Table 4 presents the results of the estimation. First, r_{t-1} has a negative coefficient of -2.950% (t-statistic = -3.77), consistent with previous studies finding the existence of a one-month return reversal in the Korean stock



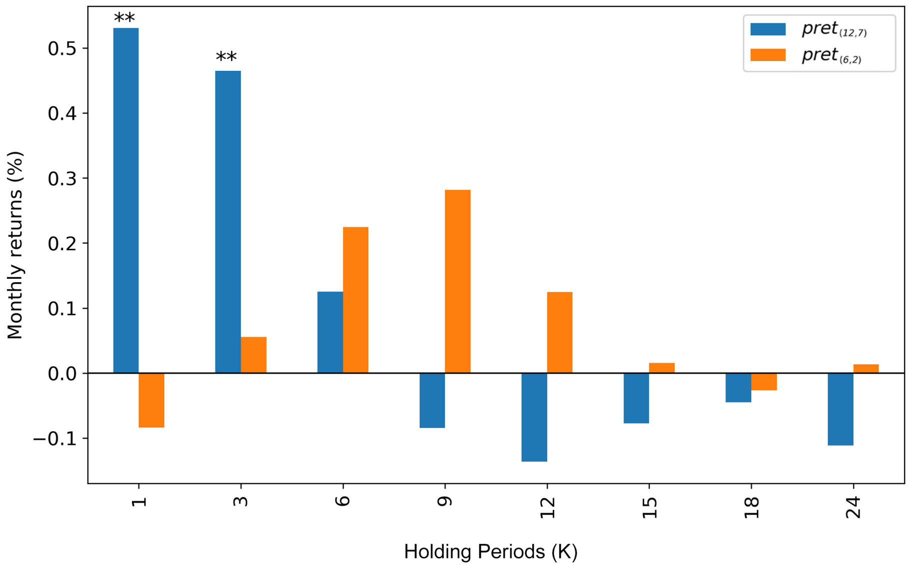
Note(s): This figure plots the cumulative returns of the $pret_{(12,7)}$ strategy (solid line) and $pret_{(6,2)}$ strategy (dashed line). For comparison purposes, we report the cumulative profits of the market index (dotted line). The $pret_{(p,q)}$ strategy refers to the momentum strategy constructed each month by buying winners and selling losers, which are defined as the top and bottom quintiles of cumulative returns over months $t–p$ to $t–q$ (inclusive)

Figure 1. Cumulative profits of the momentum strategies

market. Next, and most importantly, the coefficient of r_{t-2} is −1.108 (t-statistic = −2.01), significant at the 5% level. As we suspect, the return reversal occurs over more than one month [11].

To further examine whether a return reversal is carried over up to two months, we use the reversal strategy suggested by Nagel (2012), which involves buying stocks whose returns are less than the market return and selling stocks whose returns are greater than the market return. Panel A of Table 5 presents the returns of the reversal strategy, as shown in Equation (4). When $k = 1$, we find significant raw returns and a five-factor alpha of 1.293% (t-statistic = 3.32) and 1.275% (t-statistic = 3.22) per month, respectively. The positive and significant profit is consistent with our earlier findings. Comparing the result reported by Hameed and Mian (2015), who study the US stock market, the profit is relatively high, implying that the short-term return reversal is strong in the Korean market. More importantly, the reversal strategy exhibits significantly positive returns, even when $k = 2$. The raw return and five-factor alpha are 0.432% (t-statistic = 1.83) and 0.514% (t-statistic = 1.99), respectively. Consistent with Table 5, we find a carryover of a return reversal from month t−2. However, when $k = 3$, the reversal strategy does not exhibit significant results. Hence, the reversal effect does not appear to last for more than three months.

Panel B examines whether the term structure of momentum is more prominent during periods of a continuing return reversal using Equation (3). We define the dummy variable H, indicating the presence of the reversal, based on the $k = 2$ reversal strategy of Panel A because



Note(s): This figure presents the momentum profits across holding periods (K = 1, 3, . . ., 24). The blue and red bars represent the fivefactor alphas of the $pret_{(12,7)}$ and $pret_{(6,2)}$ strategies, respectively. The $pret_{(p,\,q)}$ strategy refers to the momentum strategy constructed each month by buying winners and selling losers, which are defined as the top and bottom quintiles of cumulative returns over months t–p to t–q (inclusive).We hold the strategy over subsequent K months using the JT's overlapping approach. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively

Figure 2.
Momentum profits over long horizons

Dependent variable =	Raw returns			Risk-adjusted returns		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	6.462***	6.202***	6.650***	5.400***	5.055***	5.479***
	(3.40)	(3.24)	(3.53)	(5.38)	(4.83)	(5.38)
$r_{(-1)}$	−2.103**	−1.803**	−1.812**	−2.230***	−1.990***	−2.025***
	(−2.56)	(−2.16)	(−2.17)	(−3.06)	(−2.70)	(−2.75)
SIZE	−0.191**	−0.176*	−0.204**	−0.160***	−0.144**	−0.169***
	(−2.09)	(−1.92)	(−2.26)	(−2.91)	(−2.56)	(−3.08)
BM	0.277***	0.251***	0.276***	0.120*	0.085	0.113
	(3.20)	(2.87)	(3.17)	(1.69)	(1.20)	(1.59)
OP	−0.009	−0.014	−0.014	−0.03	−0.035	−0.035
	(−0.17)	(−0.24)	(−0.25)	(−0.55)	(−0.62)	(−0.63)
INV	−0.688***	−0.685***	−0.634***	−0.644***	−0.662***	−0.605***
	(−3.16)	(−3.16)	(−2.95)	(−3.03)	(−3.14)	(−2.88)
ILLIQ	−0.016	−0.007	−0.018	0.031	0.038	0.027
	(−0.27)	(−0.11)	(−0.32)	(0.69)	(0.87)	(0.63)
IVOL	−0.203***	−0.238***	−0.257***	−0.191***	−0.212***	−0.228***
	(−2.91)	(−3.30)	(−3.64)	(−3.13)	(−3.37)	(−3.72)
$pret_{(12,7)}$	0.733***		0.694***	0.758***		0.727***
	(3.27)		(2.99)	(3.64)		(3.43)
$pret_{(6,2)}$		0.162	0.219		−0.025	0.033
		(0.46)	(0.61)		(−0.08)	(0.10)
$pret_{(12,7)}–pret_{(6,2)}$			0.475**			0.694**
			(1.98)			(2.14)

Note(s): This table reports the estimation results from regressing a stock's raw (Columns (1)–(3)) and risk-adjusted (Columns (4)–(6)) returns on past performance. The control variables include the return of the previous month ($r_{(-1)}$), firm size (*SIZE*), the book-to-market ratio (*BM*), operating profitability (*OP*), investment (*INV*), illiquidity (*ILLIQ*) and idiosyncratic volatility (*IVOL*). The last row presents the difference in returns between the $pret_{(12,7)}$ and $pret_{(6,2)}$ strategies. All the coefficient estimates are reported in percentage. The *t*-statistics are adjusted using the Newey–West (1987) robust standard errors. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively

Table 3. Term structure of momentum profits: cross-sectional regressions

	Coef.	*t*-statistics
Intercept	4.612***	(4.92)
$r_{(-1)}$	−2.950***	(−3.77)
$r_{(-2)}$	−1.108**	(−2.01)
$r_{(-3)}$	−0.064	(−0.12)
$r_{(-4)}$	−0.412	(−0.82)
$r_{(-5)}$	−0.133	(−0.26)
$r_{(-6)}$	0.932*	(1.83)
$r_{(-7)}$	0.569	(1.15)
$r_{(-8)}$	0.291	(0.69)
$r_{(-9)}$	1.214***	(2.88)
$r_{(-10)}$	1.275***	(2.73)
$r_{(-11)}$	0.569	(1.29)
$r_{(-12)}$	0.683	(1.51)
SIZE	−0.176***	(−5.21)
BM	0.179**	(2.57)
OP	−0.029	(−0.51)
INV	−0.608***	(−2.97)

Note(s): This table reports the coefficient estimates of the cross-sectional regressions in Equation (2). The dependent variable is a stock's return in month *t* and the independent variables are returns in month $t-12, \ldots,$ $t-1$. The control variables include firm size (*SIZE*), the book-to-market ratio (*BM*), operating profitability (*OP*) and investment (*INV*). All the coefficient estimates are reported in percentage. The *t*-statistics are adjusted using Newey–West (1987) robust standard errors. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively

Table 4. The existence of a return reversal: return responses to the prior 12 months

Panel A. Profits of the reversal strategy	Raw returns	CAPM alpha	FF3 alpha	FF5 alpha
$k=1$	1.293***	1.130***	1.256***	1.275***
	(3.32)	(3.10)	(3.17)	(3.22)
$k=2$	0.432*	0.446*	0.547**	0.514**
	(1.83)	(1.79)	(1.99)	(1.99)
$k=3$	−0.174	−0.116	−0.085	−0.043
	(−0.78)	(−0.52)	(−0.36)	(−0.18)

Panel B. Term structure of momentum profits		Raw returns (1)	Risk-adjusted returns (2)	Market-adjusted returns (3)
$f=0$	a	−0.25	−0.39	0.43
		(−0.58)	(−0.83)	(1.01)
	b	1.41**	1.57***	0.24
		(2.48)	(2.72)	(0.42)
$f=MKT$	a	−0.37	−0.51	−0.57
		(−0.89)	(−1.14)	(−1.28)
	b	1.44**	1.61***	1.87***
		(2.55)	(2.81)	(2.79)
$f=FF3$	a	−0.25	−0.42	−0.45
		(−0.55)	(−0.88)	(−0.96)
	b	1.38**	1.62***	1.83***
		(2.37)	(2.82)	(2.71)
$f=FF5$	a	−0.21	−0.34	−0.43
		(−0.44)	(−0.72)	(−0.91)
	b	1.42**	1.60***	1.92***
		(2.36)	(2.82)	(2.77)

Note(s): Panel A reports the returns of the reversal strategy, as shown in Equation (4). The reversal strategy involves buying stocks whose returns are less than the market return and selling stocks whose returns are greater than the market return in month t–k. Panel B reports the coefficient estimates, α and β, of Equation (3), where we define the dummy variable H based on the $k = 2$ reversal strategy with portfolio weights using the raw, risk-adjusted and market-adjusted returns (Columns (1)–(3)). We include the CAPM, Fama and French's (1993) three factors and Fama and French's (2015) five factors as the control variables, respectively. All the coefficient estimates are reported in percentage. The t-statistics are adjusted using the Newey–West (1987) robust standard errors. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively

Table 5.
Term structure of momentum in the presence of return reversals

our focus is a carryover of a reversal from the penultimate month [12]. Columns (1)–(3) report the estimation results for the reversal strategy assigning portfolio weights based on raw returns, risk-adjusted returns and market-adjusted returns, respectively [13]. We control for exposure to risk factors based on the CAPM, Fama and French (1993) three-factor and Fama and French (2015) five-factor model.

We find that α is not statistically significant and β is significantly positive in all the specifications regardless of the risk adjustment or dummy variable definitions adopted. For example, α is −0.43% and insignificant, and β is 1.92% (t-statistic = 2.77) and significant, as shown in the last row of Column (3). $\alpha = 0$ implies that the profits from the $pret_{(12,7)}$ and $pret_{(6,2)}$ strategies are not different when the return of the $k = 2$ reversal strategy is not positive. $\beta > 0$ implies that the $pret_{(12,7)}$ strategy outperforms the $pret_{(6,2)}$ strategy when the reversal strategy generates positive returns. Taken together, these findings suggest that the underperformance of recent return-based momentum strategies is more prominent during periods of continuing reversal.

Table 6. Term structure of momentum: inclusion of month $t-2$

$(p_1, q_1), (p_2, q_2)$	$pret_{(p_1,q_1)}-pret_{(p_2,q_2)}$		$(p_1, q_1), (p_2, q_2)$	$pret_{(p_1,q_1)}-pret_{(p_2,q_2)}$	
(12, 3), (2, 2)	1.59^{***}	(2.78)	(12, 10), (2, 2)	1.95^{***}	(2.91)
(12, 4), (2, 2)	1.63^{***}	(2.78)	(12, 10), (3, 2)	1.34^{**}	(2.45)
(12, 4), (3, 2)	1.02^{**}	(2.22)	(12, 10), (4, 2)	1.28^{***}	(2.61)
(12, 5), (2, 2)	1.73^{***}	(2.89)	(12, 10), (5, 2)	1.21^{***}	(2.68)
(12, 5), (3, 2)	1.12^{**}	(2.36)	(12, 10), (6, 2)	0.97^{**}	(2.33)
(12, 5), (4, 2)	1.06^{***}	(2.63)	(12, 10), (7, 2)	0.86^{**}	(2.16)
(12, 6), (2, 2)	1.84^{***}	(3.04)	(12, 10), (8, 2)	0.83^{**}	(2.17)
(12, 6), (3, 2)	1.23^{**}	(2.55)	(12, 10), (9, 2)	0.70^{*}	(1.94)
(12, 6), (4, 2)	1.17^{***}	(2.82)	(12, 11), (10, 2)	0.39	(1.00)
(12, 6), (5, 2)	1.11^{***}	(2.98)	(12, 11), (2, 2)	1.76^{**}	(2.57)
(12, 7), (2, 2)	1.83^{***}	(3.00)	(12, 11), (3, 2)	1.15^{**}	(2.03)
(12, 7), (3, 2)	1.22^{**}	(2.48)	(12, 11), (4, 2)	1.08^{**}	(2.10)
(12, 7), (4, 2)	1.15^{***}	(2.71)	(12, 11), (5, 2)	1.02^{**}	(2.12)
(12, 7), (5, 2)	1.09^{***}	(2.84)	(12, 11), (6, 2)	0.78^{*}	(1.73)
(12, 7), (6, 2)	0.84^{**}	(2.44)	(12, 11), (7, 2)	0.67	(1.55)
(12, 8), (2, 2)	1.86^{***}	(3.01)	(12, 11), (8, 2)	0.64	(1.53)
(12, 8), (3, 2)	1.25^{**}	(2.49)	(12, 11), (9, 2)	0.51	(1.27)
(12, 8), (4, 2)	1.19^{***}	(2.70)	(12, 12), (10, 2)	0.43	(0.91)
(12, 8), (5, 2)	1.12^{***}	(2.81)	(12, 12), (11, 2)	0.40	(0.86)
(12, 8), (6, 2)	0.88^{**}	(2.42)	(12, 12), (2, 2)	1.81^{**}	(2.46)
(12, 8), (7, 2)	0.77^{**}	(2.25)	(12, 12), (3, 2)	1.20^{*}	(1.89)
(12, 9), (2, 2)	2.01^{***}	(3.13)	(12, 12), (4, 2)	1.13^{*}	(1.91)
(12, 9), (3, 2)	1.39^{***}	(2.69)	(12, 12), (5, 2)	1.07^{*}	(1.90)
(12, 9), (4, 2)	1.33^{***}	(2.90)	(12, 12), (6, 2)	0.83	(1.55)
(12, 9), (5, 2)	1.27^{***}	(2.97)	(12, 12), (7, 2)	0.71	(1.39)
(12, 9), (6, 2)	1.02^{***}	(2.61)	(12, 12), (8, 2)	0.69	(1.36)
(12, 9), (7, 2)	0.91^{**}	(2.46)	(12, 12), (9, 2)	0.56	(1.13)
(12, 9), (8, 2)	0.88^{**}	(2.51)			

Note(s): This table reports the difference in the average coefficients estimated from the regression of Equation (2) for feasible pairs of intermediate-horizon returns and recent returns compiled from months $t-12$ to $t-2$. All the coefficient estimates are reported in percentage. The t-statistics are adjusted with the Newey–West (1987) robust standard errors. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively

As shown in Tables 6 and 7, we next compose a comprehensive set of feasible pairs of intermediate-horizon returns and recent returns that can be compiled from the previous 11 months and then examine whether the inclusion of month $t-2$ affects the term structure of momentum. The first and third columns in each table show the months used to estimate intermediate-horizon and recent performance. Specifically, $pret_{(p_1,q_1)}$ represents intermediate-horizon past performance, and $pret_{(p_2,q_2)}$ represents recent past performance. The second and fourth columns, labeled $pret_{(p_1,q_1)}-pret_{(p_2,q_2)}$, represent the difference in the average coefficients estimated from the full sample term structure regression of Equation (2). For example, $pret_{(12,4)}-pret_{(3,2)}$ is the time-series average of the difference between the average of the coefficient of $r_{(-3)}$ and $r_{(-2)}$ and the average of the coefficients of $r_{(-12)}, \ldots, r_{(-4)}$.

Table 7 shows that the term structure of momentum profits is not limited to the case of $pret_{(12,7)}-pret_{(6,2)}$. The averages of the coefficients of all the intermediate return definitions are larger than those of the recent return definitions. Most of the differences (45 out of 55) are positively significant at the 10% significance level [14]. A more interesting finding emerges from Table 7. When the second month is excluded from the recent return, the difference between the coefficients is insignificant in only 18 out of the 45 pairs. With a stricter criterion of the 5% significance level, only eight cases are significant in Table 7, while 40 cases are significant in Table 6. Further, the overall differences in Table 7 are smaller and less

Table 7.
Term structure of momentum: exclusion of month $t-2$

$(p_1, q_1), (p_2, q_2)$	$pret_{(p_1,q_1)}-pret_{(p_2,q_2)}$		$(p_1, q_1), (p_2, q_2)$	$pret_{(p_1,q_1)}-pret_{(p_2,q_2)}$	
(12, 4), (3, 3)	0.41	(0.75)	(12, 10), (5, 3)	0.97**	(2.13)
(12, 5), (3, 3)	0.51	(0.92)	(12, 10), (6, 3)	0.72*	(1.75)
(12, 5), (4, 3)	0.72*	(1.72)	(12, 10), (7, 3)	0.64	(1.63)
(12, 6), (3, 3)	0.62	(1.11)	(12, 10), (8, 3)	0.65*	(1.71)
(12, 6), (4, 3)	0.83*	(1.93)	(12, 10), (9, 3)	0.52	(1.48)
(12, 6), (5, 3)	0.86**	(2.27)	(12, 11), (10, 3)	0.21	(0.57)
(12, 7), (3, 3)	0.60	(1.06)	(12, 11), (3, 3)	0.54	(0.86)
(12, 7), (4, 3)	0.81*	(1.83)	(12, 11), (4, 3)	0.75	(1.42)
(12, 7), (5, 3)	0.84**	(2.15)	(12, 11), (5, 3)	0.77	(1.60)
(12, 7), (6, 3)	0.60*	(1.71)	(12, 11), (6, 3)	0.53	(1.19)
(12, 8), (3, 3)	0.64	(1.11)	(12, 11), (7, 3)	0.45	(1.04)
(12, 8), (4, 3)	0.85*	(1.85)	(12, 11), (8, 3)	0.45	(1.09)
(12, 8), (5, 3)	0.88**	(2.14)	(12, 11), (9, 3)	0.33	(0.83)
(12, 8), (6, 3)	0.63*	(1.72)	(12, 12), (10, 3)	0.26	(0.55)
(12, 8), (7, 3)	0.55	(1.60)	(12, 12), (11, 3)	0.24	(0.53)
(12, 9), (3, 3)	0.78	(1.34)	(12, 12), (3, 3)	0.59	(0.85)
(12, 9), (4, 3)	0.99**	(2.10)	(12, 12), (4, 3)	0.8	(1.31)
(12, 9), (5, 3)	1.02**	(2.36)	(12, 12), (5, 3)	0.82	(1.45)
(12, 9), (6, 3)	0.78**	(1.97)	(12, 12), (6, 3)	0.58	(1.09)
(12, 9), (7, 3)	0.69*	(1.87)	(12, 12), (7, 3)	0.49	(0.97)
(12, 9), (8, 3)	0.70**	(2.00)	(12, 12), (8, 3)	0.5	(0.99)
(12, 10), (3 ,3)	0.73	(1.21)	(12, 12), (9, 3)	0.38	(0.78)
(12, 10), (4, 3)	0.94*	(1.90)			

Note(s): This table reports the difference in the average coefficients estimated from the regression of Equation (2) for feasible pairs of intermediate-horizon returns and recent returns compiled from months $t-12$ to $t-3$. All the coefficient estimates are reported in percentage. The t-statistics are adjusted using the Newey–West (1987) robust standard errors. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively

significant than those in Table 6. The return differences between the intermediate-horizon performance strategy and recent performance strategy generally exceed 1% in Table 6, whereas they are mostly less than 1% in Table 7.

We obtain consistent results with the Fama–MacBeth (1973) regressions. As shown in Table 3, we run the regression of Equation (1), but with return lags that mitigate the negative effect of month $t-2$ on recent returns. Table 8 presents the estimation results [15]. Each column contains a slightly different definition of intermediate-horizon and recent returns. In Columns (1), (5) and (6), we use $pret_{(6,2)}$ instead of $pret_{(6,3)}$ as an independent variable to examine the impact of month $t-2$. Columns (2), (3) and (4) are used for a comparison with the other columns. Overall, the coefficient of intermediate-horizon returns is larger than that of recent returns. However, the difference is significant with only $pret_{(6,2)}$, not with $pret_{(6,3)}$, implying that the influence of month $t-2$ is significant for the term structure of the momentum strategy.

Finally, Figure 3 illustrates the cumulative returns of momentum strategies. Consistent with the previous results, the $pret_{(12,3)}$ strategy (dashed line) has higher cumulative returns than the $pret_{(12,2)}$ strategy (red solid line). Investing 1 Korean won in the first month of our sample period would have earned 2.43 Korean won based on the $pret_{(12,3)}$ strategy, which is much higher than the 1.43 Korean won gained from the $pret_{(12,2)}$ strategy. Similarly, the $pret_{(6,3)}$ strategy generates higher cumulative returns than the $pret_{(6,2)}$ strategy. The earlier comparison provides practical implications for the design of more profitable trading strategies. Ignoring performance over the last two months in the stock selection criteria can improve the profitability of momentum strategies.

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	5.479***	5.298***	5.435***	5.307***	5.599***	5.488***
	(5.38)	(5.25)	(5.34)	(5.19)	(5.45)	(5.31)
$r_{(-1)}$	−2.025***	−2.084***	−2.071***	−2.010***	−2.020***	−1.956***
	(−2.75)	(−2.84)	(−2.82)	(−2.74)	(−2.74)	(−2.65)
SIZE	−0.169***	−0.160***	−0.167***	−0.160***	−0.175***	−0.169***
	(−3.08)	(−2.93)	(−3.04)	(−2.90)	(−3.18)	(−3.05)
BM	0.113	0.127*	0.125*	0.120*	0.111	0.106
	(1.59)	(1.79)	(1.77)	(1.67)	(1.56)	(1.48)
OP	−0.035	−0.034	−0.037	−0.036	−0.038	−0.037
	(−0.63)	(−0.62)	(−0.67)	(−0.65)	(−0.68)	(−0.66)
INV	−0.605***	−0.604***	−0.604***	−0.609***	−0.606***	−0.610***
	(−2.88)	(−2.86)	(−2.86)	(−2.89)	(−2.89)	(−2.91)
ILLIQ	0.027	0.031	0.027	0.03	0.024	0.027
	(0.63)	(0.70)	(0.62)	(0.68)	(0.56)	(0.62)
IVOL	−0.228***	−0.221***	−0.223***	−0.217***	−0.230***	−0.224***
	(−3.72)	(−3.62)	(−3.65)	(−3.52)	(−3.73)	(−3.62)
$pret_{(12,\ 7)}$	0.727***	0.738***				
	(3.43)	(3.48)				
$pret_{(11,\ 7)}$			0.740***		0.727***	
			(3.30)		(3.24)	
$pret_{(12,\ 8)}$				0.708***		0.702***
				(3.20)		(3.16)
$pret_{(6,\ 2)}$	0.033				0.023	0.009
	(0.10)				(0.07)	(0.03)
$pret_{(6,\ 3)}$		0.265	0.265	0.238		
		(0.83)	(0.83)	(0.75)		
$pret_{(12,\ 7)}-pret_{(6,\ 2)}$	0.694**					
	(2.14)					
$pret_{(12,\ 7)}-pret_{(6,\ 3)}$		0.473				
		(1.42)				
$pret_{(11,\ 7)}-pret_{(6,\ 3)}$			0.474			
			(1.42)			
$pret_{(12,\ 8)}-pret_{(6,\ 3)}$				0.471		
				(1.33)		
$pret_{(11,\ 7)}-pret_{(6,\ 2)}$					0.704**	
					(2.16)	
$pret_{(12,\ 8)}-pret_{(6,\ 2)}$						0.692**
						(2.00)

Note(s): This table reports the estimation results from regressing a stock's raw return on past performance. The last six rows present the difference in returns between the two strategies. The control variables include the return of the previous month ($r_{(-1)}$), firm size (*SIZE*), the book-to-market ratio (*BM*), operating profitability (*OP*), investment (*INV*), illiquidity (*ILLIQ*) and idiosyncratic volatility (*IVOL*). All the coefficient estimates are reported in percentage. The *t*-statistics are adjusted using the Newey–West (1987) robust standard errors. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively

Table 8.
Term structure of momentum: comparison between $pret_{(6,3)}$ and $pret_{(6,2)}$

5. Conclusion

Previous studies demonstrate the existence of the term structure of momentum returns, which means that momentum profits are driven by returns over the intermediate rather than recent horizon (Novy-Marx, 2012). Inspired by a relatively strong reversal in the Korean stock market, we explain the term structure using the effect of short-term reversals. Our analysis finds that the term structure of momentum is more pronounced when a return reversal lasts up to two months and is substantially weakened when past performance over the last two months is not taken into account when constructing the portfolio. These findings support the

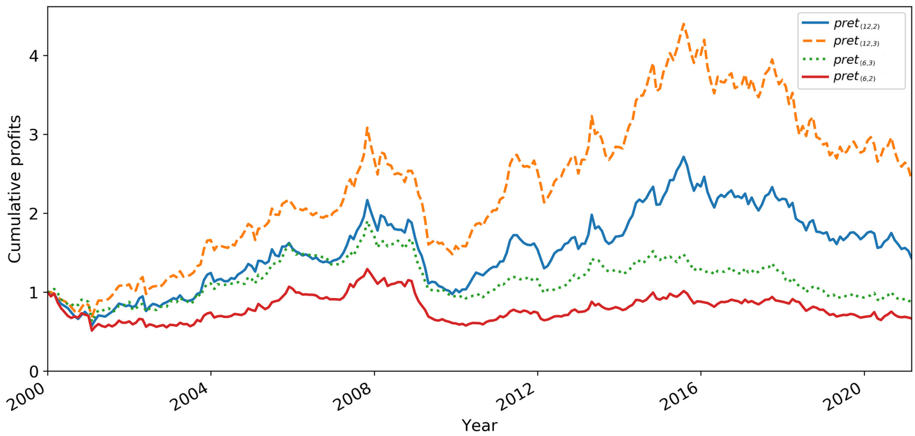


Figure 3.
Cumulative profits of the momentum strategies: the effect of month $t-2$

Note(s): This figure plots the cumulative profits of the momentum strategies, calculated at the end of January 2021, with 1 Korean won invested at the beginning of July 2002. The $pret_{(p,\,q)}$ strategy refers to the momentum strategy constructed each month by buying winners and selling losers, which are defined as the top and bottom quintiles of cumulative returns over months $t–p$ to $t–q$ (inclusive)

hypothesis that the spillover of a reversal from previous months drives the term structure of momentum profits.

Our empirical results provide practical implications for the design of profitable trading strategies. By ignoring recent performance (especially the last two months of portfolio formation) in portfolio selection criteria, portfolio managers can improve the profitability of momentum strategies. Additionally, we provide a plausible explanation for the relatively weak momentum in Korean stock prices. According to Chui *et al.* (2010), the momentum phenomenon is insignificant in the Korean market. Our findings suggest that a long-lasting return reversal reduces the profitability of the JT momentum strategy. Such a reversal also provides a clue to understanding the trend that momentum profits are insignificant (or even negative) before the Asian crisis but become more significant thereafter (Kim, 2012; Kim and Lee, 2018). Kim and Lee (2018) explain that the difference between the pre- and postcrisis periods is driven by a change in market illiquidity. Our results can be reconciled with their findings because a short-term return reversal is closely related to the illiquidity premium (Campbell *et al.*, 1993).

Notes

1. Additionally, Ahn and Lee (2004), based on data from 1994 to 2001, find that the stock price does not show momentum but tends to reverse. Park and Jee (2006), based on data from 1980 to 2003, find that the momentum phenomenon exists only in stocks with low price volatility.

2. Kim (2012) shows that momentum strategies earned significant profits after the 1997 Asian crisis, while contrarian strategies were able to generate profits in the precrisis period. The author argues that the increased participation of foreign and/or institutional investors after the crisis affected the profitability of momentum strategies. Kang *et al.* (2014b) also link the trading behavior of foreign investors to the momentum effect. Meanwhile, Kim and Lee (2018) argue that the momentum phenomenon has become significant as overall market liquidity has increased since 2000. The liquidity premium offsets momentum profits as losers tended to have less liquidity than winners

before 2000, whereas it does not offset momentum profits because the difference between winners and losers was not so large after 2000.

3. Jegadeesh (1990) shows a reversal in returns from the prior month, which is known as the one-month reversal effect.
4. The illiquidity effect and idiosyncratic volatility effect are known to be present in the Korean stock market (Kim and Lee, 2018; Kang *et al.*, 2014a).
5. The weight of stock i in month t is proportional to the stock's market-adjusted return in month $t-k$ in Equation (4).
6. We construct a long-short residual momentum portfolio by buying stocks in the top 20% of stocks and selling stocks in the bottom 20%. When we use 10% or 30% as the criteria instead of 20%, our results remain qualitatively unchanged.
7. The five factors are market, size, value, profitability and investment (Fama and French, 2015).
8. Although not reported, the three-month holding return based on the $pret_{(12,7)}$ strategy is 0.465% (t-statistic = 2.09).
9. When the holding period is K months, the weight on the momentum portfolio consists of $1/K$ of each long-short portfolio constructed at the end of month t–1, month t–2, . . ., and month t–K.
10. The risk-adjusted return is calculated following Chordia *et al.* (2009) and Goyal and Wahal (2015).
11. Additionally, we find that the coefficient estimates are negative up to r_{t-5} and become positive from r_{t-6} to r_{t-12} as k increases, indicating that intermediate-horizon returns contribute more to momentum profits than recent past returns.
12. Because the JT momentum strategy measures past performance skipping the most recent month, the one-month reversal effect cannot contaminate the profitability of the momentum strategy. Therefore, we focus on a carryover of a reversal from the penultimate month and use the $k = 2$ reversal strategy instead of $k = 1$ when we define the dummy variable H.
13. Equation (4) presents the portfolio weights based on the market-adjusted return suggested by Nagel (2012).
14. The exception occurs when we use $pret_{(12,12)}$ or $pret_{(12,11)}$ as the intermediate return.
15. We include Column (1) in Table 8, which is the same model as Column (6) in Table 3, to allow a comparison with the other strategies.

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