

# International Price and Earnings Momentum

Markus Leippold

Harald Lohre

University of Zurich

Union Investment

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# Motivation

## Momentum Puzzle

- Price and earnings momentum are constantly defying market efficiency around the globe which common research either rationalizes by risk-based or behavioral-based explanations
- Only meaningful if evidence is not spurious in the first place

## Open Issues Addressed in this Paper

- Are price and earnings momentum robust w.r.t. data snooping biases in a comprehensive sample of 17 countries?
- Is price momentum subsumed by earnings momentum?
- Is there a relation between macroeconomy and momentum?
- Is momentum an underreaction phenomenon?
- Why is momentum persistent?

## Data and Sample Selection

### Comprehensive sample of 17 developed countries:

- 16 European markets and the U.S., spanning 1988–2009
- Largest European markets: U.K., France, Germany, Switzerland and the Netherlands
- Survivorship bias avoided by including dead companies
- Adjust for secondary issues and cross listings
- Penny stocks are excluded, i.e., stock price below \$5
- In total, we end up with 59,394 firm-years (32,905 firm-years for the U.S.)

### Cleaning Datastream Return Data:

- Ince and Porter (2006), “Handle Datastream Data with Care!”
- Issues not resolved by Datastream screened and corrected

# Momentum Strategies

## Price Momentum: Jegadeesh and Titman (1993, 2001)

- Buy winners and sell losers
- Momentum measured over 6 months, 6 months holding period, monthly rebalancing implies 6 overlapping portfolios

## Earnings Momentum: Chan, Jegadeesh, Lakonishok (1996)

- Buy positive and sell negative revisions
- Earnings momentum signal is 6 months cumulated I/B/E/S revisions:

$$REV6_{it} = \sum_{j=0}^6 \frac{f_{it-j} - f_{it-j-1}}{p_{it-j-1}}$$

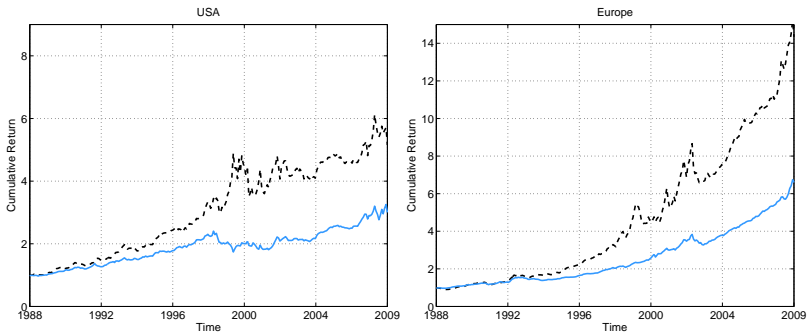
- 6 months holding period, monthly rebalancing, overlapping portfolios

## Momentum Portfolios: Risk and Return

Country		Momentum Ranking					Hedge Strategy
		Lowest	2	3	4	Highest	
<i>Price Momentum</i>							
USA	Return	0.70	0.90	1.02	1.12	1.43	<b>0.72</b>
	Volatility	7.01	5.12	4.52	4.56	6.19	3.91
	Beta	1.22	0.88	0.76	0.78	1.05	-0.16
	Size	19.81	20.33	20.50	20.54	20.27	<b>(2.99)</b>
Europe	Return	0.31	0.64	0.88	1.05	1.41	<b>1.11</b>
	Volatility	5.74	4.45	4.07	4.09	4.77	3.24
	Beta	1.27	0.99	0.91	0.91	1.04	-0.23
	Size	20.38	20.94	21.17	21.29	21.16	<b>(5.51)</b>
<i>Earnings Momentum</i>							
USA	Return	0.92	0.85	0.80	1.08	1.38	<b>0.46</b>
	Volatility	6.60	5.34	4.64	4.85	5.66	2.39
	Beta	1.18	0.94	0.79	0.83	1.00	-0.11
	Size	19.51	20.20	20.64	20.66	20.09	<b>(3.12)</b>
Europe	Return	0.52	0.62	0.73	0.87	1.28	<b>0.76</b>
	Volatility	5.26	4.64	4.18	4.15	4.49	1.65
	Beta	1.20	1.06	0.94	0.93	1.02	-0.13
	Size	20.00	21.05	21.44	21.46	20.67	<b>(7.42)</b>

- Extreme quintiles: Large volatility and beta, size bias
- Momentum portfolios: Negative betas!
- Europe: 13 (15) out of 16 with significant price (earnings) momentum alphas

## Cumulative Returns for the U.S. and Europe



- Price momentum (dashed), earnings momentum (solid)
  - Price momentum: Higher returns at a higher volatility
  - Earnings momentum: Higher risk-adjusted performance
- » Explained by Fama-French factors, i.e., simply compensation for risk?

## Fama-French Time Series Regressions

$$R_{Lt} - R_{St} = \alpha + \beta(R_{Mt} - R_{Ft}) + \gamma R_{SMBt} + \delta R_{HMLt} + \varepsilon_t$$

		Fama-French Model								
		$\alpha$	$\beta$	$\gamma$	$\delta$	$t(\alpha)$	$t(\beta)$	$t(\gamma)$	$t(\delta)$	Adj. $R^2$
<i>Price Momentum</i>										
USA	1	-0.77	1.33	-0.29	0.09	-5.21	42.87	-7.46	1.77	88.9
	5	0.05	1.06	-0.05	-0.29	0.33	32.38	-1.26	-5.38	84.3
	5-1	0.83	-0.27	0.24	-0.38	3.70	-5.84	4.08	-4.94	19.7
Europe	1	-0.63	1.27	-0.35	0.28	-5.16	42.31	-7.92	4.62	88.6
	5	0.60	1.06	-0.26	-0.03	4.90	35.50	-5.86	-0.56	83.7
	5-1	1.23	-0.21	0.09	-0.32	6.43	-4.45	1.33	-3.31	12.5
<i>Earnings Momentum</i>										
USA	1	-0.59	1.23	-0.09	0.14	-5.25	52.19	-3.16	3.73	92.8
	5	0.07	1.09	-0.24	-0.06	0.66	48.43	-8.47	-1.76	91.1
	5-1	0.66	-0.14	-0.15	-0.21	5.09	-5.16	-4.26	-4.68	26.7
Europe	1	-0.40	1.20	-0.25	0.23	-4.52	55.08	-7.76	5.14	92.8
	5	0.44	1.03	-0.24	0.12	5.21	49.89	-7.93	2.88	91.3
	5-1	0.84	-0.17	0.01	-0.11	9.19	-7.70	0.26	-2.35	22.1

- Risk factors explain most of the variation in extreme quintiles.
- Very low explanatory power for momentum portfolios
- Europe: Significant price (earnings) momentum alphas for 15 (14) countries (above 67 bp)

# Momentum Strategies and Data Snooping

- When testing several strategies some may outperform by chance alone:
  - Extensive re-use of a given database
  - Testing one investment idea in similar markets
- Control for data-snooping is essential:
  - Goal: When assessing several strategies, avoid as many false rejections of capital market efficiency.
  - Statistically speaking: Seek control of the FWE or FDP
    - ▶  $FWE = \text{Prob}(\text{Rejecting at least one of the true null hypotheses})$
    - ▶  $FDP = \# \text{false rejections} / \# \text{rejections}$
  - Classical methods are too conservative and virtually reject everything.
- We employ the most recent framework of Romano, Shaikh and Wolf (2008) (StepM Method).

## Data Snooping and Anomalies

Leippold and Lohre (2009), “The Dispersion Effect in Int'l Stock Returns.”

- Diether, Malloy, and Scherbina (2002) find evidence for anomalous dispersion returns by shorting high-dispersion stocks and going long low dispersion stocks.
- ⇒ Accounting for multiple hypothesis testing, the “dispersion anomaly” as a global phenomenon disappears.

Leippold and Lohre (2010), “Data Snooping and the Global Accrual Anomaly.”

- Profitable trading strategy: Go long in low accrual companies and short in high accruals companies (Sloan, 1996).
- ⇒ Accounting for multiple hypothesis testing, the accrual anomaly as a global phenomenon disappears.

# Is Momentum due to Data Snooping?

Country	Price Momentum					Earnings Momentum				
	$\theta_s$	StepM		FDP-StepM		$\theta_s$	StepM		FDP-StepM	
		$c_I$	rej	$c_I$	rej		$c_I$	rej	$c_I$	rej
USA	0.0083	0.0055	1	0.0064	1	0.0066	0.0036	1	0.0051	1
Europe	0.0123	0.0088	1	0.0099	1	0.0084	0.0059	1	0.0072	1
Austria	0.0067	0.0010	1	0.0028	1	0.0053	-0.0015	0	0.0019	1
Belgium	0.0104	0.0064	1	0.0077	1	0.0077	0.0037	1	0.0057	1
Denmark	0.0102	0.0056	1	0.0071	1	0.0116	0.0051	1	0.0083	1
Finland	0.0102	0.0044	1	0.0062	1	0.0097	0.0031	1	0.0064	1
France	0.0122	0.0088	1	0.0099	1	0.0090	0.0055	1	0.0072	1
Germany	0.0126	0.0083	1	0.0097	1	0.0083	0.0047	1	0.0065	1
Greece	0.0127	0.0058	1	0.0080	1	0.0033	-0.0045	0	-0.0006	0
Ireland	0.0067	0.0002	1	0.0023	1	0.0138	0.0022	1	0.0080	1
Italy	0.0129	0.0087	1	0.0100	1	0.0031	-0.0013	0	0.0009	1
Netherlands	0.0085	0.0045	1	0.0058	1	0.0095	0.0041	1	0.0068	1
Norway	0.0136	0.0077	1	0.0096	1	0.0080	0.0016	1	0.0048	1
Portugal	0.0093	0.0029	1	0.0049	1	0.0089	0.0014	1	0.0051	1
Spain	0.0089	0.0048	1	0.0061	1	0.0062	0.0007	1	0.0034	1
Sweden	0.0069	0.0015	1	0.0032	1	0.0084	0.0026	1	0.0055	1
Switzerland	0.0101	0.0052	1	0.0068	1	0.0063	0.0017	1	0.0040	1
UK	0.0094	0.0049	1	0.0064	1	0.0063	0.0032	1	0.0047	1
$\Sigma$			18		18			15		17

# Understanding Momentum

Since we find the momentum anomaly to be robust, we ask the following questions:

1. Is price momentum subsumed by earnings momentum or vice versa, i.e., do investors *underreact* to fundamental news represented by earnings revisions or do they *overreact* to price changes?
2. What is the economic rationale for the existence of momentum? In particular:
  - a) Is there a relation between macroeconomy and momentum, i.e., does momentum proxy macroeconomic risk?
  - b) Is momentum related to information uncertainty, i.e., do investors underreact when the signal about fundamentals is noisier?
3. Why is momentum not arbitrated away and what causes limits to arbitrage?



# Does Earnings Momentum Subsume Price Momentum?

$$R_{WMLt} = \alpha + \beta(R_{Mt} - R_{Ft}) + \gamma R_{SMBt} + \delta R_{HMLt} + \zeta R_{PMNt} + \varepsilon_t$$

		Fama-French Model			4-Factor Model				
		$\alpha$	$t(\alpha)$	Adj $R^2$ .	$\alpha$	$\zeta$	$t(\alpha)$	$t(\zeta)$	Adj. $R^2$
USA	1	-0.77	-5.21	88.9	-0.47	-0.45	-3.30	-6.76	90.6
	2	-0.24	-2.84	93.1	-0.18	-0.10	-2.00	-2.35	93.2
	3	-0.02	-0.22	92.0	-0.03	0.02	-0.38	0.54	92.0
	4	0.06	0.61	90.1	-0.03	0.13	-0.35	3.06	90.4
	5	0.05	0.33	84.3	-0.18	0.35	-1.16	4.85	85.6
	5-1	<b>0.83</b>	<b>3.70</b>	19.7	0.29	<b>0.80</b>	1.40	<b>8.35</b>	37.0
Europe	1	-0.63	-5.16	88.6	-0.06	-0.69	-0.47	-9.45	91.6
	2	-0.19	-2.52	93.0	-0.11	-0.10	-1.24	-1.91	93.1
	3	0.09	1.35	92.7	-0.01	0.12	-0.07	2.50	92.8
	4	0.28	3.54	91.0	0.04	0.28	0.50	5.47	91.9
	5	0.60	4.90	83.7	0.19	0.49	1.41	6.29	85.9
	5-1	<b>1.23</b>	<b>6.43</b>	12.5	0.24	<b>1.18</b>	1.33	<b>10.83</b>	40.3

- Typically high  $R^2$  for quintile portfolios
- U.S.: 4-factor alpha not significant confirming Chordia and Shivakumar (2006)
- Europe: Aggregate 4-factor alpha not significant (same for 5 other countries)

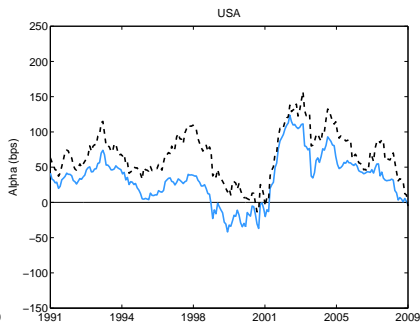
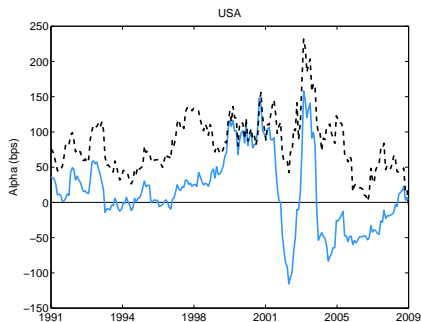
# Does Price Momentum Subsume Earnings Momentum?

$$R_{PMNt} = \alpha + \beta(R_{Mt} - R_{Ft}) + \gamma R_{SMBt} + \delta R_{HMLt} + \eta R_{WMLt} + \varepsilon_t$$

		Fama-French Model			4-Factor Model				
		$\alpha$	$t(\alpha)$	Adj. $R^2$	$\alpha$	$\eta$	$t(\alpha)$	$t(\eta)$	Adj. $R^2$
USA	1	-0.59	-5.25	92.8	-0.52	-0.08	-4.54	-2.50	93.0
	2	-0.41	-4.32	92.4	-0.38	-0.02	-3.98	-0.65	92.5
	3	-0.26	-2.97	91.5	-0.31	0.06	-3.49	2.48	91.7
	4	-0.05	-0.49	90.0	-0.13	0.11	-1.37	4.09	90.6
	5	0.07	0.66	91.1	-0.08	0.19	-0.78	7.00	92.7
	5-1	<b>0.66</b>	<b>5.09</b>	26.7	<b>0.44</b>	<b>0.27</b>	<b>3.73</b>	<b>8.35</b>	42.0
Europe	1	-0.40	-4.52	92.8	-0.25	-0.12	-2.68	-4.15	93.4
	2	-0.22	-3.45	95.3	-0.17	-0.04	-2.48	-1.88	95.3
	3	-0.04	-0.59	94.4	-0.05	0.01	-0.74	0.52	94.4
	4	0.09	1.32	92.6	-0.04	0.11	-0.58	4.80	93.2
	5	0.44	5.21	91.3	0.26	0.15	2.98	5.87	92.3
	5-1	<b>0.84</b>	<b>9.19</b>	22.1	<b>0.50</b>	<b>0.27</b>	<b>6.15</b>	<b>10.83</b>	46.9

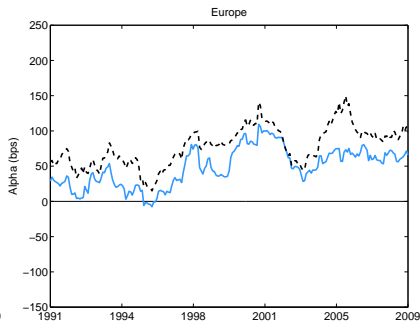
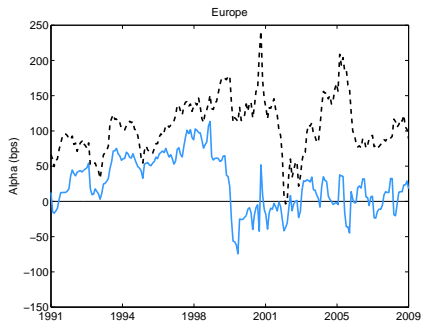
- Alphas remain large and significant, both for the U.S. and the European aggregate.
- 10/14 European earnings momentum anomalies remain significant.

## Fama-French vs. Four-Factor Alphas: U.S.



- Fama-French (dashed), 4-Factor (solid)
- Left figure: Earnings momentum subsumes price momentum except for 1999-2005.
- Right figure: Price momentum does not subsume earnings momentum.

## Fama-French vs. Four-Factor Alphas: Europe



- Fama-French (dashed), 4-Factor (solid)
- Left figure: Earnings momentum subsumes price momentum consistently throughout sample period.
- Right figure: Price momentum does not subsume earnings momentum.

## Risk or Behavioral Bias?

### What we have learned so far:

- Price momentum is mostly subsumed by earnings momentum in European equity markets.
- The market frenzy at the end of the nineties caused a temporary decoupling of this relationship in the U.S..
- Nevertheless, given this close relation suggests that both momentum phenomena may be traced back to similar sources.

### What causes momentum?

Two strands of research:

- Risk-based explanation, see Chordia and Shivakumar (2002, 2006): Momentum may reflect future economic activity or mispricing of certain macroeconomic variables.
- Behavioral-based explanation, see Zhang (2006): Investors tend to underreact to fundamental news.

# Momentum and the Macroeconomy

## Conjecture and Test Procedure:

- Momentum may reflect future economic activity or mispricing of certain macroeconomic variables.
- Regression of future GDP growth (and other variables) on lagged values of FF factors and one momentum factor.

## Results:

- Market factor tends to be a leading indicator of future economic growth.
- Negative relation: Small cap or value stocks suffer(thrive) prior to periods of economic growth(slowdown).
- Earnings momentum as a macroeconomic risk factor?
- Rather weak link between future GDP growth (and other variables) and both momentum factors.

# Momentum and Information Uncertainty

## Conjecture:

- Theoretical models suggest investors' underreaction to cause the momentum effects, see Hong and Stein (1999).
- If momentum is due to investors' underreaction, momentum should be stronger in more opaque information environments for which information diffusion is slowest.

## Test Procedure:

- Analyze winner and loser portfolios limited to different degrees of information uncertainty as measured by:
  - ▶ Analyst coverage
  - ▶ Company size
  - ▶ (Total volatility)
  - ▶ Idiosyncratic volatility

## Momentum and Information Uncertainty

Country	Analyst Coverage			Size			Idiosyncratic Volatility		
	Low	Mid	High	Low	Mid	High	Low	Mid	High
<i>Price Momentum</i>									
USA	1.05	0.70	0.56	1.15	0.68	0.60	0.72	0.75	0.71
	4.79	3.03	1.86	5.01	2.92	1.98	3.68	3.60	2.96
Europe	1.21	1.34	0.77	1.72	1.07	0.87	1.06	1.00	1.17
	4.77	6.29	3.40	5.93	4.81	3.65	5.67	5.56	5.00
# max ranking	5	6	0	8	3	0	1	1	9
	1.73	1.45	2.82	1.36	1.73	2.91	2.27	2.27	1.27
<i>Earnings Momentum</i>									
USA	0.77	0.48	0.20	0.78	0.49	0.27	0.59	0.50	0.47
	5.24	3.03	0.95	4.76	3.13	1.40	4.04	3.10	2.75
Europe	0.85	0.85	0.59	1.11	0.64	0.63	0.72	0.77	0.77
	7.13	6.76	3.75	8.39	5.74	4.04	6.99	7.51	5.52
# max ranking	5	5	1	7	2	2	3	3	5
	1.73	1.45	2.73	1.55	2.00	2.45	1.91	2.00	1.91

- U.S./most European countries: Price and earnings momentum more pronounced when limited to high information uncertainty stocks.
- Hence, high arbitrage costs (high idiosyncratic risk) may deter investors from exploiting the momentum anomalies.

## Liquidity Measures and Test Procedure

- Arbitrage costs may also be linked to liquidity.
- Liquidity metrics:
  1. Quantity dimension: Volume and turnover
  2. Price impact dimension: Amihud's (2002) *ILLIQ* measure
  3. Including trading speed as in Liu (2006):

$$\text{Liu Measure} = \# \text{ No-Trading Days} + \frac{1/\text{Turnover}}{1,000,000}$$

- Stocks are sorted into five quintiles based on past returns or earnings revisions.
- For each quintile, the stocks are further sorted into three terciles based on one of the liquidity measures.
- We exclude the six smallest countries from the analysis, i.e., Austria, Finland, Greece, Ireland, Norway, and Portugal.

## Momentum and Liquidity

Country	<i>Dollar Volume</i>			<i>Share Turnover</i>			<i>ILLIQ</i>			<i>Liu Measure</i>		
	High	Mid	Low	High	Mid	Low	Low	Mid	High	Low	Mid	High
<i>Price Momentum</i>												
USA	0.57	0.66	0.82	0.62	0.58	0.69	0.62	0.64	1.08	0.62	0.50	1.11
	1.91	2.86	4.09	2.29	2.61	3.63	2.11	2.71	4.65	2.37	2.18	5.03
Europe	0.99	1.18	1.29	1.22	0.98	1.07	0.96	1.22	1.24	1.19	0.97	1.37
	4.10	5.79	7.11	5.03	4.93	5.94	4.06	5.51	7.00	5.16	4.46	7.70
# max ranking	1	4	6	6	2	3	1	2	8	4	1	6
	2.27	1.91	1.73	1.55	2.18	2.09	2.55	2.09	1.36	2.00	2.18	1.82
<i>Earnings Momentum</i>												
USA	0.29	0.32	0.83	0.16	0.48	0.75	0.23	0.39	0.86	0.25	0.38	0.88
	1.46	1.93	5.26	0.83	2.85	5.21	1.20	2.30	5.36	1.33	2.22	6.60
Europe	0.66	0.79	0.83	0.85	0.65	0.81	0.67	0.78	0.83	0.76	0.76	0.84
	4.28	6.71	8.02	6.01	5.36	8.37	4.53	6.81	7.50	4.93	7.02	8.78
# max ranking	1	6	4	5	2	4	3	2	6	1	5	5
	2.64	1.45	1.91	1.82	2.27	1.91	2.27	1.91	1.82	2.45	1.55	1.91

- Liquidity appears to be a more severe impediment to implementing earnings momentum strategies as opposed to price momentum strategies.

## Conclusion

- International momentum effects are robust when controlling for data snooping biases.
- Price momentum is mostly earnings momentum in disguise, with some decoupling in the U.S. after the burst of the tech bubble.
- The evidence of momentum is due to investors' underreaction to fundamental news, not macroeconomic risk.
- Liquidity turns out to be a crucial driver in governing the momentum effects.
- The U.S. momentum effects are clearly most pronounced among illiquid winner and loser stocks.
- However, some European markets exhibit very profitable price momentum strategies even for highly liquid stocks.

## List of Abbreviations

- $f_{it}$  is the consensus estimate for company  $i$  in month  $t$
- Several Ingredients to the Fama French Regressions:
  - $R_{Lt} - R_{St}$  denotes the differential return of long minus short leg
  - $\alpha$  is the regression's intercept (alpha)
  - $(R_{Mt} - R_{Ft})$  is the excess market return
  - $R_{SMBt}$  is the return to the size factor of Fama and French
  - $R_{HMLt}$  is the return to the value factor of Fama and French
  - $R_{WMLt}$  is the return to the price momentum portfolio
  - $R_{PMNt}$  is the return to the earnings momentum portfolio
  - $\beta, \gamma, \delta, \eta, \zeta$  denote the coefficients and  $\varepsilon_t$  is the error term
- Data Snooping Methodology:
  - $\theta_s$  denotes the test statistic, in this case the Fama French alpha
  - $c_l$  denotes the lower boundary of the confidence region
  - $rej$  is the test decision where one indicates rejection of  $\theta_s = 0$  (capital market efficiency)