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On the linkage of momentum and reversal – evidence from the G7 stock markets

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Abstract

This paper studies the linkage of momentum and reversal in the G7 stock markets. We confirm Conrad and Yavuz's (Rev Financ 21(2):555–581, 2017) finding that momentum is not linked to subsequent return reversal in the US stock market. In the stock markets of the remaining G7 countries, our results object the decoupling of momentum and return reversal. In these stock markets, the two return anomalies are linked to each other. In particular, momentum is followed by return reversal in the stock markets of Germany, the UK, Japan, Canada, France, and Italy. These observations obtain for momentum portfolios which are made up of different risk profiles with respect to size and book-to-market ratio. Our results hold true both in raw returns and in risk-adjusted returns.

Keywords Momentum · Return reversal · Linkage · International stock markets

JEL Classification $G11 \cdot G15 \cdot G40$

1 Introduction

The seminal papers by Jegadeesh and Titman (1993) and De Bondt and Thaler (1985) started research agendas in empirical finance on momentum and reversal, that is two return anomalies which are seemingly at odds with Fama's (1970) efficient market

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¹ European University Viadrina, Faculty of Business Administration and Economics, Große Scharrnstr. 59, D–15230 Frankfurt (Oder), Germany hypothesis in the weak form.¹ However, Fama (1998) advocates the efficient market hypothesis in the light of conflicting empirical evidence on underreaction and overreaction of securities prices implying short-term momentum and long-run reversal in returns, respectively.

Behavioral theories which provide integrated explanations of momentum and return reversal are suggested by Daniel et al. (1998), Barberis et al. (1998), and Hong and Stein (1999). These behavioral theories are substantiated in psychological traits of investors as there are overconfidence and biased self-attribution, conservatism and representativeness as well as bounded rationality with limited cognitive abilities in information processing. Recently, Luo et al. (2021) propose a theory which incorporates both momentum and reversal based on investors' overconfidence and skepticism with respect to the quality of other investors' signals. In a rational expectations model, Andrei and Cujean (2017) show that information percolation – that is a flow of private information at increasing rate – through word-of-mouth communication as mechanism also leads to the integration of momentum and return reversal.

Conrad and Yavuz (2017) report evidence for the US stock market that momentum and return reversal are separate phenomena. Put differently, they document that momentum is not followed by return reversal in the US stock market.² Ultimately and on grounds of their single-country evidence, Conrad and Yavuz (2017) cast doubts on whether behavioral theories linking both phenomena are appropriate and suggest to revisit them. In this paper, we add to this academic debate by extending Conrad and Yavuz's (2017) analysis to the G7 countries.

More precisely, we study the *linkage* of momentum and reversal from an international multi-country perspective.³ Thus, we pick up on Karolyi's (2016) insight that there are more lessons to be learned from international stock markets beyond the US stock market. By opting for the G7 stock markets, we circumvent what Karolyi (2016) terms the home bias in academic research.⁴ Karolyi (2016, p. 2076) points out that there is "great potential in exploring important ideas that lie at the core of our discipline with new data in new settings." Finally, our multi-country evidence stimulates the controversy on the integration of momentum and reversal and, thus, the validity of the behavioral approaches to asset pricing mentioned above.

Also inspired by Conrad and Yavuz's (2017) findings, Walkshäusl et al. (2019) study investment strategies which draw on momentum and reversal in an international sample of 20 non-US stock markets comprising the G7 countries except for the USA, naturally, and Canada. In their analysis, all stocks are pooled when stocks are assigned

¹ On the one hand, momentum is reported by Rouwenhorst (1998) and Leippold and Lohre (2012) in European stock markets, by Griffin et al. (2003) in international stock markets, and by Asness et al. (2013) across different asset classes. On the other hand, return reversals had been documented by Jegadeesh (1990), De Bondt and Thaler (1987), and Balvers et al. (2000).

 $^{^2}$ Intriguingly, Luo et al. (2021) discuss how momentum prevails but reversal disappears in their model. Thus, their model might serve as an ex-post rationalization of Conrad and Yavuz's (2017) results.

³ Baytas and Cakici (1999) also study the G7 stock markets but only focus on return reversals. That is they solely test for the overreaction hypothesis. They do not address the issue of *linkage* of momentum and reversal. Furthermore, their sample ends in the year 1991 when our sample starts.

⁴ Karolyi (2016) reports that more than 75% of total top-tier empirical research in Finance is based on US stock market data.

to either leg upon forming long-short portfolios. Hence, it is impossible to attribute empirical evidence to a specific country. Additionally, the pooled results remain opaque whether they are driven only by the stocks of some countries. Therefore, the reported findings are limited when one is interested in country-wise insights.

Momentum and subsequent return reversal is studied by Blackburn and Cakici (2017) in a sample of 23 countries comprising the G7 countries, too. However, the stock market data of their sample countries are pooled in four subsets representing the regions North-America, Europe, Asia, and Japan as a singleton.⁵ Except for Japan, the pooling of stock market data in their study also does not allow for gaining country-wise insights or attributing evidence to a specific country. In contrast, Auer (2019) presents country-wise evidence for momentum in a sample of 21 countries including the G7 countries.

Besides preventing country-wise attribution of empirical evidence, pooling of international stock market data raises another issue. Ensuring that reported findings on momentum and reversal are not driven by exposure to fundamental risk requires riskadjustment. With pooled data from multiple stock markets, fundamental risk factors cannot be interpreted cleanly. More precisely, a country-wise interpretation of riskadjusted performance is impossible as it might happen that the fundamental risk factors constructed from a pool of countries do not measure the risk of some pool country under consideration if the fundamental risk factors for the pool are dominated by stocks of some country in the pool other than the one considered.

Reporting unambiguous results with respect to both the attribution of empirical evidence to a country and the risk-adjustment of momentum and reversal to country-specific fundamental risk requires a country-wise study. In these respects, the design of our empirical study differs from the pooling design underlying both Blackburn and Cakici (2017) and Walkshäusl et al. (2019). In essence, we conduct an international country-wise analysis and, thus, expand Conrad and Yavuz's (2017) analysis for the US stock market by a clean multi-country perspective.

We contribute with our analysis to the literature in various aspects. First, we apply Conrad and Yavuz's (2017) research design used in the analysis of the US stock market to the stock markets of the G7 countries and, thus, add an international dimension to their study. Second, we conduct a clean country-wise study which allows for drawing country-specific conclusions on the linkage of momentum and reversal. As discussed before, the country-specific attribution of evidence is a strength compared to the studies by Walkshäusl et al. (2019) and Blackburn and Cakici (2017). Third, we can judge cleanly whether or not evidence from the US stock market translates into other stock markets and, thus, pick up Karolyi's (2016) impulse to generate insights beyond the US stock market. Fourth, our study adds further evidence to the academic debate on the appropriateness of theoretical models which integrate both momentum and reversal. Hence, we are able to substantiate or to invalidate Conrad and Yavuz's (2017) claim.

⁵ The region North-America comprises the USA and Canada. Blackburn and Cakici (2017) report momentum and subsequent reversal in this region. Hence, one might conclude on grounds of their result that the linkage of momentum and reversal is present in the US stock market. This contradicts Conrad and Yavuz's (2017) finding on the decoupling of momentum and reversal in the US stock market. Thus, the Canadian stock market data might supersede the absence of this linkage in the US data.

Our findings for the G7 countries are as follows. First, unconditional momentum portfolios in the stock markets of the USA and Japan only exhibit reversal but not momentum. This sets the USA and Japan apart from the remaining G7 countries. In Germany, the UK, Canada, France, and Italy short-run momentum is followed by reversal. Second, the findings on unconditional momentum portfolios can be rationalized from studying conditional reversal at the level of individual stocks. We document the largest portions of winner stocks with realized momentum which exhibit return reversal in the USA and Japan. Furthermore, we are able to put the reversal in unconditional momentum portfolios driven by the loser leg in line with the reversal of loser stocks with realized momentum. Third, we report that conditional momentum portfolios – that is momentum portfolios formed of realized momentum stocks – unveil a linkage of short-run momentum and long-term reversal in both raw returns and riskadjusted returns across all G7 stock markets. Conditional momentum portfolios of contrarian stocks do not exhibit return continuation but reversal in all G7 countries. These results prove robust with respect to different portfolio formation procedures. Fourth, we confirm Conrad and Yavuz's (2017) finding for the US stock market on the separation of momentum and reversal in momentum portfolios which originate from different risk profiles of stocks. But, we report adverse evidence for these momentum portfolios from the remaining G7 countries. In the G7 stock markets except for the US stock market, those momentum portfolios realize short-term momentum and experience long-run reversal. Hence, both phenomena are reported to be linked in Germany, the UK, Japan, Canada, France, and Italy.

We conclude that the finding from the US stock market on the separation of momentum and reversal does not translate into the remaining G7 stock markets. Furthermore, our results weaken Conrad and Yavuz's (2017) strong stance as regards the need to revisit behavioral theories which embed the linkage of short-run momentum and longterm reversal on grounds of psychological traits in human decision making. In general, our clean country-wise multi-country study allows for insights beyond what is reported by Conrad and Yavuz (2017).

The remainder of this paper proceeds as follows. Section 2 describes the data and outlines the core methodological aspects of our multi-country study. The four-step empirical analysis on the linkage of momentum and reversal in the G7 stock markets along Conrad and Yavuz (2017) is presented in section 3. Section 4 summarizes the four-step analysis and concludes.

2 Data and methodology

In this section, we outline both the data and the methodological framework underlying our empirical analysis. Naturally, the execution of a multi-country study for the G7 stock markets is by far more elaborate regarding the data requirements than a single-country study as did Conrad and Yavuz (2017). The G7 countries comprise the USA, Germany, the United Kingdom (UK), Japan, Canada, France, and Italy. According to data reported by statista.com, the market capitalization of the G7 stock markets amounts to 75% of the world market capitalization.

We rely on the following data in our empirical study. Our sample comprises monthly stock returns of the G7 stock markets and spreads the period from July 1991 to December 2017.⁶ The stock return data is collected from Thomson Reuters Datastream (TDS). US stock markets data is obtained from the Center of Research in Security Prices (CRSP).

Fundamental risk factors as well as the risk free rate of return for the G7 stock markets throughout the period from July 1991 to December 2017 are provided by Schmidt et al. (2019) at monthly frequency.

Monthly stock-specific data on market capitalization and book-to-market ratio is collected from Thomson Reuters Datastream (TDS) and the Center of Research in Security Prices (CRSP) for the case of US data.

Stock return data is screened and filtered as follows. We remove stocks whose prices had been stale during three months prior to portfolio formation date. By doing so, we guarantee that either illiquid stocks do not affect our results or delisted stocks are kept in the database erroneously. By applying this filter dynamically at each portfolio formation date, we prevent using forward-looking information in our analysis and, thus, ensure our results being not subject to the survivorship bias. Put differently, our adjustments only rely on information available at portfolio formation date. Therefore, our data filtering is conservative. Descriptive statistics of the filtered data are summarized in Table 1 and visualized in Figs. 1 and 2. Average monthly returns are very similar amongst the G7 countries in terms of 25th percentile, median and 75th percentile. The average monthly stock counts for the G7 countries show a high dispersion.

We construct momentum portfolios by either using the methodology introduced by Lo and MacKinlay (1990) or implementing a quintile as well as tertile approach in addition to Jegadeesh and Titman's (1993) decile approach. Lo and MacKinlay (1990) categorize stocks as winners (losers) if their past performance exceeds (falls short of) the respective average past performance of all stocks. The portfolio weight of a stock is determined by the difference between its past performance and the average past performance of all stocks. Hence, the zero cost long-short portfolio contains all stocks available. Alternatively, the quintile [tertile|decile] approach groups all stocks in five [threelten] equally weighted portfolios with equal stock count after ranking stocks based on their past performance. The zero cost long-short portfolio consists of 40% [66.67%|20%] of all stocks available at portfolio formation date and is referred to as quintile [tertileldecile] spread portfolio. Generally, past performance is assessed by a stock's return throughout the last six months prior to portfolio formation. Following Grundy and Martin (2001), one month between portfolio formation date and the holding period is skipped in order to avoid microstructure issues when calculating returns of the momentum portfolios.

Besides raw return performance, we report risk-adjusted performance. When we report risk-adjusted returns, these are Fama and French (1993) three factor alphas obtained from linear time-series regressions of momentum portfolio returns in excess of the risk free rate of return on the country-specific fundamental risk factors provided by Schmidt et al. (2019). Thus, we ensure that our results are corrected for exposure to

⁶ We opt for this time horizon as the fundamental risk factors for the G7 stock markets used in this study are supplied for this period.

Panel A				Returns			
	Min	25	Median	Mean	75	Max	SD
USA	-89.57	-5.71	0.10	0.01	5.86	209.00	14.35
Germany	-70.53	-6.09	-0.46	-0.44	5.05	105.66	14.52
UK	-84.26	-6.61	-0.51	-0.51	5.59	109.32	14.62
Japan	-62.85	-5.49	-0.58	-0.18	4.54	86.68	10.09
Canada	-80.39	-7.03	-0.20	0.16	6.66	120.13	16.58
France	-67.27	-5.25	-0.13	0.07	5.18	95.18	13.19
Italy	-41.41	-5.34	-0.53	-0.21	4.45	54.41	10.02
Panel B				Stocks			
	Min	25	Median	Mean	75	Max	SD
USA	2221	3829	4158	4012	4431	4954	635
Germany	336	404	614	592	735	842	162
UK	991	1111	1320	1298	1454	1619	193
Japan	1933	2370	2658	2550	2769	2919	276
Canada	583	826	953	924	1018	1176	140
France	379	431	473	481	530	596	62
Italy	271	286	294	297	307	334	15

 Table 1
 Descriptive Statistics

This table presents descriptive statistics for the G7 countries. The statistics are computed for each country as time series averages of the monthly cross-sectional statistics over the sample period July 1991–December 2017. Panel A reports the minimum, 25th percentile, median, mean, 75th percentile, maximum and standard deviation of the monthly returns in percent. Panel B reports the minimum, 25th percentile, median, mean, 75th percentile, median, mean, 75th percentile, maximum and standard deviation of the monthly stock counts

fundamental risk in the specific stock market. Consequently, risk-adjusted performance is not confounded by sensitivity to outside fundamental risk factors irrelevant to a stock. Upon constructing momentum portfolios using different risk profiles on grounds of market capitalization and book-to-market ratio, we calculate proper book-to-market ratios following Fama and French (1992) in order to avoid the look-ahead bias in accounting data.

3 Linkage of momentum and reversal in the G7 stock markets

The design of our empirical study follows Conrad and Yavuz (2017). We address the core research question as regards the linkage of momentum and reversal in a fourstep country-wise empirical analysis of the G7 stock markets. Briefly, these four steps are as follows. First, unconditional momentum portfolios in the spirit of Jegadeesh and Titman (1993) are analyzed up to five years after portfolio formation. Second, conditional reversal is studied at the level of individual stocks throughout a holding period of up to three years. Using short-term performance throughout the next six months upon classifying a stock as a realized momentum stock or contrarian stock distinguishes the conditional view from the usual unconditional perspective. Third, the performance of conditional momentum portfolios is analyzed for up to five years.



Fig. 1 Average Monthly Returns of G7 Countries. The boxplots illustrate the descriptive statistics of average monthly returns in percent per country as provided in Table 1 Panel A. Whiskers illustrate minimum and maximum returns. Boxes display the 25th percentile, median and the 75th percentile

That is the classification of stocks as realized momentum stock or contrarian stock is exploited upon forming momentum portfolios. Fourth, the question of whether risk characteristics of stocks unveil the linkage of momentum and reversal is studied along the performance of unconditional momentum portfolios formed of stocks from different risk profiles throughout a time horizon of up to three years.

3.1 Unconditional momentum portfolios

In the first step of our multi-country analysis, we study unconditional momentum portfolios in each stock market of the G7 countries separately. The term *unconditional* reminds of the fact that no additional information is used in portfolio formation other than past return performance of each stock. On a monthly basis, we construct the winner portfolio, the loser portfolio, and the relative strength portfolio with a long leg



Fig. 2 Average Monthly Stocks of G7 Countries. The boxplots illustrate the descriptive statistics of average monthly stock counts per country as provided in Table 1 Panel B. Whiskers illustrate minimum and maximum returns. Boxes display the 25th percentile, median and the 75th percentile

carrying past winner stocks and a short leg consisting of past loser stocks. Thus, the relative strength portfolio is a zero-investment portfolio. The two legs are determined using the Lo and MacKinlay (1990) methodology. Foregoing microstructure issues, we skip one month between portfolio formation and the subsequent holding periods.

Table 2 displays average monthly raw returns and Table 3 exhibits monthly riskadjusted returns of unconditional momentum portfolios. Risk-adjusted returns are the intercepts of time-series regressions of monthly portfolio returns in excess of the risk free rate on Fama and French (1993) three factors of the respective G7 stock market.

In Table 2, we find both economically and highly statistically significant reversal but no momentum for the zero-investment portfolio (W–L) in the US stock market. Although we document momentum in the winner leg (W), this reversal is driven by the short loser leg (L) which does not continue to lose. This reversal pattern is most pronounced throughout the first year (0–6, 6–12) with -1.67% and -1.77% and is

Country		0-6		6-12	2	12-24		24-36		36-48		48-60	
`		months		months		months		months		months		months	
USA	M	1.07	(6.38)	0.78	(4.66)	0.63	(5.68)	0.66	(6.23)	0.88	(8.37)	09.0	(5.41)
	L	2.74	(10.52)	2.55	(9.61)	1.96	(10.58)	1.40	(9.61)	1.18	(9.23)	1.11	(8.53)
	W-L	-1.67	(-7.69)	-1.77	(-8.22)	-1.33	(-8.71)	-0.74	(-7.15)	-0.30	(-3.72)	-0.51	(-5.44)
Germany	M	1.00	(6.57)	0.64	(4.35)	0.37	(3.70)	0.36	(3.83)	0.79	(8.94)	0.61	(6.38)
	L	-0.70	(-3.64)	-0.19	(-1.21)	0.43	(4.37)	0.65	(7.54)	0.62	(7.48)	0.64	(8.21)
	W-L	1.70	(9.83)	0.82	(5.84)	-0.06	(-0.70)	-0.29	(-3.72)	0.17	(2.39)	-0.03	(-0.38)
UK	M	1.03	(7.05)	0.74	(5.12)	0.47	(4.78)	0.47	(4.94)	0.73	(7.61)	0.68	(7.10)
	Г	-0.07	(-0.40)	0.41	(2.64)	0.75	(7.44)	0.72	(7.47)	0.65	(7.16)	0.71	(8.11)
	W-L	1.11	(7.77)	0.33	(3.08)	-0.28	(-4.34)	-0.26	(-4.37)	0.07	(1.25)	-0.02	(-0.39)
Japan	M	0.36	(2.08)	0.43	(2.58)	0.16	(1.46)	0.25	(2.30)	0.32	(3.03)	0.36	(3.40)
	Г	0.47	(2.28)	0.71	(3.61)	0.70	(5.28)	0.48	(3.94)	0.50	(4.24)	0.50	(4.48)
	W-L	-0.11	(-0.88)	-0.27	(-2.47)	-0.54	(-8.40)	-0.23	(-4.11)	-0.18	(-3.21)	-0.14	(-2.59)
Canada	M	1.63	(9.32)	1.03	(5.88)	0.61	(5.27)	0.57	(4.95)	0.82	(7.51)	0.74	(6.57)
	L	0.24	(1.32)	0.77	(4.49)	1.05	(6.65)	0.73	(6.72)	0.81	(7.41)	0.76	(7.43)
	W-L	1.39	(8.98)	0.25	(1.85)	-0.44	(-5.32)	-0.16	(-1.85)	0.02	(0.20)	-0.02	(-0.28)
France	M	1.02	(7.10)	0.68	(4.87)	0.52	(5.02)	0.54	(5.01)	0.87	(8.27)	0.67	(6.84)
	L	0.14	(0.81)	0.40	(2.66)	0.71	(7.12)	0.65	(7.04)	0.60	(6.27)	0.99	(10.98)
	W-L	0.88	(6.21)	0.27	(2.33)	-0.19	(-2.37)	-0.11	(-1.41)	0.27	(3.49)	-0.32	(-4.81)
Italy	M	0.88	(5.01)	0.83	(4.64)	0.43	(3.62)	0.47	(3.94)	0.67	(5.36)	0.75	(09.9)
	L	0.26	(0.96)	1.01	(3.25)	0.97	(6.97)	0.86	(6.55)	0.44	(2.95)	0.52	(3.42)
	M-L	0.62	(2.79)	-0.19	(-0.68)	-0.54	(-6.45)	-0.39	(-5.27)	0.23	(2.15)	0.23	(2.36)
Values are av	/erage mon	thly raw retu	irns of portfoli	ios in semi-a	nnual holding	(periods (0-	6, 6–12 mont	hs) or annua	1 holding peri	ods (12–24,	, 24–36, 36–48	8, 48–60 mo	nths) after
portfolio for	mation in F	bercent. The	winner portfo	lio (W) and	the loser port	folio (L) are	formed using	the Lo and	MacKinlay (1990) methc	odology. By w	vinner-loser	(W-L) we
denote the re	elative strei	ngth portfolic	o which is a z	ero-investma	ent portfolio v	vith past wir	nner stocks lo	ng and past	loser stocks s	hort. The s	ample spreads	-1991 ylul :	December
2017 and po	rtfolios are	e formed at r	monthly frequ	iency. Accou	unting for mic	prostructure	effects, we s.	kip one mor	nth between p	portfolio for	mation and th	ne subseque	nt holding

periods. Figures in bold-face are statistically significant at the 10% level (t-stat > 1.65). T-statistics are in parenthesis

lable 3 KIS	k-Adjusted	Keturns of L	nconditiona	I Momentum	Portiolios								
Country		00		6-12		12–24		24–36		36-48		48–60	
		months		months		months		months		months		months	
USA	M	0.67	(2.51)	0.41	(1.52)	0.25	(2.07)	0.33	(2.71)	0.55	(4.30)	0.30	(2.30)
	Γ	2.14	(5.61)	2.01	(5.64)	1.60	(6.46)	1.05	(5.55)	0.87	(6.78)	0.79	(5.86)
	W-L	-1.71	(-6.02)	-1.84	(-7.68)	-1.58	(66.7-)	-0.94	(66.9-)	-0.52	(-6.05)	-0.67	(-6.89)
Germany	Μ	0.54	(3.77)	0.16	(1.26)	-0.15	(-2.19)	-0.16	(-2.44)	0.21	(3.16)	-0.06	(-0.77)
	Г	-1.13	(-9.15)	-0.94	(-6.57)	-0.27	(-4.88)	0.01	(0.13)	-0.02	(-0.42)	-0.01	(-0.18)
	M-L	1.40	(6.25)	0.85	(3.69)	-0.11	(-1.01)	-0.37	(-4.11)	0.05	(0.68)	-0.21	(-2.36)
UK	M	0.35	(2.75)	-0.03	(-0.28)	-0.21	(-4.11)	-0.20	(-5.14)	0.09	(1.82)	0.05	(1.09)
	L	-1.10	(-7.87)	-0.65	(-6.33)	-0.12	(-1.99)	-0.01	(-0.25)	-0.07	(-1.42)	0.02	(0.36)
	M-L	1.09	(4.94)	0.28	(1.48)	-0.42	(-5.06)	-0.49	(66.9-)	-0.13	(-1.71)	-0.23	(-3.21)
Japan	M	0.13	(1.23)	0.10	(1.28)	-0.06	(-1.76)	0.00	(90.0-)	0.01	(0.12)	-0.01	(-0.19)
	Г	0.35	(2.21)	0.42	(3.62)	0.33	(7.03)	0.08	(1.85)	0.05	(1.00)	0.09	(1.65)
	M-L	-0.27	(-1.16)	-0.37	(-2.26)	-0.42	(-6.61)	-0.11	(-1.75)	-0.06	(-0.79)	-0.11	(-1.43)
Canada	W	0.52	(3.52)	-0.13	(-1.08)	-0.50	(66.7-)	-0.46	(-6.54)	-0.24	(-4.20)	-0.31	(-5.39)
	Γ	-0.98	(-5.56)	-0.52	(-3.77)	-0.10	(-1.55)	-0.31	(-4.69)	-0.24	(-3.48)	-0.18	(-2.75)
	W-L	1.22	(4.73)	0.11	(0.54)	-0.66	(-6.77)	-0.40	(-3.59)	-0.23	(-2.31)	-0.34	(-3.48)
France	M	0.23	(2.27)	-0.19	(-1.91)	-0.36	(-7.93)	-0.36	(-6.00)	-0.07	(-1.28)	-0.27	(-4.14)
	L	-0.85	(-6.44)	-0.65	(-5.12)	-0.31	(-6.30)	-0.28	(-5.66)	-0.40	(-8.43)	0.04	(0.91)
	M-L	0.79	(4.30)	0.19	(1.10)	-0.28	(-4.09)	-0.30	(-3.40)	0.15	(1.92)	-0.47	(-5.85)
Italy	M	0.25	(2.27)	0.04	(0.37)	-0.33	(-6.26)	-0.23	(-4.27)	-0.06	(70.0-)	-0.03	(-0.56)
	Г	-0.43	(-1.30)	0.22	(0.47)	0.14	(1.55)	0.14	(2.01)	-0.26	(-2.23)	-0.39	(-3.93)
	M-L	0.31	(0.85)	-0.53	(-1.06)	-0.78	(-8.00)	-0.64	(-8.49)	-0.03	(-0.26)	0.16	(1.36)
Values are a	iverage mor	thly risk-adj	justed returns	of portfolio	s in semi-ann	ual holding	periods (0–6	, 6–12 mont	hs) or annual	holding per	iods (12–24,	24-36, 36-	48, 48–60
montns) atte and French (r portiolio 1 (1993) three	ormation in J factors. The	percent. Kisk- s winner portfi	-adjusted rett olio (W) and	the loser port	tercepts of tu ffolio (L.) are	me-series reg formed usin	ressions of n g the L o and	nontnly portro MacKinlav (lio returns II 1990) methc	n excess of the dology. By w	i risk free rat inner-loser	e on Fama [W-L.) we
denote the re	elative stren	gth portfolic) which is a z	ero-investme	ant portfolio w	vith past wir	mer stocks lc	ong and past	loser stocks s	hort. The sa	mple spreads	July 1991–1	December
2017 and pc	ortfolios are	formed at n	nonthly frequ	lency. Accou	inting for mic	crostructure	effects, we s	kip one mor	nth between p	ortfolio for	nation and th	e subseque	nt holding
periods. The the 10% leve	e t-statistics el (t-stat > 1	are calculate	ed with Newe	sy-West robu	st standard en	rors with 12	lags and sho	wn in parent	heses. Figure:	s in bold-fac	e indicate sta	tistical signi	ficance at
	· · · · · · · · · · ·	(20.											

driven by the short loser leg which generates positive average raw return of 2.74% and 2.55% in the respective periods but continues for five years. In the US stock market, the winner-loser portfolio does not show initial momentum in the short run but only reversal throughout a horizon of up to five years after portfolio formation.

Table 3 shows quite similar results for the US in terms of risk-adjusted returns. The Fama and French (1993) three factor alphas follow the same pattern as the average raw returns. For the winner-loser portfolio (W–L), we observe a reversal of alpha performance throughout five years. Again, this reversal stems from the loser leg which generates higher alphas in magnitude than does the winner leg.

Among the remaining G7 countries, only Japan features results for the zeroinvestment portfolio (W–L) which compare favorable with those of the USA. Although lower in magnitude and with slightly smaller statistical significance, both average raw returns and Fama and French (1993) three factor alphas of the relative strength portfolio (W–L) document reversal throughout the whole time horizon. Again the reversal in the Japanese stock market is driven by the short loser leg (L), predominantly.⁷

For the remainder of the G7 stock markets, we report contrasting evidence. As can be seen from Table 2, the winner-loser portfolio (W–L) exhibits momentum at least throughout the first six months (0–6) after portfolio formation. For Germany, the UK, Canada, and France, this momentum in average raw returns continues for another half year (6–12). Table 3 confirms the initial momentum (0–6) even in risk-adjusted performance measured by Fama and French (1993) three factor alphas. Most importantly, the momentum of the relative strength portfolio (W–L) in both raw returns and risk-adjusted returns turns into a reversal in the years two (12–24) and three (24–36) after portfolio formation.

Finally, studying unconditional momentum portfolios delivers the insight that both the US stock market and the Japanese stock market exhibit only reversal but not momentum. In contrast, the remaining G7 stock markets, that is the stock markets of Germany, the UK, Canada, France, and Italy, show short-run momentum followed by reversal at least one year after the formation of the momentum portfolio.

Extending this full sample evidence, we study unconditional momentum portfolios in two subperiods ranging from 1991 to 2004 and from 2005 to 2017. The subperiod results are reported in Table 12 for raw returns and in Table 13 for risk-adjusted returns. Despite slight differences, our evidence from the full sample is confirmed. For instance, unconditional momentum portfolios of German stocks only exhibit momentum in terms of both raw returns and risk-adjusted returns but no reversal during the first subperiod which covers the years after the German reunification in October 1990. However, raw returns and risk-adjusted returns of unconditional momentum portfolios in the US stock market solely revert in both subperiods as is reported also in the full sample. Again, momentum is not followed by reversal in the Japanese stock market in both subperiods for raw returns as well as risk-adjusted returns. In the stock markets of the UK, Canada, and France unconditional momentum portfolios feature momentum followed by reversal in both types of returns except for the second subperiod which covers the US subprime crisis and the European sovereign debt crisis. In the Italian

⁷ Note that our evidence is in line with Asness (2011) who documents that momentum strategies do not work in the Japanese stock market.

stock market, results from the first subperiod match the full sample evidence with momentum followed by reversal.

3.2 Conditional reversal of individual stocks

After having studied unconditional momentum and reversal patterns in the G7 countries, we now analyze *conditional* reversal of individual stocks. Two questions arise immediately. First, why are we focusing on individual stocks. And second, what is the conditioning information employed. The answer to the first question is obvious. Reversal of momentum portfolios must originate from stocks which constitute these portfolios. Hence, reversal must occur at the individual stock's level and calls for studying reversal for each stock.

The answer to the second question is more involved. At portfolio formation date, one can determine a stock's past performance throughout the last six months (-6–0). Hence, it qualifies as winner stock or loser stock. Next, we look at this stock's performance throughout the upcoming half year (0–6). If on the one hand a winner (loser) stock prior to portfolio formation stays a winner (loser) stock after portfolio formation then this stock will realize momentum. Such a stock is called *realized momentum stock*. If on the other hand a winner (loser) stock prior to portfolio formation then this stock after portfolio formation then this stock after portfolio formation then this stock after portfolio formation then this stock will experience reversal. Such a stock is called *contrarian stock*. At portfolio formation date, realized momentum stocks form the realized momentum portfolio and contrarian stocks make up the contrarian portfolio. The conditioning information used is whether a stock is element of the realized momentum portfolio or of the contrarian portfolio requires forward-looking information. Another important note is that both the realized momentum portfolio and the contrarian portfolio and loser stocks.

Now, if the hypothesis is true that momentum and reversal are linked phenomena then a stock which features realized momentum initially will experience reversal later on. As we are interested in the linkage of momentum and reversal, we focus in this second step of the analysis on how realized momentum stocks perform in the second year (12–24) and in the third year (24–36) after portfolio formation, in particular. Focussing on the second and third year after portfolio formation is justified by the fact that reversal is documented in these periods in Tables 2 and 3 across all G7 stock markets. Table 4 provides aggregate country-wise results on conditional reversal of individual stocks in the respective stock market.

Let us have look at the evidence from the US stock market at first. Throughout all portfolio formation dates, 52.2% (47.8%) of all stocks are identified as winner (loser) stocks prior to portfolio formation (-6–0).⁸ Out of these winner (loser) stocks 52.9% (48.3%) are realized momentum stocks. Now 48.6% and 47.4% of realized momentum winner stocks experience medium-term reversal (12–24) and long-run reversal (24–36), respectively. Also 54.7% and 54.4% of the realized momentum loser

⁸ Each stock in the sample is classified at each potential portfolio formation date throughout our sample period from July 1991 to December 2017. Percentages are ratios of the count of stocks classified and the count of all classifications carried out.

Winner				МТР	IDD	Loser				МТР	IDD
$\frac{-6-0}{-6-0}$		0-6		12-24	24-36	$\frac{10801}{-6-0}$		0-6		12-24	24-36
months		months		months	months	months		months		months	months
USA											
52.2%	Real	52.9%	No Rev	51.4%	52.6%		Cont	51.7%	Rev	52.3%	53.5%
			Rev	48.6%	47.4%				No Rev	47.7%	46.5%
	Cont	47.1%	No Rev	53.0%	53.6%	47.8%	Real	48.3%	Rev	54.7%	54.4%
			Rev	47.0%	46.4%				No Rev	45.3%	45.6%
Germany											
49.6%	Real	50.5%	No Rev	62.3%	62.2%		Cont	44.4%	Rev	61.1%	62.1%
			Rev	37.7%	37.8%				No Rev	38.9%	37.9%
	Cont	49.5%	No Rev	58.0%	62.4%	50.4%	Real	55.6%	Rev	56.9%	59.3%
			Rev	42.0%	37.6%				No Rev	43.1%	40.7%
UK											
51.2%	Real	50.9%	No Rev	63.3%	61.5%		Cont	46.1%	Rev	62.7%	62.9%
			Rev	36.7%	38.5%				No Rev	37.3%	37.1%
	Cont	49.1%	No Rev	59.5%	62.0%	48.8%	Real	53.9%	Rev	59.7%	60.7%
			Rev	40.6%	38.0%				No Rev	40.3%	39.3%
Japan											
48.9%	Real	48.4%	No Rev	47.6%	48.7%		Cont	49.4%	Rev	49.1%	49.4%
			Rev	52.4%	51.3%				No Rev	50.9%	50.6%
	Cont	51.6%	No Rev	49.4%	49.6%	51.1%	Real	50.6%	Rev	50.4%	49.7%
			Rev	50.6%	50.4%				No Rev	49.6%	50.3%
Canada											
48.2%	Real	48.5%	No Rev	51.5%	51.9%		Cont	42.5%	Rev	53.2%	52.4%
			Rev	48.5%	48.1%				No Rev	46.8%	47.6%
	Cont	51.5%	No Rev	50.5%	52.2%	51.8%	Real	57.5%	Rev	51.3%	52.4%
-			Rev	49.5%	47.8%				No Rev	48.7%	47.6%
France		51.00									
49.8%	Real	51.0%	No Rev	55.9%	56.0%		Cont	45.4%	Rev	57.3%	56.6%
	a .	10.00	Rev	44.1%	44.0%	50.00	D 1	54.60	No Rev	42.7%	43.4%
	Cont	49.0%	No Rev	54.1%	56.8%	50.2%	Real	54.6%	Rev	54.6%	55.8%
T. 1			Rev	45.9%	43.2%				No Rev	45.4%	44.2%
Italy	D 1	51 70	N D	54.20	54.00		C .	45.20	D	50.70	50.00
49.5%	Keal	51./%	NO Rev	54.5%	54.2%		Cont	45.5%	Kev	52.1%	52.2%
	Cont	10.20	Kev	45.7%	45.8%	50.70	D 1	5170	INO KEV	47.5%	4/.8%
	Cont	48.5%	NO KEV	31.5%	52.0%	50.7%	Real	54.1%	Kev	49.0%	49.8%
			ĸev	48.7%	47.4%				INO KEV	51.0%	50.2%

Table 4 Conditional Reversal of Individual Stocks

Values are portions of stocks which qualify as (i.) winner stock (Winner) or loser stock (Loser) in the formation period (-6–0) following the Lo and MacKinlay (1990) methodology, (ii.) realized momentum stock (Real) or contrarian stock (Cont) in the short-run holding period (0–6), and (iii.) reversal stock (Rev) or stock without reversal (No Rev) in the medium-term (12–24) or long-run (24–36) holding period compared to the formation period (-6–0). Portions of stocks with medium-term reversal (12–24) are shown in the next to last column (MTR) and portions of stocks with long-run reversal (24–36) are collected in the last columns (LRR). Past stock performance and, thus, whether a stock classifies as winner or loser is determined using raw returns. We skip one month between the formation period and the subsequent holding periods. The sample spreads July 1991–December 2017

stocks show medium-term reversal (12–24) and long-run reversal (24–36), respectively.

Inspecting Table 4 yields that those G7 countries with the lowest portions of reversal among realized momentum winner stocks in the second (12–24) and third (24–36) year after portfolio formation showed short-term momentum in unconditional portfolios. These countries are Germany, the UK, Canada, France, and Italy. The highest portions of reversal among realized momentum winners in the second (12–24) and third (24–36) year after portfolio formation is reported for the USA and Japan. Both countries revealed a lack of momentum in unconditional portfolios.

Furthermore, we observe higher portions of reversal in the second (12–24) and third (24–36) year after portfolio formation among realized momentum losers than among realized momentum winners across all G7 countries except for Japan. This corresponds to the finding that the loser legs of unconditional momentum portfolios caused reversal in the corresponding years after portfolio formation. Finally, the portions of realized momentum stocks – both winners and losers – featuring reversal in the second (12–24) and third (24–36) year after portfolio formation in the G7 stock markets argue for a linkage of momentum and reversal at the individual stock level which can be put in line with evidence on reversal in raw return performance of unconditional momentum portfolios in those years after portfolio formation documented in the first step of the analysis.

Note that this second step of the analysis highlights that exploiting conditional information on realized momentum at the individual stock level delivers evidence for the US and the Japanese stock markets which differs from the rest of the G7 countries. These conditional observations correspond to findings for unconditional momentum portfolios before.

We substantiate the analysis of conditional momentum stocks exhibiting reversal in either the medium term or the long run by performing country-wise Binomial tests. The null hypothesis of such a Binomial test is that momentum and reversal are unrelated phenomena meaning that a realized momentum stock's probability of reversal equals 50%. In this case, reversal following momentum is a pure chance event.

Table 5 displays country-wise estimates of Binomial probabilities for reversal following momentum in the medium term (12-24) and the long run (24-36). Surprisingly, the null hypothesis is rejected in all G7 countries in the medium term except for Canada and France on the one hand and in the long run except for Germany and the UK on the other hand. Most notably, the rejection of the null hypothesis is observed in all G7 stock markets either in the medium term or the long run, or in both the medium term and the long run. Thus, the Binomial tests suggest that the linkage of momentum and reversal is not a chance event in the G7 stock markets. From an investor's perspective, this result at the individual stock's level must be scrutinized economically at the portfolio level.

3.3 Conditional momentum portfolios

In the previous section, we report that a linkage of momentum and reversal can be identified at the level of individual stocks in each G7 stock market. The extent of reversal is in line with evidence on unconditional momentum across the G7 countries.

	12-24 1	nonths	24-36 1	nonths
Country	Estimate	p-Value	Estimate	p-Value
USA	51.7%	(0.000)	51.0%	(0.000)
Germany	47.4%	(0.000)	50.2%	(0.496)
UK	48.9%	(0.000)	50.3%	(0.101)
Japan	51.3%	(0.000)	51.3%	(0.000)
Canada	50.3%	(0.199)	50.6%	(0.004)
France	49.7%	(0.251)	50.8%	(0.005)
Italy	47.7%	(0.000)	47.9%	(0.000)

Values are estimates of country-wise Binomial tests which allow to judge whether the percentage of observed reversals differs from 50% which represents pure chance and, hence, means independence of momentum and reversal. The null hypothesis is that momentum and reversal are independent of each other, that is the percentage of observed reversals equals 50%. The estimates are obtained for mediumterm reversal (12-24) and long-run reversal (24-36)

In the third step of our analysis, we analyze the performance of momentum portfolios which rely on conditioning information. That is momentum portfolios are formed of either realized momentum stocks (Real) or contrarian stocks (Cont). Of course, as conditioning information is forward-looking, the reported returns cannot be realized by some trading strategy. However, the conditioning information is crucial in order to potentially detect a linkage of momentum and reversal. In general, if momentum and reversal are linked phenomena then a stock which has shown short-term momentum can be expected to experience long-term reversal. Alternatively, any lack of return continuation indicates a reversal. Therefore, we distinguish stocks based on whether they have experienced momentum in the short run or not when forming conditional momentum portfolios. Doing this is particularly useful in our comparative multi-country study, as differences across or similarities between countries can be identified.⁹

Table 6 collects average monthly raw returns of conditional momentum portfolios which are formed of realized momentum stocks. Panel A underlies the methodology of Lo and MacKinlay (1990). Underlying Panel B is the decile approach of Jegadeesh and Titman (1993). Panels C and D display raw returns of quintile spread portfolios and of tertile spread portfolios, respectively. All panels report extreme short-run momentum throughout the first half year (0–6) across all G7 stock markets. Note that this extreme performance is by construction as we only analyze realized momentum stocks from which we know to feature momentum in these first six months after portfolio formation.

Having analyzed unconditional momentum portfolios in the first step of our analysis, we know that reversal occurs in the second or third year after portfolio formation. Hence, we mainly focus on the performance of conditional momentum portfolios in year two (12–24) and year three (24–36) after portfolio formation.

Panels A and B of Table 6 show that the momentum portfolios of realized momentum stocks feature reversal in the medium term (12-24) or the long run (24-36) in

 Table 5
 Reversal of Realized

 Momentum Stocks
 Figure 1

⁹ Note that forming groups of countries as effected in Blackburn and Cakici (2017) and Walkshäusl et al. (2019) prevents spotting country-wise differences or similarities.

Stocks
Momentum
Realized
Portfolios of
Momentum
aw Performance of
Table 6 R_i

							M-L (Real)						
	USA		Germany		UK		Japan		Canada		France		Italy	
Panel A: LMK														
0–6 months	7.47	(34.29)	69.9	(29.36)	6.34	(35.23)	5.69	(31.87)	7.87	(38.24)	5.44	(28.85)	5.54	(28.42)
6–12 months	-2.34	(-13.44)	1.76	(10.37)	0.75	(5.00)	-0.27	(-1.87)	1.17	(7.23)	0.62	(4.13)	-0.25	(-0.43)
12–24 months	-2.04	(-21.26)	0.14	(1.31)	-0.12	(-1.53)	-0.84	(-10.46)	-0.28	(-2.75)	-0.14	(-1.19)	-0.47	(-3.79)
24–36 months	-1.23	(-8.51)	-0.48	(-5.05)	-0.38	(-4.96)	-0.52	(-7.63)	-0.40	(-4.07)	-0.18	(-1.48)	-0.75	(-7.86)
36-48 months	-0.47	(-5.32)	0.27	(2.92)	0.14	(1.91)	-0.23	(-3.63)	-0.08	(-0.81)	0.37	(3.61)	0.10	(0.91)
48–60 months	-0.53	(-6.50)	-0.17	(-1.65)	0.06	(0.72)	-0.31	(-4.79)	-0.13	(-1.28)	-0.37	(-4.62)	0.19	(1.61)
Panel B: Decile spreads														
0–6 months	8.30	(33.68)	7.29	(27.54)	7.02	(32.00)	6.10	(30.16)	8.70	(35.16)	5.99	(22.96)	5.94	(24.79)
6–12 months	-2.82	(-14.25)	2.13	(10.43)	1.00	(5.31)	-0.30	(-1.77)	1.39	(06.9)	0.78	(4.11)	-0.19	(-0.25)
12–24 months	-2.36	(-20.77)	0.17	(1.20)	-0.15	(-1.39)	-0.99	(-10.04)	-0.42	(-3.04)	0.47	(0.93)	-0.61	(-3.10)
24–36 months	-1.35	(-10.48)	-0.73	(-5.20)	-0.52	(-4.66)	-0.60	(-7.05)	-0.50	(-3.55)	0.95	(1.00)	-0.88	(-5.48)
36–48 months	-0.51	(-5.16)	0.26	(1.68)	0.12	(1.05)	-0.27	(-3.40)	-0.28	(-1.99)	1.61	(1.36)	0.15	(0.90)
48–60 months	-0.61	(-5.78)	-0.17	(-0.94)	0.15	(1.22)	-0.47	(-6.01)	-0.21	(-1.34)	-0.31	(-1.73)	0.02	(0.10)
Panel C: Quintile spreads														
0–6 months	7.57	(36.05)	6.49	(31.79)	6.29	(35.88)	5.46	(31.81)	7.74	(40.88)	5.38	(29.83)	5.48	(28.01)
6–12 months	-1.92	(-12.11)	1.76	(10.83)	96.0	(6.51)	-0.18	(-1.30)	1.27	(8.05)	0.72	(4.92)	0.31	(0.87)
12–24 months	-1.89	(-21.25)	0.16	(1.59)	0.01	(0.15)	-0.78	(-9.51)	-0.18	(-1.77)	0.00	(0.02)	-0.49	(-3.72)
24–36 months	-1.12	(-12.41)	-0.35	(-3.74)	-0.30	(-3.93)	-0.45	(-6.57)	-0.46	(-4.52)	-0.08	(-0.74)	-0.58	(-5.39)
36-48 months	-0.38	(-4.99)	0.25	(2.65)	0.12	(1.61)	-0.17	(-2.75)	-0.16	(-1.67)	0.34	(3.31)	0.13	(1.10)
48-60 months	-0.56	(-7.15)	-0.16	(-1.40)	-0.01	(-0.08)	-0.33	(-5.37)	-0.20	(-1.79)	-0.40	(-4.32)	0.17	(1.29)

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							M-L ((Real)						
	USA		Germany		UK		Japan		Canada		France		Italy	
Panel D: Tertile spreads														
0–6 months	6.91	(38.27)	5.90	(34.53)	5.80	(38.06)	5.06	(33.97)	7.00	(44.73)	5.01	(33.43)	5.21	(31.08)
6–12 months	-1.35	(-10.08)	1.50	(11.00)	0.84	(6.87)	-0.19	(-1.53)	1.11	(8.61)	0.66	(5.63)	0.48	(2.15)
12–24 months	-1.53	(-20.23)	0.19	(2.38)	0.06	(06.0)	-0.63	(-8.87)	-0.14	(-1.80)	0.00	(-0.04)	-0.38	(-3.60)
24–36 months	-0.90	(-12.21)	-0.16	(-2.17)	-0.16	(-2.68)	-0.33	(-5.62)	-0.27	(-3.49)	-0.11	(-1.38)	-0.50	(-5.72)
36-48 months	-0.31	(-4.86)	0.17	(2.30)	0.14	(2.36)	-0.13	(-2.51)	-0.01	(-0.16)	0.22	(2.90)	0.08	(0.74)
48–60 months	-0.41	(-6.70)	-0.02	(-0.27)	-0.06	(-0.94)	-0.25	(-4.74)	-0.10	(-1.26)	-0.28	(-4.06)	0.17	(1.53)
Values are average month holding periods (12–24.	1 24–36. 36	turns of wir	mer-loser po	rtfolios (W- er portfolio	L) of real formatio	lized mom	entum sto	cks (Real)	in semi-an	nual holding cKinlav (19	g periods (990) meth	0-6, 6-12 0doloev (I	months) e MK) for	or annual portfolio

formation whereas panel B [CID] employs the decile [quintileltertile] spread approach in the spirit of Jegadeesh and Titman (1993). Panels A and B [CID] summarize average monthly raw returns of relative strength portfolios and of decile [quintileltertile] spread portfolios, respectively. The sample spreads July 1991–December 2017 and portfolios are formed at monthly frequency. Accounting for microstructure effects, we skip one month between portfolio formation and the subsequent holding periods. Figures in bold-face are statistically significant at the 10% level (t-stat > 1.65). T-statistics are in parenthesis all G7 stock markets except for France.¹⁰ Thus, short-term momentum (0–6) by construction is followed by reversal later on. Put differently, realized momentum stocks feature return reversal after exhibiting short-run momentum in the G7 stock markets. Comparing Panel A to Panel C, we see that relying on the top quintile and bottom quintile of the realized momentum stocks makes this observation of linkage of momentum and reversal even more pronounced.

Similarly, Table 7 reports average monthly raw returns of conditional momentum portfolios which are composed of contrarian stocks. Panel A and Panel C differ with respect to whether the methodology of Lo and MacKinlay (1990) or the quintile spread approach had been used in portfolio formation. In the short run (0–6), both panels show the contrarian movement of the conditional momentum portfolios in each stock market of the G7 countries. However, this observation is again by construction. A conditional momentum portfolio of contrarian stocks consists of past winners long and past losers short which we know to become losers and winners in the short run (0–6), respectively. Note that this contrarian stocks revert in the second year (12–24) after portfolio formation. If these portfolios featured return continuation they would have average raw returns of higher magnitude. Hence, even contrarian stocks show a reversal in the G7 stock markets as the continuation of the initial contrarian movement vanishes.

Conrad and Yavuz (2017, p. 560) point out that continuation and reversal are return anomalies. Therefore, it is essential to study risk-adjusted performance. Thus, we report Fama and French (1993) three factor alphas for conditional momentum portfolios composed of either realized momentum stocks or contrarian stocks in Tables 8 and 9 respectively. In both tables, Panel A obtains according to the Lo and MacKinlay (1990) methodology and Panel C results from the quintile spread approach in the spirit of Jegadeesh and Titman (1993).

In Table 8, we report Fama and French (1993) three factor alphas of conditional momentum portfolios of realized momentum stocks. Panel A and Panel C display pronounced risk-adjusted performance in the short-run period (0–6). This means that the momentum portfolios of realized momentum stocks feature a return component in the first semi-annual holding period which cannot be explained by fundamental risk factors. The outperformance compared to the Fama and French (1993) three factor benchmark originates from the momentum of the underlying realized momentum stocks by construction. This observation applies to all G7 stock markets.

Notably, the short-run risk-adjusted outperformance turns into risk-adjusted underperformance during the second year (12–24) and third year (24-36). Hence, this turn of performance documents a reversal of the momentum portfolios consisting of realized momentum stocks in risk-adjusted terms in all G7 stock markets. Again, this reversal in Fama and French (1993) three factor alphas is emphasized more strongly in Panel C by using the quintile spread approach in portfolio formation.¹¹

Completing the third step of our analysis, we report in Table 9 the risk-adjusted performance of conditional momentum portfolios which are made up of contrarian stocks.

 $^{^{10}}$ France also shows the weakest reversal in unconditional momentum portfolios. Cf. Table 2.

¹¹ As regards France, comparing Panel A to Panel C lets one conclude that the documented reversal in Panel A is not driven by the top and bottom quintile of realized momentum stocks.

	(Cont)
	I-M
7 Raw Performance of Momentum Portfolios of Realized Contrarian Stocks	
Table 7	

							M-L	(Cont)						
	USA		Germany		UK		Japan		Canada		France		Italy	
Panel A: LMK														
0–6 months	-9.34	(-27.60)	-5.08	(-26.45)	-5.76	(-35.05)	-5.44	(-37.85)	-6.71	(-36.65)	-4.70	(-26.51)	-5.07	(-17.71)
6–12 months	-0.59	(-4.51)	0.00	(-0.03)	-0.04	(-0.41)	-0.10	(-1.04)	-0.37	(-2.67)	0.02	(0.11)	0.07	(0.59)
12–24 months	-0.29	(-2.64)	-0.39	(-3.88)	-0.36	(-4.73)	-0.26	(-3.62)	-0.42	(-4.29)	-0.25	(-2.77)	-0.30	(-3.70)
24–36 months	-0.08	(-0.91)	0.03	(0.30)	-0.07	(66.0-)	-0.03	(-0.43)	0.07	(0.74)	-0.02	(-0.25)	0.09	(1.08)
36-48 months	-0.05	(-0.53)	0.06	(0.76)	0.01	(0.19)	-0.11	(-1.64)	0.03	(0.27)	0.07	(0.88)	0.10	(0.98)
48–60 months	-0.41	(-3.94)	0.08	(0.91)	-0.16	(-2.19)	0.04	(0.62)	0.07	(0.69)	-0.21	(-2.58)	0.03	(0.31)
Panel B: Decile spreads														
0–6 months	-9.94	(-39.54)	-5.20	(-21.08)	-6.20	(-30.99)	-5.86	(-35.20)	-7.37	(-31.99)	-4.99	(-22.56)	-5.38	(-11.35)
6–12 months	-0.58	(-4.19)	0.12	(0.66)	0.12	(0.81)	-0.22	(-1.81)	-0.32	(-1.76)	0.12	(0.69)	0.10	(0.57)
12–24 months	-0.43	(-4.17)	-0.58	(-4.09)	-0.32	(-2.72)	-0.42	(-4.69)	-0.54	(-3.77)	-0.34	(-2.63)	-0.43	(-3.03)
24–36 months	-0.12	(-1.20)	0.08	(0.55)	-0.24	(-2.19)	-0.07	(-0.82)	0.05	(0.34)	-0.16	(-1.06)	-0.01	(-0.03)
36–48 months	-0.13	(-1.26)	0.11	(0.83)	-0.05	(-0.42)	-0.17	(-2.15)	0.14	(0.93)	-0.09	(-0.60)	0.17	(1.06)
48–60 months	-0.42	(-3.75)	0.19	(1.35)	-0.40	(-3.24)	0.00	(0.02)	0.41	(2.43)	-0.23	(-1.58)	-0.04	(-0.25)
Panel C: Quintile spreads														
0–6 months	-8.52	(-44.54)	-4.92	(-26.74)	-5.58	(-35.06)	-5.25	(-37.01)	-6.68	(-36.80)	-4.54	(-28.78)	-5.18	(-15.50)
6–12 months	-0.48	(-4.25)	0.02	(0.17)	0.08	(0.70)	-0.06	(-0.61)	-0.36	(-2.54)	0.00	(-0.01)	0.15	(1.13)
12–24 months	-0.26	(-3.25)	-0.37	(-3.74)	-0.30	(-3.76)	-0.26	(-3.53)	-0.32	(-3.21)	-0.20	(-2.37)	-0.28	(-2.91)
24–36 months	-0.09	(-1.20)	0.08	(0.85)	0.04	(0.52)	0.01	(0.11)	0.18	(1.73)	0.03	(0.30)	0.02	(0.23)
36-48 months	-0.05	(-0.70)	0.12	(1.25)	0.02	(0.26)	-0.11	(-1.77)	0.07	(0.64)	0.04	(0.39)	0.05	(0.40)
48–60 months	-0.38	(-4.82)	0.18	(1.84)	-0.12	(-1.53)	-0.02	(-0.38)	0.12	(1.10)	-0.33	(-3.49)	0.09	(0.78)

							M-L	(Cont)						
	USA		Germany		UK		Japan		Canada		France		Italy	
Panel D: Tertile spreads														
0–6 months	-7.57	(-46.04)	-4.73	(-31.23)	-5.22	(-39.28)	-4.88	(-39.12)	-6.14	(-39.91)	-4.37	(-32.59)	-4.90	(-21.15)
6–12 months	-0.31	(-2.99)	-0.09	(-0.77)	-0.03	(-0.31)	0.04	(0.47)	-0.37	(-3.25)	-0.06	(09.0-)	0.08	(0.76)
12-24 months	-0.10	(-1.47)	-0.31	(-4.07)	-0.23	(-3.79)	-0.14	(-2.25)	-0.24	(-2.98)	-0.18	(-2.91)	-0.19	(-2.46)
24–36 months	-0.01	(-0.19)	0.08	(1.13)	0.06	(1.07)	0.02	(0.47)	0.20	(2.58)	0.03	(0.50)	0.14	(1.83)
36–48 months	0.01	(0.00)	0.09	(1.33)	0.02	(0.33)	-0.08	(-1.54)	0.04	(0.54)	0.01	(0.14)	0.03	(0.35)
48-60 months	-0.30	(-4.92)	0.12	(1.57)	-0.06	(-1.00)	0.02	(0.34)	0.04	(0.45)	-0.19	(-2.80)	0.03	(0.38)
Values are average mont periods (12–24, 24–36, 3 whereas panel B [CID] et raw returns of relative st formed at monthly freque	hly raw re 6–48, 48- mploys th rength po mcv. Acco	eturns of w -60 months e decile [qu ortfolios an	inner-loser I s) after portf initileltertile d of decile microstructi	portfolios (M colio formatic s] spread app [quintilelterti ure effects, w	⁷⁻ L) of cc on in per roach in le] sprea	ontrarian sto cent. Panel. the spirit of d portfolios	ocks (Coi A uses th f Jegadee s, respect	nt) in semi- le Lo and M sh and Titrr ively. The prefolio form	annual hol lacKinlay nan (1993) sample spr nation and	lding periods (1990) meth . Panels A au reads July 1 the subseque	s (0–6, 6– odology (nd B [CIE 991–Dece	-12 months) -12 months) (LMK) for p Summariz Suber 2017 Suber 2017 Suberiods, F	or annus portfolio c average and port	ul holding formation e monthly folios are bold-face
•	•)			-		-			-		- 10	0	

are statistically significant at the 10% level (t-stat > 1.65). T-statistics are in parenthesis

Stocks
Momentum
f Realized
Portfolios of
ed Returns of Momentum
Risk-Adjuste
Table 8

ISA		Germany		UK		Japan		Canada		France		Italy	
43	(30.85)	6.45	(20.40)	6.42	(22.54)	5.53	(19.17)	7.81	(27.39)	5.42	(23.54)	5.27	(25.20)
2.21	(-10.06)	1.78	(7.40)	0.89	(4.04)	-0.42	(-1.72)	1.08	(4.52)	0.67	(3.27)	-0.60	(-0.65)
2.10	(-18.30)	0.21	(1.75)	-0.15	(-1.57)	-0.69	(-8.82)	-0.46	(-3.78)	-0.15	(-1.59)	-0.70	(-4.69)
1.4	(-7.18)	-0.50	(-4.88)	-0.58	(-6.31)	-0.28	(-4.26)	-0.64	(-5.53)	-0.36	(-3.83)	-0.99	(-9.91)
).63	(-6.71)	0.14	(1.56)	-0.03	(-0.37)	-0.04	(-0.59)	-0.32	(-3.04)	0.26	(2.87)	-0.18	(-1.42)
0.71	(-7.88)	-0.37	(-3.78)	-0.14	(-1.58)	-0.18	(-2.34)	-0.48	(-4.34)	-0.54	(-5.96)	0.11	(0.76)
33	(33.49)	7.05	(20.68)	7.19	(24.24)	5.91	(18.95)	8.68	(28.21)	6.03	(20.17)	5.68	(22.15)
2.64	(-10.53)	2.19	(7.72)	1.20	(4.38)	-0.44	(-1.60)	1.35	(4.81)	06.0	(3.46)	-0.54	(-0.45)
2.37	(-18.67)	0.23	(1.45)	-0.11	(-0.88)	-0.79	(-8.17)	-0.60	(-3.71)	0.49	(0.80)	-0.84	(-3.60)
1.51	(-9.31)	-0.73	(-4.99)	-0.67	(-5.46)	-0.33	(-3.96)	-0.71	(-4.45)	0.77	(0.80)	-1.08	(-6.43)
).68	(-6.55)	0.17	(1.26)	-0.03	(-0.22)	-0.06	(-0.58)	-0.48	(-3.07)	1.49	(1.43)	-0.12	(-0.66)
).80	(-7.02)	-0.39	(-2.45)	-0.05	(-0.33)	-0.32	(-3.35)	-0.50	(-2.82)	-0.42	(-2.05)	0.05	(0.25)
.53	(31.52)	6.27	(22.29)	6.38	(24.36)	5.31	(19.58)	7.66	(31.72)	5.37	(23.95)	5.21	(24.29)
1.81	(-8.81)	1.77	(7.29)	1.09	(4.79)	-0.30	(-1.26)	1.19	(5.07)	0.81	(4.19)	0.04	(0.07)
1.96	(-17.76)	0.20	(1.73)	-0.02	(-0.17)	-0.62	(-7.78)	-0.34	(-2.89)	0.01	(0.16)	-0.71	(-4.50)
1.27	(-10.53)	-0.39	(-3.80)	-0.48	(-5.64)	-0.20	(-3.22)	-0.68	(-5.52)	-0.23	(-2.59)	-0.82	(-7.37)
).54	(-6.83)	0.12	(1.27)	-0.04	(-0.53)	0.02	(0.28)	-0.37	(-3.32)	0.26	(2.74)	-0.17	(-1.26)
0.75	(-8.78)	-0.36	(-3.36)	-0.21	(-2.11)	-0.19	(-2.61)	-0.54	(-4.29)	-0.52	(-4.83)	0.12	(0.78)
1	7 7 7 5 5 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	43 (30.85) 21 (-10.06) 44 (-7.18) 66 (-7.18) 63 (-6.71) 53 (33.49) 64 (-10.53) 541 (-7.18) 64 (-10.53) 64 (-10.53) 68 (-6.55) 80 (-7.02) 81 (-8.81) 96 (-17.76) 57 (-10.53) 57 (-10.53)	43 (30.85) 6.45 21 (-10.06) 1.78 10 (-18.30) 0.21 6.4 (-7.18) 0.21 6.7 (-7.18) 0.23 7.1 (-7.28) -0.37 7.1 (-7.23) 2.19 33 (-10.53) 2.19 34 (-10.53) 2.19 37 (-18.67) 0.23 38 (-10.53) 2.19 37 (-18.67) 0.23 38 (-10.53) 0.17 80 (-7.02) -0.39 81 (-8.81) 1.77 96 (-17.76) 0.20 27 (-10.53) 0.39 27 (-10.53) 0.12 37 (-10.53) 0.39	43(30.85) 6.45 (20.40)21(-10.06) 1.78 (7.40)10(-18.30) 0.21 (1.75) 6.4 (-7.18) -0.50 (-4.88) 6.3 (-6.71) 0.14 (1.56) 7.1 (-7.88) -0.37 (-3.78) 33 (33.49) 7.05 (20.68) 6.4 (-10.53) 2.19 (7.72) 33 (33.49) 7.05 (20.68) 6.4 (-10.53) 2.19 (7.72) 33 (33.49) 7.05 (20.68) 6.4 (-10.53) 2.19 (7.72) 33 (33.49) 7.05 (20.29) 34 (-7.02) -0.39 (-7.29) 36 (-7.02) -0.39 (-7.29) 81 (-8.81) 1.77 (7.29) 96 (-17.76) 0.20 (1.73) 27 (-10.53) 0.12 (-3.80) 27 (-10.53) 0.12 (-3.36) 36 (-5.78) 0.12 (1.27) 56 (-8.78) 0.12 (1.27) 57 (-8.78) 0.12 (1.27) 57 (-8.78) 0.12 (1.27)	43 (30.85) 6.45 (20.40) 6.42 21 (-10.06) 1.78 (7.40) 0.89 10 (-18.30) 0.21 (1.75) -0.15 6.4 (-7.18) -0.50 (-4.88) -0.58 6.3 (-7.18) -0.50 (-4.88) -0.58 6.3 (-7.18) -0.37 (-3.78) -0.14 7.1 (-7.88) -0.37 (-3.78) -0.14 7.1 (-7.88) -0.37 (-3.78) -0.14 33 (33.49) 7.05 (20.68) 7.19 54 (-10.53) 2.19 (7.72) 1.20 36 (-5.55) 0.17 (1.26) -0.03 68 (-7.02) -0.73 (-4.99) -0.67 81 (-8.81) 1.77 (7.29) 1.09 96 (-17.76) 0.20 (1.73) -0.02 27 (-10.53) -0.39 (-2.45) -0.02 27 (-10.53) -0.39 (-2.45) -0.02 54 (-6.83) 0.12 (1.27) -0.04 54 (-6.83) 0.12 (-3.36) -0.20 57 (-8.78) -0.36 (-3.36) -0.04	43 (30.85) 6.45 (20.40) 6.42 (22.54) 21 (-10.06) 1.78 (7.40) 0.89 (4.04) 10 (-18.30) 0.21 (1.75) -0.15 (-1.57) 6.4 (-7.18) -0.50 (-4.83) -0.33 (-1.57) 6.3 (-7.18) -0.50 (-4.88) -0.39 (-0.31) 6.3 (-7.18) -0.50 (-4.88) -0.36 (-1.57) 6.3 (-7.18) -0.37 (-3.78) -0.14 (-1.58) 7.1 (-7.88) -0.37 (-3.78) -0.14 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0.11 (-7.29) -0.33 -0.33 59 (-7.02) -0.39 (-7.29) 0.02 (-7.17) 0.20 (-7.33) -0.33 59 (-7.02) -0.39 (-7.29) 0.109 (-7.29) -0.33 -0.30 59 (-7.17) 0.20 (-7.17) 0.20 (-1.77) 0.20 (-0.17) -0.33	13 (30.85) 6.45 (20.40) 6.42 (22.54) 5.53 (19.17) 21 (-1006) 1.78 (7.40) 0.89 (4.04) -0.42 (-1.72) 10 (-18.30) 0.21 (1.75) -0.15 (-1.57) -0.69 (8.82) 6.4 (-7.18) -0.50 (-4.88) -0.37 (-0.59) (-1.72) 6.3 (-7.18) -0.50 (-4.88) -0.37 (-0.69) (-2.54) 6.3 (-7.18) -0.37 (-3.78) -0.14 (-1.58) (-4.26) 6.3 (-7.18) -0.37 (-3.78) -0.14 (-1.58) (-4.26) 6.4 (-7.18) -0.37 (-3.78) -0.14 (-1.58) (-4.26) 6.4 (-10.53) 2.19 (7.72) 1.20 (4.38) -0.14 (-1.60) 33 (-33.49) 7.19 (-1.58) -0.18 (-2.24) (-2.33) (-2.34) 5.1 (-10.53) 2.19 (7.72) 1.20 (4.38) -0.14 (-1.60) 34 (-10.53) 2.19 (7.72) 1.20 (4.38) -0.26 (-2.34) 5.1 (-10.53) 2.19 (7.22) 1.20 (4.38) -0.26 (-2.54) 35 (-10.53) 2.19 (-1.58) -0.14 (-1.60) 36 (-7.02) -0.33 (-2.45) -0.13 (-2.54) 37 (-18.67) 0.23 (-1.45) -0.26 (-2.78)	13 (30.85) 6.45 (20.40) 6.42 (22.54) 5.53 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							M-L	(Real)						
	USA		Germany		UK		Japan		Canada		France		Italy	
Panel D: Tertile spreads														
0–6 months	6.83	(31.63)	5.64	(23.02)	5.83	(23.87)	4.93	(20.42)	6.90	(31.90)	4.96	(24.43)	4.92	(26.21)
6–12 months	-1.30	(-7.77)	1.46	(7.27)	0.89	(4.76)	-0.29	(-1.38)	1.00	(4.98)	0.70	(4.54)	0.24	(0.64)
12–24 months	-1.63	(-17.05)	0.19	(1.97)	-0.01	(-0.12)	-0.50	(-7.28)	-0.31	(-3.16)	-0.03	(-0.47)	-0.60	(-4.84)
24-36 months	-1.06	(-10.30)	-0.25	(-3.29)	-0.36	(-5.42)	-0.11	(-2.15)	-0.51	(-5.07)	-0.26	(-3.70)	-0.74	(-7.67)
36-48 months	-0.49	(-6.95)	0.04	(0.50)	-0.06	(-0.95)	0.04	(0.79)	-0.22	(-2.56)	0.11	(1.54)	-0.19	(-1.63)
48-60 months	-0.60	(-8.49)	-0.20	(-2.29)	-0.26	(-3.37)	-0.11	(-1.88)	-0.45	(-4.81)	-0.44	(-5.33)	0.08	(0.59)
Values are monthly risk- holding periods (12–24,	adjusted r 24–36, 30	eturns of wi 5–48, 48–60	nner-loser po) months) aft	er portfolio	-L) of rea	lized mom	ientum ste nt. Risk-a	ocks (Real) adjusted ret	in semi-an urns are th	nual holdin ne intercept	g periods	(0-6, 6-12 series regre	months) essions of	or annual monthly

portiolio returns in excess of the risk free rate of return on Fama and French (1993) three factors. Panel A uses the Lo and MacKinlay (1990) methodology (LMK) for portfolio formation whereas panel B [CID] employs the decile [quintileltertile] spread approach in the spirit of Jegadeesh and Titman (1993). Panels A and B [CID] summarize monthly three factor alphas of relative strength portfolios and of decile [quintileltertile] spread portfolios, respectively. The sample spreads July 1991–December 2017 and portfolios are formed at monthly frequency. Accounting for microstructure effects, we skip one month between portfolio formation and the subsequent holding periods. The t-statistics are calculated with Newey-West robust standard errors with 12 lags and shown in parentheses. Figures in bold-face indicate statistical significance at the 10% level (t-stat > 1.65)

ntrarian Stocks	
of Momentum Portfolios of Cor	
Risk-Adjusted Returns o	
Table 9	

							M-L (Cont)						
	USA		Germany		UK		Japan		Canada		France		Italy	
Panel A: LMK														
0–6 months	-9.50	(-23.34)	-5.32	(-18.88)	-6.01	(-22.68)	-5.59	(-33.89)	-7.05	(-23.28)	-4.96	(-21.39)	-5.44	(-12.27)
6–12 months	-0.81	(-4.12)	-0.03	(-0.17)	-0.34	(-1.92)	-0.18	(-1.20)	-0.61	(-2.81)	-0.24	(-1.35)	-0.26	(-1.54)
12–24 months	-0.55	(-4.50)	-0.61	(-5.71)	-0.64	(-6.23)	-0.24	(-3.35)	-0.68	(-5.79)	-0.46	(-5.33)	-0.57	(-6.88)
24–36 months	-0.27	(-2.85)	-0.13	(-1.45)	-0.38	(-4.89)	-0.04	(-0.54)	-0.19	(-1.55)	-0.23	(-2.60)	-0.17	(-2.18)
36-48 months	-0.25	(-2.86)	-0.07	(-0.82)	-0.25	(-3.18)	-0.08	(-0.95)	-0.21	(-1.95)	-0.09	(-1.07)	-0.15	(-1.39)
48–60 months	-0.58	(-5.95)	-0.07	(-0.75)	-0.42	(-5.19)	0.00	(-0.03)	-0.21	(-1.78)	-0.37	(-4.90)	-0.05	(-0.50)
Panel B: Decile spreads														
0–6 months	-10.02	(-32.76)	-5.42	(-16.90)	-6.42	(-21.33)	-6.05	(-32.22)	-7.66	(-22.42)	-5.21	(-18.74)	-5.74	(06.8-)
6–12 months	-0.77	(-3.66)	0.09	(0.35)	-0.14	(-0.60)	-0.30	(-1.76)	-0.51	(-1.87)	-0.06	(-0.28)	-0.18	(-0.79)
12–24 months	-0.67	(-5.66)	-0.77	(-5.40)	-0.53	(-3.75)	-0.38	(-4.43)	-0.79	(-4.74)	-0.46	(-3.65)	-0.65	(-4.64)
24–36 months	-0.29	(-2.94)	-0.04	(-0.29)	-0.52	(-4.27)	-0.07	(-0.67)	-0.20	(-1.12)	-0.36	(-2.53)	-0.24	(-1.76)
36-48 months	-0.33	(-3.26)	0.00	(0.02)	-0.30	(-2.38)	-0.14	(-1.46)	-0.08	(-0.53)	-0.21	(-1.58)	-0.13	(-0.83)
48–60 months	-0.61	(-5.79)	0.08	(0.53)	-0.64	(-4.81)	-0.03	(-0.33)	0.12	(0.69)	-0.44	(-3.15)	-0.09	(-0.53)
Panel C: Quintile spreads														
0–6 months	-8.66	(-36.07)	-5.13	(-18.28)	-5.87	(-21.91)	-5.40	(-33.72)	-7.01	(-22.95)	-4.81	(-22.29)	-5.55	(-10.70)
6–12 months	-0.70	(-4.04)	-0.01	(-0.05)	-0.23	(-1.28)	-0.12	(-0.86)	-0.59	(-2.80)	-0.22	(-1.34)	-0.18	(-0.95)
12–24 months	-0.51	(-5.45)	-0.60	(-5.36)	-0.57	(-5.67)	-0.23	(-3.14)	-0.58	(-4.96)	-0.37	(-4.39)	-0.54	(-5.52)
24–36 months	-0.28	(-3.40)	-0.08	(-0.91)	-0.27	(-3.16)	0.00	(0.05)	-0.07	(-0.59)	-0.19	(-1.96)	-0.22	(-2.28)
36-48 months	-0.25	(-3.43)	-0.01	(-0.10)	-0.23	(-2.70)	-0.09	(-1.17)	-0.14	(-1.17)	-0.12	(-1.45)	-0.19	(-1.56)
48–60 months	-0.56	(-6.75)	0.04	(0.35)	-0.38	(-4.41)	-0.04	(-0.51)	-0.13	(86.0-)	-0.48	(-5.11)	0.01	(0.11)

							M-L	(Cont)						
	USA		Germany		UK		Japan		Canada		France		Italy	
Panel D: Tertile spreads														
0–6 months	-7.74	(-34.95)	-4.94	(-19.47)	-5.57	(-23.13)	-5.01	(-35.53)	-6.50	(-24.15)	-4.69	(-22.90)	-5.27	(-13.78)
6–12 months	-0.56	(-3.57)	-0.18	(-1.11)	-0.37	(-2.48)	-0.01	(90.0-)	-0.62	(-3.51)	-0.30	(-2.16)	-0.27	(-1.89)
12–24 months	-0.35	(-4.34)	-0.58	(-5.96)	-0.54	(-6.40)	-0.12	(-1.99)	-0.49	(-4.94)	-0.41	(-5.79)	-0.47	(-6.04)
24-36 months	-0.21	(-3.07)	-0.13	(-1.86)	-0.28	(-4.07)	0.00	(-0.03)	-0.05	(-0.51)	-0.17	(-2.25)	-0.12	(-1.59)
36-48 months	-0.19	(-3.11)	-0.08	(-1.02)	-0.24	(-3.60)	-0.07	(-1.16)	-0.16	(-1.66)	-0.16	(-2.21)	-0.20	(-1.86)
48-60 months	-0.48	(-7.21)	-0.06	(69.0-)	-0.32	(-4.87)	-0.01	(-0.18)	-0.21	(-2.09)	-0.34	(-4.79)	-0.06	(-0.72)
Values are monthly risk- periods (12–24, 24–36, : returns in excess of the	adjusted 1 36–48, 48 risk free	returns of w 5-60 months rate of retu	inner-loser J s) after portf rn on Fama	portfolios (V folio formati and French	V-L) of c on in per (1993) f	ontrarian st rcent. Risk- hree factors	ocks (Co adjusted s. Panel	nt) in semi- returns are A uses the	annual ho the interc Lo and M	lding period epts of time- acKinlay (19	s (0–6, 6- -series re; 990) metl	-12 months) gressions of nodology (L	or annua monthly MK) for	ll holding portfolio portfolio

are calculated with Newey-West robust standard errors with 12 lags and shown in parentheses. Figures in bold-face indicate statistical significance at the 10% level (t-stat > 1.65) formation whereas panel B [CID] employs the decile [quintiletertile] spread approach in the spirit of Jegadeesh and Titman (1993). Panels A and B [CID] summarize monthly three factor alphas of relative strength portfolios and of decile [quintileltertile] spread portfolios, respectively. The sample spreads July 1991–December 2017 and portfolios

Irrespective of whether the conditional momentum portfolios are build along the Lo and MacKinlay (1990) methodology or the quintile spread approach, we observe in Panels A and C severe risk-adjusted underperformance in the first six months (0–6) after portfolio formation. Hence, contrarian stocks do not earn an adequate compensation for their exposure to fundamental risk. Put differently, the contrarian evolution of returns in the short-run period (0–6) cannot be explained by Fama and French (1993) three factors. However, the contrarian movement of returns does not continue as can be seen from the Fama and French (1993) three factor alphas in the second year (12-24) and third year (24-36) after portfolio formation. These alphas are substantially lower – roughly at least by factor eight – compared to the short-run period (0–6). Hence, we document a reversal in risk-adjusted returns of the universe of contrarian stocks across all G7 stock markets without any exception.

All in all, studying the performance of conditional momentum portfolios manifests reversal and lack of continuation in both average raw returns and risk-adjusted returns in the second or third year after portfolio formation across all G7 stock markets. In particular, analyzing momentum portfolios of realized momentum stocks unveils that momentum is followed by reversal.

The variation of the portfolio formation – that is the analysis of decile spread portfolios (Tables 6-9, Panel B) and of tertile spread portfolios (Tables 6-9, Panel D) – confirms our observations. Moving from decile spread portfolios through quintile spread portfolios to tertile spread portfolios – that is including more stocks in each leg of the spread portfolios – dilutes the reported returns but does not alter the pattern of momentum and reversal. Hence, our findings are robust to different portfolio formation procedures.

3.4 Momentum and reversal using risk profiles

After having studied conditional momentum portfolios in the previous section, we now return to analyzing unconditional momentum portfolios. Hence, we do not use any forward-looking information upon portfolio formation anymore. Thus, the reported returns could be realized by implementing the corresponding momentum strategies in the G7 stock markets.

In the last step of our empirical study, we study the linkage of momentum and reversal in the G7 stock markets using subgroups of stocks with different risk profiles. In the US stock market, Conrad and Yavuz (2017) report that momentum portfolios with legs from different risk profiles can be formed such that the separation of momentum and reversal obtains. That is Conrad and Yavuz (2017) identify momentum portfolios which either solely exhibit momentum but no reversal or lack momentum and only experience reversal. Checking whether this dichotomous evidence holds true across the G7 stock markets is at the very heart of this last step of our analysis.

Monthly portfolio formation strictly follows Conrad and Yavuz (2017) in order to ensure that our results are comparable to theirs. We briefly describe the formation of risk profiles and the formation of momentum portfolios relying on these risk profiles. The formation of risk profiles is repeated on a monthly basis prior to portfolio formation in each G7 stock market.

- (Formation of Risk Profiles) Stocks are sorted in size and book-to-market ratio (BM) tertiles. Size is measured by market capitalization and book-to-market ratio is determined according to Fama and French (1992). This double sort yields small, medium-sized, and big stocks on the one hand, and high, medium, and low BM stocks on the other hand. The high risk (HR) profile comprises either small or medium-sized stocks with a high BM and small stocks with a medium BM. The low risk (LR) profile includes big or medium-sized stocks with a low BM and big stocks with a medium BM.
- (Formation of Momentum Portfolios) Within the HR profile and the LR profile, stocks are sorted in winner stocks and loser stocks based on their performance throughout the previous six months. The MAX portfolio consists of HR winners long and LR losers short. The MIN portfolio is composed of LR winners long and HR losers short.

Note that the double sort along size and BM draws on the insights of Banz (1981) and Fama and French (1992) who report that small stocks and stocks with high BM are expected to generate higher expected returns and vice versa. These return expectations translate into the MAX and MIN portfolios.¹²

We documented that unconditional momentum portfolios show reversal in the second year (12–24) and the third year (24–36) after portfolio formation both in raw returns and risk-adjusted returns in all G7 stock markets.¹³ We now study whether a linkage of momentum and subsequent reversal can be observed in the momentum portfolios MAX and MIN in the G7 stock markets or whether these portfolios allow for a separation of both phenomena.

Table 10 displays country-wise average monthly raw returns of the MAX portfolio and the MIN portfolio for each G7 stock market. Portfolio formation follows the Lo and MacKinlay (1990) methodology.

Let us first inspect the results for the MAX portfolio. In all G7 countries, the MAX portfolio only realizes momentum in raw returns up to three years after portfolio formation with the UK being an exception. In the UK, the MAX portfolio having realized momentum in the first two years (0–6, 6–12, 12–24) shows reversal in the third year (24–36) after portfolio formation. For the MAX portfolio, a separation of momentum and reversal can be observed for six G7 countries.¹⁴

Let us turn to the MIN portfolio. In the stock markets of the USA, Japan, and Italy, the MIN portfolio only exhibits reversal. However, in the German, UK, Canadian, and French stock markets the MIN portfolio realizes momentum initially and reversal in the second year (12–24) and third year (24–36) after portfolio formation. Hence, the

¹² The MAX portfolio holds HR winners long which earn high expected returns and LR losers short which earn low expected returns. On the long leg, the MAX portfolio should earn high returns if winners realize momentum. In contrast, the loser leg of the MAX portfolio should earn low expected returns if losers realize momentum. Hence, the MAX portfolio is constructed such that if momentum is realized it will earn *maximum* returns what calls for its naming. The logic behind the MIN portfolio is similar.

¹³ Cf. Tables 2 and 3.

¹⁴ Using the quintile spread approach in the spirit of Jegadeesh and Titman (1993) when forming the MAX portfolio yields that the UK and Italy change roles. Still, six G7 countries show a separation of momentum and reversal in the MAX portfolio.

					0				
	Portfolio	0–6 m	onths	6–12 n	nonths	12-24	months	24–36	months
USA									
	MAX	1.49	(9.76)	0.73	(5.18)	0.32	(3.12)	0.31	(3.21)
	MIN	-3.43	(-13.62)	-3.49	(-6.97)	-2.42	(-10.47)	-1.55	(-9.24)
Germany									
	MAX	1.83	(8.76)	0.67	(4.30)	0.37	(3.44)	0.14	(1.39)
	MIN	1.55	(8.28)	0.63	(3.90)	-0.32	(-3.10)	-0.31	(-3.19)
UK									
	MAX	1.57	(10.92)	0.57	(4.44)	0.15	(1.79)	-0.34	(-3.68)
	MIN	0.76	(4.32)	0.03	(0.19)	-0.53	(-5.95)	-0.27	(-3.09)
Japan									
	MAX	0.78	(6.03)	0.49	(4.21)	-0.04	(-0.48)	-0.11	(-1.56)
	MIN	-0.69	(-4.49)	-0.78	(-5.53)	-0.81	(-9.81)	-0.35	(-4.49)
Canada									
	MAX	2.31	(13.24)	1.07	(7.06)	0.39	(3.41)	0.50	(4.37)
	MIN	0.88	(5.14)	-0.18	(-1.17)	-0.95	(-8.97)	-0.38	(-3.49)
France									
	MAX	0.92	(5.22)	0.19	(1.18)	0.21	(1.50)	0.13	(1.17)
	MIN	0.63	(3.83)	0.05	(0.37)	-0.23	(-2.36)	-0.24	(-2.50)
Italy									
	MAX	1.17	(5.85)	0.90	(4.73)	0.02	(0.12)	-0.24	(-1.46)
	MIN	-0.04	(-0.13)	-1.18	(-2.39)	-0.98	(-7.96)	-0.54	(-5.07)

Table 10 Momentum and Reversal in Raw Returns Using Risk Profiles

Values are average monthly raw returns of MAX and MIN portfolios throughout semi-annual periods (0-6, 6-12 months) and annual periods (12-24, 24-36 months) after portfolio formation in percent. The construction of MAX and MIN portfolios using risk profiles is described in section 3.4. Portfolio weights are determined following the Lo and MacKinlay (1990) methodology at monthly frequency. The sample spreads July 1991–December 2017. Accounting for microstructure effects, we skip one month between portfolio formation and the subsequent holding periods. Figures in bold-face are statistically significant at the 10% level (t-stat > 1.65). T-statistics are in parenthesis

linkage of momentum and reversal can be reported in four G7 stock market regarding the MIN portfolio.¹⁵

Analyzing the evidence in Table 10 country-by-country reveals that the separation of momentum and reversal in raw returns can be observed solely in the USA, Japan, and Italy. In these countries, the MAX portfolio only shows momentum and the MIN portfolio only experiences reversal. In the remaining G7 countries, the linkage of momentum and reversal in raw returns is documented in the MIN portfolio.

As pointed out by Conrad and Yavuz (2017), return continuation and reversal are anomalies. Thus, scrutinizing whether the raw return results in Table 10 are driven by fundamental risk requires the analysis of the MAX and MIN portfolios in risk-adjusted

¹⁵ In France, the MIN portfolio only realizes momentum but no reversal upon applying the quintile spread approach in the spirit of Jegadeesh and Titman (1993) for portfolio construction. All other observations remain unchanged.

terms. Redoing the analysis gives us country-specific Fama and French (1993) three factor alphas in Table 11 for both the MAX portfolio and the MIN portfolio.

A first observation from Table 11 is that those portfolios showing momentum in raw returns also exhibit momentum in Fama and French (1993) three factor alphas. However, momentum in risk-adjusted returns is never realized in the second year (12–24) or third year (24–36) after portfolio formation. Hence, the momentum in raw returns in these periods is merely a compensation for fundamental risk rather than true momentum.

In the US-American, German, and Canadian stock market, the MAX portfolio only exhibits momentum but does not experience reversal. In these countries, we observe a separation of momentum and reversal in risk-adjusted returns of the MAX portfolio. In the UK, Japan, France, and Italy, the MAX portfolio shows a linkage of short-

	Portfolio	0–6 m	onths	6–12 n	nonths	12-24	months	24–36	months
USA									
	MAX	1.03	(5.41)	0.30	(1.47)	-0.14	(-1.27)	-0.11	(-0.88)
	MIN	-3.20	(-9.21)	-3.29	(-6.88)	-2.51	(-8.15)	-1.63	(-8.25)
Germany									
	MAX	1.54	(6.16)	0.53	(2.24)	0.18	(1.41)	0.07	(0.70)
	MIN	1.27	(5.49)	0.75	(3.17)	-0.35	(-3.15)	-0.43	(-4.12)
UK									
	MAX	1.24	(5.79)	0.24	(1.12)	-0.17	(-1.77)	-0.68	(-6.27)
	MIN	0.93	(4.14)	0.17	(0.81)	-0.59	(-6.05)	-0.46	(-5.03)
Japan									
	MAX	0.41	(2.16)	0.13	(0.87)	-0.25	(-3.25)	-0.22	(-2.51)
	MIN	-0.68	(-2.57)	-0.69	(-3.88)	-0.52	(-7.55)	-0.11	(-1.68)
Canada									
	MAX	1.79	(6.30)	0.62	(2.69)	-0.06	(-0.50)	0.10	(0.73)
	MIN	0.88	(3.16)	-0.16	(-0.77)	-1.11	(-10.07)	-0.50	(-3.81)
France									
	MAX	0.60	(2.99)	-0.15	(-0.79)	-0.18	(-1.76)	-0.27	(-2.17)
	MIN	0.70	(3.58)	0.08	(0.41)	-0.11	(-1.26)	-0.25	(-2.81)
Italy									
	MAX	0.84	(3.20)	0.58	(2.17)	-0.32	(-2.12)	-0.52	(-2.77)
	MIN	-0.34	(-0.63)	-1.52	(-1.75)	-1.17	(-8.45)	-0.74	(-7.22)

Table 11 Momentum and Reversal in Risk-Adjusted Returns Using Risk Profiles

Values are risk-adjusted returns of MAX and MIN portfolios throughout semi-annual periods (0–6, 6–12 months) and annual periods (12–24, 24–36 months) after portfolio formation in percent. Risk-adjusted returns are the intercepts of time-series regressions of monthly portfolio returns in excess of the risk free rate on Fama and French (1993) three factors. The construction of MAX and MIN portfolios using risk profiles is described in section 3.4. Portfolio weights are determined following the Lo and MacKinlay (1990) methodology at monthly frequency. The sample spreads July 1991–December 2017. Accounting for microstructure effects, we skip one month between portfolio formation and the subsequent holding periods. The t-statistics are calculated with Newey-West robust standard errors with 12 lags and shown in parentheses. Figures in bold-face indicate statistical significance at the 10% level (t-stat > 1.65)

run momentum and long-run reversal in risk-adjusted returns. Hence, the linkage of momentum and reversal in the MAX portfolio is documented in four G7 countries.

As regards the MIN portfolio, the evidence in risk-adjusted returns compares favorably with the raw return results. In the USA, Japan, and Italy, the Fama and French (1993) three factor alphas of the MIN portfolio only report reversal but do not show momentum. In contrast, the MIN portfolio shows short-run momentum followed by long-run reversal in risk-adjusted returns in the German, the UK, the Canadian, and the French stock market. In those G7 countries, the MIN portfolio documents the linkage of momentum and reversal in risk-adjusted terms.

Inspecting the results in Table 11 country-wise yields that the linkage of momentum and reversal can be observed in the MAX portfolio or in the MIN portfolio across all G7 countries except for the USA. Put differently, the separation of momentum and reversal in both the MAX portfolio and the MIN portfolio can only be observed in the US stock market.

Finally, we analyze the decoupling of momentum in the MAX portfolio and of reversal in the MIN portfolio across G7 stock markets in two subperiods spreading the years 1991-2004 and 2005-2017. Raw returns and risk-adjusted returns of the portfolios MAX and MIN are collected in Tables 14 and 15, respectively. In case of the US stock market, the decoupling of momentum in the MAX portfolio and of reversal in the MIN portfolio found in the full period both in raw returns and risk-adjusted returns can only be confirmed in raw returns during the first subperiod.

In the non-US G7 stock markets, the separation of momentum in the MAX portfolio and reversal in the MIN portfolio cannot be observed in the first subperiod both in raw returns and risk-adjusted returns. In contrast, in the stock markets of Japan, Canada, and Italy the separation of momentum in the MAX portfolio and reversal in the MIN portfolio is documented in the second subperiod in both raw returns and risk-adjusted returns.

We point out that findings in subperiods differ from those in the full sample period. But, similar to Conrad and Yavuz (2017, p. 566) who do not report subperiod results at all we argue that the results in the full sample are due to the aggregation of returns from subperiods.

4 Conclusion

This paper puts Conrad and Yavuz's (2017) findings to the test. Conrad and Yavuz (2017) document that momentum and reversal are separate phenomena in the US stock market. In essence, Conrad and Yavuz (2017) identify momentum portfolios – more precisely, winner-loser portfolios which draw on different risk profiles – such that the returns of these momentum portfolios either exhibit momentum or reversal in the US stock market. Hence, Conrad and Yavuz (2017) conclude that the widely postulated linkage of momentum and reversal cannot be sustained.

We expand Conrad and Yavuz's (2017) study by an international perspective and challenge their results with evidence from the stock markets of the G7 countries. We document the following results from analyzing the G7 stock markets. First, in the German, UK, Canadian, French, and Italian stock markets unconditional momen-

tum portfolios show short-run momentum and long-term reversal. From the USA and Japan, we report different evidence. There, unconditional portfolios solely experience reversal but lack momentum. A subperiod analysis for unconditional momentum portfolios does not alter these insights substantially. Second, conditional reversal at the level of individual stocks corresponds to the findings on unconditional momentum portfolios. In the US and Japanese stock markets, winner stocks with realized momentum revert most likely. Furthermore, we find that reversal in unconditional momentum portfolios driven by the short loser leg is consistent with the portions of loser stocks with realized momentum which experience reversal. Third, conditional momentum portfolios - momentum portfolios formed of realized momentum stocks, in particular – show a linkage of momentum and reversal both in terms of raw returns and risk-adjusted returns in each G7 country. In all G7 stock markets, conditional momentum portfolios made up of contrarian stocks solely exhibit reversal but not return continuation. Finally, in the USA the separation of momentum and reversal obtains in momentum portfolios which rely on different risk profiles. Contrary to the US result, momentum portfolios made up of different risk profiles from the remaining G7 countries exhibit momentum in the short run and long-term reversal. Thus, we document the linkage of momentum and reversal in Germany, the UK, Japan, Canada, France, and Italy.

Briefly, we confirm Conrad and Yavuz's (2017) evidence for the US stock market. Momentum portfolios can be constructed from different risk profiles which show either return continuation or return reversal. In contrast, we report that the linkage of momentum and reversal can be observed for these momentum portfolios across the remaining G7 countries. Put differently, our clean country-wise multi-country study delivers unambiguous results for non-US countries which stand in sharp contrast to the US evidence. Thus, our study highlights that US evidence does not translate to other international stock markets without reservation.

On grounds of our results, we resurrect the behavioral theories which explain a linkage of short-run momentum and long-run reversal in asset prices based on behavioral traits of economic agents. However, the mixed evidence from the US and the remaining G7 stock markets on the linkage or separation of both phenomena calls for versatile behavioral theories similar to Luo et al. (2021).

From an investor's perspective, our evidence on reversal following momentum suggests that the respective portfolios should be held in the momentum period but not throughout the reversal period. This means that momentum portfolios should be liquidated after one year (two years) if reversal occurs in the medium term (long term). On the one hand, our analysis suggests such a strategic behavior for the MIN portfolio in Germany, the UK, Canada, and France as in those countries the MIN portfolio shows medium-term reversal. On the other hand, the MAX portfolio can be held up to three years without experiencing reversal in the G7 stock markets except for the UK where reversal occurs in the third year after portfolio formations. Note that these implications are not to be misconstrued as one-shot investment advice since our analysis relies on monthly portfolio formation throughout roughly 25 years and reports average monthly returns from roundabout three hundred portfolio formations.

We point out that our analysis is subject to a straightforward limitation related to the investor's perspective mentioned above. Namely, we argue along past data and do not predict future stock market behavior. Learning from the past implicitly assumes that the future stock market evolution is similar to what we observed in the past. However, our sample period covers unprecedented crises as the US subprime crisis and the European sovereign debt crisis. Such events cannot be projected in the future. Whether and how the Covid-19 pandemic as well as the Russian-Ukrainian military conflict affects the G7 stock markets regarding the linkage of momentum and reversal is beyond our insights as our sample period does not cover those crises. Furthermore, our sample period is short since the availability of systematic risk factor data for the G7 stock markets except for the US stock market is limited. Finally, we did not explicitly take into account transaction costs. In this respect, we follow Conrad and Yavuz (2017). However, we account for microstructure effects by skipping one month between portfolio formation and subsequent holding periods.

In the Chinese stock market, Chui et al. (2022) report that investor clienteles matter for momentum and reversal. They document that a market segment dominated by retail investors exhibits reversal whereas a market segment with a relatively stronger prevalence of institutional investors exhibits momentum. Drawing on these insights, our clean country-wise multi-country study immediately raises the question whether the linkage of momentum and reversal is driven by differences in the mixes of investor clienteles in the non-US G7 stock markets compared to the US stock market. We leave this issue for future research.

Appendix

						W-L						
Country	0–6 month	IS	6–12 month	15	12–24 month	IS	24–36 month	IS	36–48 month	IS	48–60 month	IS
Panel A: 1	991 – 2	2004										
USA	-0.89	(-4.56)	-1.84	(-3.66)	-1.49	(-8.92)	-0.96	(-5.21)	-0.37	(-2.40)	-0.49	(-2.28)
Germany	1.60	(6.22)	1.08	(4.91)	0.04	(0.28)	0.10	(0.81)	0.27	(2.24)	0.11	(0.80)
UK	1.75	(10.43)	0.91	(5.80)	-0.13	(-1.29)	-0.29	(-3.09)	0.13	(1.18)	0.11	(0.82)
Japan	0.00	(-0.01)	-0.16	(-0.77)	-0.45	(-4.28)	0.04	(0.41)	-0.18	(-1.87)	0.19	(1.83)
Canada	1.93	(7.66)	0.05	(0.18)	-0.83	(-5.93)	-0.47	(-3.34)	0.12	(0.91)	-0.06	(-0.39)
France	1.10	(7.33)	0.43	(3.05)	-0.10	(-0.88)	0.09	(0.86)	0.23	(1.64)	-0.51	(-4.45)
Italy	1.07	(4.64)	0.75	(3.25)	-0.73	(-5.15)	-0.18	(-1.28)	0.02	(0.16)	-0.32	(-2.03)
Panel B: 2	005 - 2	2017										
USA	-2.58	(-5.95)	-1.38	(-7.63)	-1.45	(-3.99)	-0.82	(-4.36)	-0.20	(-1.51)	-0.35	(-3.31)
Germany	1.29	(5.64)	0.47	(2.94)	-0.07	(-0.64)	-0.42	(-3.52)	0.32	(2.91)	-0.04	(-0.36)
UK	0.41	(1.69)	0.19	(1.31)	-0.18	(-1.80)	-0.08	(-0.83)	-0.12	(-1.42)	-0.01	(-0.08)
Japan	-0.08	(-0.39)	-0.40	(-2.76)	-0.56	(-5.94)	-0.32	(-3.41)	-0.13	(-1.53)	-0.55	(-6.39)
Canada	0.44	(1.87)	0.47	(2.43)	-0.30	(-2.25)	-0.04	(-0.25)	-0.25	(-1.90)	-0.09	(-0.75)

 Table 12
 Raw Returns of Unconditional Momentum Portfolios (1991-2004 and 2005-2017)

Table	12	continued
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						W-L						
Country	0–6 month	15	6–12 month	IS	12–24 month	1S	24–36 month	18	36–4 mont	8 hs	48–60 month	IS
France	0.58	(2.72)	0.00	(0.02)	-0.41	(-3.73)	-0.06	(-0.58)	0.40	(3.78)	-0.16	(-1.74)
Italy	-0.29	(-0.55)	-1.57	(-2.20)	-0.82	(-5.13)	-0.61	(-4.59)	0.84	(3.35)	0.74	(3.70)

Values are average monthly raw returns of portfolios in semi-annual holding periods (0-6, 6-12 months) or annual holding periods (12-24, 24-36, 36-48, 48-60 months) after portfolio formation in percent. Portfolios are formed using the Lo and MacKinlay (1990) methodology. By winner-loser (W–L) we denote the relative strength portfolio which is a zero-investment portfolio with past winner stocks long and past loser stocks short. The sample spreads July 1991–December 2017 and portfolios are formed at monthly frequency. Accounting for microstructure effects, we skip one month between portfolio formation and the subsequent holding periods. Figures in bold-face are statistically significant at the 10% level (t-stat > 1.65). T-statistics are in parenthesis

 Table 13
 Risk-Adjusted Returns of Unconditional Momentum Portfolios (1991-2004 and 2005-2017)

						W-L						
Country	0–6 month	IS	6–12 month	IS	12–24 month	1S	24–36 month	IS	36–48 month	IS	48–60 month	IS
Panel A: 1	991 – 2	2004										
USA	-1.07	(-3.35)	-1.91	(-4.36)	-1.99	(-11.29)	-1.34	(-6.34)	-0.91	(-4.70)	-0.62	(-2.83)
Germany	0.74	(2.27)	0.51	(2.08)	-0.18	(-1.17)	0.08	(0.74)	0.25	(2.27)	-0.04	(-0.27)
UK	1.30	(5.70)	0.43	(2.20)	-0.51	(-4.69)	-0.72	(-5.42)	0.02	(0.12)	0.11	(0.74)
Japan	-0.69	(-2.06)	-0.62	(-2.23)	-0.52	(-4.79)	-0.02	(-0.16)	-0.19	(-1.21)	0.23	(1.57)
Canada	1.50	(4.09)	-0.34	(-1.11)	-1.30	(-7.76)	-1.01	(-5.99)	-0.19	(-1.17)	-0.40	(-2.06)
France	0.58	(3.33)	0.01	(0.09)	-0.46	(-4.54)	-0.19	(-1.76)	0.28	(1.89)	-0.54	(-4.41)
Italy	0.58	(1.97)	0.25	(0.95)	-1.12	(-8.71)	-0.58	(-4.51)	-0.42	(-3.47)	-0.31	(-2.36)
Panel B: 2	005 - 2	2017										
USA	-2.57	(-4.58)	-1.35	(-4.66)	-1.62	(-3.87)	-0.90	(-3.66)	-0.12	(-1.00)	-0.42	(-3.32)
Germany	1.27	(4.15)	0.38	(1.63)	-0.18	(-1.36)	-0.52	(-4.58)	0.22	(2.11)	-0.07	(-0.64)
UK	0.27	(0.67)	0.08	(0.39)	-0.32	(-2.42)	-0.15	(-1.37)	-0.09	(-0.84)	-0.02	(-0.20)
Japan	-0.34	(-0.84)	-0.59	(-2.68)	-0.45	(-5.78)	-0.16	(-1.82)	-0.02	(-0.30)	-0.31	(-3.51)
Canada	0.32	(0.62)	0.46	(1.31)	-0.25	(-1.90)	-0.08	(-0.52)	-0.36	(-2.02)	-0.19	(-1.48)
France	0.49	(1.45)	-0.06	(-0.27)	-0.45	(-4.67)	-0.11	(-0.77)	0.46	(3.84)	-0.09	(-1.06)
Italy	-0.53	(-0.73)	-1.63	(-1.54)	-0.99	(-5.35)	-0.90	(-5.56)	0.86	(1.92)	0.81	(2.31)

Values are average monthly risk-adjusted returns of portfolios in semi-annual holding periods (0–6, 6–12 months) or annual holding periods (12–24, 24–36, 36–48, 48–60 months) after portfolio formation in percent. Risk-adjusted returns are the intercepts of time-series regressions of monthly portfolio returns in excess of the risk free rate on Fama and French (1993) three factors. Portfolios are formed using the Lo and MacKinlay (1990) methodology. By winner-loser (W–L) we denote the relative strength portfolio which is a zero-investment portfolio with past winner stocks long and past loser stocks short. The sample spreads July 1991–December 2017 and portfolios are formed at monthly frequency. Accounting for microstructure effects, we skip one month between portfolio formation and the subsequent holding periods. The t-statistics are calculated with Newey-West robust standard errors with 12 lags and shown in parentheses. Figures in bold-face indicate statistical significance at the 10% level (t-stat > 1.65)

	Portfolio	0–6 mc	nonths 6–12		nonths	12–24 months		24–36 months	
Panel A: 19	91 – 2004								
USA	MAX	1.59	(8.80)	0.98	(5.01)	0.24	(1.52)	0.77	(5.06)
	MIN	-2.38	(-7.84)	-4.02	(-3.14)	-2.93	(-10.54)	-2.31	(-7.12)
Germany	MAX	0.73	(2.97)	0.45	(2.24)	0.10	(0.58)	0.07	(0.44)
	MIN	1.58	(6.25)	1.16	(4.85)	0.22	(1.44)	0.78	(5.29)
UK	MAX	1.74	(10.77)	1.05	(5.57)	0.28	(2.48)	-0.45	(-3.12)
	MIN	1.59	(7.16)	0.72	(3.76)	-0.18	(-1.30)	-0.18	(-1.25)
Japan	MAX	0.16	(0.72)	-0.20	(-0.99)	-0.47	(-3.59)	-0.43	(-3.27)
	MIN	0.04	(0.14)	-0.10	(-0.41)	-0.32	(-2.33)	0.40	(3.05)
Canada	MAX	2.53	(10.29)	1.13	(4.30)	-0.29	(-1.45)	0.32	(1.61)
	MIN	1.93	(6.92)	0.28	(1.07)	-0.72	(-3.85)	-0.41	(-2.24)
France	MAX	0.74	(3.10)	-0.39	(-1.44)	-0.31	(-1.25)	0.05	(0.21)
	MIN	1.16	(5.62)	0.48	(2.36)	0.05	(0.31)	0.10	(0.60)
Italy	MAX	0.64	(1.65)	1.01	(2.48)	-0.55	(-1.87)	-1.21	(-3.07)
	MIN	1.00	(3.45)	0.26	(0.82)	-0.64	(-3.25)	-0.14	(-0.70)
Panel B: 20	05 – 2017								
USA	MAX	0.34	(1.63)	-0.04	(-0.21)	-0.21	(-1.27)	-0.32	(-1.87)
	MIN	-3.65	(-9.95)	-2.10	(-8.79)	-1.94	(-3.51)	-1.03	(-3.59)
Germany	MAX	1.73	(4.78)	0.01	(0.04)	0.14	(0.99)	0.08	(0.55)
	MIN	1.31	(5.03)	0.65	(3.34)	-0.16	(-1.07)	-0.76	(-5.02)
UK	MAX	0.50	(2.15)	-0.15	(-0.73)	-0.32	(-2.13)	-0.62	(-3.56)
	MIN	0.58	(1.82)	0.41	(2.00)	-0.30	(-1.94)	0.26	(1.79)
Japan	MAX	1.11	(5.60)	0.71	(3.86)	0.19	(1.44)	0.11	(0.93)
	MIN	-0.93	(-3.90)	-1.04	(-5.40)	-1.06	(-8.11)	-0.72	(-5.64)
Canada	MAX	1.47	(5.24)	0.89	(3.83)	0.44	(2.66)	0.50	(2.61)
	MIN	-0.18	(-0.67)	-0.32	(-1.41)	-1.11	(-6.41)	-0.20	(-1.07)
France	MAX	0.33	(1.16)	0.13	(0.51)	0.33	(1.37)	0.25	(1.45)
	MIN	0.82	(3.13)	-0.03	(-0.18)	-0.31	(-2.40)	-0.05	(-0.40)
Italy	MAX	1.20	(4.31)	0.85	(3.47)	0.12	(0.71)	0.05	(0.30)
	MIN	-1.19	(-1.42)	-3.32	(-2.50)	-1.54	(-6.03)	-0.44	(-2.49)

Table 14 Momentum and Reversal in Raw Returns Using Risk Profiles (1991-2004 and 2005-2017)

Values are average monthly raw returns of MAX and MIN portfolios throughout semi-annual periods (0–6, 6–12 months) and annual periods (12–24, 24–36 months) after portfolio formation in percent. The construction of MAX and MIN portfolios using risk profiles is described in section 3.4. Portfolio weights are determined following the Lo and MacKinlay (1990) methodology at monthly frequency. The sample spreads July 1991–December 2017. Accounting for microstructure effects, we skip one month between portfolio formation and the subsequent holding periods. Figures in bold-face are statistically significant at the 10% level (t-stat > 1.65). T-statistics are in parenthesis

	Portfolio	0–6 mo	onths	6–12 months		12-24 months		24–36 months	
Panel A: 19	991 – 2004								
USA	MAX	0.87	(3.75)	0.51	(1.85)	-0.49	(-2.52)	0.03	(0.15)
	MIN	-2.25	(-4.49)	-3.59	(-3.61)	-3.20	(-12.22)	-2.34	(-7.79)
Germany	MAX	0.64	(1.75)	0.38	(1.40)	-0.17	(-0.74)	0.33	(2.02)
	MIN	0.47	(1.66)	0.44	(1.80)	-0.23	(-1.61)	0.48	(4.30)
UK	MAX	1.33	(5.61)	0.50	(1.77)	-0.28	(-2.20)	-1.15	(-6.65)
	MIN	1.09	(4.81)	0.36	(1.82)	-0.54	(-3.76)	-0.46	(-2.77)
Japan	MAX	-0.11	(-0.31)	-0.46	(-1.43)	-0.54	(-3.70)	-0.50	(-3.10)
	MIN	-0.87	(-2.52)	-0.73	(-2.76)	-0.46	(-3.81)	0.26	(2.60)
Canada	MAX	2.27	(4.67)	0.88	(2.24)	-0.83	(-4.00)	-0.39	(-1.91)
	MIN	1.36	(3.48)	-0.26	(-0.80)	-1.32	(-7.75)	-0.81	(-4.28)
France	MAX	0.59	(2.62)	-0.60	(-2.54)	-0.88	(-4.77)	-0.62	(-3.06)
	MIN	0.43	(2.17)	0.06	(0.29)	-0.13	(-1.00)	0.02	(0.15)
Italy	MAX	0.04	(0.07)	0.26	(0.54)	-1.23	(-3.95)	-1.64	(-4.12)
	MIN	0.60	(1.58)	0.04	(0.13)	-0.84	(-4.88)	-0.42	(-2.61)
Panel B: 20	005 - 2017								
USA	MAX	0.22	(0.71)	-0.20	(-0.52)	-0.42	(-2.81)	-0.52	(-2.33)
	MIN	-3.53	(-6.38)	-2.00	(-6.31)	-1.99	(-3.12)	-1.09	(-3.14)
Germany	MAX	1.82	(4.00)	-0.13	(-0.38)	0.07	(0.52)	0.05	(0.41)
	MIN	1.20	(3.38)	0.55	(1.98)	-0.29	(-1.65)	-0.95	(-5.77)
UK	MAX	0.46	(1.41)	-0.21	(-0.79)	-0.39	(-2.87)	-0.71	(-3.77)
	MIN	0.40	(0.86)	0.29	(1.06)	-0.49	(-2.95)	0.20	(1.43)
Japan	MAX	0.69	(2.41)	0.21	(1.02)	-0.12	(-1.19)	0.02	(0.16)
	MIN	-0.98	(-1.98)	-1.02	(-3.29)	-0.67	(-7.63)	-0.35	(-3.09)
Canada	MAX	1.07	(2.11)	0.66	(1.96)	0.39	(2.32)	0.40	(2.33)
	MIN	-0.12	(-0.21)	-0.21	(-0.57)	-1.02	(-5.98)	-0.19	(-0.88)
France	MAX	0.18	(0.52)	-0.03	(-0.11)	0.08	(0.58)	0.06	(0.27)
	MIN	0.76	(2.06)	-0.07	(-0.26)	-0.23	(-1.76)	0.01	(0.10)
Italy	MAX	1.03	(2.96)	0.67	(1.67)	-0.01	(-0.07)	-0.15	(-0.78)
	MIN	-1.45	(-1.29)	-3.25	(-1.72)	-1.75	(-6.20)	-0.77	(-3.79)

Table 15Momentum and Reversal in Risk-Adjusted Returns Using Risk Profiles (1991-2004 and 2005-2017)

Values are risk-adjusted returns of MAX and MIN portfolios throughout semi-annual periods (0–6, 6–12 months) and annual periods (12–24, 24–36 months) after portfolio formation in percent. Risk-adjusted returns are the intercepts of time-series regressions of monthly portfolio returns in excess of the risk free rate on Fama and French (1993) three factors. The construction of MAX and MIN portfolios using risk profiles is described in section 3.4. Portfolio weights are determined following the Lo and MacKinlay (1990) methodology at monthly frequency. The sample spreads July 1991–December 2017. Accounting for microstructure effects, we skip one month between portfolio formation and the subsequent holding periods. The t-statistics are calculated with Newey-West robust standard errors with 12 lags and shown in parentheses. Figures in bold-face indicate statistical significance at the 10% level (t-stat > 1.65)

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Data Availability The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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