Cryptocurrency Momentum and Reversal

Victoria Dobrynskaya[1]

Abstract

We consider a variety of highly-diversified cross-sectional momentum and reversal strategies, with sorting and holding periods from 1 week up to 2 years. In a sample of 2,000 biggest cryptocurrencies, we identify a positive momentum on short horizons up to 2-4 weeks and a significant reversal on longer horizons. The reversal effect becomes more pronounced once we expand the sorting or holding periods. Momentum and, particularly, reversal returns are economically large, statistically significant and cannot be explained by standard cryptocurrency risk factors. The main drivers of the reversal effect are 'past loser' cryptocurrencies.

JEL classification: D14, G12, G15

Keywords: cryptocurrency, momentum, reversal, trading strategy, alternative investments

[1] HSE University, School of Finance, 11 Pokrovskiy boulevard, Moscow, Russian Federation, e-mail vdobrynskaya@hse.ru, tel. +79166864264.

I am grateful to ICEF brown bag participants and particularly to Alexei Boulatov for helpful comments and discussions. Mikhail Dubrovsky provided excellent research assistance.

INTRODUCTION

Momentum and reversal anomalies have been at the center of financial markets analysis for decades. Momentum is the tendency of a financial asset with high recent returns to continue to generate high returns in the future, while reversal is the opposite. Since De Bondt and Thaler (1985), and Jegadeesh and Titman (1993), who were among the first to uncover these anomalies in the stock market, up to Asness et al. (2013), who claimed "value and momentum everywhere"[2], many researchers tested and confirmed short-run momentum and long-run reversal effects in different countries and asset markets, and provided explanations for them.

But what about the cryptocurrency market – a new very fast growing alternative investments market with outrageous average returns, huge volatility and so-called 'fast metabolism'? Of course, momentum was among the first 'anomalies' tested in this market. However, there is no unanimity in the results. Some authors identify the momentum effect on short horizons (Liu et al., 2020; Liu et al., 2021; Tzouvanas et al., 2021), whereas others document insignificant momentum or even reversal (Grobys and Sapkota, 2019; Shen et al., 2020; Kozlowski et al., 2021). The main reasons for the opposite findings are different samples of cryptocurrencies, data frequencies and time frames.

This study contributes to this stream of literature by looking at the whole cryptocurrency market (the sample includes approximately 2,000 cryptocurrencies with market capitalizations above $1 million) and analyzing a great number of highly-diversified momentum strategies, with various sorting and holding horizons from 1 week to 2 years. The period of study, 2014-2020, basically covers the whole history of the crypto-market with a sufficient number of cryptocurrencies traded in order to form diversified strategies. Hence, this is the most comprehensive study of momentum and reversal effects in the cryptocurrency market.

To analyze the cross-sectional momentum (or reversal), cryptocurrencies are sorted by their previous returns into winner and loser portfolios, the winner-minus-loser (WML) portfolio is held for some time and regularly rebalanced. A positive average return on the WML portfolio is evidence of momentum, whereas a negative return is evidence of reversal. We document a surprisingly monotonic pattern of the WML returns: the returns are positive and statistically significant in the case of short sorting and holding horizons up to 2 weeks, become insignificant for horizons 2-4 weeks, then become negative and decrease further on longer horizons up to 2 years. Hence, we confirm short-run momentum and document strong, longer-run reversal in the cryptocurrency market. In fact, the patterns of momentum and reversal returns resemble those in the stock market,

[2] Whereas value is defined by book-to-market ratios for stocks, it is often proxied for other asset classes by the negative of the long-run preceding return, i.e. reversal.

but on significantly shorter horizons. The switching of momentum into reversal occurs approximately after 1 month, whereas in traditional asset markets, it usually occurs after one year. Therefore, our findings provide additional evidence in favor of faster metabolism of cryptocurrencies.

Our findings square well with the existing contradictory literature on momentum and reversal in the cryptocurrency market. Liu et al. (2021) identify significant momentum in the case of sorting 1,800 cryptocurrencies by previous 1-4-week returns and holding the winner-minus-loser portfolio for 1 week. Shen et al. (2020), consider similar, but equal-weighted, strategies for 1,700 cryptocurrencies and document insignificant reversals. We confirm positive momentum rather than reversal on these horizons for value-weighted portfolios, however, the momentum effect has become less significant in recent years.

Grobys and Sapkota (2019), using monthly data for 143 cryptocurrencies, document insignificant momentum in the case of sorts by previous-year returns and keeping the portfolios for 1 month, and significant reversal in the case of sorts by previous-month returns and keeping the portfolios for 1 month. Hence, they claim no momentum, but rather reversal. Our findings confirm the results of Grobys and Sapkota (2019), that there is reversal on monthly holding horizons, not momentum, However, we show that the momentum effect is present on shorter holding horizons (1-2 weeks) than what they consider.

Liu et al. (2020) document significantly positive momentum in the case of sorting 78 cryptocurrencies by previous-year returns and rebalancing the portfolio weekly. Tzouvanas et al. (2021), analyzing only 12 biggest cryptocurrencies, also document significant momentum in the case of 1/1 strategy with weekly data, which disappears if the sorting and holding horizons are increased up to 1 month. We demonstrate similar patterns for the general cryptocurrency market and a wider spectrum of sorting and holding horizons. We consider sorting horizons up to 2 years and holding horizons up to 12 weeks, with different frequencies of rebalancing. This is the first study, which considers holding horizons beyond 1 month and documents significant long-run return reversals in the cryptocurrency market.

High-frequency studies of cryptocurrency return patterns include Kozlovski et al. (2021), who document next-day reversals for 200 cryptocurrencies, Caporale and Plastun (2020), who present evidence of strong momentum on days with abnormal returns, and the day after for Bitcoin, Ethereum and Litecoin, and Long et al. (2020), who demonstrate the day-of-the-week effect for 151 cryptocurrencies. Our study contributes to this emerging cryptocurrency pricing literature, which demonstrates similar patterns and anomalies as in traditional asset markets, which is not surprising given that investor psychology and biases are common.

DATA AND METHODOLOGY

Unlike most previous studies of momentum and reversal anomalies, which consider only a few of the biggest cryptocurrencies, our sample includes *all* cryptocurrencies with market capitalizations above $1 million. We do not consider smaller cryptocurrencies to avoid problems with illiquidity. The time period, 2014-2020, basically covers the *whole* history of the cryptocurrency market, when a sufficient number of cryptocurrencies is traded to form diversified portfolios. Hence, this paper presents the most general evidence of momentum and reversal effects in the cryptocurrency market.

The daily data on cryptocurrency prices are obtained from the usual source www.coinmarketcap.com, which aggregates prices from more than 200 cryptocurrency exchanges around the globe. The daily data is transformed into weekly frequency. Such frequency is the most common in cryptofinance because, on the one hand, the data is not as noisy as in the case of daily frequency, but on the other hand, we have a sufficient number of time series observations for such a young market in order to obtain consistent results. Moreover, previous research speaks about a faster metabolism of cryptocurrencies compared to traditional financial assets, so that the weekly frequency is more appropriate to study short-run return dynamics than the monthly frequency.

Cryptocurrency returns are extremely volatile, so we winsorize them at the 0.005% level. The final sample includes about 2,000 cryptocurrencies, but the number of cryptocurrencies traded at each point of time varies between 20 at the beginning of the study period and 1,900 at the end.

Cryptocurrencies are sorted into momentum (or reversal) portfolios following the standard J/K methodology, which originates in Jegadeesh and Titman (1993). Cryptocurrencies are sorted by their previous cumulative returns over J weeks in increasing order. The first 30% of cryptocurrencies with the lowest returns form the loser portfolio, the last 30% of cryptocurrencies with the highest returns form the winner portfolio, and the momentum (or reversal) portfolio is the zero-cost winner-minus-loser portfolio[3], which is held for the subsequent K weeks. The portfolios are rebalanced weekly or every K weeks. In the case of weekly rebalancing and the holding period above one week, the portfolios are overlapping with weights 1/K. Such a portfolio approach allows us to test for cross-sectional momentum or reversal. If the winner-minus-loser portfolio yields a positive average return, we conclude that there is a momentum effect, whereas in the case of a negative return, we claim reversal.

[3] The winner and loser portfolios are capitalization-weighted.

MOMENTUM AND REVERSAL OVER VARIOUS HORIZONS

First of all, let us consider a set of J/1 cryptocurrency reversal strategies, where cryptocurrencies are sorted by their returns over the previous J weeks, allocated to the winner and loser portfolios and held for one week only. The strategies are rebalanced weekly. The sort period J varies between 1 and 104 weeks (i.e. 2 years). The average number of cryptocurrencies in each strategy is between 600 (strategy 1/1) and 200 (strategy 104/1), so all strategies are highly diversified. Figure 1 plots the average returns of the 104 strategies, together with 95% confidence interval.

We observe a clear, almost monotonically decreasing, pattern of returns. Strategies with sort periods of 1-4 weeks yield positive average returns, which is evidence of a short-term momentum effect. Portfolio 1/1 generates the highest return of 40% pa. However, all momentum returns are statistically insignificant. These results are in line with Grobys and Sapkota (2019), who cast doubt on the significant momentum effect in the cryptocurrency market.

Strategies with sort periods of longer than 4 weeks yield negative average returns, which become statistically significant beyond 11-13 weeks. Hence, portfolios sorted by quarterly, or longer, past returns demonstrate significant return reversal. The reversal effect becomes much stronger with increasing J up to 2 years and stabilizes thereafter[4].

Next, we consider 144 (12*12) J/K strategies, where both sort periods and holding periods vary between 1 and 12 weeks. The average returns and t-statistics are reported in table 1[5]. Column 1 reports the same returns as in figure 1, but only for J up to 12 weeks. Other columns report returns on portfolios with holding periods longer than 1 week.

Interestingly, the general pattern of J/K strategies' returns resembles the results in Jegadeesh and Titman (1993), for the stock market, but with shorter horizons. We observe positive returns in the top-left corner, which almost monotonically decrease, moving downwards and to the right, and are significantly negative in the bottom-right corner. In other words, there is a short-term momentum effect and a longer-term reversal effect. However, the 'terms' are defined differently in the cryptocurrency market. The short-term momentum effect is observed on sorting and holding horizons below 1 month, and the longer-term reversal effect is observed on horizons beyond 1 month, whereas, in the stock market, the short-term momentum effect is commonly observed on horizons below 1 year and long-term reversal is commonly observed on horizons longer than 1 year.

[4] I do not report the results for strategies with J above 104 weeks because they become noisy for two reasons. Firstly, the number of cryptocurrencies with available data is significantly reduced and portfolios are not diversified well. Secondly, the time period for estimating average portfolio returns becomes rather short (2016-2020).

[5] I report regular t-statistics and with Newey-West adjustment with 4 lags. Adjustment with 12 lags does not affect the results qualitatively.

Quicker reversal in the cryptocurrency market, compared to the stock market, is further evidence of the 'fast metabolism of cryptocurrencies'.

Figure 2 presents visual patterns of returns in table 1, where each line represents the returns on portfolios with a particular sort period J and varying holding periods K. We observe similar patterns of returns as on figure 1: for each J, the returns are decreasing with increasing holding period K. There is some short-term momentum for small sorting and holding periods, but the longer the portfolio holding period, the more pronounced is the reversal effect in the cryptocurrency market.

In terms of timing, the highest and statistically significant momentum (70% pa)[6] is generated by the 2/2 strategy. Strategies 1/2 and 1/4 also yield significantly positive returns. It seems that the 2-week holding period is optimal in order to generate momentum. Increasing the sorting and holding horizons beyond 2-4 weeks leads to lower average returns, and significant return reversal is observed on horizons above 4-6 weeks.

Strategy 1/1 generates insignificant momentum because of its high volatility. This is why many authors questioned momentum in the crypto-market after considering only this specification (Shen et al., 2020; Kozlowski et al. 2021). Researchers who used monthly data (Grobys and Sapkota, 2019) also could not identify momentum because it is only observed on shorter horizons.

Unusual patterns, compared to the stock market, are observed for longer-term strategies with holding periods above 10 weeks (K=10 and 12). In these cases, the reversal effect is stronger for shorter sort periods than for longer sort periods. The strongest reversal is observed when cryptocurrencies are sorted by the most recent returns (1-2 weeks prior to sort) and held for 12 weeks. In general, sorting cryptocurrencies by the previous 1-2-week returns is the most 'extreme' strategy: holding this portfolio for the subsequent 1-2 weeks generates the highest momentum (up to 70% pa), whereas holding it for the subsequent 10-12 weeks generates the highest reversal (up to -1,200% pa). Such a return dynamic resembles bubble growth and its subsequent burst.

The momentum and reversal premiums are not compensations for risk. To demonstrate this, we regress each portfolio's returns on standard risk factors, which have been proposed to explain cryptocurrency returns (cryptocurrency-specific size, volatility and uncertainty factors, as well as downside and upside cryptocurrency market factors)[7], and report the risk-adjusted alphas in table 2. Short-term strategies, reported in the top-left corner, generate positive alphas, which are even higher

[6] Although this level of returns seems huge in comparison with traditional financial markets, it is in line with momentum returns documented by other authors for the cryptocurrency market (e.g. Liu et al., 2021; Tzouvanas et al., 2021).

[7] Liu et al. (2020), and Liu et al. (2021) propose a three-factor model with cryptocurrency market, size and momentum factors, while Dobrynskaya (2020) demonstrates the importance of cryptocurrency downside and upside market risks, in addition to these factors. Kim et al. (2019) propose the cryptocurrency volatility factor (VCRIX), which is similar to VIX, and Lucey et al. (2021) propose the cryptocurrency uncertainty factor (UCRY).

than their unadjusted average returns. Moving to the bottom-right corner, alphas are decreasing and become negative. Strategies with sorting and holding periods above 8 weeks yield significantly negative alphas. In general, one third of the strategies generate statistically significant alphas after controlling for the common risk factors.

Regarding risk factor exposure, 95% of downside betas are close to zero, whereas 95% of upside betas are negative and half of them are significantly negative. Hence, momentum (and reversal) strategies tend to generate losses when the cryptocurrency market returns are high.[8] One third of the strategies are also significantly negatively exposed to the cryptocurrency size factor. Less than 10% of the strategies have significant exposure to either volatility or uncertainty factors. Overall, exposure of cryptocurrency momentum and reversal strategies to common risk factors is rather low and does not explain their average returns.

WINNERS AND LOSERS, SEPARATELY

The momentum (and reversal) strategies are zero-cost winner-minus-loser strategies, and it is intriguing to know which leg (long or short or both) provides the highest return. Moreover, some cryptocurrencies may be difficult to short, and hence, these strategies may not be fully implementable in practice. Therefore, we analyze the performance of 'past winners' and 'past losers' separately as long-only portfolios.

Table 3 reports their average returns. We see that the winner portfolios yield roughly the same positive average returns irrespective of the sorting and holding horizons. The average returns of all loser portfolios are also positive in line with return reversal. However, the performance of the loser portfolios varies significantly depending on the horizon. The average returns are increasing with increasing sorting and holding periods, therefore, reversal becomes stronger over time.

Past losers, being in a short position of winner-minus-loser strategies, are the main drivers of their returns. In short-term strategies (J and K below 2-4 weeks), winners yield higher returns than losers, which results in positive momentum returns of the zero-cost strategies. In longer-term strategies, losers yield higher returns than winners, which results in negative momentum returns (i.e. reversal) of the winner-minus-loser strategies. Taking a long position in the 'past losers' generates very high returns in the long run (i.e. holding the portfolios for 2-3 months) and can be considered as an attractive, long-only strategy.

[8] Interestingly, similar performance of momentum strategies has been observed in the stock market, where momentum strategies tend to crash after significant stock market losses when the market rebounds (Daniel and Moskowitz, 2016), which is reflected by negative upside betas (Dobrynskaya, 2021).

LESS FREQUENT REBALANCING

Strategies with weekly rebalancing, considered above, document the momentum and reversal patterns well, however, they are rather complicated and costly in practice. Therefore, we also consider more practically-oriented strategies with less frequent rebalancing of portfolios and, hence, lower transaction costs. Table 4 reports the average returns on strategies with rebalancing every 2, 4, 6 and 8 weeks. These strategies demonstrate similar return patterns. There is some momentum or insignificant reversal on short horizons up to 2 weeks, turning into significant reversal if we increase sorting and holding periods. The greatest reversal is observed in the case of sorting cryptocurrencies by their previous 4-6-week returns and rebalancing the portfolios every 6 and 8 weeks. The annualized reversal returns in these cases exceed 100%.

CONCLUSION

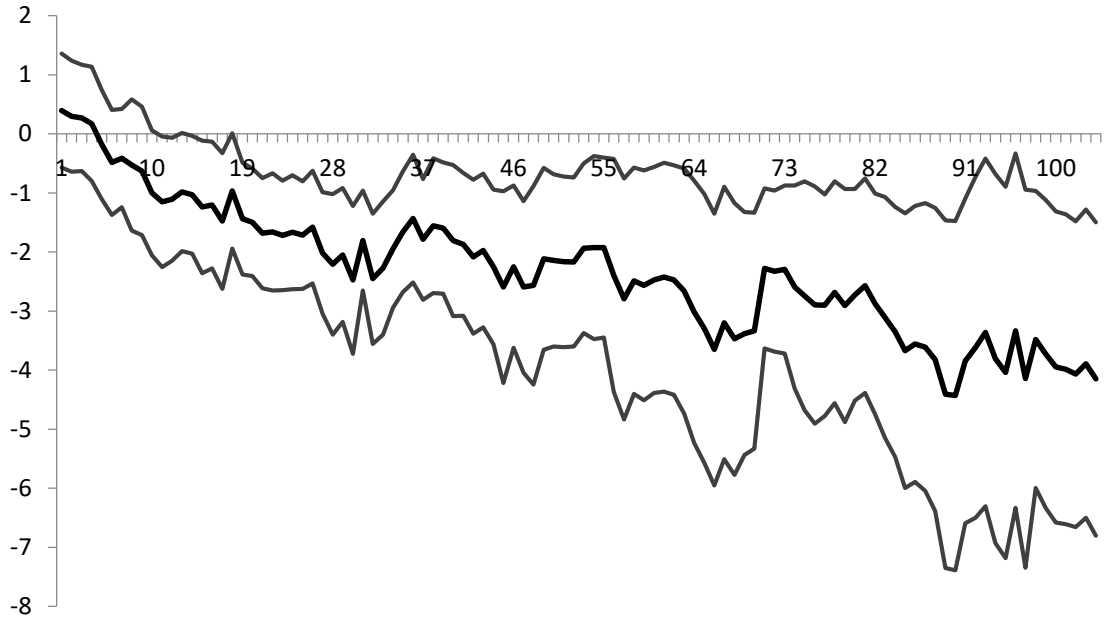
We document a significant, but rather small, momentum effect on short horizons up to 2-4 weeks, which turns into a significant and economically large reversal effect on longer horizons, up to 2 years. Momentum turns into reversal if we expand the sorting period and keep the holding period short, or if we expand the holding period and keep the sorting period short, or if we expand both periods. Particularly large reversal is observed in the case of short sorting periods and long holding periods, resulting from a high volatility of returns in the cryptocurrency market. The momentum and reversal strategies are not strongly exposed to standard cryptocurrency-specific risk factors, and the risk factors cannot explain their premiums. Finally, we find that the reversal effect is due to 'past loser' cryptocurrencies, which yield very high returns during the subsequent several months.

Our results represent general patterns of return dynamics in the cryptocurrency market and do not guarantee that the same returns would be generated by momentum and reversal strategies for any smaller sub-sample of cryptocurrencies or any shorter sub-period. Although our findings are in line with previous research for small samples of cryptocurrencies (Liu et al., 2020; Tzouvanas et al., 2021), nevertheless, an investor should be careful in designing a particular trading strategy depending on the sample of cryptocurrencies they trade.

REFERENCES

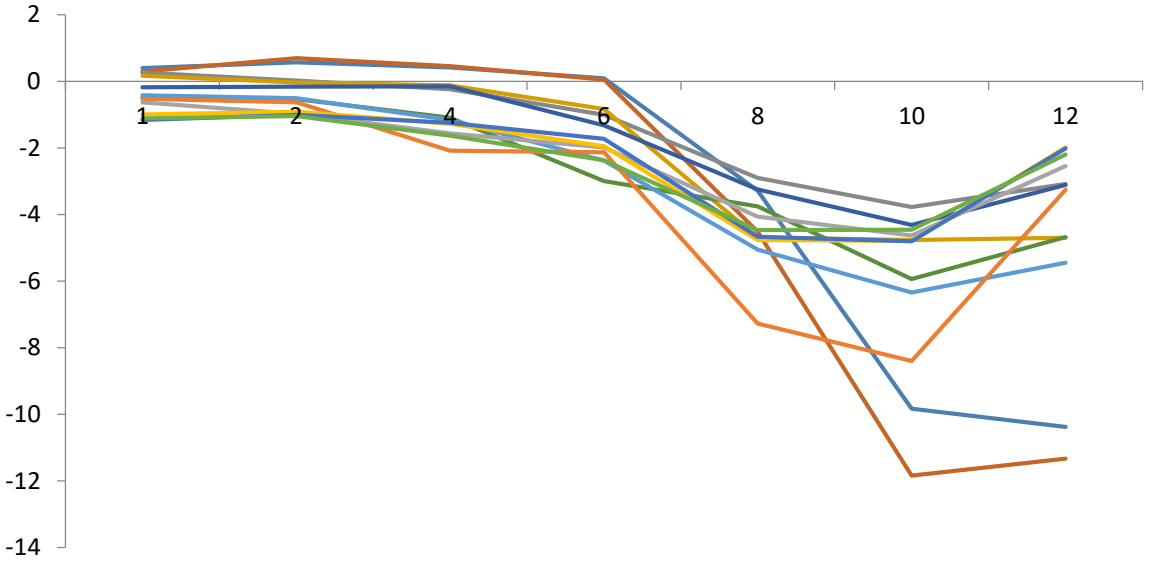
1. Asness, C.S., Moskowitz, T.J, and Pedersen L.H. (2013). Value and Momentum Everywhere. Journal of Finance 68(3): 929-985.
2. Caporale G.M., Plastun A. (2020). Momentum effects in the cryptocurrency market after one-day abnormal returns. Financial Markets and Portfolio Management 34, 251-266.
3. Daniel, K., and T.J. Moskowitz (2016). Momentum crashes. Journal of Financial Economics 122, 221-247.
4. Dobrynskaya, V. (2021). Does momentum trading generate extra downside risk? Quarterly Journal of Finance, forthcoming.
5. Dobrynskaya, V. (2020). Is downside risk priced in cryptocurrency market? Available at SSRN: https://ssrn.com/abstract=3623359.
6. Grobys K. and N. Sapkota (2019). Cryptocurrencies and momentum. Economics Letters 180, 6-10.
7. Kim A., Trimborn S., Härdle W.K. (2019). VCRIX – a volatility index for crypto-currencies. Available at SSRN: https://ssrn.com/abstract=3480348.
8. Kozlowski S.E., Puleo M.R., Zhou J. (2021). Cryptocurrency return reversals. Applied Economics Letters 28(11), 887-893.
9. Liu W., Liang X. and Cui G. (2020). Common risk factors in the returns on cryptocurrencies. Economic Modelling 86, 299-305.
10. Liu Y., Tsyvinski A. (2021). Risks and returns of cryptocurrency. Review of Financial Studies 34(6), 2589-2727.
11. Liu Y., Tsyvinski A., Wu X. (2021). Common risk factors in cryptocurrency. Journal of Finance, forthcoming.
12. Lucey B., Vigne S.A., Yarovaya L., Wang Y. (2021). The cryptocurrency uncertainty index. Finance Research Letters, forthcoming.
13. Shen D., Urquhart A., Wang P. (2020). A three-factor pricing model for cryptocurrencies. Finance Research Letters 34, 101248.
14. Tzouvanas P., Kizys R., Tsend-Ayush B. (2021). Momentum trading in cryptocurrencies: Short-term returns and diversification benefits. Economics Letters, forthcoming.

Figure 1. Returns of J/1 strategies, where J∈[1;104]



The figure plots average annualized returns (in absolute values) and 95% confidence intervals for J/1 momentum strategies, where cryptocurrencies are sorted by returns over J previous weeks and held for 1 week, weekly rebalanced. J varies from 1 to 104 weeks.

Figure 2. Returns of J/K strategies



The figure plots average annualized returns (in absolute values) of J/K momentum strategies, where cryptocurrencies are sorted by returns over J previous weeks and held for K subsequent weeks, weekly rebalanced. J and K vary from 1 to 12. Each line represents strategies with varying K for each level of J.

Table 1. Average returns on J/K strategies with weekly rebalancing

J\K	1	2	4	6	8	10	12
1	0.40	0.57	0.42	0.10	-3.29	-9.83	-10.38
	[0.80]	[2.14]	[2.80]	[0.64]	[-4.10]	[-4.16]	[-4.25]
	(0.76)	(1.61)	(1.62)	(0.35)	(-2.08)	(-2.05)	(-2.08)
2	0.30	0.70	0.45	0.06	-4.51	-11.84	-11.33
	[0.62]	[2.46]	[1.63]	[0.25]	[-4.45]	[-4.66]	[-4.58]
	(0.73)	(1.98)	(0.89)	(0.13)	(-2.23)	(-2.28)	(-2.20)
4	0.17	-0.03	-0.12	-0.83	-4.68	-4.76	-4.70
	[0.35]	[-0.11]	[-0.34]	[-2.05]	[-5.16]	[-5.24]	[-7.80]
	(0.34)	(-0.08)	(-0.18)	(-1.02)	(-2.56)	(-2.49)	(-3.67)
6	-0.48	-0.53	-1.09	-2.99	-3.75	-5.94	-4.67
	[-1.07]	[-1.49]	[-3.07]	[-5.00]	[-4.89]	[-5.23]	[-7.38]
	(-0.98)	(-1.05)	(-1.62)	(-2.54)	(-2.40)	(-2.46)	(-3.47)
8	-0.53	-0.63	-2.08	-2.13	-7.28	-8.40	-3.26
	[-0.93]	[-1.42]	[-4.03]	[-5.07]	[-4.11]	[-4.60]	[-8.15]
	(-0.93)	(-0.98)	(-2.17)	(-2.49)	(-2.03)	(-2.20)	(-3.81)
10	-1.00	-0.91	-1.27	-1.94	-4.77	-4.80	-1.98
	[-1.85]	[-2.28]	[-3.17]	[-5.01]	[-4.69]	[-5.43]	[-9.98]
	(-1.66)	(-1.48)	(-1.99)	(-2.45)	(-2.31)	(-2.63)	(-4.69)
12	-1.11	-1.04	-1.63	-2.37	-4.47	-4.46	-2.19
	[-2.09]	[-2.60]	[-4.38]	[-5.06]	[-4.98]	[-5.78]	[-8.04]
	(-1.93)	(-1.80)	(-2.33)	(-2.46)	(-2.43)	(-2.77)	(-3.67)

The table reports average annualized returns (in absolute values) of J/K momentum strategies, where cryptocurrencies are sorted by returns over J previous weeks and held for K subsequent weeks, weekly rebalanced. J and K vary from 1 to 12. Regular t-statistics are reported in brackets, and robust t-statistics, with Newey-West adjustment, with 4 lags, are reported in parentheses. The dark-grey areas represent significant momentum, the light-grey areas represent insignificant momentum or insignificant reversal, and the white areas represent significant reversal. Sample period: 2014-2020.

Table 2. Risk-adjusted alphas of J/K strategies with weekly rebalancing

J\K	1	2	4	6	8	10	12
1	3.29	1.41	0.67	-0.13	-4.20	-7.33	0.12
	[2.71]	[2.10]	[1.76]	[-0.35]	[-2.01]	[-1.19]	[0.02]
2	1.34	0.56	1.10	0.65	-4.13	-8.69	-0.92
	[1.17]	[0.77]	[1.49]	[1.14]	[-1.61]	[-1.32]	[-0.15]
4	0.11	0.55	0.39	1.69	-3.93	-5.94	-4.61
	[0.11]	[0.70]	[0.45]	[1.72]	[-1.68]	[-2.48]	[-2.97]
6	2.05	1.23	0.06	-0.43	-3.24	-8.79	-5.49
	[1.70]	[1.33]	[0.06]	[-0.27]	[-1.62]	[-2.94]	[-3.33]
8	2.02	0.86	1.01	0.85	-11.35	-13.93	-2.69
	[1.40]	[0.77]	[0.76]	[0.80]	[-2.42]	[-2.89]	[-2.67]
10	1.69	1.76	1.01	1.29	-5.82	-6.45	-0.76
	[1.25]	[1.74]	[0.96]	[1.33]	[-2.19]	[-2.78]	[-1.60]
12	2.53	1.91	-0.19	1.12	-4.88	-5.72	-0.97
	[1.92]	[1.84]	[-0.20]	[0.98]	[-2.12]	[-2.87]	[-1.48]

The table reports annualized alphas of J/K momentum strategies from a five-factor asset-pricing model with cryptocurrency-specific upside and downside risk, size, volatility and uncertainty factors. T-statistics are reported in brackets. The dark-grey areas represent significantly positive alphas, the light-grey areas represent insignificant alphas, and the white areas represent significantly negative alphas. Sample period: 2014-2020.

Table 3. Returns on past winner and past loser portfolios

Past winners							
J\K	1	2	4	6	8	10	12
1	2.28	2.14	2.17	2.15	2.26	2.63	3.37
2	2.12	2.16	2.64	2.50	2.43	2.46	2.38
4	2.14	2.04	2.76	2.61	2.51	2.33	2.02
6	1.75	1.95	2.06	2.13	2.06	1.74	1.74
8	2.09	2.09	2.13	2.12	1.79	1.75	2.04
10	2.00	1.91	2.08	1.81	1.65	1.83	2.12
12	1.59	1.57	1.59	1.54	1.71	1.73	1.91
Past losers							
J\K	1	2	4	6	8	10	12
1	1.89	1.57	1.75	2.06	5.54	12.46	13.75
2	1.82	1.46	2.18	2.45	6.94	14.30	13.71
4	1.97	2.07	2.88	3.44	7.20	7.09	6.71
6	2.23	2.48	3.16	5.12	5.81	7.68	6.41
8	2.62	2.72	4.21	4.26	9.07	10.15	5.29
10	3.00	2.82	3.35	3.75	6.41	6.63	4.10
12	2.69	2.61	3.22	3.91	6.17	6.19	4.10

The table reports average annualized returns (in absolute values) of J/K past winner and past loser strategies, separately, where cryptocurrencies are sorted by returns over J previous weeks and held for K subsequent weeks, weekly rebalanced. J and K vary from 1 to 12. All returns are highly significant, t-statistics are not reported. Sample period: 2014-2020.

Table 4. Average returns on J/K strategies with less frequent rebalancing

K\J	1	2	4	6	8	10	12
Rebalancing every 2 weeks	-0.24	0.75	-0.15	-0.63	-0.64	-0.80	-1.00
	[-0.54]	[1.57]	[-0.26]	[-1.39]	[-1.09]	[-1.53]	[-1.80]
	(-0.69)	(1.48)	(-0.40)	(-1.32)	(-1.09)	(-1.41)	(-1.65)
Rebalancing every 4 weeks	-0.30	0.51	-0.08	-0.64	-1.21	-1.08	-1.95
	[-0.56]	[1.22]	[-0.16]	[-1.27]	[-1.97]	[-1.17]	[-3.41]
	(-0.72)	(1.44)	(-0.33)	(-1.32)	(-1.72)	(-1.04)	(-3.13)
Rebalancing every 6 weeks	-0.14	-0.25	-0.06	-1.56	-1.05	-1.32	-1.70
	[-0.26]	[-0.51]	[-0.12]	[-2.63]	[-1.91]	[-1.40]	[-2.77]
	(-0.37)	(-0.65)	(-0.04)	(-2.37)	(-1.76)	(-1.24)	(-2.5)
Rebalancing every 8 weeks	-0.29	-0.56	-1.27	-0.89	-1.15	-1.60	-2.16
	[-0.65]	[-1.27]	[-2.52]	[-1.88]	[-2.38]	[-1.74]	[-3.94]
	(-0.78)	(-1.34)	(-2.57)	(-1.67)	(-2.34)	(-1.56)	(-3.66)

The table reports average annualized returns (in absolute values) of J/K momentum strategies, where cryptocurrencies are sorted by returns over J previous weeks, held for K subsequent weeks and rebalanced every K weeks. Regular t-statistics are reported in brackets, and robust t-statistics, with Newey-West adjustment, with 4 lags, are reported in parentheses. Sample period: 2014-2020.