

# Covering-Up when the Tide Goes Out?

## Momentum Seasonality and Investor Preferences

Nigel J. Barradale

Copenhagen Business School

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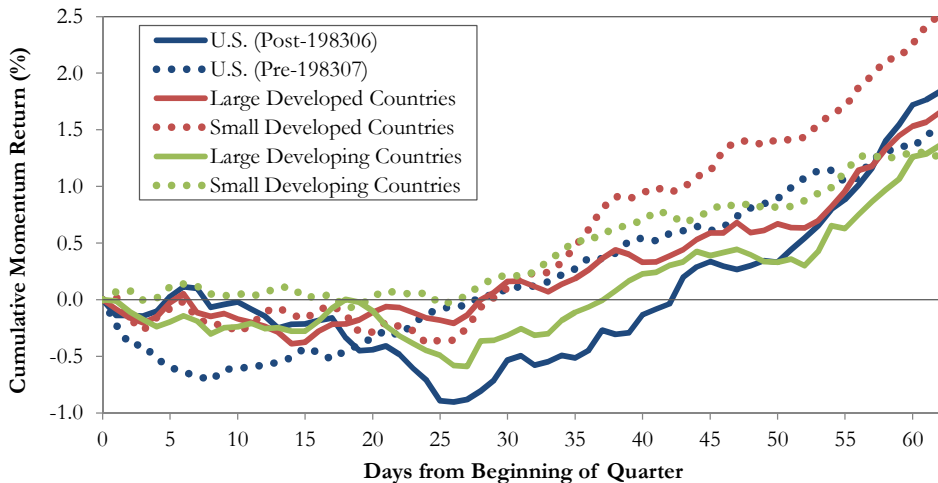
# Momentum

- Cross-sectional momentum:
  - Stocks that have performed well (poorly) for 3-12 months continue to perform well (poorly) (Jegadeesh Titman 1993)
  - Year-end effect: high in December, low in January
    - Consistent with tax-loss selling (Wachtel 1942; Roll 1983; Grinblatt Moskowitz 2004)
- Time-series momentum:
  - (Stock) markets that have performed well (poorly) for 3-12 months continue to perform well (poorly) (Cutler et al 1991; Moskowitz et al 2012)

# Main Contributions

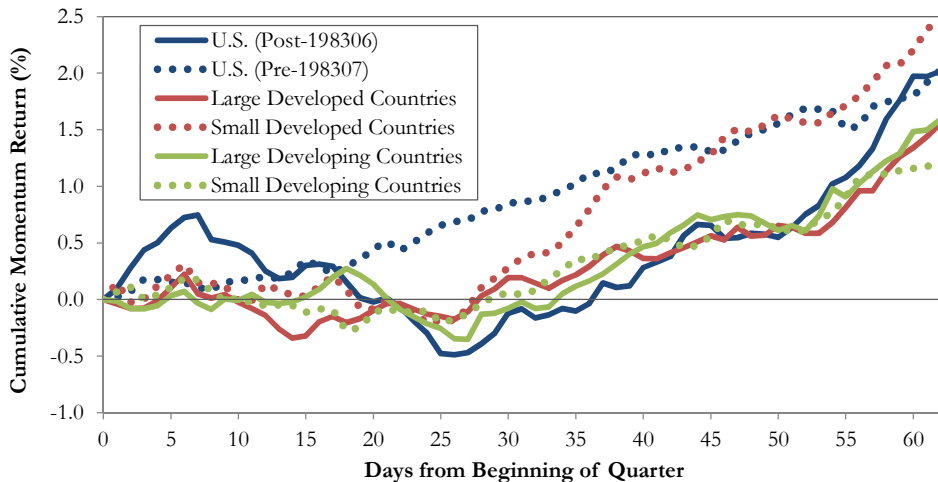
- Cross-sectional momentum has intra-quarter seasonality
  - Increasing returns through the quarter
    - Even when the year-end is excluded (unlike Sias 2007)
  - For US and internationally
  - Especially after a market decline

# Cumulative Momentum Factor Return (Including Year-End)



Data: Ken French (US), Datastream (International), value weighted, daily, 30/70, 21-251 days

# Cumulative Momentum Factor Return (Excluding 31 December +/- 30 Days)



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  - Increasing returns through the quarter
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- Cross-sectional momentum has annual seasonality
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- Equity time-series momentum has intra-quarter seasonality
  - Increasing returns through the quarter
  - For US and internationally
  - Especially after a market decline

# Rational or Behavioral Explanations?

- Rational Unlikely:
  - Returns too extreme and discontinuous
    - E.g., after market decline, expected return 29bps/day higher at end of quarter
  - Not tied to firm's earnings news
    - Firms with offset quarter-ends have seasonality tied to the *calendar*
  - Consistent patterns for cross-section and time-series
- Behavioral Unlikely:
  - Effect is stronger for larger stocks
  - Holds equally for winner and loser stocks
  - Effect stronger in recent years



# Preferences of the Representative Investor

- Window dressing by institutions?
  - Existing evidence is mixed (Lakonishok et al 1991; Ng Wang 2004; vs. Sias Starks 1997; Hvidkjaer 2006; Hu et al 2014)
  - The effect is stronger among stocks with high institutional trading (Sias 2007) and larger stocks
- Cognitive dissonance among general investors?
  - Individuals / institutions don't like statements that demonstrate lack of skill
    - Especially in a down-market

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*After all, you only find out who is swimming naked when the tide goes out.*

Warren E. Buffet, *Chairman's Letter*, 2001

# Data

- Data sources:
  - US series (192607–201206) from Ken French's website
  - Non-US data (198307–201206) from Datastream
- Portfolio construction:
  - Daily series: daily rebalancing, 21–251 days past return, 30/70 break points, value weighted
  - Monthly series: monthly rebalancing, 2-12 months past return, 30/70 break points, value weighted
  - Datastream data cleaning: exclude infrequently-traded firms, require  $>29$  firms per country (Watanabe et al 2013)
- Data analysis:
  - International: pooled based on unweighted, unbalanced panel
  - Daily standard errors: Driscoll Kraay (1998) clustered by date with five lags
  - Monthly standard errors: clustered by month

# Momentum Factor Quarterly Seasonality

- Quarterly seasonality:
  - Initial statistics
  - Stronger in down markets
  - Holds equally for firms with offset quarter-ends
    - So not related to timing of earnings announcements
- Other Findings (Back-Up Slides):
  - Seasonality stronger for larger US firms
  - Positively correlated with NYSE trading volume
  - Strengthened over time
  - Developed countries with more momentum have more seasonality
  - Robust to out-of-sample testing

## Seasonality by Country Group (bps/day)

$$R_{c,t} = a_c + b_c \cdot \text{QuarterDays}_{c,t} + u_{c,t}$$

	Unconditional		Quarterly Excl. Y/E		Quarterly Incl. Y/E	
	Mean	t-statistic	Slope	t-statistic	Slope	t-statistic
US	2.72	(4.58)***	0.080	(2.22)**	0.175	(5.45)***
US Early	2.60	(4.04)***	0.031	(0.74)	0.144	(3.86)***
US Late	3.40	(2.22)**	0.207	(2.93)***	0.256	(4.14)***
All Non-US, Pooled	2.80	(3.19)***	0.147	(2.82)***	0.166	(3.46)***
<i>Large Developed</i>	3.20	(3.49)***	0.141	(2.42)**	0.169	(3.05)***
Australia	3.10	(3.99)***	0.063	(0.71)	0.155	(2.00)**
Canada	1.70	(2.99)***	0.008	(0.09)	-0.003	(-0.03)
France	2.20	(2.60)***	0.200	(1.98)**	0.211	(2.42)**
Germany	1.50	(1.95)*	0.162	(1.45)	0.119	(1.20)
Japan	6.00	(0.62)	0.175	(1.68)*	0.298	(3.27)***
UK	4.50	(1.94)*	0.235	(2.37)**	0.238	(2.61)***
<i>Small Developed</i>	3.70	(3.35)***	0.193	(2.38)**	0.227	(3.24)***
<i>Large Developing</i>	3.30	(1.52)	0.114	(1.79)*	0.191	(3.16)***
<i>Small Developing</i>	0.90	(2.01)**	0.115	(2.05)**	0.066	(1.31)

\* Year-end excluding 31 December +/-30 days

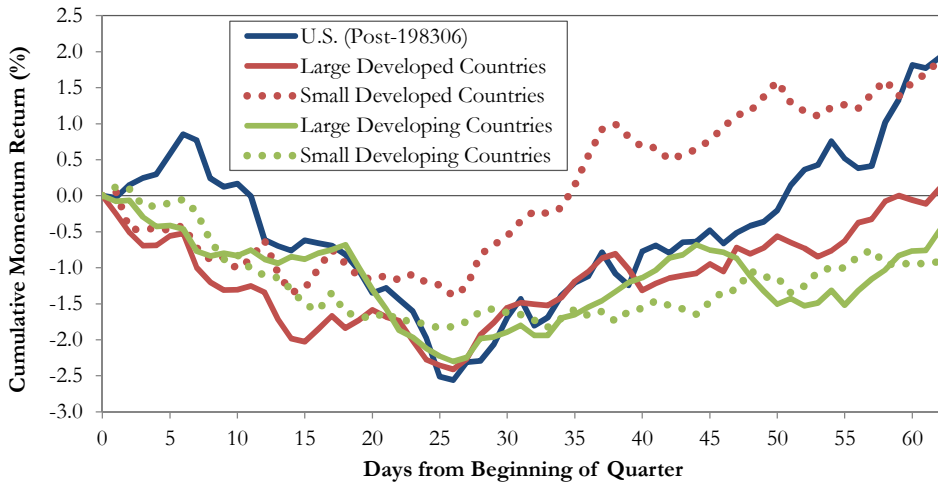
# Quarterly Momentum is Stronger in Down Markets

$$\text{Regression: } R_{c,t} = \mu_c + b_c \cdot \text{QDays}_{c,t} + u_{c,t} \mid \text{UpMarket}_{c,t-2,t-126} = 1$$

	Up Market		Down Market		Up-Down	
	$\mu_c$	$b_c$	$\mu_c$	$b_c$	$\mu_c$	$b_c$
US	3.80 (5.71)***	0.062 (1.69)*	3.21 (2.09)**	0.145 (1.87)*	0.59 (0.36)	-0.083 (-0.98)
US Pre-198307	4.04 (4.90)***	0.043 (0.95)	3.61 (2.22)**	0.034 (0.42)	0.43 (0.24)	0.009 (0.09)
US Post-198306	3.40 (3.02)***	0.098 (1.57)	2.16 (0.60)	0.488 (2.57)**	1.25 (0.33)	-0.391 (-1.96)**
All Non-US	3.89 (4.67)***	0.070 (1.71)*	1.98 (0.92)	0.306 (2.52)**	1.91 (0.88)	-0.237 (-1.93)*
Large Developed	4.09 (4.25)***	0.034 (0.69)	2.01 (0.73)	0.393 (2.65)***	2.08 (0.73)	-0.358 (-2.33)**
Small Developed	4.15 (3.35)***	0.103 (1.67)*	5.10 (1.49)	0.366 (1.87)*	-0.95 (-0.27)	-0.263 (-1.32)
Large Developing	4.86 (3.99)***	0.059 (0.87)	-0.01 (0.00)	0.184 (1.58)	4.87 (2.03)**	-0.125 (-0.97)
Small Developing	2.72 (2.35)**	0.065 (1.14)	-0.31 (-0.14)	0.265 (2.15)**	3.03 (1.26)	-0.200 (-1.50)

\* UpMarket = 1 if country market index increased over prior 2-126 days; excluding year-end +/-30 days; QDays is demeaned

## Cumulative Return Conditional on Down Market



Conditional on country market index decreased over prior 2-126 days; excluding year-end +/-30 days

# Not Related to Firms' Quarter-End: Seasonality of US Firms with Offset Quarter-Ends

Slope coefficient  $b_i$  from Regression:  $R_{i,t} = a_i + b_i \cdot \text{QDays}_{m,t} + u_{i,t}$

where  $m \in \{0, 1, 2\}$  is the months that QDays is offset from the calendar quarter-end.

Portfolio of Firms with Quarter-End Equal to:	Uncond Mean	Avg. Firms	Regression coefficient $b_i$ for QDays offset by		
			0 Months	1 Month	2 Months
Calendar Quarter-End	2.146 (1.15)	4014	0.288 (2.77)***	0.077 (0.78)	-0.239 (-2.64)***
Offset 1 Month	3.884 (1.85)*	476	0.038 (0.35)	0.025 (0.21)	-0.101 (-0.91)
Offset 2 Months	3.849 (1.47)	324	0.489 (3.38)***	-0.062 (-0.47)	-0.293 (-2.17)**
Wald $F$ -stats of Equal Coefficients along Diagonal			Coefficient Comparison		
			(1,1)=(0,0)		(2,2)=(0,0)
Diagonal from Panel A1 (Without Conditioning)			2.263		10.000
$p$ -value			0.133		0.002***

\* excluding year-end +/-30 days



# Momentum Factor Year-End Seasonality

- Disproving the tax-loss selling argument:
  - Countries with non-calendar tax year-ends
    - Have similar seasonality around calendar year-end
  - Seasonality is stronger when the market has declined
    - When there are less gains to shelter

# Tax or Calendar Year-End?

(Mean daily return, bps)

Trading Days:	First 10	First 20	Mid-Year	Last 20	Last 10	L20-F20	L10-F10
Panel A: Tax Year-End Seasonality for Non-Calendar Countries							
Winners	0.397 (0.19)	0.623 (0.46)	1.689 (4.05)***	1.106 (0.75)	3.910 (2.04)**	0.483 (0.25)	3.513 (1.27)
Losers	5.638 (1.57)	5.170 (2.15)**	-2.833 (-4.24)***	-3.070 (-1.30)	-4.916 (-1.41)	-8.240 (-2.54)**	-10.554 (-2.26)**
Momentum	-5.241 (-1.01)	-4.547 (-1.35)	4.523 (4.78)***	4.176 (1.23)	8.826 (1.86)*	8.723 (1.91)*	14.067 (2.16)**
Panel B: Calendar Year-End Seasonality for Non-Calendar Countries							
Winners	-0.191 (-0.09)	1.866 (1.25)	1.669 (3.89)***	4.071 (3.16)***	4.978 (2.83)***	2.205 (1.13)	5.169 (1.99)**
Losers	6.051 (1.33)	-0.905 (-0.31)	-2.914 (-4.25)***	-3.694 (-2.05)**	-3.573 (-1.55)	-2.789 (-0.83)	-9.623 (-1.96)**
Momentum	-6.241 (-1.01)	2.771 (0.72)	4.583 (4.67)***	7.766 (2.98)***	8.551 (2.63)***	4.994 (1.08)	14.793 (2.24)**
Panel C: Year-End Seasonality for Calendar Countries							
Winners	0.969 (0.54)	1.096 (0.80)	1.275 (3.26)***	2.072 (1.85)*	2.365 (2.18)**	0.976 (0.56)	1.396 (0.69)
Losers	7.221 (2.05)**	4.335 (1.70)*	-1.449 (-2.24)**	-4.185 (-2.56)**	-7.027 (-3.70)***	-8.520 (-2.80)***	-14.248 (-3.56)***
Momentum	-6.251 (-1.23)	-3.239 (-0.87)	2.724 (2.76)***	6.258 (2.39)**	9.392 (3.36)***	9.496 (2.09)**	15.644 (2.74)***

# Year-End Momentum is Stronger in a Down Market

	January			December			December-January		
	Up Mkt	Down Mkt	U-D	Up Mkt	Down Mkt	U-D	Up Mkt	Down Mkt	U-D
Panel A: US Market									
Winners	1.141 (3.63)***	0.214 (0.61)	0.927 (1.98)**	1.171 (4.65)***	0.809 (2.17)**	0.361 (0.81)	0.029 (0.07)	0.595 (1.17)	-0.566 (-0.87)
Losers	1.304 (3.37)***	5.566 (5.33)***	-4.262 (-3.85)***	-0.816 (-2.63)***	-3.142 (-3.98)***	2.326 (2.76)***	-2.120 (-4.28)***	-8.708 (-6.65)***	6.588 (4.74)***
Momentum	-0.163 (-0.38)	-5.352 (-4.72)***	5.189 (4.32)***	1.987 (4.61)***	3.951 (4.44)***	-1.964 (-2.00)**	2.150 (3.56)***	9.303 (6.46)***	-7.154 (-4.61)***
Panel B: Non-US Markets with Calendar Year-End									
Winners	0.808 (3.11)***	0.007 (0.01)	0.801 (1.49)	0.410 (2.22)**	0.333 (0.76)	0.077 (0.17)	-0.398 (-1.26)	0.326 (0.47)	-0.724 (-1.04)
Losers	0.054 (0.19)	1.944 (2.23)**	-1.891 (-2.44)**	-1.183 (-3.69)***	-1.048 (-1.53)	-0.134 (-0.19)	-1.236 (-2.94)***	-2.992 (-2.72)***	1.756 (1.69)*
Momentum	0.754 (1.53)	-1.938 (-1.42)	2.692 (2.17)**	1.592 (3.42)***	1.381 (1.26)	0.211 (0.19)	0.838 (1.25)	3.319 (1.92)*	-2.480 (-1.50)

\* Return is % per month.

UpMarket = 1 if country market index increased over prior 12 months.

# Time-Series (Market) Momentum Seasonality

- Quarterly
  - Momentum increases during the quarter
  - Especially after a market decline
- At the Year-End
  - Momentum is stronger in December
  - Especially after a market decline
    - Not consistent with tax-loss selling
- Other Findings (Back-Up Slides):
  - Seasonality holds using data of Moskowitz et al 2012
  - Robust to out-of-sample testing
  - Powerful at predicting the equity premium

# Time-Series Quarterly Momentum of Market Indices

$$RmRf_{c,t} = a + b \cdot \text{Indicator}[RmRf_{c,t-1,t-12} > 0] + u_{c,t}$$

	First Month		Second Month		Third Month		Third-First	
US	-0.596	(-0.76)	0.925	(1.26)	2.029	(2.84)***	2.625	(2.47)**
US Pre-198307	-0.608	(-0.60)	0.961	(1.04)	2.367	(2.54)**	2.976	(2.15)**
US Post-198306	-0.477	(-0.41)	0.887	(0.76)	1.279	(1.28)	1.756	(1.15)
All Non-US	0.162	(0.17)	0.462	(0.66)	2.564	(3.69)***	2.403	(2.02)**
Large Developed	-0.126	(-0.16)	-0.005	(-0.01)	2.133	(3.12)***	2.258	(2.16)**
Small Developed	0.128	(0.13)	0.645	(0.78)	3.244	(3.82)***	3.116	(2.38)**
Large Developing	0.274	(0.21)	0.715	(0.64)	2.317	(2.40)**	2.043	(1.27)
Small Developing	0.352	(0.25)	0.352	(0.36)	2.203	(2.65)***	1.851	(1.14)

# Time-Series Annual Momentum of Market Indices

$$RmRf_{c,t} = a + b \cdot \text{Indicator}[RmRf_{c,t-1,t-12} > 0] + u_{c,t}$$

Panel B: Annual Seasonality (Regression coefficient,  $b$ )

	January		Mid-Year		December		Dec–Jan	
US	-0.889	(-0.75)	0.786	(1.58)	2.683	(2.77)***	3.572	(2.34)**
US Pre-198307	-1.134	(-0.77)	0.880	(1.37)	3.454	(2.81)***	4.589	(2.38)**
US Post-198306	-0.315	(-0.16)	0.637	(0.87)	0.961	(0.69)	1.276	(0.53)
All Non-US	0.561	(0.48)	0.813	(1.52)	4.090	(4.37)***	3.529	(2.36)**
Large Developed	1.854	(1.45)	0.252	(0.54)	3.536	(4.38)***	1.683	(1.12)
Small Developed	2.822	(2.44)**	0.905	(1.49)	4.273	(3.69)***	1.451	(0.89)
Large Developing	-1.938	(-0.90)	1.067	(1.46)	4.534	(3.13)***	6.472	(2.51)**
Small Developing	-1.112	(-0.50)	0.901	(1.28)	4.071	(3.05)***	5.183	(2.02)**
Calendar Countries	0.607	(0.48)	0.999	(1.83)*	4.194	(4.15)***	3.587	(2.22)**
Non-Calendar Countries	0.456	(0.39)	-0.157	(-0.27)	3.645	(3.22)***	3.189	(1.98)**

# Conclusions

- Momentum is strong before the quarter / year end and close to zero after
  - Both cross-sectional and time-series
  - Especially after a market decline
  - International and US
  - Stronger for larger stocks
  - Not declining over time
  - Out-of-sample, trading strategies
- Not consistent with risk-based explanations
  - Or investor biases/mistakes explanations
  - Or firm earnings-announcements
  - Or tax-loss selling
- Points to investor preferences
  - Window dressing by institutions
  - Cognitive dissonance: prefer good stocks on quarterly statements

# Back-Up Slides

- Seasonality by firm size
- Seasonality vs. NYSE Trading Volume
- Seasonal pattern by year
- Countries with more momentum have more seasonality?
- Out-of-sample quarterly momentum factor
- Time-series momentum in up and down markets
- Time-series momentum factors
- Out-of-sample time-series momentum factors
- Out-of-sample equity premium prediction



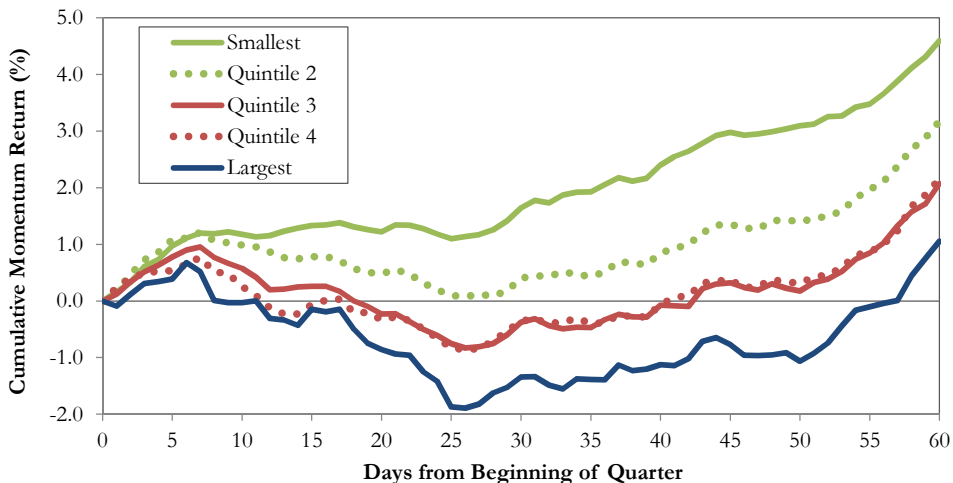
# Quarterly Momentum for US Size Quintiles

$$R_{C,t} = a + b \cdot QDays_t + u_{C,t}$$

	Uncond.	Qtly	Quarterly Slope		Qtly Slope by Market State		
	Mean	Slope	Winners	Losers	UpMkt	Down	Diff.
Small	6.900 (6.14)***	0.147 (2.14)**	0.070 (1.56)	-0.077 (-1.46)	0.073 (1.33)	0.341 (1.74)*	-0.268 (-1.31)
Quintile 2	4.796 (3.62)***	0.217 (2.59)***	0.095 (1.87)*	-0.122 (-1.94)*	0.103 (1.44)	0.513 (2.20)**	-0.411 (-1.69)*
Quintile 3	2.815 (1.84)*	0.280 (2.84)***	0.156 (2.74)***	-0.124 (-1.68)*	0.114 (1.36)	0.706 (2.60)***	-0.592 (-2.10)**
Quintile 4	3.151 (1.87)*	0.322 (2.95)***	0.132 (2.23)**	-0.190 (-2.38)**	0.099 (1.09)	0.900 (2.95)***	-0.801 (-2.53)**
Big	1.535 (0.83)	0.354 (2.93)***	0.163 (2.83)***	-0.191 (-2.07)**	0.131 (1.31)	0.926 (2.71)***	-0.795 (-2.23)**
Big-Small	-5.364 (-3.79)***	0.207 (2.17)**	0.094 (1.89)*	-0.114 (-1.49)	0.058 (0.68)	0.585 (2.21)**	-0.527 (-1.32)

\* US Stocks 198307–201207, excluding year-end +/-30 days, Ken French 5x5 data

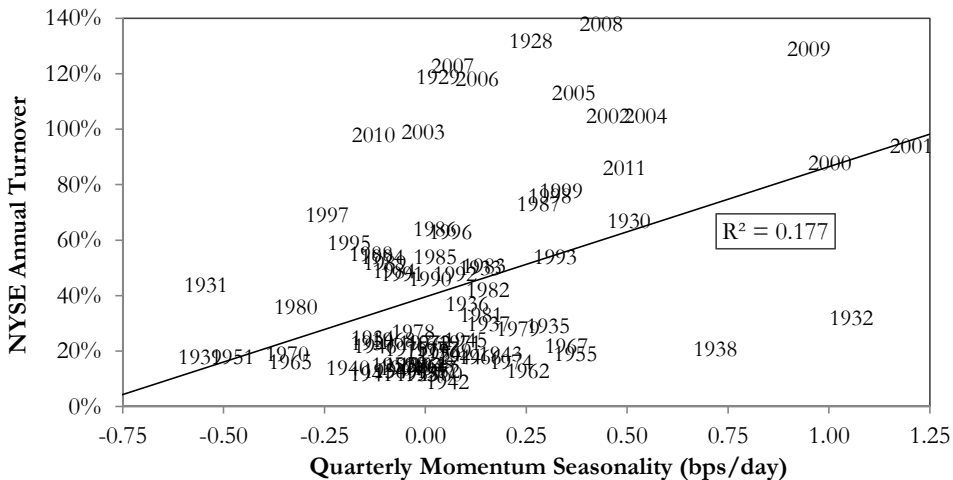
## Cumulative Quarterly Momentum for Size Quintiles



\* US Stocks 198307–201207, excluding year-end +/-30 days, Ken French 5x5 data

# Seasonality is Stronger when Trading Volume is Higher

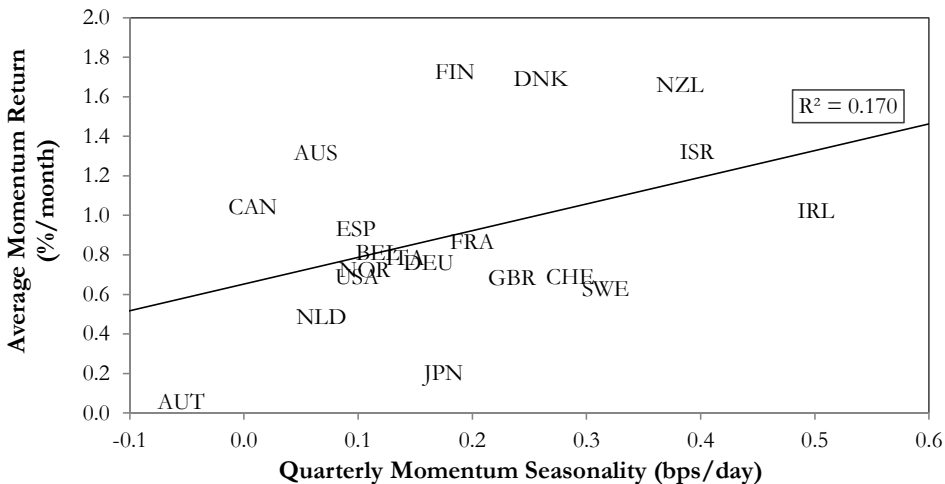
## US Quarterly Seasonality vs. NYSE Turnover



\* US stocks, excluding year-end +/-30 days

Introduction	Data	Cross-Sectional	Year-End	Time-Series Momentum	Conclusions	Back-Up Slides		
	Unconditional Avg.		Yearly Seasonality		Qtly Excl. Y/E		Qtly Incl. Y/E	
	mean	t-stat	slope	t-stat	slope	t-stat	slope	t-stat
pooled	2.96	(3.32)***	0.028	(2.22)**	0.149	(2.86)***	0.170	(3.54)***
1984	2.69	(1.08)	0.059	(1.80)*	0.052	(0.39)	0.194	(1.41)
1985	6.01	(2.47)**	0.010	(0.32)	0.052	(0.30)	0.133	(0.91)
1986	2.10	(0.85)	-0.024	(-0.80)	0.006	(0.04)	0.015	(0.13)
1987	-0.62	(-0.18)	-0.019	(-0.45)	0.142	(0.71)	-0.026	(-0.15)
1988	-2.08	(-1.21)	0.050	(2.43)**	-0.027	(-0.25)	0.039	(0.41)
1989	4.26	(2.59)***	-0.019	(-0.90)	0.060	(0.49)	0.035	(0.35)
1990	6.90	(2.78)***	0.023	(0.57)	0.213	(1.93)*	0.163	(1.34)
1991	3.96	(1.40)	0.145	(3.73)***	-0.093	(-1.14)	0.037	(0.38)
1992	4.81	(2.33)**	0.030	(1.05)	0.173	(1.53)	0.179	(1.69)*
1993	0.31	(0.14)	0.054	(1.94)*	-0.041	(-0.29)	0.000	(0.00)
1994	0.64	(0.35)	0.014	(0.46)	-0.206	(-2.54)**	-0.185	(-2.08)**
1995	2.62	(1.75)*	0.008	(0.45)	0.057	(0.58)	0.010	(0.12)
1996	3.24	(2.15)**	0.036	(1.69)*	0.131	(1.54)	0.176	(2.15)**
1997	8.36	(3.12)***	0.059	(1.66)*	0.125	(1.00)	0.213	(2.01)**
1998	-1.62	(-0.38)	-0.078	(-1.26)	0.062	(0.26)	0.056	(0.26)
1999	2.81	(0.78)	0.135	(2.87)***	0.039	(0.20)	0.189	(0.96)
2000	1.43	(0.25)	-0.009	(-0.11)	0.176	(0.67)	0.143	(0.52)
2001	3.94	(0.62)	-0.030	(-0.31)	0.684	(1.98)**	0.808	(2.56)**
2002	10.73	(2.03)**	-0.094	(-1.15)	0.392	(1.35)	0.346	(1.32)
2003	-1.08	(-0.26)	0.050	(0.82)	0.125	(0.40)	0.226	(0.84)
2004	2.63	(1.07)	0.029	(0.94)	0.243	(2.01)**	0.196	(1.76)*
2005	4.74	(2.66)***	-0.011	(-0.48)	0.197	(1.85)*	0.128	(1.41)
2006	3.77	(1.37)	0.009	(0.29)	-0.097	(-0.71)	-0.045	(-0.37)
2007	6.51	(2.62)***	0.016	(0.50)	-0.056	(-0.41)	-0.053	(-0.44)
2008	8.42	(1.18)	0.027	(0.26)	0.275	(0.71)	0.046	(0.14)
2009	-19.09	(-2.28)**	0.180	(1.46)	0.468	(0.85)	0.467	(0.90)
2010	7.16	(2.97)***	0.010	(0.25)	0.183	(1.93)*	0.194	(1.88)*
2011	8.53	(2.54)**	0.040	(0.73)	0.224	(1.09)	0.272	(1.49)

## Developed Countries with Stronger Momentum have Stronger Seasonality



\* Seasonality excluding year-end +/-30 days

# Out-of-Sample Quarterly Momentum Returns (Monthly)

$$\text{for } \tau \leq t : R_{c,\tau} = a_t + b_t \cdot \text{QuarterlyMonthNo}_\tau + u_{c,\tau}$$

Prediction Starts:	195807	198807	199307	199807	200307
Panel A: Out-of-Sample $R^2$ -Statistics					
US	2.45%	3.60%	3.69%	3.85%	2.42%
All Non-US	0.30%	0.33%	0.31%	0.40%	-0.06%
Large Developed	0.72%	0.91%	0.98%	1.02%	0.07%
Small Developed	0.72%	0.76%	0.72%	0.79%	0.47%
Large Developing	-0.08%	-0.05%	-0.07%	-0.06%	-0.61%
Small Developing	-0.11%	-0.11%	-0.08%	-0.01%	-0.48%
Panel B: MSPE-Adjusted $t$ -Statistics					
US	3.86***	3.40***	3.23***	3.13***	1.51*
All Non-US	2.09**	2.11**	1.91**	1.90**	0.74
Large Developed	2.35***	2.33***	2.22**	2.05**	0.67
Small Developed	2.57***	2.62***	2.26**	2.19**	1.29*
Large Developing	0.78	0.82	0.71	0.72	0.13
Small Developing	0.76	0.76	0.84	1.06	0.13

\* QuarterlyMonthNo = 0 for first month of quarter, 1 for middle, 2 for last

\* Adjustment to  $t$ -statistics of Clark West (2007)

# Time-Series Momentum in Up and Down Markets

Panel A: Quarterly Seasonality (% / month)

	First Month		Second Month		Third Month		Third-First	
<i>Panel A1: Excess Market Return after Market Increase</i>								
US	0.082	(0.24)	0.259	(0.86)	0.378	(1.43)	0.296	(0.68)
US Pre-198307	0.197	(0.43)	0.284	(0.71)	0.405	(1.15)	0.209	(0.36)
US Post-198306	-0.115	(-0.22)	0.224	(0.51)	0.339	(0.88)	0.454	(0.71)
All Non-US	0.562	(1.36)	-0.266	(-0.65)	0.893	(2.18)**	0.331	(0.57)
Large Developed	0.225	(0.52)	-0.260	(-0.68)	0.713	(2.09)**	0.488	(0.89)
Small Developed	0.704	(1.63)	-0.052	(-0.11)	0.892	(2.09)**	0.188	(0.31)
Large Developing	0.586	(0.93)	-0.081	(-0.17)	0.734	(1.20)	0.148	(0.17)
Small Developing	0.624	(1.21)	-0.676	(-1.25)	1.157	(2.11)**	0.533	(0.71)
<i>Panel A2: Excess Market Return after Market Decrease</i>								
US	0.679	(0.95)	-0.666	(-1.00)	-1.651	(-2.48)**	-2.329	(-2.39)**
US Pre-198307	0.805	(0.88)	-0.677	(-0.81)	-1.962	(-2.27)**	-2.767	(-2.20)**
US Post-198306	0.363	(0.35)	-0.663	(-0.61)	-0.940	(-1.01)	-1.303	(-0.93)
All Non-US	0.400	(0.41)	-0.727	(-1.01)	-1.672	(-2.43)**	-2.072	(-1.75)*
Large Developed	0.351	(0.48)	-0.255	(-0.43)	-1.420	(-2.21)**	-1.771	(-1.82)*
Small Developed	0.576	(0.60)	-0.697	(-0.91)	-2.353	(-2.94)***	-2.929	(-2.35)**
Large Developing	0.312	(0.25)	-0.796	(-0.73)	-1.583	(-1.74)*	-1.896	(-1.24)
Small Developing	0.273	(0.20)	-1.028	(-1.08)	-1.045	(-1.33)	-1.318	(-0.84)

\* Market Increase if country market index increased over prior 12 months

# Time-Series Momentum Factors

Panel A: Annual Seasonality

	January		Mid-Year		December		Dec–Jan	
All Assets	0.970	(1.83)*	1.171	(5.45)***	3.088	(6.19)***	2.118	(2.91)***
Global Equity Indices	2.610	(1.81)*	1.339	(2.78)***	5.440	(5.27)***	2.830	(1.60)
Currencies	0.625	(0.55)	1.004	(3.23)***	1.833	(1.85)*	1.208	(0.80)
Fixed Income	0.755	(0.57)	1.782	(3.49)***	3.397	(2.41)**	2.642	(1.37)
Commodities	0.310	(0.47)	0.973	(4.01)***	2.741	(3.98)***	2.431	(2.55)**

Panel B: Quarterly Seasonality

	First Month		Second Month		Third Month		Third–First	
All Assets	0.634	(2.04)**	1.654	(4.94)***	1.654	(4.89)***	1.020	(2.22)**
Global Equity Indices	0.743	(0.91)	1.265	(1.84)*	3.352	(4.67)***	2.609	(2.40)**
Currencies	0.475	(0.95)	1.188	(2.41)**	1.462	(2.91)***	0.987	(1.40)
Fixed Income	0.813	(1.23)	2.444	(2.67)***	2.237	(2.94)***	1.423	(1.41)
Commodities	0.693	(1.99)**	1.670	(4.59)***	0.832	(1.99)**	0.139	(0.25)

\* 198501–201312. Data from Lasse Pedersen's website



# Out-of-Sample Time-Series Momentum Prediction

$$R_{f,\tau} = a_t + b_t \cdot \text{QuarterlyMonthNo}_\tau \cdot \text{Sign}(R_{f,t-1,t-12}) + u_{f,\tau}$$

Panel C: Out-of-Sample  $R^2$ -Statistics

Prediction Starts:	199001	199501	200001	200501
All Assets	0.99%	1.21%	0.45%	-1.19%
Global Equity Indices	1.45%	2.14%	2.38%	1.22%
Currencies	0.09%	0.42%	-1.14%	-2.66%
Fixed Income	-0.11%	0.44%	0.66%	0.91%
Commodities	-0.85%	-0.93%	-0.87%	-1.00%

Panel D: Out-of-Sample MSPE-Adjusted  $t$ -Statistics

Prediction Starts:	199001	199501	200001	200501
All Assets	1.85**	1.74**	0.96	0.41
Global Equity Indices	2.09**	2.13**	1.22	1.17
Currencies	0.99	1.20	-0.11	-0.44
Fixed Income	0.36	1.29*	-0.34	1.18
Commodities	-0.24	-0.53	-0.20	-0.96

\* 198501–201312. Data from Lasse Pedersen's website

\* QuarterlyMonthNo = 0 for first month of quarter, 1 for middle, 2 for last

\* Adjustment to  $t$ -statistics of Clark West (2007)

# Out-of-Sample Equity Premium Prediction

$$RmRf_{c,\tau} = a_t + b_t \cdot \text{QuarterlyMonthNo}_\tau \cdot \text{Sign}(RmRf_{c,t-1,t-12}) + u_{c,\tau}$$

Prediction Starts:	195807	198807	199307	199807	200307
Panel A: Out-of-Sample $R^2$ -Statistics					
US	0.23%	0.94%	1.47%	1.65%	0.11%
All Non-US	0.73%	0.80%	0.83%	0.94%	1.18%
Large Developed	0.67%	1.04%	1.51%	1.81%	2.03%
Small Developed	1.50%	1.58%	1.63%	1.87%	2.16%
Large Developing	0.36%	0.42%	0.43%	0.22%	0.43%
Small Developing	0.49%	0.49%	0.54%	0.67%	0.87%
Panel B: MSPE-Adjusted $t$ -Statistics					
US	1.89**	1.57*	1.75**	1.65**	0.62
All Non-US	2.76***	2.78***	2.60***	2.40***	1.91**
Large Developed	2.16**	2.22**	2.26**	2.18**	1.70**
Small Developed	2.93***	2.93***	2.59***	2.46***	1.88**
Large Developing	1.74**	1.82**	1.69**	1.18	1.16
Small Developing	2.21**	2.21**	2.25**	2.26**	1.86**
Panel C: Market Premium Monthly Squared Sharpe Ratios					
US	1.07%	1.30%	1.08%	0.16%	1.07%
All Non-US	0.55%	0.49%	0.60%	0.53%	1.41%
Large Developed	0.74%	0.41%	0.69%	0.19%	0.80%
Small Developed	0.54%	0.56%	0.92%	0.15%	0.68%
Large Developing	0.69%	0.59%	0.50%	1.43%	2.34%
Small Developing	0.46%	0.46%	0.48%	0.67%	1.87%

\* QuarterlyMonthNo = 0 for first month of quarter, 1 for middle, 2 for last