

VALUE AND MOMENTUM EVERYWHERE

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Motivation

- Some of the most studied capital market phenomena are
 - *Value effect*: assets with high “book value”-to-market value outperform low ones
 - *Momentum effect*: recent relative winners outperform recent relative losers

- Value and momentum are often studied
 - only *separately*
 - only in *certain asset classes*
 - only *one asset class at a time*

► Literature

- US stock selection (Statman (1980), Fama-French (1992), Jegadeesh and Titman (1993), Asness (1994))
- Stocks in other countries (Fama and French (1998), Rouwenhorst (1998), Liew and Vassalou (2000), Griffin and Martin (2003), Chui, Titman, Wei (2002))
- Country equity indices (Asness, Liew, and Stevens (1997), Bhojraj and Swaminathan (2006))
- Currency momentum (Shleifer and Summers (1990), Kho (1996), LeBaron (1999))
- Commodity momentum (Gorton, Hayashi and Rouwenhorst (2007))
- Value effects in currencies and commodities (?)
- Value and momentum in government bonds (?)

What We Do

- Extend and unify analysis of value and momentum (almost) “everywhere”
 - Breadth of asset classes and markets studied in a **unified** setting **simultaneously**
 - Combining asset classes and combining value with momentum → **large economic and statistical gains**
 - Gain insight by looking across asset classes and globally at once
- Identify **connections** between value and momentum across markets
 - Providing evidence for **common** global phenomena/ factors
 - Consider **common explanations**: macro and liquidity risks
- New evidence consistent with or against existing theories for these phenomena
 - Rational explanations---common factor structure, production-based theories?
 - Behavioral explanations---misreaction to idiosyncratic information?

Main Results

- Value and momentum effects appear in **all** of the major asset classes
 - Value and momentum strategies both have positive Sharpe ratios despite being negatively correlated
 - Therefore, a 50/50 combination has higher Sharpe than either stand alone
 - Large diversification benefits from combining asset classes globally:
 1. Economic power of the combined asset class portfolios
 2. Statistical power of the combined portfolio reduces noise

- Striking **co-movement** patterns across asset classes:
 - Value here correlates with value there
 - Momentum here correlates with momentum there
 - Value and momentum negatively correlated everywhere

Main Results

- ▶ **Macro risk** doesn't explain much
- ▶ **Liquidity risk:**
 - Value loads positively and momentum loads negatively on our measure of funding liquidity risk
 - Liquidity risk is priced and may explain part of value premium, but makes momentum more puzzling
 - Partly explains global comovement patterns and negative correlation between value and momentum
- ▶ Interesting **dynamic effects:**
 - Importance of liquidity risk increases significantly over time, rising sharply after the summer of 1998
 - Over time, value and momentum both become less profitable, more correlated across markets and asset classes, and more correlated with each other

Main Results

- These risks and patterns are statistically present when **looking everywhere**
 - Not easy to detect these in any single strategy or asset class
 - Liquidity risk and dynamics may point to the importance of trading costs and limited arbitrage in explaining these phenomena
 - But, there is a **lot left to be explained**
- We're planning to make our data available for other researchers and to maintain it going forward at: <http://www.aqr.com/research.htm>

Overview of Talk

- Data and methodology
- New facts on performance of value and momentum everywhere
- Co-movement patterns
- Exposures to macroeconomic and liquidity risks
 - The power of looking everywhere at once
 - Some interesting dynamics

Data Sources

➤ Stock selection

- U.S.:

- Universe: CRSP common equity with a recent book value, at least 12 months of returns, excluding ADR's, foreign shares REITS, financials, closed-end funds, stocks with share prices less than \$1, and stocks in bottom quartile of market cap. Focus on top half of remaining universe based on market cap (top 37.5% of total universe).
- Prices and returns: CRSP
- Book values: Compustat

- U.K., Japan, Continental Europe:

- Universe: BARRA with recent book value from Worldscope, at least 12 months of returns and same filters as US.
- Prices and returns: Barra
- Book values: Worldscope

➤ Equity country selection

- Stock index returns and book values: MSCI

➤ Bond country selection

- Returns: Datastream MSCI 10-year government bond index in excess of local short rate
- Short rate and 10-year government bond yield: Bloomberg
- Inflation forecasts for next 12 months: analysts estimates compiled by Consensus Economics

➤ Currency selection

- Spot exchange rates: Datastream
- LIBOR short rates: Bloomberg

Data Sources

► Commodity selection

- Aluminum, Copper, Nickel, Zinc, Lead, Tin: London Metal Exchange (LME)
- Brent Crude, Gas Oil: Intercontinental Exchange (ICE)
- Live Cattle, Feeder Cattle, Lean Hogs: Chicago Mercantile Exchange (CME)
- Corn, Soybeans, Soy Meal, Soy Oil, Wheat: Chicago Board of Trade (CBOT)
- WTI Crude, RBOB Gasoline, Heating Oil, Natural Gas: New York Mercantile Exchange (NYMEX)
- Gold, Silver: New York Commodities Exchange (COMEX)
- Cotton, Coffee, Cocoa, Sugar: New York Board of Trade (NYBOT)
- Platinum: Tokyo Commodity Exchange (TOCOM)

► Macro indicators

- Recession = linear interpolation between peak (=0) and trough dates (=1)
 - US dates from NBER, Non-US dates from Economic Cycle Research Institute
- Long-run consumption growth = 3-year future growth in per capita consumption (sum of 3-year changes in above)

► Funding liquidity indicators

- TED spread (3 month LIBOR minus 3 month T-bill rate), U.S., U.K., Japan, Germany (Bloomberg and International Fund Services (IFS))
- 3-month LIBOR minus term repo rate (IFS, various brokers)
- Supplement with quantity and market liquidity indicators: VIX, Pastor-Stambaugh, Acharya-Pedersen, Sadka, Adrian-Shin.

Measures of Value and Momentum

- ▶ We use **simple** and, to the extent possible, standard and **uniform** measures
- ▶ **Momentum**: Return from t-12 to t-2 months
- ▶ **Value**:
 - Stocks: book-to-price
 - Country equity indices: aggregate book-to-price
 - Commodities: “book” is the average commodity spot price 4.5 to 5.5 years ago
 - Currencies: “book” is the average exchange rate 4.5 to 5.5 years ago adjusted for interest-rate differentials, i.e. excess return from t-60 to t-1
 - deviation from UIP, or change in PPP if real rates are constant across countries
 - Bonds: real bond yield, i.e. yield minus expected inflation
 - “book” is discounted cash-flows using expected inflation

Lagging Price in the Value Measure

- We use **most recently available price** in our value measure
 - Induces some negative correlation between value and momentum *within* (but not across) asset classes
 - Easy to create highly negatively correlated portfolios, harder to have them both deliver positive expected returns/alphas
 - Replicate using lagged value measures for robustness (appendix in the paper)
 - Using most recent price is a natural value measure (hard to imagine more recent price does not provide useful information)
 - Efficient frontier will look the same

Methodology

- Portfolios sorted on value and momentum within each asset class:
 - Three equal groups (high, middle, low)
 - Value-weight for stocks, equal-weight for other asset classes

- Portfolios based on **50/50 combination** of value/momentum:

- Also examine **High – Low spread** returns

- Allows us to also examine **long vs. short** side of trade

- *Robustness: when combine across asset classes, do both equal-weighting and equal-volatility weighting
(e.g., commodities have 5 times the volatility as bonds)

Table I: Performance of Value and Momentum Sorted Portfolios Across Markets and Asset Classes

	Value			Momentum			Combo			corr(val,mom)	
	H - L	H - M <i>long</i>	L - M <i>short</i>	H - L	H - M <i>long</i>	L - M <i>short</i>	H - L	H - M <i>long</i>	L - M <i>short</i>	H - L	
Panel A: Stock Selection											
<i>U.S.</i>	alpha	4.3%	1.7%	-2.6%	6.1%	4.0%	-2.1%	5.2%	2.9%	-2.3%	-0.55
	(t-stat)	(1.85)	(1.39)	(-1.52)	(2.22)	(2.22)	(-1.35)	(4.28)	(3.19)	(-2.23)	
	info ratio	0.32	0.24	-0.26	0.38	0.38	-0.23	0.73	0.54	-0.38	
	% contribution		39.7%	60.3%		65.8%	34.3%		55.1%	45.0%	
<i>U.K.</i>		2.7%	0.8%	-1.9%	10.8%	2.4%	-8.4%	6.7%	1.6%	-5.2%	-0.53
		(1.05)	(0.35)	(-0.93)	(3.05)	(1.01)	(-3.34)	(4.39)	(1.01)	(-3.15)	
		0.22	0.07	-0.19	0.63	0.21	-0.69	0.90	0.21	-0.65	
			29.3%	70.7%		22.0%	78.0%		23.4%	76.6%	
<i>Continental Europe</i>		4.2%	4.5%	0.3%	10.9%	5.3%	-5.6%	7.6%	4.9%	-2.7%	-0.52
		(1.41)	(2.96)	(0.13)	(2.92)	(2.12)	(-2.41)	(4.53)	(3.61)	(-1.70)	
		0.31	0.65	0.03	0.66	0.48	-0.54	1.02	0.81	-0.38	
			107.5%	-7.5%		48.3%	51.7%		64.4%	35.7%	
<i>Japan</i>		11.3%	4.0%	-7.3%	4.2%	1.1%	-3.0%	7.7%	2.6%	-5.2%	-0.63
		(3.35)	(2.00)	(-3.32)	(1.01)	(0.42)	(-1.38)	(4.71)	(2.09)	(-3.66)	
		0.69	0.41	-0.68	0.21	0.09	-0.28	0.97	0.43	-0.76	
			35.1%	64.9%		27.3%	72.8%		33.0%	67.0%	
<i>All stock selection (equal vol. weighted)</i>		6.8%	3.5%	-3.4%	7.2%	3.5%	-3.7%	7.0%	3.5%	-3.5%	-0.54
		(3.44)	(3.09)	(-2.42)	(3.07)	(2.36)	(-2.80)	(6.69)	(4.87)	(-3.89)	
		0.59	0.53	-0.41	0.52	0.40	-0.48	1.14	0.83	-0.66	
			50.6%	49.4%		48.9%	51.1%		49.7%	50.3%	

Table I (cont.)

	Value			Momentum			Combo			corr(val,mom)
	H - L	H - M <i>long</i>	L - M <i>short</i>	H - L	H - M <i>long</i>	L - M <i>short</i>	H - L	H - M <i>long</i>	L - M <i>short</i>	H - L
Panel B: Non-Stock Selection										
<i>Equity country indices</i>										
alpha	4.5%	3.3%	-1.1%	4.8%	1.8%	-3.0%	4.4%	2.5%	-2.0%	-0.35
(t-stat)	(2.64)	(1.85)	(-0.69)	(2.21)	(1.08)	(-1.63)	(3.49)	(2.13)	(-1.54)	
info ratio	0.46	0.32	-0.12	0.38	0.19	-0.28	0.60	0.37	-0.27	
% contribution		74.3%	25.7%		37.0%	63.0%		56.0%	44.0%	
<i>Currencies</i>										
	4.9%	3.2%	-1.7%	2.7%	1.5%	-1.2%	3.8%	2.4%	-1.4%	-0.34
	(2.84)	(2.35)	(-1.27)	(1.56)	(1.22)	(-0.89)	(3.84)	(2.67)	(-1.58)	
	0.54	0.44	-0.24	0.29	0.23	-0.17	0.72	0.50	-0.30	
		65.1%	34.9%		56.8%	43.2%		62.2%	37.8%	
<i>Country bonds</i>										
	0.3%	0.3%	0.0%	0.3%	0.7%	0.5%	0.3%	0.5%	0.3%	-0.12
	(0.48)	(0.52)	(0.03)	(0.33)	(1.22)	(0.71)	(0.61)	(1.15)	(0.50)	
	0.09	0.10	0.01	0.06	0.23	0.13	0.11	0.22	0.09	
		106.3%	-6.3%		295.6%	-195.6%		189.4%	-89.4%	
<i>Commodities</i>										
	6.4%	6.7%	0.4%	8.8%	3.6%	-5.3%	7.6%	5.1%	-2.4%	-0.45
	(1.64)	(2.38)	(0.12)	(2.43)	(1.13)	(-1.98)	(3.87)	(2.59)	(-1.25)	
	0.28	0.41	0.02	0.42	0.20	-0.34	0.67	0.45	-0.22	
		106.0%	-6.0%		40.3%	59.7%		67.8%	32.2%	
<i>All non-stock selection (equal vol. weighted)</i>										
	5.6%	3.6%	-2.0%	3.3%	0.7%	-2.6%	4.5%	2.2%	-2.3%	-0.45
	(4.40)	(3.45)	(-2.09)	(2.40)	(0.68)	(-2.51)	(6.40)	(3.06)	(-3.49)	
	0.84	0.66	-0.40	0.46	0.13	-0.48	1.22	0.59	-0.67	
		63.5%	36.5%		22.1%	77.9%		48.1%	51.9%	
<i>All asset selection (equal vol. weighted)</i>										
	5.7%	3.5%	-2.2%	3.9%	1.0%	-2.9%	4.8%	2.3%	-2.5%	-0.52
	(4.99)	(4.01)	(-2.60)	(2.81)	(1.04)	(-3.06)	(7.62)	(3.83)	(-4.42)	
	0.95	0.77	-0.50	0.54	0.20	-0.59	1.46	0.73	-0.85	
		62.0%	38.0%		25.9%	74.1%		47.2%	52.8%	

Table II: Correlation of Value and Momentum Across Markets and Asset Classes

	Average of individual correlations				Correlation of average return series			
	Stock value	Non-stock value	Stock momentum	Non-stock momentum	Stock value	Non-stock value	Stock momentum	Non-stock momentum
	Quarterly return correlations				Quarterly return correlations			
Stock value	0.49*	0.03	-0.36*	0.14*	0.61*	0.15*	-0.74*	-0.22*
Non-stock value		0.05	-0.06	-0.06		0.09	-0.20*	-0.45*
Stock momentum			0.42*	0.22*			0.55*	0.45*
Non-stock momentum				0.18*				0.27*

*indicates significantly different from zero at the 5% level.

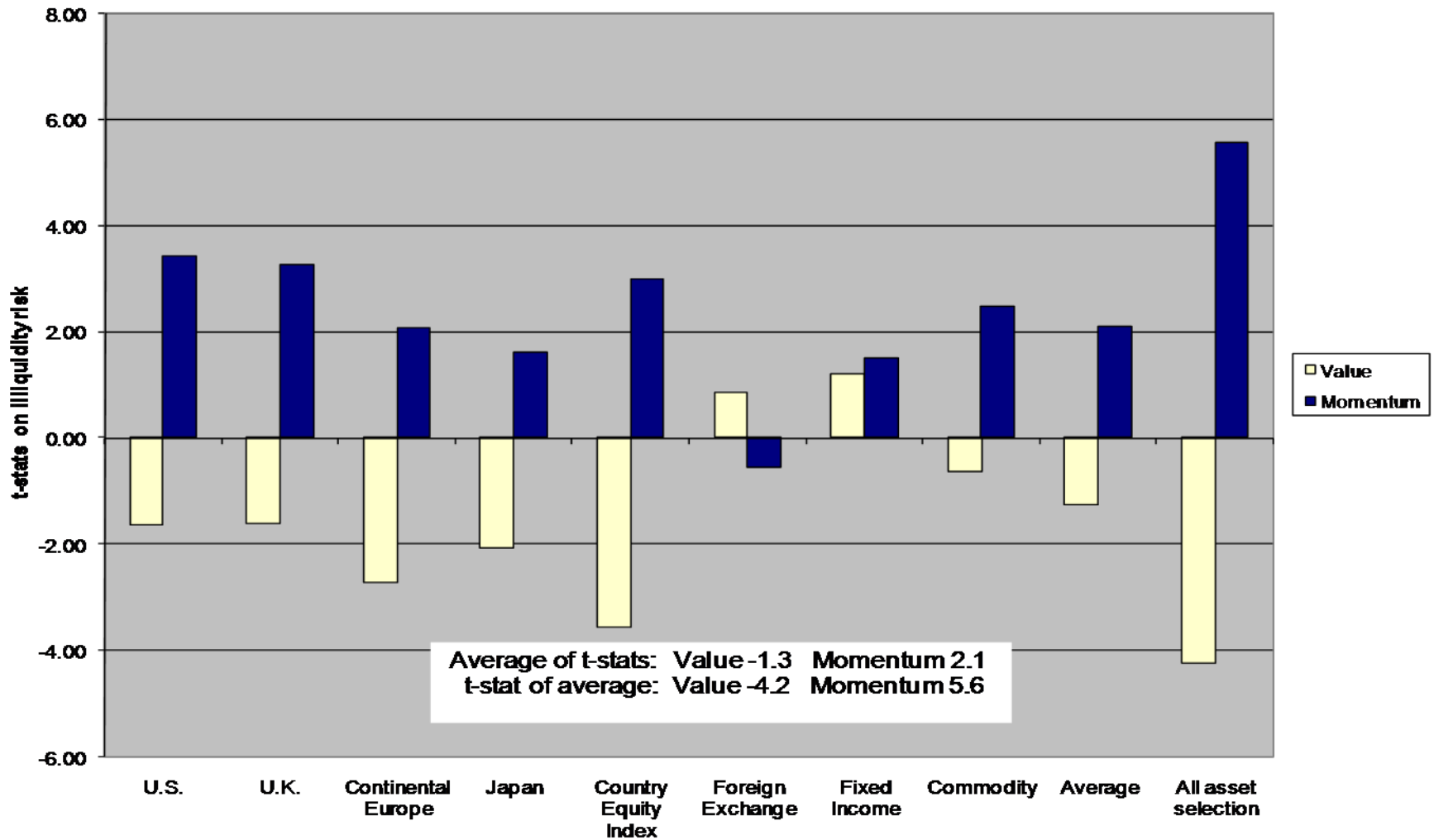
Table II (cont.)

Panel C: Correlation of average stock selection with each non-stock strategy								
	Country index value	Currency value	Country bond value	Commodity value	Country index momentum	Currency momentum	Country bond momentum	Commodity momentum
	Quarterly return correlations							
All stock selection, value	0.19*	0.02	0.10*	0.02	-0.34*	-0.08	-0.10*	-0.05
All stock selection, momentum	-0.32*	-0.07	-0.04	-0.06	0.48*	0.27*	0.22*	0.18*
*indicates significantly different from zero at the 5% level.								

Table IV: Macroeconomic and Liquidity Risk Exposures

Panel B: Liquidity risk measures				
Dependent variable =	Value	All Asset Selection (full sample)		
		Momentum	Combo	Val-Mom
<i>Funding illiquidity measures:</i>				
On-the-run - off-the-run PC	-0.041	0.029	-0.006	-0.070
04/1991	(-2.24)	(1.32)	(-0.55)	(-2.00)
TED spread PC	-0.025	0.026	0.001	-0.051
04/1991	(-2.99)	(5.68)	(0.22)	(-4.21)
Libor - term repo PC	-0.016	0.023	0.004	-0.038
01/1996	(-1.95)	(2.96)	(1.33)	(-2.59)
All funding PC	-0.027	0.024	-0.001	-0.052
	(-3.14)	(3.66)	(-0.33)	(-4.06)
Δ All funding PC	-0.022	0.019	-0.001	-0.041
	(-2.11)	(2.02)	(-0.34)	(-2.27)
<i>Other illiquidity measures: (includes Pastor-Stambaugh, Sadka, Acharya-Pedersen, Adrian-</i>				
All other illiquidity PC	-0.052	0.098	0.023	-0.151
	(-2.25)	(4.59)	(1.79)	(-4.12)
<i>All illiquidity measures:</i>				
Illiquidity index (PC of all)	-0.022	0.026	0.002	-0.048
04/1991	(-4.15)	(5.59)	(0.73)	(-4.54)
Δ Illiquidity index	-0.018	0.019	0.001	-0.037
05/1991	(-2.44)	(2.77)	(0.20)	(-2.96)

Power of Looking Everywhere: Liquidity Risk

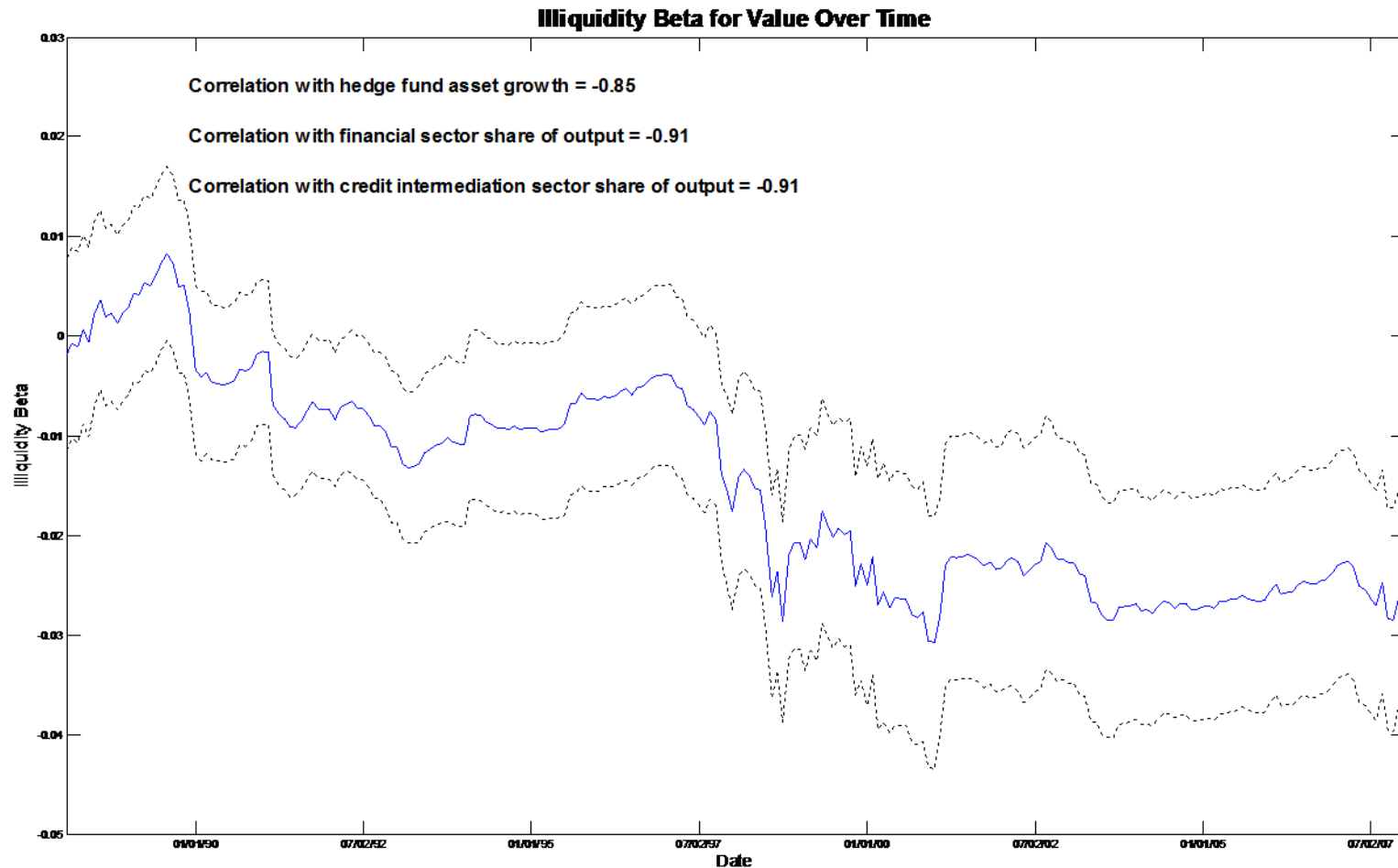


Economic Magnitudes

- Statistical correlations we uncover are significant and interesting, but only a starting point
- Economic magnitudes of premia and correlation structure explained is small
- Liquidity risk may explain part of value premium and negative correlation between value and momentum, but only makes momentum premium more puzzling
- A lot left to be explained!

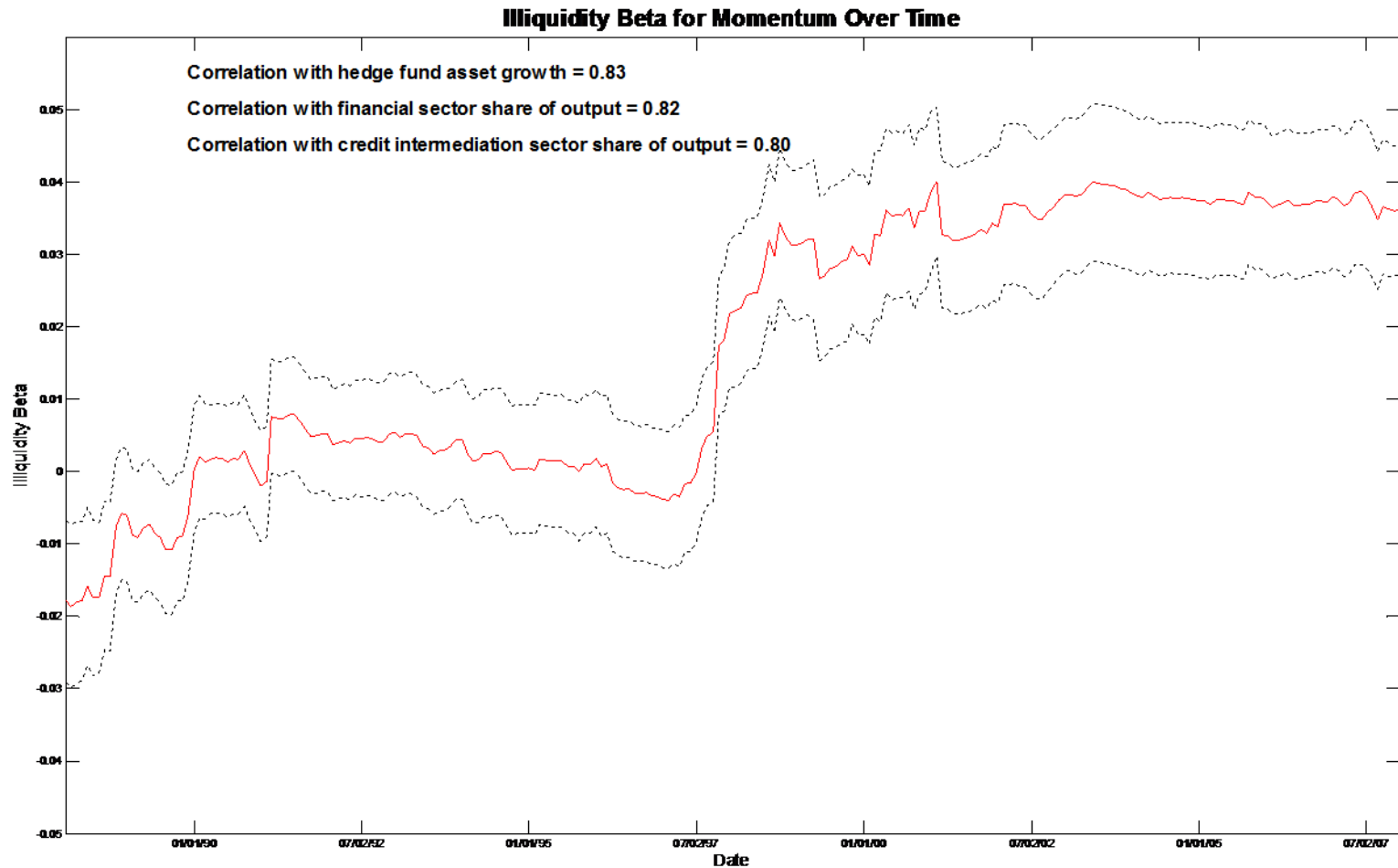
Dynamics of Value and Liquidity Risk

► Illiquidity Beta for value over time

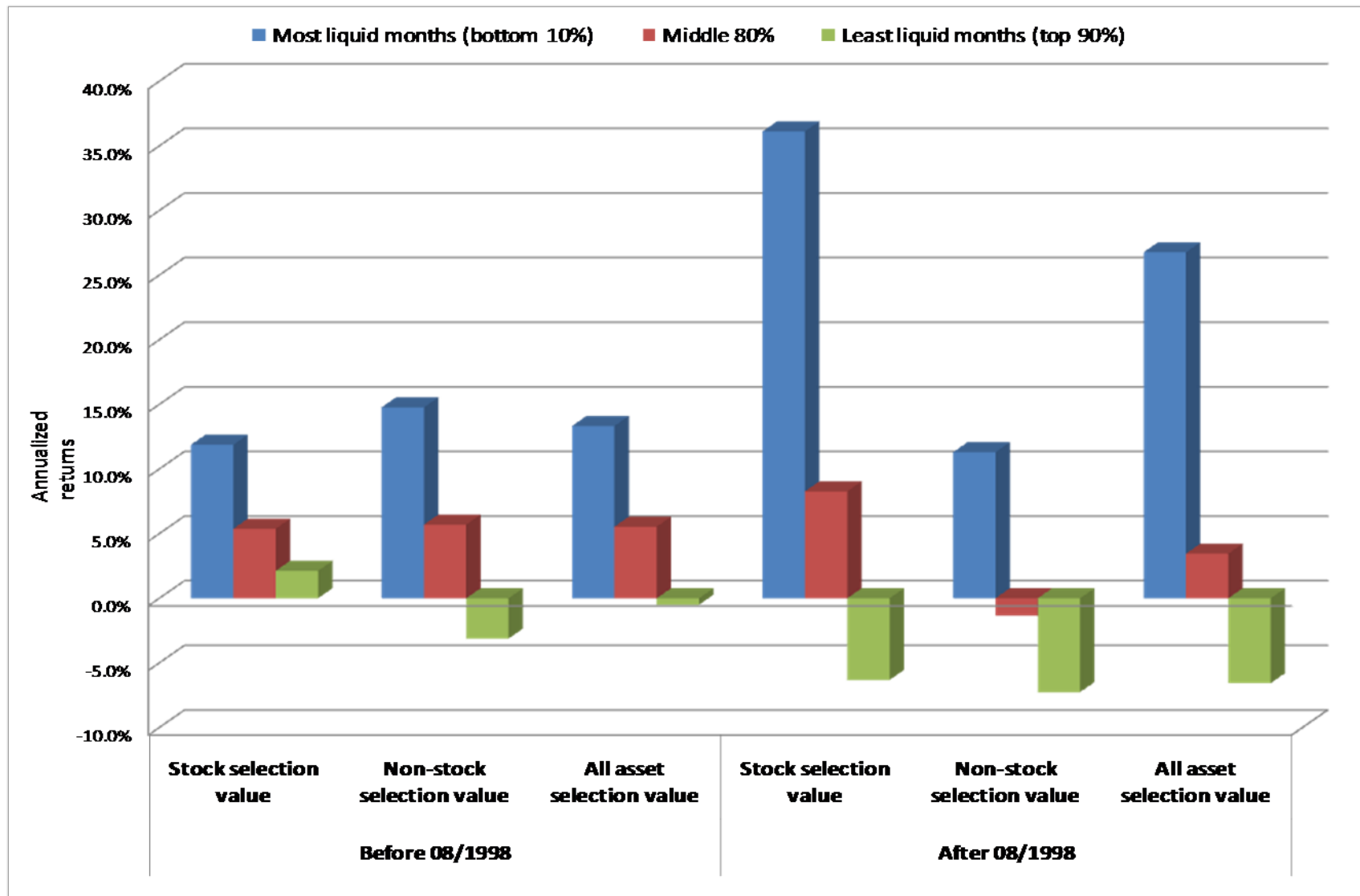


Dynamics of Momentum and Liquidity Risk

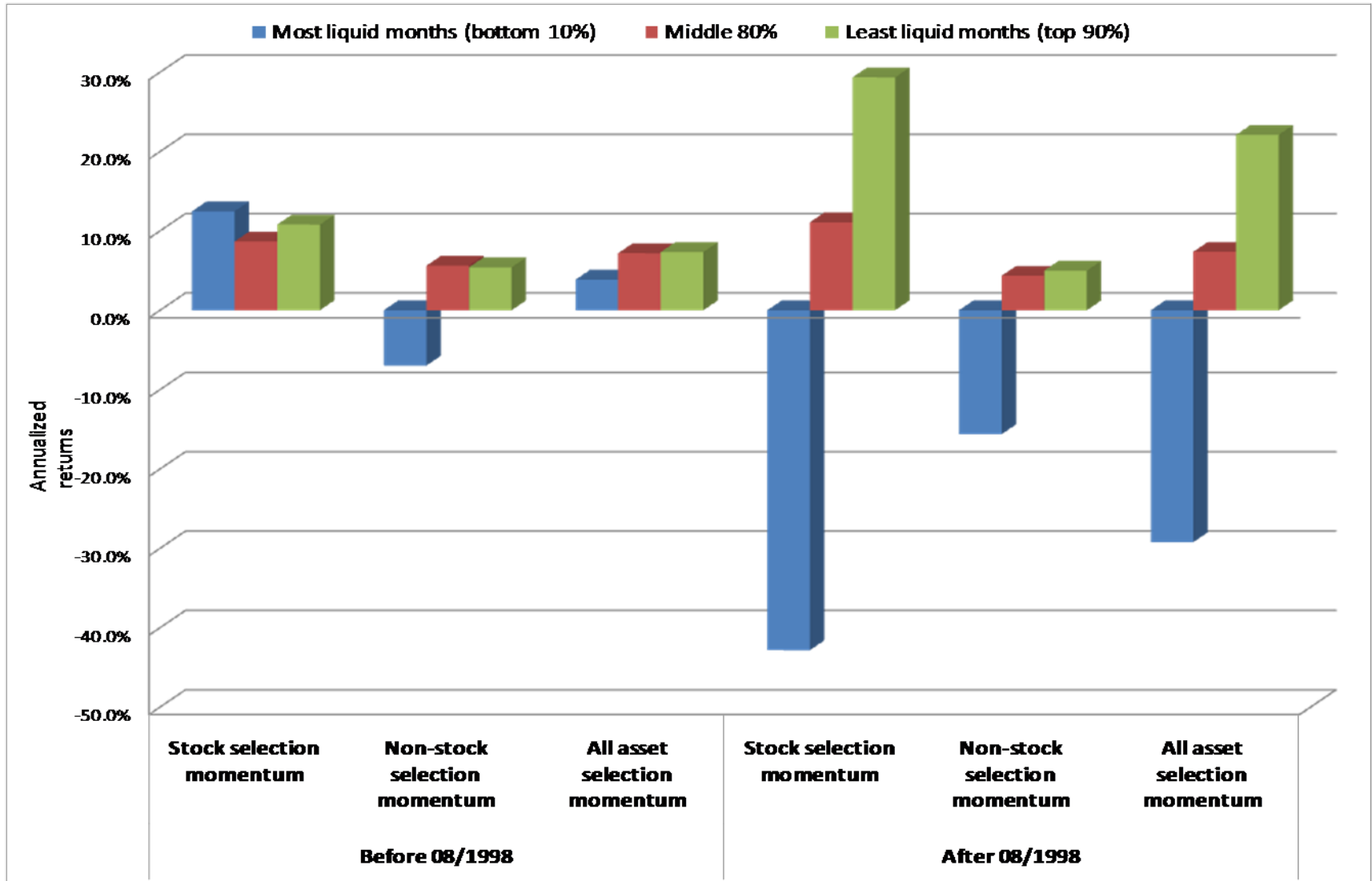
► Illiquidity Beta for momentum over time



Value in Liquid vs. Illiquid Times



Momentum in Liquid vs. Illiquid Times



Conclusions

- Value and momentum work in a variety of markets and asset classes
 - Their **combination** works better than either stand alone
 - Large **economic and statistical benefits** to our **unified** approach of looking across markets and asset classes
- Identify interesting global **co-movement** structure
- Data hint toward a link between these phenomena and **liquidity risk**
- Interesting **dynamics** related to liquidity risk and extreme events
- Still far from a full explanation

Conclusions

- Theory must accommodate the patterns we uncover:
 1. Large Sharpe ratios from combining strategies across asset classes
 2. Why value and momentum load oppositely on liquidity risk
 3. What causes the link between similar strategies in seemingly different asset classes?
 4. What is driving the dynamics we observe?

Over-Optimistic or Pessimistic for Real-World Implementation?

➤ Over-optimistic

- No transactions or financing costs
 - makes performance closer for stock vs. non-stock and val vs. mom
- Backtests never hit a funding-liquidity (or confidence) problem
- Going forward returns may be lower
 - data-mining (though having looked everywhere reduces this risk)
 - because some people trade on these strategies

or, not, e.g. because returns are compensation for risk?

➤ Over-pessimistic

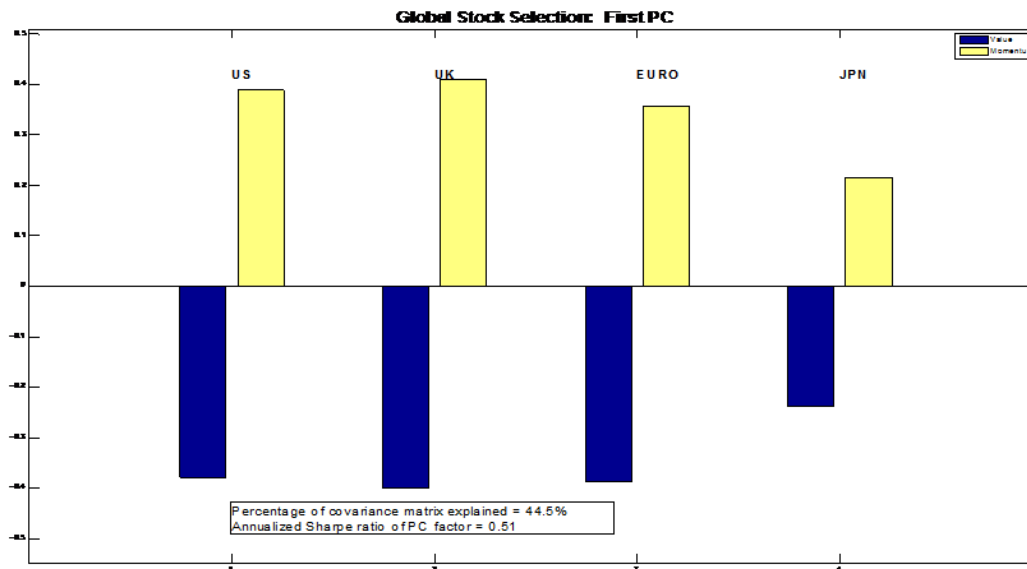
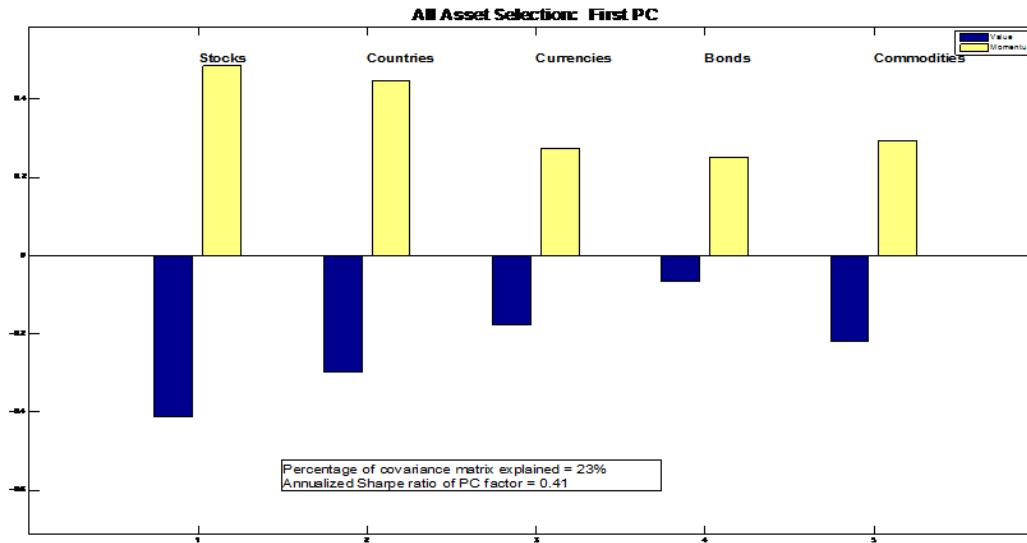
- We used only the simplest value and momentum measures; weighting each strategy the same
- There are many possible improvements (that must be balanced vs. the dangers of data-mining); e.g., improved value/momentum measures, variable strategy weighting (statically and dynamically)

Current versus Lagged Measures of Value

Comparison to Fama-French Portfolios (02/1973-10/2008)

Panel A: Sharpe ratio comparison				
	Value	Momentum	Combo	Corr(Val, Mom)
Fama-French	0.51	0.70	0.93	-0.15
<i>Using most recent value measure available:</i>				
U.S. AMP	0.32	0.63	1.04	-0.55
Correlation with FF	0.78	0.92	0.83	
<i>Using value measure lagged an additional year:</i>				
U.S. AMP	0.57	0.63	0.82	-0.18
Correlation with FF	0.88	0.92	0.92	
Panel B: Regression of U.S. AMP portfolios on Fama-French portfolios				
Dependent variable =	AMP Value	AMP Value (lag)	AMP Momentum	AMP Combo
Coefficient				
Intercept	1.99	0.73	1.75	3.13
RMRF	-0.08	-0.08	0.06	-0.01
SMB	-0.11	-0.03	0.13	0.03
HML	0.71	0.85	-0.10	0.67
UMD	-0.35	-0.02	0.65	0.44
t-statistic				
Intercept	2.37	0.74	2.11	3.34
RMRF	-4.97	-4.02	3.81	-0.44
SMB	-4.62	-1.25	5.51	1.24
HML	28.07	28.43	-3.98	23.60
UMD	-20.66	-1.08	39.08	23.15
R-square	0.81	0.75	0.80	0.74
Panel C: Regression of Fama-French portfolios on AMP portfolios				
Dependent variable =	HML	UMD	HML+UMD	
Coefficient				
Intercept	0.17	0.71	0.44	
AMP Value	0.99	0.02	0.50	
AMP Momentum	0.45	1.21	0.83	
t-statistic				
Intercept	0.18	0.61	0.54	
AMP Value	28.27	0.49	17.00	
AMP Momentum	13.39	30.03	29.31	
R-square	0.74	0.79	0.72	

First principal component for value and momentum strategies



Comovement Everywhere

	Stock selection, combo	Non-stock selection, combo	Stock selection, combo	Non-stock selection, combo
	Monthly return correlations		Quarterly return correlations	
Stock Selection, combo	0.29	0.10	0.44	0.12
Non-stock selection, combo		0.06		0.07

**Significant at the 5% level.*

Table 5: Asset Pricing Tests

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i(MSCI_t - r_{f,t}) + \gamma_i VAL_t^{rank} + \delta_i MOM_t^{rank} + \varepsilon_{i,t} \quad \forall i \in N$$

Panel A: Each Individual High, Middle, and Low Value and Momentum Portfolio												
		Coefficient estimates					t-statistics					
		AMP 3-factor model			CAPM	AMP 3-factor model			CAPM	3-factor		
		alpha	MSCI-Rf	Value	Momentum	alpha	MSCI-Rf	Value	Momentum	alpha	R-square	
Value portfolios:												
U.S.	High	0.31%	0.91	0.26	-0.37	0.16%	(1.75)	(22.40)	(2.39)	(-4.11)	(0.94)	0.75
	Middle	0.37%	0.89	0.03	-0.15	0.28%	(2.47)	(26.09)	(0.29)	(-1.96)	(2.14)	0.78
	Low	0.32%	0.97	-0.79	0.10	0.11%	(1.69)	(22.30)	(-6.72)	(1.02)	(0.57)	0.75
U.K.	High	0.03%	0.88	0.37	-0.25	0.00%	(0.13)	(17.33)	(2.68)	(-2.17)	(-0.01)	0.63
	Middle	-0.16%	0.81	0.30	0.15	0.04%	(-0.73)	(15.77)	(2.19)	(1.31)	(0.19)	0.54
	Low	-0.01%	0.76	-0.45	0.16	-0.06%	(-0.05)	(17.45)	(-3.80)	(1.60)	(-0.36)	0.63
Europe	High	0.55%	1.05	0.31	-0.11	0.59%	(2.09)	(17.38)	(1.91)	(-0.80)	(2.53)	0.61
	Middle	0.15%	1.02	0.10	0.04	0.21%	(0.63)	(18.44)	(0.66)	(0.29)	(1.00)	0.62
	Low	0.54%	1.00	-1.00	0.05	0.23%	(2.19)	(17.73)	(-6.56)	(0.41)	(0.92)	0.67
Japan	High	-0.24%	0.90	0.70	0.04	0.02%	(-0.64)	(10.35)	(2.97)	(0.21)	(0.07)	0.35
	Middle	-0.35%	0.92	0.17	-0.01	-0.30%	(-1.12)	(12.88)	(0.88)	(-0.05)	(-1.09)	0.45
	Low	-0.59%	1.00	-0.76	0.01	-0.84%	(-1.77)	(13.22)	(-3.70)	(0.09)	(-2.79)	0.51
Country index	High	-0.02%	1.04	0.32	0.05	0.13%	(-0.11)	(29.53)	(3.31)	(0.69)	(0.93)	0.81
	Middle	0.00%	1.03	-0.05	0.18	0.10%	(0.01)	(27.26)	(-0.50)	(2.10)	(0.67)	0.78
	Low	0.00%	1.02	-0.11	0.06	0.01%	(0.04)	(38.13)	(-1.45)	(1.02)	(0.07)	0.88
Currency	High	0.16%	0.02	0.20	0.07	0.27%	(1.11)	(0.53)	(2.27)	(0.99)	(2.20)	0.02
	Middle	0.11%	0.05	-0.17	0.00	0.05%	(0.60)	(1.25)	(-1.54)	(-0.02)	(0.30)	0.03
	Low	0.09%	0.02	-0.29	-0.13	-0.10%	(0.49)	(0.50)	(-2.60)	(-1.43)	(-0.61)	0.04
Bond	High	0.05%	0.06	0.17	0.13	0.19%	(0.75)	(4.01)	(4.13)	(3.66)	(3.15)	0.10
	Middle	0.04%	0.04	0.10	0.07	0.12%	(0.62)	(2.60)	(2.57)	(2.04)	(2.10)	0.04
	Low	0.03%	0.01	0.05	0.04	0.08%	(0.64)	(1.17)	(1.52)	(1.65)	(1.74)	0.01
Commodity	High	0.29%	0.18	0.49	0.04	0.49%	(0.99)	(2.59)	(2.68)	(0.29)	(1.88)	0.06
	Middle	0.12%	0.13	-0.16	-0.13	-0.01%	(0.41)	(1.90)	(-0.85)	(-0.81)	(-0.05)	0.03
	Low	0.37%	0.11	-0.92	0.02	0.07%	(0.97)	(1.25)	(-3.87)	(0.11)	(0.20)	0.12
Momentum portfolios:												
U.S.	High	0.26%	1.02	-0.54	0.65	0.49%	(1.28)	(22.26)	(-4.32)	(6.36)	(2.16)	0.75
	Middle	0.13%	0.81	0.08	-0.04	0.13%	(0.91)	(24.90)	(0.90)	(-0.54)	(1.07)	0.76
	Low	0.50%	0.94	-0.28	-0.93	-0.20%	(2.26)	(18.66)	(-2.03)	(-8.23)	(-0.87)	0.72
U.K.	High	-0.15%	0.84	-0.18	0.79	0.29%	(-0.73)	(17.26)	(-1.40)	(7.28)	(1.29)	0.63
	Middle	-0.08%	0.80	0.33	0.16	0.14%	(-0.36)	(16.62)	(2.55)	(1.45)	(0.76)	0.56
	Low	0.05%	0.86	-0.29	-0.95	-0.66%	(0.21)	(14.92)	(-1.88)	(-7.38)	(-2.66)	0.64
Europe	High	0.34%	1.04	-0.38	0.73	0.68%	(1.33)	(17.69)	(-2.39)	(5.53)	(2.58)	0.64
	Middle	0.18%	0.93	-0.03	0.12	0.24%	(0.73)	(16.86)	(-0.22)	(0.94)	(1.15)	0.58
	Low	0.48%	1.07	-0.41	-0.89	-0.23%	(1.86)	(17.99)	(-2.52)	(-6.71)	(-0.93)	0.69
Japan	High	-0.57%	0.97	-0.30	0.53	-0.34%	(-1.77)	(13.02)	(-1.49)	(3.16)	(-1.13)	0.47
	Middle	-0.52%	0.91	0.11	-0.06	-0.52%	(-1.63)	(12.41)	(0.53)	(-0.34)	(-1.88)	0.44
	Low	-0.29%	0.93	-0.06	-0.64	-0.72%	(-0.71)	(9.96)	(-0.22)	(-3.07)	(-1.98)	0.39
Country index	High	-0.13%	1.07	0.09	0.55	0.26%	(-0.90)	(32.13)	(1.02)	(7.44)	(1.76)	0.83
	Middle	0.03%	0.96	-0.02	0.06	0.06%	(0.20)	(27.89)	(-0.19)	(0.82)	(0.50)	0.79
	Low	0.09%	1.06	0.09	-0.34	-0.09%	(0.64)	(31.24)	(1.01)	(-4.54)	(-0.67)	0.84
Currency	High	0.13%	0.06	-0.08	0.08	0.15%	(0.73)	(1.64)	(-0.75)	(0.95)	(1.01)	0.03
	Middle	0.10%	0.01	-0.07	0.04	0.10%	(0.65)	(0.17)	(-0.76)	(0.44)	(0.73)	0.01
	Low	0.12%	0.03	-0.14	-0.19	-0.05%	(0.70)	(0.80)	(-1.25)	(-2.15)	(-0.31)	0.03
Bond	High	0.02%	0.04	0.12	0.12	0.13%	(0.28)	(2.84)	(2.90)	(3.56)	(2.32)	0.06
	Middle	0.02%	0.03	0.10	0.06	0.10%	(0.40)	(2.20)	(2.72)	(2.13)	(1.91)	0.04
	Low	0.08%	0.04	0.11	0.05	0.15%	(1.34)	(2.91)	(2.97)	(1.70)	(2.87)	0.06
Commodity	High	0.26%	0.20	-0.11	0.64	0.63%	(0.67)	(2.33)	(-0.48)	(3.27)	(1.82)	0.10
	Middle	0.29%	0.11	-0.12	0.00	0.25%	(1.06)	(1.72)	(-0.69)	(-0.02)	(1.04)	0.02
	Low	0.18%	0.10	-0.31	-0.62	-0.32%	(0.60)	(1.43)	(-1.61)	(-3.88)	(-1.14)	0.10
avg. alpha		0.13%					0.32%					
GRS F-stat (p-value)		1.08 (0.348)					1.89 (0.001)					

Table 5: Asset Pricing Tests (cont.)

		Coefficient estimates					t-statistics					3-factor R-square
		AMP 3-factor model				CAPM	AMP 3-factor model				CAPM	
		alpha	MSCI-Rf	Value	Momentum	alpha	alpha	MSCI-Rf	Value	Momentum	alpha	
Panel B: Each Individual High, Middle, and Low Combination Portfolio												
Combination portfolios:												
U.S.	High	0.23%	0.96	-0.03	0.10	0.33%	(1.49)	(28.24)	(-0.69)	(1.94)	(2.37)	0.78
	Middle	0.19%	0.86	0.05	-0.01	0.21%	(1.41)	(28.78)	(1.04)	(-0.17)	(1.73)	0.79
	Low	0.18%	1.01	-0.14	-0.13	-0.04%	(0.97)	(24.95)	(-2.39)	(-2.18)	(-0.26)	0.75
U.K.	High	-0.06%	0.84	0.06	0.16	0.14%	(-0.33)	(20.79)	(0.98)	(2.56)	(0.88)	0.65
	Middle	-0.04%	0.79	0.13	0.06	0.09%	(-0.20)	(17.38)	(1.97)	(0.83)	(0.49)	0.57
	Low	-0.20%	0.86	-0.04	-0.13	-0.36%	(-1.01)	(20.11)	(-0.64)	(-2.01)	(-2.11)	0.66
Europe	High	0.46%	1.02	-0.08	0.20	0.63%	(1.92)	(19.66)	(-1.01)	(2.48)	(2.97)	0.64
	Middle	0.20%	0.96	-0.06	0.05	0.22%	(0.84)	(18.83)	(-0.82)	(0.70)	(1.10)	0.62
	Low	0.22%	1.09	-0.23	-0.10	0.00%	(0.92)	(20.69)	(-2.96)	(-1.20)	(-0.01)	0.68
Japan	High	-0.01%	0.87	-0.07	-0.10	-0.16%	(-0.04)	(12.53)	(-0.74)	(-0.93)	(-0.57)	0.43
	Middle	-0.04%	0.88	-0.11	-0.28	-0.41%	(-0.13)	(12.98)	(-1.11)	(-2.77)	(-1.51)	0.46
	Low	-0.18%	0.96	-0.30	-0.41	-0.78%	(-0.52)	(13.02)	(-2.77)	(-3.63)	(-2.59)	0.48
Country index	High	-0.09%	1.04	0.13	0.19	0.19%	(-0.76)	(38.95)	(3.38)	(4.82)	(1.73)	0.87
	Middle	-0.05%	0.99	0.00	0.12	0.08%	(-0.39)	(32.87)	(0.06)	(2.63)	(0.66)	0.83
	Low	-0.03%	1.06	0.05	-0.04	-0.04%	(-0.25)	(44.72)	(1.53)	(-1.10)	(-0.46)	0.90
Currency	High	0.19%	0.03	-0.01	0.02	0.21%	(1.43)	(1.01)	(-0.31)	(0.56)	(1.82)	0.01
	Middle	0.16%	0.02	-0.11	-0.02	0.07%	(0.97)	(0.62)	(-2.20)	(-0.40)	(0.52)	0.03
	Low	0.18%	0.03	-0.15	-0.15	-0.07%	(1.13)	(0.86)	(-3.08)	(-2.92)	(-0.52)	0.06
Bond	High	0.04%	0.04	0.08	0.07	0.16%	(0.70)	(3.13)	(3.80)	(3.46)	(2.90)	0.08
	Middle	0.07%	0.03	0.04	0.02	0.11%	(1.13)	(1.96)	(2.20)	(0.89)	(2.07)	0.03
	Low	0.08%	0.02	0.03	0.01	0.11%	(1.56)	(1.85)	(2.11)	(0.84)	(2.53)	0.03
Commodity	High	0.13%	0.19	0.18	0.31	0.56%	(0.44)	(2.89)	(1.88)	(3.20)	(2.17)	0.06
	Middle	0.11%	0.13	-0.03	0.02	0.12%	(0.41)	(2.36)	(-0.41)	(0.29)	(0.52)	0.03
	Low	0.39%	0.11	-0.39	-0.28	-0.12%	(1.32)	(1.77)	(-4.11)	(-2.89)	(-0.47)	0.10
avg. alpha		0.18%				0.29%						
GRS F-stat (p-value)		0.97	(0.512)			2.87	(0.000)					
Panel C: Average Across All Asset Classes High, Middle, and Low Value, Momentum, and Combination Portfolios												
Value portfolios:												
All assets	High	0.11%	0.82	0.30	0.06	0.36%	(0.94)	(30.80)	(7.17)	(1.41)	(3.10)	0.71
	Middle	-0.03%	0.79	-0.05	0.11	0.04%	(-0.21)	(27.07)	(-1.08)	(2.53)	(0.37)	0.66
	Low	0.17%	0.69	-0.44	0.02	-0.09%	(1.52)	(28.15)	(-11.50)	(0.48)	(-0.77)	0.73
Momentum portfolios:												
All assets	High	0.06%	0.75	-0.08	0.46	0.43%	(0.52)	(29.73)	(-1.99)	(12.04)	(3.30)	0.75
	Middle	0.19%	0.79	-0.06	0.02	0.17%	(1.46)	(28.10)	(-1.35)	(0.53)	(1.51)	0.67
	Low	0.04%	0.80	-0.05	-0.36	-0.33%	(0.30)	(30.51)	(-1.17)	(-9.03)	(-2.75)	0.73
avg. alpha		0.12%				0.28%						
GRS F-stat (p-value)		1.12	(0.352)			11.81	(0.000)					
50/50 Combination portfolios:												
All assets	High	0.11%	0.83	0.14	0.29	0.47%	(0.88)	(31.41)	(3.35)	(7.37)	(4.14)	0.72
	Middle	0.07%	0.81	-0.05	0.08	0.11%	(0.54)	(28.47)	(-1.20)	(1.88)	(0.96)	0.68
	Low	0.14%	0.78	-0.26	-0.18	-0.20%	(1.19)	(30.58)	(-6.61)	(-4.72)	(-1.84)	0.72
avg. alpha		0.11%				0.30%						
GRS F-stat (p-value)		0.60	(0.617)			19.96	(0.000)					

Other Liquidity Measures: Correlations

Correlations from 04/1987 to 09/2008														
	Global TED	change Global TED	US TED	change US TED	Global Liq-Illiq	US liq-Illiq	PS_level	PS_innov	Sad_trans	Sad_perm	PS_VW_liqfac	PS_EW_liqfac	AP_illiq	PC index
Global TED	1.00	0.25	0.85	0.17	0.11	0.14	-0.07	-0.11	-0.20	-0.16	-0.02	0.07	-0.02	0.83
change Global TED	0.25	1.00	0.16	0.66	0.20	0.22	-0.15	-0.11	-0.02	0.09	0.02	0.06	0.09	0.49
US TED	0.85	0.16	1.00	0.24	0.09	0.16	-0.13	-0.15	-0.23	-0.21	0.01	0.07	0.07	0.89
change USTED	0.17	0.66	0.24	1.00	0.21	0.26	-0.18	-0.15	-0.11	-0.07	0.01	0.05	0.22	0.56
Global Liq-Illiq	0.11	0.20	0.09	0.21	1.00	0.64	-0.04	-0.05	-0.22	-0.13	0.03	0.06	0.02	0.21
US liq-Illiq	0.14	0.22	0.16	0.26	0.64	1.00	-0.12	-0.13	-0.14	-0.17	-0.03	0.07	0.12	0.31
PS_level	-0.07	-0.15	-0.13	-0.18	-0.04	-0.12	1.00	0.85	0.06	0.21	0.00	0.01	-0.13	-0.31
PS_innov	-0.11	-0.11	-0.15	-0.15	-0.05	-0.13	0.85	1.00	0.10	0.29	-0.03	-0.01	-0.05	-0.31
Sad_trans	-0.20	-0.02	-0.23	-0.11	-0.22	-0.14	0.06	0.10	1.00	0.21	0.03	0.01	-0.21	-0.26
Sad_perm	-0.16	0.09	-0.21	-0.07	-0.13	-0.17	0.21	0.29	0.21	1.00	0.05	0.10	-0.27	-0.25
PS_VW_liqfac	-0.02	0.02	0.01	0.01	0.03	-0.03	0.00	-0.03	0.03	0.05	1.00	0.78	0.00	0.02
PS_EW_liqfac	0.07	0.06	0.07	0.05	0.06	0.07	0.01	-0.01	0.01	0.10	0.78	1.00	0.01	0.10
AP_illiq	-0.02	0.09	0.07	0.22	0.02	0.12	-0.13	-0.05	-0.21	-0.27	0.00	0.01	1.00	0.24
PC index	0.83	0.49	0.89	0.56	0.21	0.31	-0.31	-0.31	-0.26	-0.25	0.02	0.10	0.24	1.00
Average absolute value of correlations =					0.22									
Correlations over the 10% most extreme liquidity events														
<i>(1994Q4, 2002Q3, 1998Q8, 200411, 2004Q9, 1990Q8, 1996Q1, 1998Q6, 1993Q2, 1989Q6, 200112, 1989Q7, 1999Q1, 1999Q3, 1997Q4, 2002Q9, 199912, 2002Q4, 2000Q6, 1990Q7, 2000Q8, 198710, 1990Q9, 2000Q2)</i>														
	Global TED	change Global TED	US TED	change US TED	Global Liq-Illiq	US liq-Illiq	PS_level	PS_innov	Sad_trans	Sad_perm	PS_VW_liqfac	PS_EW_liqfac	AP_illiq	PC index
Global TED	1.00	0.71	0.94	0.78	0.19	0.44	-0.70	-0.75	-0.54	-0.74	0.03	0.06	0.33	0.94
change Global TED	0.71	1.00	0.64	0.95	0.03	0.33	-0.82	-0.82	-0.50	-0.70	0.01	-0.02	0.46	0.85
US TED	0.94	0.64	1.00	0.73	0.19	0.37	-0.72	-0.77	-0.51	-0.68	0.06	0.18	0.39	0.94
change USTED	0.78	0.95	0.73	1.00	0.06	0.38	-0.81	-0.84	-0.51	-0.70	-0.06	-0.02	0.46	0.91
Global Liq-Illiq	0.19	0.03	0.19	0.06	1.00	0.66	0.08	0.07	-0.15	-0.23	-0.19	-0.26	0.15	0.17
US liq-Illiq	0.44	0.33	0.37	0.38	0.66	1.00	-0.19	-0.17	-0.38	-0.47	-0.41	-0.43	0.41	0.45
PS_level	-0.70	-0.82	-0.72	-0.81	0.08	-0.19	1.00	0.97	0.41	0.58	-0.12	-0.16	-0.45	-0.85
PS_innov	-0.75	-0.82	-0.77	-0.84	0.07	-0.17	0.97	1.00	0.36	0.66	-0.09	-0.19	-0.46	-0.88
Sad_trans	-0.54	-0.50	-0.51	-0.51	-0.15	-0.38	0.41	0.36	1.00	0.39	-0.21	-0.13	-0.22	-0.55
Sad_perm	-0.74	-0.70	-0.68	-0.70	-0.23	-0.47	0.58	0.66	0.39	1.00	-0.06	-0.08	-0.60	-0.78
PS_VW_liqfac	0.03	0.01	0.06	-0.06	-0.19	-0.41	-0.12	-0.09	-0.21	-0.06	1.00	0.77	-0.02	0.02
PS_EW_liqfac	0.06	-0.02	0.18	-0.02	-0.26	-0.43	-0.16	-0.19	-0.13	-0.08	0.77	1.00	0.00	0.09
AP_illiq	0.33	0.46	0.39	0.46	0.15	0.41	-0.45	-0.46	-0.22	-0.60	-0.02	0.00	1.00	0.53
PC index	0.94	0.85	0.94	0.91	0.17	0.45	-0.85	-0.88	-0.55	-0.78	0.02	0.09	0.53	1.00
Average absolute value of correlations =					0.46									

Table 7: Dynamics of Value and Momentum

	Sharpe ratios			Average correlations, ρ		
	Value	Momentum	Combo	$\rho(\text{val, val})$	$\rho(\text{mom, mom})$	$\rho(\text{val, mom})$
Panel A: Stock selection strategies						
pre-08/1998	0.51	1.46	2.51	0.32	0.35	-0.65
post-08/1998	0.68	0.70	1.47	0.52	0.50	-0.52
Illiquid pre-08/1998	0.39	1.94	2.92	0.34	0.37	-0.65
Liquid pre-08/1998	0.84	0.60	1.63	0.31	0.33	-0.69
Illiquid post-08/1998	0.50	1.20	1.72	0.53	0.50	-0.46
Liquid post-08/1998	0.98	-0.21	0.95	0.51	0.50	-0.61
Worst 20% MSCI returns	1.70	1.69	2.26	0.37	0.44	0.11
Best 20% MSCI returns	0.47	0.20	1.25	0.44	0.50	-0.86
Top 20% value abs(returns)	1.02	0.17	1.45	0.63	0.59	-0.65
Bottom 20% value abs(returns)	-0.30	2.55	2.75	-0.11	0.25	-0.09
Top 20% momentum abs(returns)	0.55	0.96	1.69	0.60	0.57	-0.55
Bottom 20% momentum abs(returns)	1.53	0.57	1.81	0.22	-0.07	-0.19
Panel B: Non-stock selection strategies						
pre-08/1998	0.85	0.60	1.34	0.19	0.28	-0.43
post-08/1998	0.07	0.44	0.63	0.17	0.28	-0.65
Illiquid pre-08/1998	0.79	0.69	1.31	0.21	0.32	-0.37
Liquid pre-08/1998	0.91	0.52	1.36	0.18	0.25	-0.47
Illiquid post-08/1998	-0.17	0.74	0.67	0.16	0.28	-0.58
Liquid post-08/1998	0.49	-0.11	0.53	0.21	0.26	-0.75
Worst 20% MSCI returns	1.83	-0.38	1.11	0.14	0.34	-0.38
Best 20% MSCI returns	0.06	0.40	0.50	0.23	0.30	-0.51
Top 20% value abs(returns)	1.16	-0.15	1.43	0.28	0.30	-0.71
Bottom 20% value abs(returns)	0.50	0.61	0.69	-0.17	0.29	-0.10
Top 20% momentum abs(returns)	0.32	0.51	0.98	0.19	0.40	-0.67
Bottom 20% momentum abs(returns)	0.75	-0.36	0.68	0.20	-0.13	-0.08

Not Everything Works Everywhere

- The power of looking everywhere at once can also highlight patterns specific to an asset class or market.
 - Provides a more general test of patterns found in U.S. equities
- Example: January effect in value and momentum (Table 8)

	Annualized Sharpe ratio						Cor(val,mom)	
	Value		Momentum		Combo		Jan.	Feb.-Dec.
	Jan.	Feb.-Dec.	Jan.	Feb.-Dec.	Jan.	Feb.-Dec.		
Panel A: Stock Selection								
U.S.	0.53	0.21	-0.10	0.61	0.22	1.00	-0.67	-0.52
U.K.	-0.57	0.19	1.53	0.86	1.46	1.32	-0.78	-0.60
Continental Europe	0.65	0.48	1.41	0.95	2.90	1.51	-0.42	-0.45
Japan	0.42	0.85	0.96	0.20	1.83	1.20	-0.70	-0.60
Global stock selection	0.31	0.58	0.96	1.04	1.63	1.64	-0.58	-0.56
Panel B: Non-Stock Selection								
Equity country selection	0.85	0.15	1.38	0.23	2.21	0.38	-0.55	-0.42
Currency selection	0.09	0.53	0.11	0.27	0.12	0.74	-0.05	-0.45
Bond country selection	0.65	0.59	-0.05	0.07	0.41	0.47	-0.08	-0.02
Commodity selection	-0.06	0.19	-0.08	0.58	-0.15	0.74	-0.50	-0.51
All non-stock selection	0.44	0.43	0.54	0.59	0.96	1.03	-0.31	-0.52
All asset selection	0.39	0.60	0.98	0.94	1.83	1.94	-0.70	-0.61

Seasonal patterns to correlation structure?

- Are seasonal effects in value and momentum driving the strong correlation structure?

Panel C: Correlation of Average Return Series								
	Stock selection, value	Non-stock selection, value	Stock selection, momentum	Non-stock selection, momentum	Stock selection, value	Non-stock selection, value	Stock selection, momentum	Non-stock selection, momentum
	Monthly return correlations in January				Monthly return correlations Feb.-Dec.			
Stock selection, value	0.38	0.45	-0.67	-0.53	0.44	0.03	-0.60	-0.18
Non-stock selection, value		0.13	-0.34	-0.50		0.19	-0.12	-0.48
Stock selection, momentum			0.28	0.58			0.44	0.32
Non-stock selection, momentum				0.19				0.28