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Size and Sector effects in Momentum Returns

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Overview

- In Scowcroft and Sefton (June, 2003), we argued that, contrary to the popularly held belief that momentum effects were stock specific and behavioural in nature, they were in fact largely an industry or sector phenomenon
- Here, we extend our sample back to 1980 and confirm that the results hold over a much longer sample period
- We also present completely new results from a vector auto-regression or VAR model. The model is used to compute impulse responses to changes in “news” for large stocks and shows that the lagged response of stocks in the same industry gives rise to the momentum effect in industry returns
- Finally, we consider the extent to which momentum returns are regime dependent and how robust alternative portfolio weighting strategies are to transaction costs

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Methodology - Jegadeesh and Titman (1993)

- Rank stocks according to their cumulated price performance over the last *J* months, time *t-J to t*
- In each period sort stocks into portfolio quintiles by either number (equally weighted) or by market cap
- Measure the return to these portfolios over the next immediate months *t* to *t+K* or after leaving a month's gap *t+1* to *t+1+K* so as to avoid short term price reversals
- The return to Momentum Winners (Losers) in period *t* - period *t+1* if a month's gap is left - is the average of the return to the top (bottom) quintile portfolios formed at *t*, *t-1, ... t-K+1*
- The return to the Momentum Strategy (*J,K,*0) or ((*J,K,*1) if a month's gap is left) is the average return to the self-financing portfolio of Winners – Losers, or WML, over the data sample

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Momentum Returns, Jan 1980 to March 2003

Market Cap Weighted MSCI World, returns to (J, K, 1) strategies

		Holding Period in Months, K					
		1	3	6	12	24	36
Formation Period in Months, J	1	-0.36	0.07	0.11	0.21	0.09	0.04
		(0.25)	(0.17)	(0.13)	(0.09)	(0.07)	(0.05)
	3	0.01	0.11	0.30	0.30	0.14	0.07
		(0.28)	(0.24)	(0.19)	(0.14)	(0.11)	(0.09)
	6	0.30	0.44	0.68	0.36	0.19	0.10
		(0.31)	(0.27)	(0.24)	(0.20)	(0.16)	(0.13)
	12	0.65	0.61	0.45	0.22	0.07	0.01
		(0.30)	(0.29)	(0.27)	(0.24)	(0.20)	(0.17)
	24	0.27	0.31	0.22	-0.02	-0.08	-0.10
		(0.31)	(0.30)	(0.29)	(0.27)	(0.24)	(0.22)
	36	0.00	0.04	0.01	-0.16	-0.21	-0.17
		(0.31)	(0.30)	(0.30)	(0.29)	(0.26)	(0.24)

Source: UBS Quantitative Research. Standard Errors are recorded below in parenthesis.

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Studies in Equally Weighted Small Cap Universes

- Jegadeesh and Titman (1993) suggest that medium term momentum is consistent with a delayed reaction to firm specific information (Sample: **Equally Weighted** Portfolios on the US CRSP data set – n.b. large number of small cap stocks)

- Jegadeesh and Titman (2001) extend the dataset to 1998 and show that the initial results held out of sample, hence are robust to the criticism of data mining

- Grundy and Martin (2001) find industry momentum profits but suggest that stock specific momentum strategies deliver greater profits. (Sample: **Equally Weighted** Portfolios on the US CRSP data set)

- Rouwenhorst (1998) finds momentum present in all 12 European markets and suggests momentum profits not due to country effects. (Sample: **Equally Weighted** Portfolios on the data set of 2190 companies from 12 European Markets

Studies in a Market Cap Weighted Universe

- Moskowitz and Grinblatt (1999) and O'Neal (2000) suggest that industry momentum can explain nearly all of medium term momentum. (Sample: **Market Cap Weighted** Portfolios on the US CRSP data set)
- Swinkels (2002), using an index approach on **Market Cap Weighted** Datastream Global Sector indices, finds significant excess returns to global industry momentum strategies
- Chan, Hameed and Tong (2000) using an index approach on **Market Cap Weighted** Datastream Country indices, find excess returns to country momentum strategies - Richards (1997) though finds a smaller effect
- In the the Journal of Asset Management, Swinkels (2004) provides a very good recent survey of both equal and value weighted studies

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Decomposing momentum strategy returns

- We estimated the following cross-sectional regression model

$$r_t = f_t^{Market} + \sum_{i \in Sector} I_t^{Sector\,i} f_t^{Sector\,i} + \sum_{j \in Country} I_t^{Country\,j} f_t^{Country\,j} + e_t$$

$$\begin{bmatrix} r_{1t} \\ r_{2t} \\ \vdots \\ r_{nt} \\ r_{(n+1)t} \\ \vdots \end{bmatrix} = \begin{bmatrix} 1 & 1 & 0 & \cdots & 0 & 1 & 0 & \cdots & 0 \\ 1 & 1 & 0 & \cdots & 0 & 0 & 1 & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & 0 & 1 & \cdots & 0 & 1 & 0 & \cdots & 0 \\ 1 & 0 & 1 & \cdots & 0 & 0 & 1 & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \ddots & \vdots \end{bmatrix} \begin{bmatrix} f_t^{Market} \\ f_t^{Sector\,1} \\ f_t^{Sector\,2} \\ \vdots \\ f_t^{Sector\,M} \\ f_t^{Country\,1} \\ f_t^{Country\,2} \\ \vdots \\ f_t^{Country\,N} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ \vdots \\ e_{nt} \\ e_{(n+1)t} \\ \vdots \end{bmatrix}$$

Subject to $\sum_{j \in Country} \sum_{i \in Sector} w_{ij} f_t^{Sector\,i} = 0 \qquad \sum_{j \in Country} \sum_{i \in Sector} w_{ij} f_t^{Country\,j} = 0$

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Decomposing momentum strategy returns

- This is a much simpler model than the UBS Global Country-Sector model - Scowcroft and Sefton (2002) - but it allows us to estimate the component of stock returns due to sector and country, period by period

- We then use this decomposition of stock returns into sector, country and company specific components to decompose the profits due to momentum strategies

- We use the same portfolios as before, where stocks are ranked on the previous *J* months performance. However, instead of using the total return to the stocks we use the return components calculated from the factor model

- The three components, country, sector and company specific will of course sum to the total return reported above

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Decomposing momentum strategy returns

- In an MSCI value weighted global universe, from 1980 to 2003 74% of momentum returns to a (6,6,1) strategy are attributable to sectors, 20% to country factors and less than 1% to stock specific effects
- In an equally weighted small cap universe however, we find that the proportion of momentum return than can be attributed to stock specific effects increases to 65%, with industries accounting for 30% and countries 11% (sample period was 1992-2003)
- Over our sample period, 1980-2003, we therefore conclude that at least as far as large cap stocks are concerned, the momentum effect is largely an industry or sector phenomenon
- Over other periods momentum could well be either an industry, country or style phenomenon – in our view, it is the chameleon character of this factor which presents such a challenge

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MSCI market cap weighted global universe

Total % Monthly Average Returns to (J,K,1) Momentum Strategies in Market Cap Weighted MSCI Universe

Formation Period in Months, J		Holding Period in Months, K: 1	3	6	12	24
	1	-0.36	0.07	0.11	0.21	0.09
		(0.25)	(0.17)	(0.13)	(0.09)	(0.07)
	3	0.01	0.11	0.30	0.30	0.14
		(0.28)	(0.24)	(0.19)	(0.14)	(0.11)
	6	0.30	0.44	0.68	0.36	0.19
		(0.31)	(0.27)	(0.24)	(0.20)	(0.16)
	12	0.65	0.61	0.45	0.22	0.07
		(0.30)	(0.29)	(0.27)	(0.24)	(0.20)

% Monthly Average Returns to firm specific returns

Formation Period in Months, J		Holding Period in Months, K: 1	3	6	12	24
	1	-0.04	0.07	0.09	0.19	0.06
		(0.09)	(0.14)	(0.14)	(0.13)	(0.17)
	3	0.02	0.17	0.22	0.20	0.17
		(0.11)	(0.18)	(0.20)	(0.22)	(0.30)
	6	0.15	0.11	0.05	0.03	0.10
		(0.11)	(0.19)	(0.23)	(0.30)	(0.43)
	12	0.18	0.04	-0.05	0.10	0.05
		(0.11)	(0.20)	(0.27)	(0.41)	(0.60)

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Source: UBS Quantitative Research

MSCI market cap weighted global universe

% Monthly Average Returns to the Global Sector Factors

Formation Period in Months, J		Holding Period in Months, K: 1	3	6	12	24
	1	-0.03	0.04	0.13	0.05	0.04
		(0.19)	(0.15)	(0.12)	(0.11)	(0.10)
	3	-0.01	0.00	0.14	0.13	0.08
		(0.21)	(0.20)	(0.19)	(0.17)	(0.18)
	6	0.09	0.17	0.50	0.15	0.01
		(0.23)	(0.23)	(0.23)	(0.25)	(0.28)
	12	0.34	0.39	0.38	0.15	0.08
		(0.23)	(0.24)	(0.27)	(0.33)	(0.37)

% Monthly Average Returns to the Country Factors

Formation Period in Months, J		Holding Period in Months, K: 1	3	6	12	24
	1	-0.28	-0.04	-0.11	-0.03	-0.01
		(0.25)	(0.17)	(0.13)	(0.09)	(0.07)
	3	-0.01	-0.05	-0.06	-0.03	-0.11
		(0.28)	(0.24)	(0.19)	(0.14)	(0.11)
	6	0.06	0.16	0.14	0.18	0.08
		(0.31)	(0.27)	(0.24)	(0.20)	(0.16)
	12	0.13	0.18	0.12	-0.03	-0.06
		(0.30)	(0.29)	(0.27)	(0.24)	(0.20)

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Source: UBS Quantitative Research

Dow Jones equally weighted global universe

Total % Monthly Average Returns to (J,K,1) Momentum Strategies in Equally Weighted Dow Jones Universe

		Holding Period in Months, K				
		1	3	6	12	24
Formation Period in Months, J	1	0.02	0.25	0.34	0.41	0.20
		(0.52)	(0.39)	(0.31)	(0.23)	(0.17)
	3	0.41	0.43	0.77	0.67	0.28
		(0.62)	(0.55)	(0.46)	(0.35)	(0.26)
	6	0.88	1.03	1.12	0.72	0.24
		(0.67)	(0.61)	(0.53)	(0.45)	(0.32)
	12	1.06	1.00	0.79	0.32	-0.04
		(0.64)	(0.60)	(0.58)	(0.52)	(0.39)

% Monthly Average Returns to firm specific returns

		Holding Period in Months, K				
		1	3	6	12	24
Formation Period in Months, J	1	0.03	0.23	0.29	0.29	0.16
		(0.23)	(0.19)	(0.16)	(0.12)	(0.08)
	3	0.41	0.47	0.55	0.46	0.24
		(0.31)	(0.28)	(0.24)	(0.18)	(0.13)
	6	0.70	0.74	0.73	0.48	0.23
		(0.35)	(0.32)	(0.28)	(0.22)	(0.16)
	12	0.66	0.60	0.47	0.22	0.06
		(0.34)	(0.31)	(0.29)	(0.24)	(0.18)

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Source: UBS Quantitative Research

Dow Jones equally weighted global universe

Total Monthly Excess Returns from only the Global Sector Returns

		Holding Period in Months				
		1	3	6	12	24
Formation Period in Months	1	0.13	0.18	0.18	0.11	0.05
		(0.46)	(0.33)	(0.27)	(0.19)	(0.14)
	3	0.30	0.15	0.19	0.13	0.07
		(0.53)	(0.48)	(0.39)	(0.30)	(0.22)
	6	0.28	0.22	0.33	0.30	0.11
		(0.58)	(0.52)	(0.44)	(0.39)	(0.28)
	12	0.47	0.38	0.41	0.45	0.15
		(0.54)	(0.52)	(0.51)	(0.46)	(0.34)

Total Monthly Excess Returns from only the Country Returns

		Holding Period in Months				
		1	3	6	12	24
Formation Period in Months	1	0.07	0.11	0.08	0.01	0.00
		(0.28)	(0.23)	(0.18)	(0.13)	(0.09)
	3	0.16	0.03	0.05	-0.01	0.01
		(0.36)	(0.32)	(0.27)	(0.20)	(0.14)
	6	0.03	0.02	0.12	0.14	0.08
		(0.39)	(0.36)	(0.31)	(0.25)	(0.18)
	12	0.24	0.17	0.25	0.38	0.19
		(0.38)	(0.35)	(0.32)	(0.28)	(0.20)

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Source: UBS Quantitative Research

Do sectors drive momentum?

- Moskowitz and Grinblatt (1999) argued that momentum returns were solely due to industry effects and that after controlling for this the momentum effect disappears
- This result appeared to depend critically upon using a one third weighting scheme and not dropping a month between the formation and holding periods
- Our regression based approach confirms the Moskowitz and Grinblatt result for **value weighted portfolios** and is robust to leaving a gap between the formation and holding period
- For **equal weighted portfolios** over a broader universe, the stock specific component of return is highly significant accounting for over 70% of the total

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Sector strategies generate similar returns

- O'Neal (2000) and Swinkels (2002) show that simple sector rotation or sector momentum strategies also generate similar returns to stock level momentum strategies

Market Cap Weighted MSCI Universe, returns to (J, K, 1) strategies, 1980-2003

		Holding Period in Months, K				
		1	3	6	12	24
Formation Period in Months, J	1	0.11	0.18	0.22	0.26	0.13
		(0.25)	(0.15)	(0.12)	(0.09)	(0.07)
	3	0.34	0.44	0.34	0.40	0.16
		(0.24)	(0.20)	(0.18)	(0.14)	(0.12)
	6	0.39	0.47	0.57	0.39	0.16
		(0.26)	(0.24)	(0.22)	(0.18)	(0.16)
	12	0.66	0.69	0.54	0.30	0.07
		(0.28)	(0.26)	(0.24)	(0.22)	(0.19)

Source: UBS Quantitative Research. Standard Errors are recorded below in parenthesis.

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Behavioural explanations

- A number of influential theoretical papers have sought to explain momentum effects by an appeal to the known psychological traits of individual investors
- In Daniel, Hirshleifer and Subrahmanyam (1998) irrational investors overreact initially because of overconfidence in their own forecasts and then subsequently underreact to public information
- In Barberis, Shleifer and Vishney (1998) momentum is caused by underreaction to news as irrational investors suffer from representativeness bias and conservatism
- Of particular interest to this study is Barberis and Shleifer (2003) in which institutional investors participate in “positive feedback” trading at the style level; this seems more consistent with style or sector level momentum effects

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Lead-lag effects and industry momentum

- Hou (2004) finds strong evidence for within or intra-industry lead-lag effects explaining virtually all industry momentum profits yet finds no evidence for cross or inter-industry effects
- The lead-lag effect is asymmetric with large firms leading small firms but not vice-versa, consistent with diffusion of information from industry leaders to other firms in the same industry
- Swinkels (2000) also finds support for a lead-lag effect from US to European stocks forming European industry portfolios based on US industry performance lagged one month
- This also appears consistent with the findings of Lo and MacKinlay (1990, 1999) that positive autocorrelation at the portfolio level is completely attributable to cross correlation effects as small caps always lag large caps

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Intra-industry lead-lag effects

Panel A: Intra-Industry Lead-Lag Effect

LHS	4-Lag Regressions			1-Lag Regressions		
	$R_{i,1}(t\text{-}1{:}t\text{-}4)$	$R_{i,3}(t\text{-}1{:}t\text{-}4)$	F_1	$R_{i,1}(t\text{-}1)$	$R_{i,3}(t\text{-}1)$	F_1
$R_{i,1}(t)$	0.3027	0.2629	204.37***	0.2137	0.1836	309.77***
	*565.55****	*302.30****		*28.21****	*24.02****	
$R_{i,3}(t)$	-0.0183	0.1946		-0.0031	0.1414	
	2.14	*150.23****		*-0.42*	*17.80****	

Panel B: Intra- versus Inter-Industry Lead-Lag Effects

LHS	4-Lag Regressions				1-Lag Regressions			
	$R_{i,1}(t\text{-}1{:}t\text{-}4)$	$R_{i,3}(t\text{-}1{:}t\text{-}4)$	$R_{\sum j,3}(t\text{-}1{:}t\text{-}4)$	F_1 (F_2)	$R_{i,1}(t\text{-}1)$	$R_{i,3}(t\text{-}1)$	$R_{\sum j,3}(t\text{-}1)$	F_1 (F_2)
$R_{i,1}(t)$	0.2937	0.2304	0.0294	125.08***	0.2025	0.1482	0.0376	146.91***
	*487.58****	*157.94****	*2.05*	(40.66***)	*25.85****	*14.72****	*3.10****	(31.51***)
$R_{i,3}(t)$	-0.0183	0.1946			-0.0031	0.1414		
	2.14	*150.23****			*-0.42*	*17.80****		

Source: reproduced with permission from Hou (2004)

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Lead-lag effects and non-synchronous trading

- One explanation for lead-lag effects is non-synchronous trading giving rise to spurious autocorrelations. However, such effects will be mitigated by skipping a month before forming the portfolios

- An obvious concern is that cross-autocovariances have typically been found to be significant over much shorter horizons than those of momentum strategies

- Yet the fact that the lead-lag effect is driven by firms within the same industry lends support to the idea that momentum might be due to the slow diffusion of information regarding common industry factors

- It seems likely that the difficulty investors face in deciding whether “news” on a stock relates to common industry factors or to that specific stock is one of the main drivers of momentum returns

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Price Momentum versus Earnings Revisions

- In order to better understand the relationship between “news” and returns it seems natural to model the impact of earnings revisions on subsequent returns
- Chan, Jegadeesh and Lakonishok (1996 ,1999) compare the performance of both earnings and price momentum strategies, they find price momentum to be stronger and longer lived
- Hou (2004) also finds that past price movements on large firms in the same industry convey a much less noisy signal about the future performance of small stocks than past earnings surprises
- Our own experiments with VARs on quarterly earnings data were similarly frustrating. We could find no relationship between quarterly IBES data and stock returns, although we could predict future IBES consensus earnings with some success!

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A return decomposition approach

- As an alternative to modelling the impact of news directly, we extend the return decomposition framework of Vuolteenaho (2002) to include sector effects
- We confirm Vuolteenaho's result that cash flow news is twice as important at the single stock level as expected return news and that for large caps this news is not correlated and diversifies away
- As a consequence, at the sector level, news on cash flows is relatively less important than information on expected returns or discount rates
- The information in past cash flow news at the sector level is more important for explaining momentum effects at the stock level
- At the large cap level cash flow news on a stock is much more likely to be interpreted as information on factors affecting stocks across the industry

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Stock Return Decomposition - Vuolteenaho (2002)

Assume Book Value (B_t) to Market Equity (M_t) ratio is stationary:

$$r_t - E_{t-1}(r_t) = \underbrace{\Delta E_t \sum_{j=0}^{\infty} \rho^j e_{t+j}}_{\text{Cash Flow News}} - \underbrace{\Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j}}_{\text{Expected Return News}} + \underbrace{k_t}_{\text{approx. error}}$$

where

$$e_t = \text{Excess ROE} = \log(1+\text{E}_t/\text{B}_{t-1}) - \log(1+R_t^f)$$

$$r_t = \text{Excess Return} = \log(1+R_t) - \log(1+R_t^f)$$

$$\Delta E_t(.) = \text{Change in expectations} = E_t(.) - E_{t-1}(.)$$

$$\rho = 0.96 = \text{Estimated constant related to payout ratio}$$

- If returns in any period are higher than expected then *either*
  - 1) Future earnings expectations must have increased *or*
  - 2) Future expected returns must be lower

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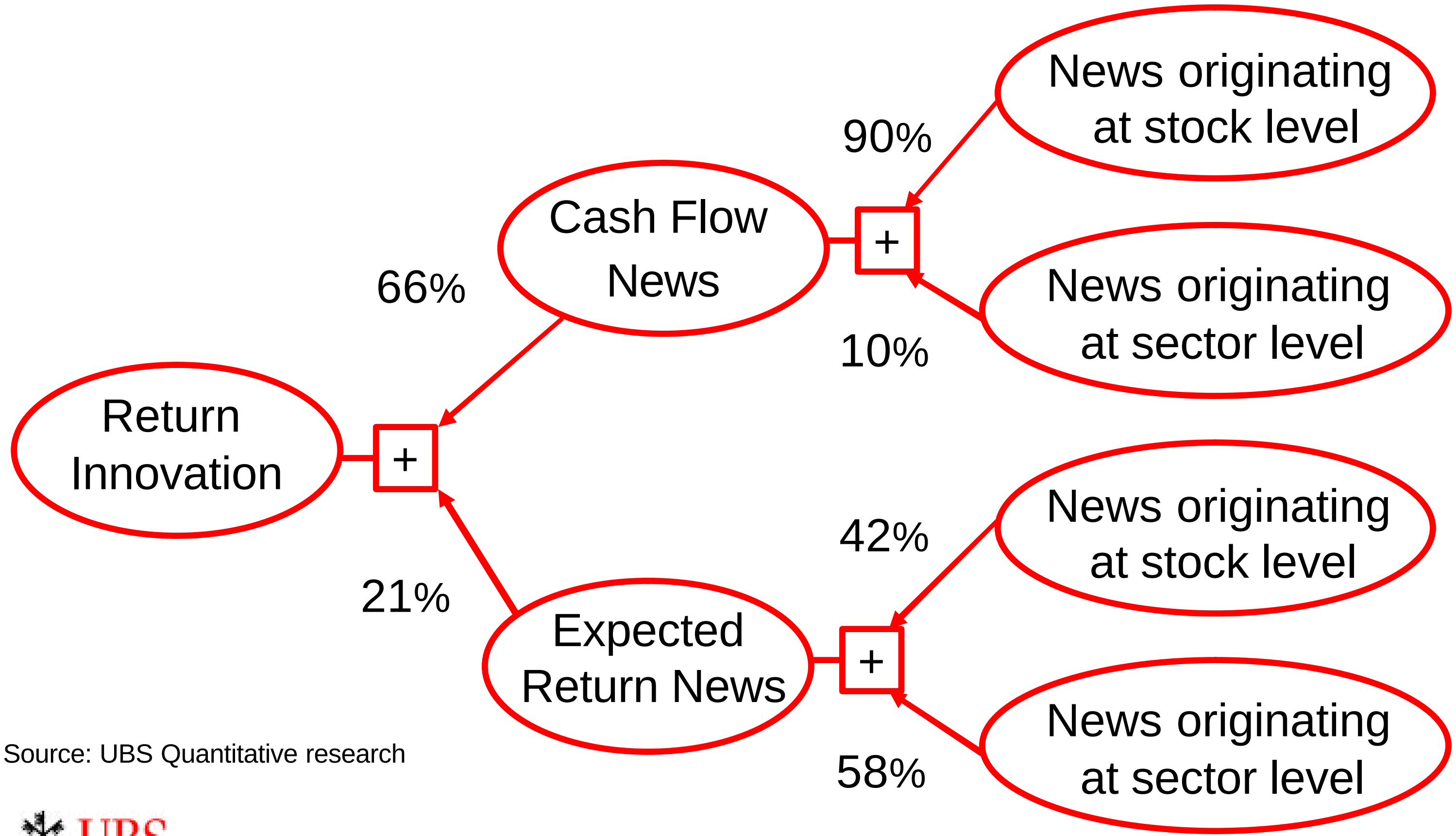
Stock Return Decomposition

$$r_t - E_{t-1}(r_t) = \underbrace{\Delta E_t \sum_{j=0}^{\infty} \rho^j e_{t+j}}_{\text{Cash Flow News}} - \underbrace{\Delta E_t \sum_{j=1}^{\infty} \rho^j r_{t+j}}_{\text{Expected Return News}} + \underbrace{k_t}_{\text{approx. error}}$$



Source: UBS Quantitative research

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Derivation of the Decomposition Formula (1)

Campbell and Shiller (1989) Log Linear approximation:

$$(1+R_t+R_t^f) = \left(\frac{M_t+D_t}{M_{t-1}}\right) = \left(\frac{M_t+D_t}{D_t}\right)\left(\frac{D_t}{D_{t-1}}\right)\left(\frac{D_{t-1}}{M_{t-1}}\right)$$

and take logs

$$r_t + r_t^f = \log\left(1+e^{-d_t}\right) + \Delta d_t + d_{t-1}$$

$$\approx \underbrace{(k - r d_t)}_{\text{log linear approx}} + \underbrace{\Delta d_t}_{\text{log of dividend growth}} + \underbrace{d_{t-1}}_{\text{log of Dividend Yield}}$$

- If returns in any period are higher than expected then *either*

    1) Dividend growth is higher than expected *or*

    2) Yields have fallen

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Derivation of the Decomposition Formula (2)

From the clean surplus accounting relation, $B_t = B_{t-1} + E_t - D_t$

$$(1 + E_t / B_{t-1}) = \left(\frac{B_t + D_t}{B_{t-1}} \right) = \left(\frac{B_t + D_t}{D_t} \right) \left(\frac{D_t}{D_{t-1}} \right) \left(\frac{D_{t-1}}{B_{t-1}} \right)$$

and take logs

$$e_t + r_t^f \approx \underbrace{(k - r g_t)}_{\text{log linear approx}} + \underbrace{\Delta d_t}_{\text{log of dividend growth}} + \underbrace{g_{t-1}}_{\text{log(Dividend/Book)}}$$

and subtracting the Campbell and Shiller relation gives

$$e_t - r_t \approx r \underbrace{(d_t - g_t)}_{\text{log(Book/Market)}} - \underbrace{(d_{t-1} - g_{t-1})}_{\text{lagged log(Book/Market)}}$$

- If ROE is greater than returns then the Book to Market Ratio increases (by an amount related to payout ratios)

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Estimating future expected returns on annual data

$$\begin{bmatrix} r_{i,t} \\ q_{i,t} \\ e_{i,t} \\ --- \\ r_t^{S_i} \\ q_t^{S_i} \\ e_t^{S_i} \end{bmatrix} = \begin{bmatrix} 0.08^* & 0.11^* & 0.23^* & 0.36^* & 0.73^* & 0.92^* \\ -0.13^* & 0.76^* & -0.03 & -0.25^* & -0.41^* & -0.55^* \\ 0.04^* & -0.05^* & 0.51^* & -0.02^* & 0.02^* & -0.03 \\ 0 & 0 & 0 & 0.26^* & 0.63^* & 0.76^* \\ 0 & 0 & 0 & -0.14^* & 0.33^* & 0.28 \\ 0 & 0 & 0 & -0.01 & -0.05^* & 0.30^* \end{bmatrix} \begin{bmatrix} r_{i,t-1} \\ q_{i,t-1} \\ e_{i,t-1} \\ --- \\ r_{t-1}^{S_i} \\ q_{t-1}^{S_i} \\ e_{t-1}^{S_i} \end{bmatrix} + \begin{bmatrix} u_{i,t}^{r} \\ u_{i,t}^{q} \\ u_{i,t}^{e} \\ --- \\ u_{i,t}^{r^S} \\ u_{i,t}^{q^S} \\ u_{i,t}^{e^S} \end{bmatrix}$$

* Implies significance at 95% level

- Estimated on panel of all stocks in Dow Jones US Universe 1992-2004
  - An observation for each firm reporting event; data as of next quarter end
  - All variables measured relative to the value weighted market average
  - The sector independent variables correspond to the relevant DJ group value weighted averages
  - A group level fixed effect is included

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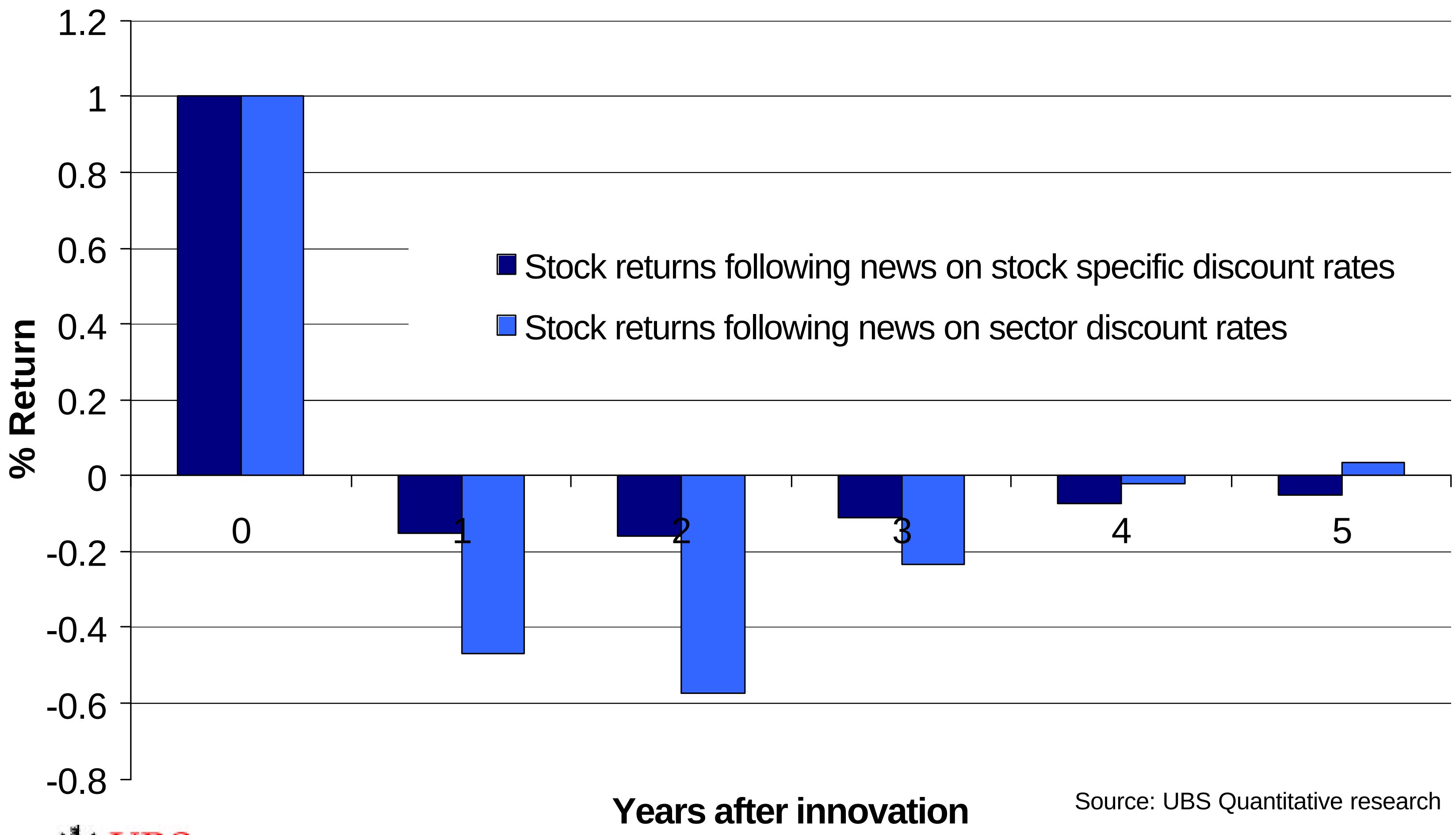
Impulse response to expected return news

- The covariance matrix of innovations is upper triangular, so orthogonalising the sector and stock specific innovations



Source: UBS Quantitative research

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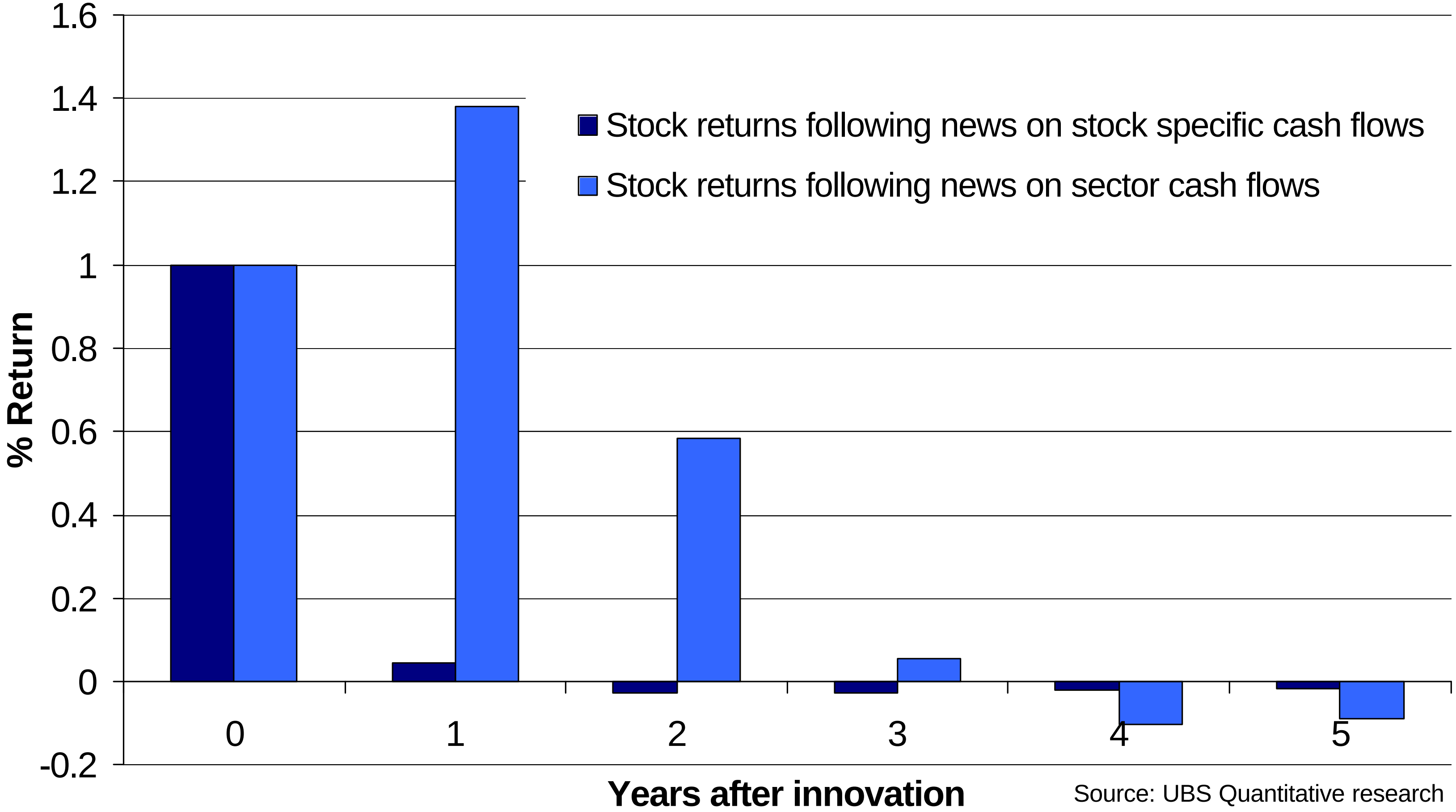
Impulse response to cash flow news

- The covariance matrix of innovations is upper triangular, so orthogonalising the sector and stock specific innovations



Source: UBS Quantitative research

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Aggregate Results of Annual of Vuolteenaho Model

- Use the estimated VAR to decompose unexpected return variance into Cash Flow and Expected Return News

	Annual Variances					
	Returns (1)	*Cash Flow News (2)*	*Expected Return News (3)*	*Ratio of (3) / (1)*	*News Covariance*	*News Correlation Coefficient*
Stock Returns	0.122	0.081	0.025	20.9%	-0.008	-0.173
Sector Returns	0.014	0.008	0.006	40.7%	0.000	-0.024

Source: UBS Quantitative research

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Breakdown by Sector for all stocks

- To estimate the sector innovations average the stock innovations in each period by sector
- The diversification coefficients are the sector variances divided the average the variances of constituent stock variances

	Annual Variances				*Diversification Coefficients*		
	Returns (1)	*Cash Flow News (2)*	*Expected Return News (3)*	*Ratio of (3) / (1)*	*Returns*	*Cash Flow News*	*Expected Return News*
Basic Materials	0.032	0.012	0.035	108.7%	0.384	0.232	0.823
Consumer Cyclical	0.023	0.018	0.009	39.5%	0.178	0.204	0.454
Energy	0.051	0.021	0.022	43.1%	0.478	0.336	0.657
Financial	0.029	0.021	0.015	52.9%	0.404	0.416	0.713
Healthcare	0.030	0.018	0.008	26.1%	0.164	0.142	0.343
Industrial	0.015	0.007	0.007	46.7%	0.136	0.103	0.388
Consumer Non-Cycl.	0.020	0.014	0.016	78.6%	0.213	0.225	0.671
Technology	0.056	0.034	0.018	31.5%	0.239	0.213	0.475
Telecommunic.	0.058	0.038	0.048	82.1%	0.465	0.440	0.796
Utilities	0.037	0.008	0.022	59.2%	0.583	0.266	0.894
TOTAL	0.013	0.009	0.004	29.7%	0.110	0.111	0.157

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Source: UBS Quantitative research

Breakdown by Sector using only large and medium cap stocks

- To estimate the sector innovations average the stock innovations in each period by sector
- The diversification coefficients are the sector variances divided by the average the variances of constituent stock variances

	Annual Variances				*Diversification Coefficients*		
	Returns (1)	*Cash Flow News (2)*	*Expected Return News (3)*	*Ratio of (3) / (1)*	*Returns*	*Cash Flow News*	*Expected Return News*
Basic Materials	0.024	0.009	0.033	108.0%	0.403	0.256	0.814
Consumer Cyclical	0.017	0.013	0.010	56.7%	0.166	0.177	0.534
Energy	0.041	0.018	0.019	45.4%	0.468	0.349	0.678
Financial	0.028	0.019	0.015	55.0%	0.458	0.435	0.764
Healthcare	0.022	0.008	0.009	40.9%	0.178	0.096	0.535
Industrial	0.016	0.009	0.007	42.0%	0.189	0.157	0.516
Consumer Non-Cycl.	0.020	0.015	0.015	73.8%	0.327	0.356	0.693
Technology	0.051	0.028	0.015	30.3%	0.235	0.184	0.520
Telecommunications	0.056	0.038	0.042	75.2%	0.518	0.485	0.923
Utilities	0.037	0.007	0.022	59.7%	0.570	0.235	0.893
TOTAL	0.011	0.006	0.005	42.7%	0.112	0.093	0.204

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Source: UBS Quantitative research

Regime dependency

- If the average return to momentum strategies is compensation for bearing increased economic risk then we should be able to find a relationship between the profitability of momentum strategies and economic risk factors, yet the evidence is very mixed
- Griffin, Ji and Martin (2003) found that macro factor models were of “paltry help” in explaining momentum returns and that such profits were inconsistent with risk based explanations they also report that profits were indistinguishable between up and down markets
- Cooper et. al. (2004) in contrast find that on US data, **momentum profits exclusively follow markets where the lagged market return is positive** “a significant mean monthly profit of 0.93% after three year UP markets and an insignificant –0.37% following three year DOWN markets”

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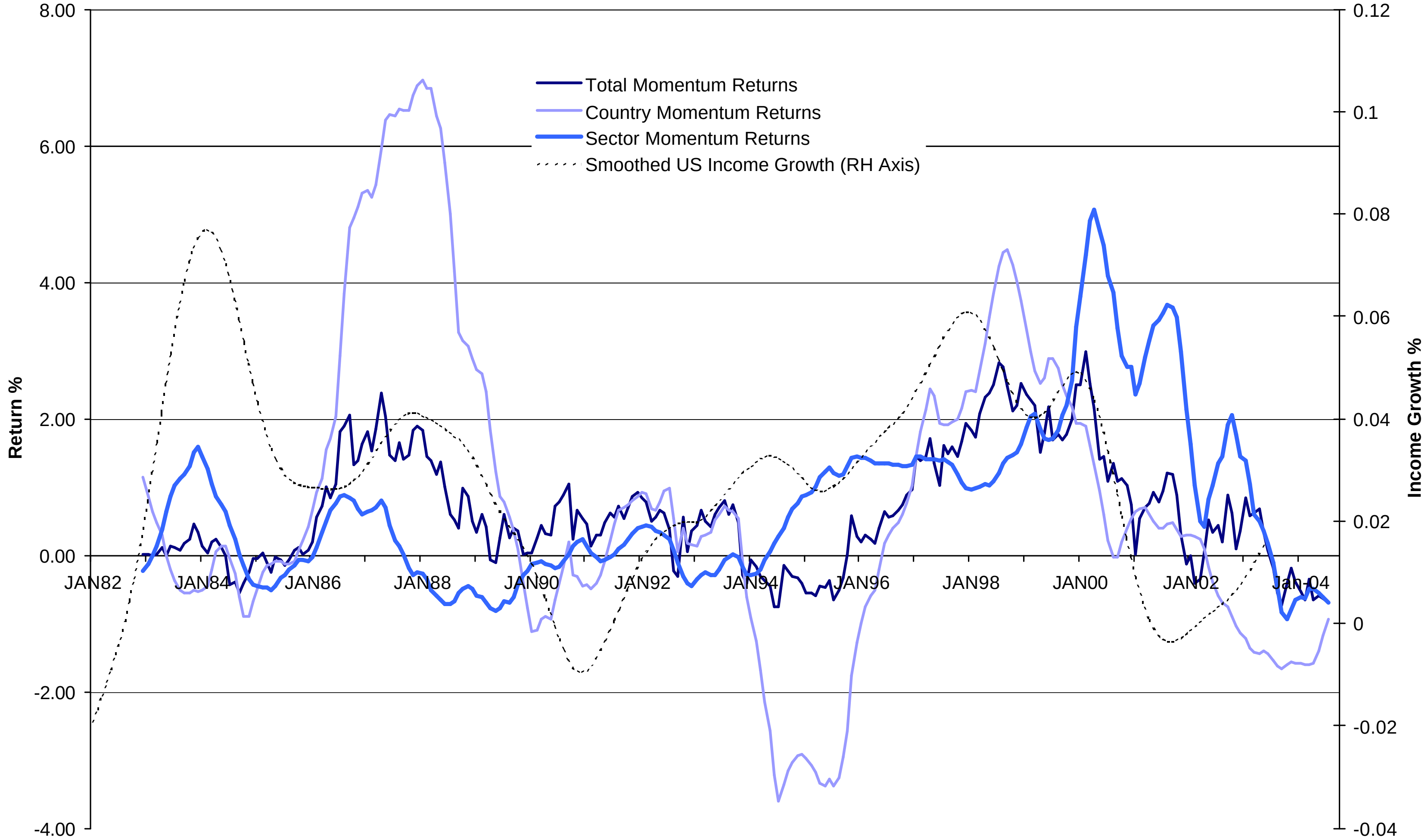
Decomposition of Momentum Profits over Time

- Momentum profits are larger during periods of economic growth



Returns series averaged over a moving 12 month window

Source: UBS Quantitative research

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Transaction costs

- A problem with the majority of academic studies is that transaction costs are ignored, or assumed to be proportional, yet the typical equal weighted WML strategy would require shorting illiquid stocks or the purchase of stocks in strong demand

- Value weighted WML strategies are more profitable on the long side e.g. Moskowitz and Grinblatt (1999) found an average monthly return of 0.37% long and only 0.06% short, Scowcroft and Sefton (2003) found 0.54 (0.37) long and –0.27 (0.53) short

- In a detailed study of market impact costs on momentum profits Korajczyk and Sadka (2004) computed the break even fund sizes for long only momentum strategies
  - Equal weighted $200m
  - Value Weighted $2bn
  - Liquidity Weighted $5bn

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Conclusions

- Extending the analysis of Scowcroft and Sefton (2003) back to 1980 has confirmed our original conclusion that the returns to momentum strategies are primarily driven by sector effects
- The VAR model illustrates that news on large stocks is more likely to be interpreted as news on factors driving sector returns
- This has important implications for both portfolio construction and risk control
  - simple sector rotation strategies will capture momentum returns O'Neal (2002)
  - sector neutrality will help reduce the risk of value strategies with short momentum positions, Asness (1989)
- There are two caveats
  - the returns to momentum strategies are highly regime dependent
  - transactions costs and market impact mean that the returns to naive equal weighted long-short strategies are unattainable in practice

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Appendix A - Estimating future expected returns

- Observe earnings only annually, but we observe earnings forecasts more frequently. Given *L* is the lag operator, assume the underlying model is

$$\begin{bmatrix} r_{i,t} \\ e_{i,t} \end{bmatrix} = \begin{bmatrix} A_{11}(L) & A_{12}(L) \\ A_{21}(L) & A_{22}(L) \end{bmatrix} \begin{bmatrix} r_{i,t-1} \\ e_{i,t-1} \end{bmatrix} + \begin{bmatrix} u_{i,t}^{r} \\ u_{i,t}^{e} \end{bmatrix}$$

- Now we define the earnings surprise s_t as

$$s_{i,t} = E_t(e_{i,t+4}) - E_{t-1}(e_{i,t+4})$$

- And assume these forecasts contain information on the innovation to earnings, i.e.

$$s_{i,t} = B_1(L)u_{i,t}^{e} + B_2(L)r_{i,t-1}$$

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Estimating future expected returns on quarterly data

- We can then substitute out underlying earnings in terms of earnings surprise

$$\begin{bmatrix} r_{i,t} \\ s_{i,t} \end{bmatrix} = \begin{bmatrix} A_{11}^{*}(L) & A_{11}^{*}(L) \\ A_{11}^{*}(L) & A_{11}^{*}(L) \end{bmatrix} \begin{bmatrix} r_{i,t-1} \\ s_{i,t-1} \end{bmatrix} + \begin{bmatrix} u_{i,t}^{r} \\ u_{i,t}^{e} \end{bmatrix}$$

where

$$A_{11}^{*} = A_{11}(L) + A_{12}(L)\left(I - A_{22}(L)\right)^{-1}\left(A_{21}(L)L - B_{1}^{-1}(L)B_{2}(L)\right)$$

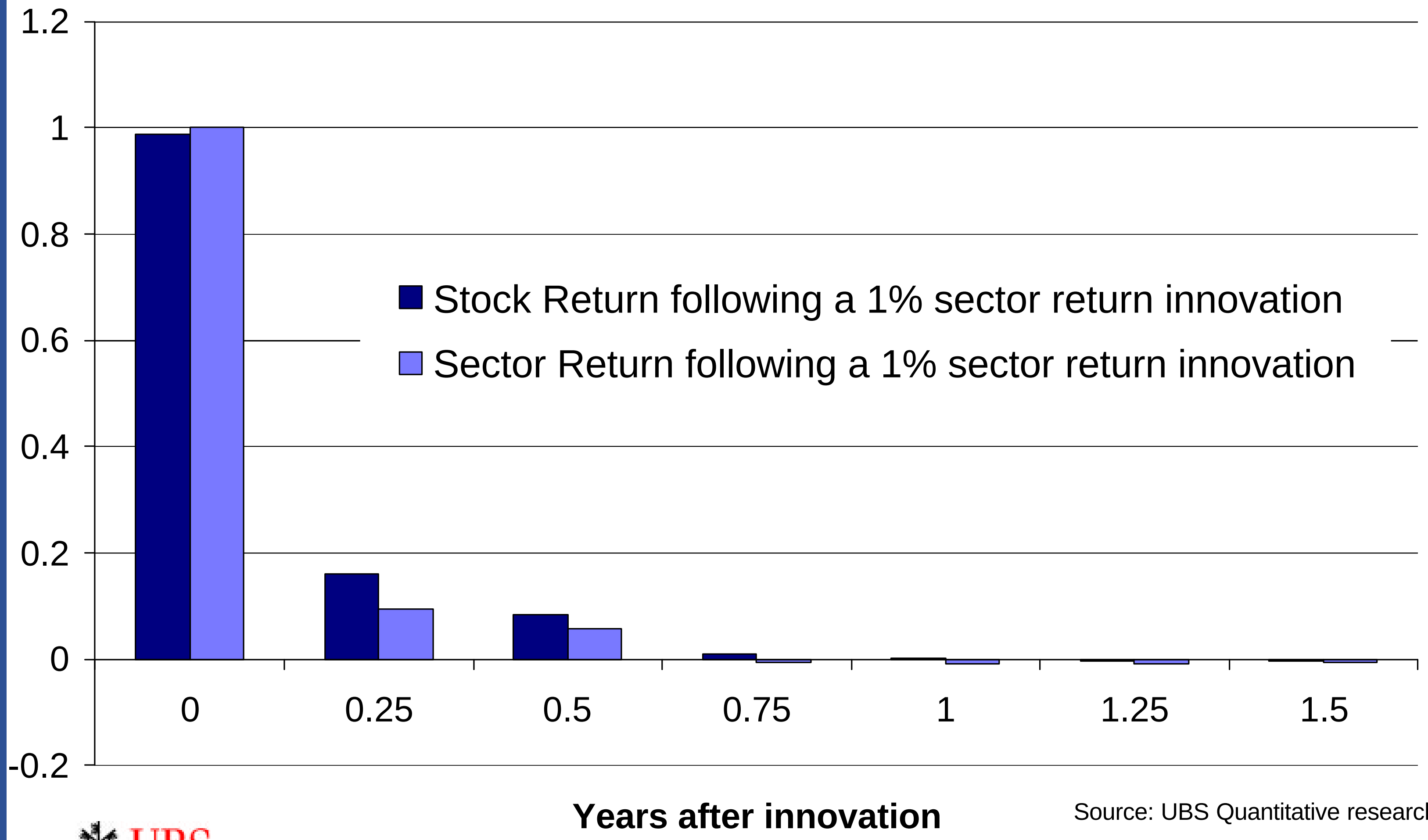
$$A_{12}^{*} = A_{12}(L)\left(I - A_{22}(L)\right)^{-1} B_{1}^{-1}(L)$$

$$A_{21}^{*} = B_{1}^{-1}(L)B_{2}(L)$$

$$A_{22}^{*} = L^{-1}\left(B_{1}^{-1}(L) - I\right)$$

Impulse Response to Stock and Sector innovations

- The covariance matrix of innovations is triangular, effectively orthogonalising the sector and stock specific innovations



Source: UBS Quantitative research

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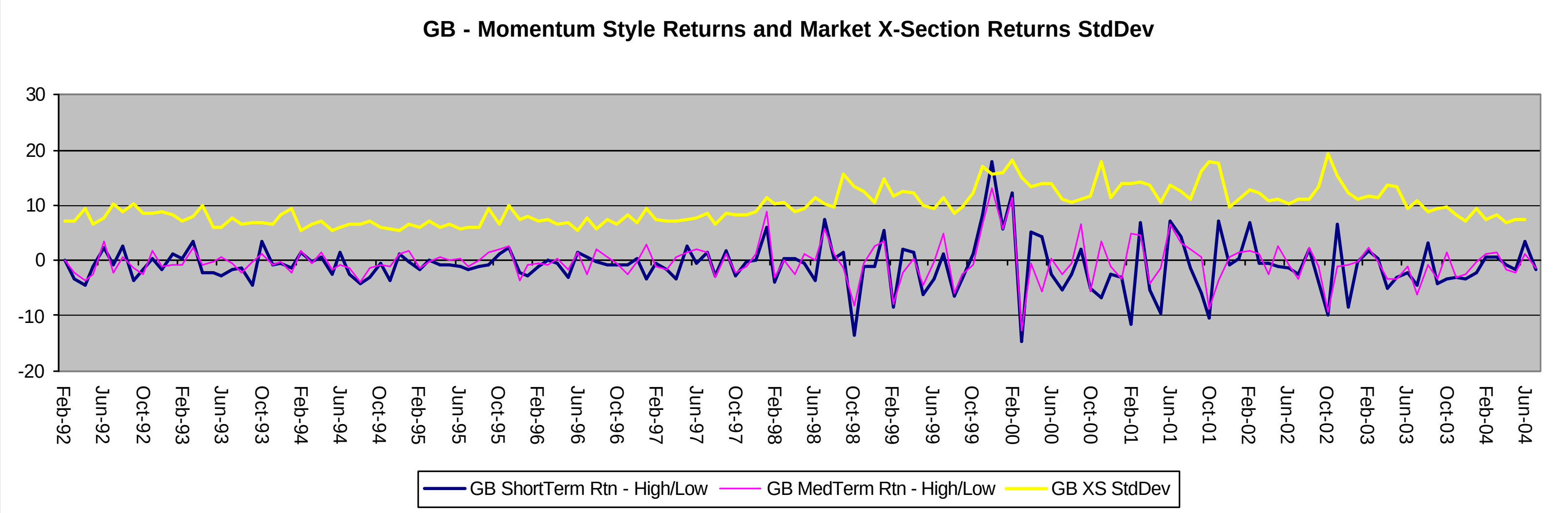
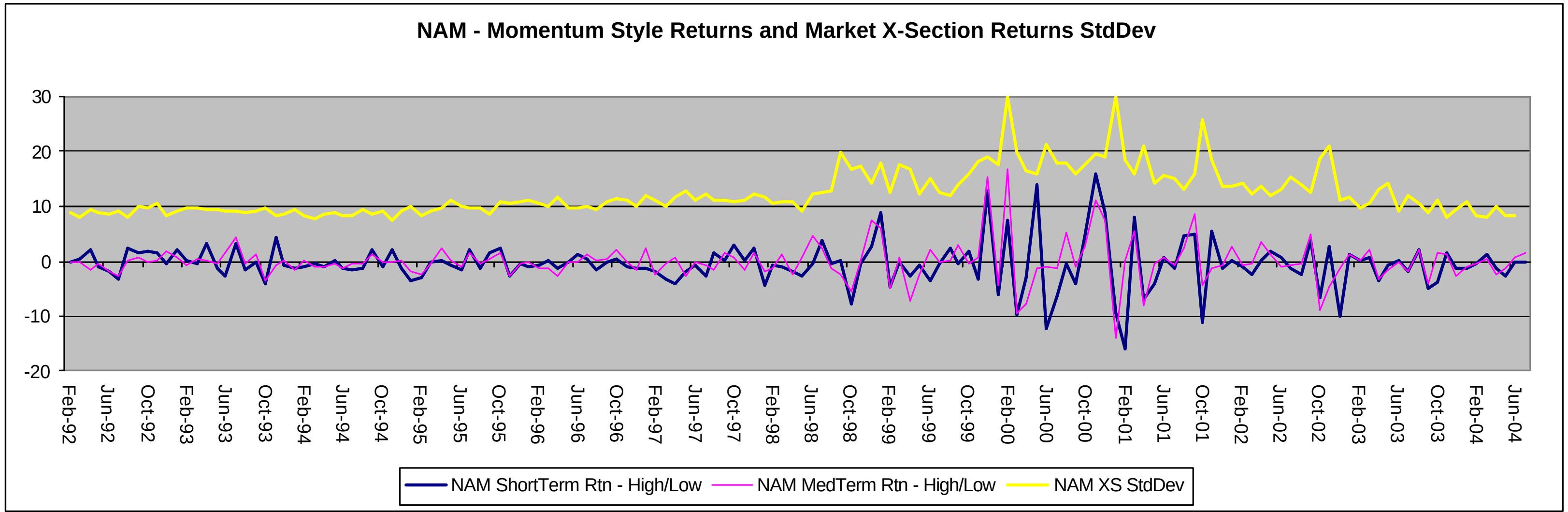
Appendix B - Cross-Sectional Volatility





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Source: UBS Quantitative research

Appendix C: Recent Performance

- MMSCI World, WML, value weighted, all returns in USD

Performance as at end July, 2004

	Performance				
Strategy	Last 3 Months	Last 6 Months	Last 1 year	Last 5 years	Last 10 years
1,1,1	-0.87	-0.92	-0.65	0.09	0.03
6,1,1	1.71	0.89	0.61	0.70	0.98
6,6,1	0.18	-0.08	0.02	0.30	0.84

Source: UBS Quantitative research

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Disclosures

Global ratings: Definitions and allocations

UBS rating	Definition	UBS rating	Definition	Rating category	Coverage[1]	IB services[2]
Buy 1	FSR is > 10% above the MRA, higher degree of predictability	**Buy 2**	FSR is > 10% above the MRA, lower degree of predictability	**Buy**	37%	30%
Neutral 1	FSR is between –10% and 10% of the MRA, higher degree of predictability	**Neutral 2**	FSR is between –10% and 10% of the MRA, lower degree of predictability	**Hold/Neutral**	52%	32%
Reduce 1	FSR is > 10% below the MRA, higher degree of predictability	**Reduce 2**	FSR is > 10% below the MRA, lower degree of predictability	**Sell**	11%	25%

1: Percentage of companies under coverage globally within this rating category.

2: Percentage of companies within this rating category for which investment banking (IB) services were provided within the past 12 months.

Source: UBS; as of 31 March 2005.

KEY DEFINITIONS

Forecast Stock Return (FSR) is defined as expected percentage price appreciation plus gross dividend yield over the next 12 months.

Market Return Assumption (MRA) is defined as the one-year local market interest rate plus 5% (an approximation of the equity risk premium).

Predictability Level The predictability level indicates an analyst's conviction in the FSR. A predictability level of '1' means that the analyst's estimate of FSR is in the middle of a narrower, or smaller, range of possibilities. A predictability level of '2' means that the analyst's estimate of FSR is in the middle of a broader, or larger, range of possibilities.

Under Review (UR) Stocks may be flagged as UR by the analyst, indicating that the stock's price target and/or rating are subject to possible change in the near term, usually in response to an event that may affect the investment case or valuation.

Rating/Return Divergence (RRD) This qualifier is automatically appended to the rating when stock price movement has caused the prevailing rating to differ from that which would be assigned according to the rating system and will be removed when there is no longer a divergence, either through market movement or analyst intervention.

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Global ratings: Definitions and allocations

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US Closed-End Fund ratings and definitions are: Buy: Higher stability of principal and higher stability of dividends; Neutral: Potential loss of principal, stability of dividend; Reduce: High potential for loss of principal and dividend risk.

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