AQR CAPITAL MANAGEMENT

VALUE AND MOMENTUM EVERYWHERE

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Preliminary and Incomplete

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Motivation

- Some of the most studied phenomena are
  - *Value effect:* assets with high "book value"-to-market value outperform those with 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))
  - Stocks in other countries (Fama and French (1998), Rouwenhorst (1998), Liew and Vassalou (2000), Griffin and Martin (2003), Chui, Titman, Wei (2002))
  - Country equity (Asness, Liew, and Stevens (1997), Bhojraj and Swaminathan (2006))
  - Government bonds (?)
  - Currency momentum (Bhojraj and Swaminathan (2006))
  - Commodity momentum (Gorton, Hayashi and Rouwenhorst (2007))

What We Do

- Extend and unify analysis of value and momentum "everywhere"
  - Breadth of asset classes and markets
    - Stock selection within several countries globally
    - Country equity index selection
    - Country bond selection
    - Currency selection
    - Commodity selection
  - Studying both value and momentum simultaneously everywhere

- Study *connections* between value and momentum across markets

- Gain insight by looking across asset classes and globally at once
  - Providing added statistical power and new insights
  - Consider *common* explanations: macro and liquidity risks

Our Main Results

- Value and momentum effects appear in all of the major asset classes
  - Value and momentum strategies have positive Sharpe ratios
  - They are negatively correlated so the 50/50 combo has higher Sharpe than either

- 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

- Relationship to macro risk:
  - These effects have little to do with most measures of macro risk, except long-run consumption risk
  - Both value and momentum load positively on long-run consumption risk
  - This can explain a (small) part of the premiums

- Liquidity risk:
  - Value loads positively on liquidity risk (illiquidity bad)
  - Momentum loads negatively
  - This common driver explains part of the global co-movement patterns

Literature on Common Explanations

- Global macro-economic risk
  - Value strategy for US stocks has negative market beta (Fama and French (1993), Lakonishok, Shleifer, and Vishny (1994))
  - But, positive loading on long-run consumption risk (Parker and Julliard (2005), Hansen, Heaton and Li (2008), Malloy, Moskowitz, Vissing-Jorgensen (2008))

- Liquidity risk
  - Liquidity risk is priced (Acharya and Pedersen (2005), Pastor and Stambaugh (2003))
  - Market liquidity and funding liquidity are linked and affect security co-movement (Brunnermeier and Pedersen (2008))
  - Funding problems can lead to value unwind due to slow moving capital (Mitchell, Pedersen, and Pulvino (2007))

Overview of Talk

- Data and methodology
- Basic performance of value and momentum everywhere
- Commonality
- Potential explanations: Liquidity and macro risk

Data: Measures of Value and Momentum

- We use *simple* and standard measures
- Momentum: Return from t-12 to t-2 months
- Value:
  - Stocks: book to price
  - Country equity: book to price
  - Bonds: real bond yield, i.e. yield minus expected inflation
  - Currencies: “book” to price, where “book” is the average exchange rate 4.5 to 5.5 years ago
  - Commodities: “book” to price, where “book” is the average commodity spot price 4.5 to 5.5 years ago

Data: Sources

- Stocks 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 in bottom quartile of market cap and stocks with share prices less than $1.
    - 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 above, including eliminating bottom quartile of market cap and stocks with share prices less than $1.
    - Prices and returns: Barra
    - Book values: Worldscope
- Equity country selection
  - Stock index returns and book values: MSCI
- Bonds country selection
  - Returns: Datastream data on MSCI 10-year government bond index in excess local short rate
  - Short rate and 10-year government bond yield: Bloomberg
  - Inflation forecasts for next 12M: analysts estimates compiled by Consensus Economics
- Currency selection
  - Spot exchange rates: Datastream
  - IBOR short rates: Bloomberg

Data: Sources

- Commodities
  - 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)

- Passive benchmarks
  - MSCI world, Lehman Macro Global Treasury Hedged Returns, GS Commodity Index (GSCI)

- Macro indicators
  - Recession = linear interpolation between peak and trough dates (US dates from NBER, Non-US dates from Economic Cycle Research Institute)
  - GDP growth = per capita real growth in GDP quarterly (from NIPA in the US and ECRI for Non-US)
  - Consumption growth = per capita real growth in non-durable consumption quarterly (from NIPA in the US and ECRI for Non-US)
  - 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, Canada, Australia (Bloomberg and International Fund Services (IFS))
  - 3-month Libor minus term repo rate (IFS, various brokers)

Methodology

- For each asset class, construct a long-short portfolio with weights

$$w_{it}^{VALUE} = c_t \left(rank(VALUE_{it}) - Average(rank) \right)$$

where c_t is chosen such that the portfolio has annualized volatility of 10% ex ante

- Variance-covariance matrix
  - For stocks, from BARRA short-run risk model
  - Otherwise, from rolling 3-year weekly returns

- Returns to value

$$r_t^{VALUE} = \Sigma_i \, w_{it}^{VALUE} \, r_{it}$$

- Similar for momentum. The 50/50 Combo returns are

$$r_t^{COMBO} = s_t \left(0.5 \, r_t^{VALUE} + 0.5 \, r_t^{MOM} \right)$$

where s_t scales volatility to 10% ex ante

- We combine strategies across asset classes and rescale to 10% ex post
  - Global stock selection: weight by number of stocks in each market
  - All non-stock selection: equal weights
  - All asset selection: 50% global stock selection, 50% non-stock selection

Long-Short or Long-Only Portfolio?

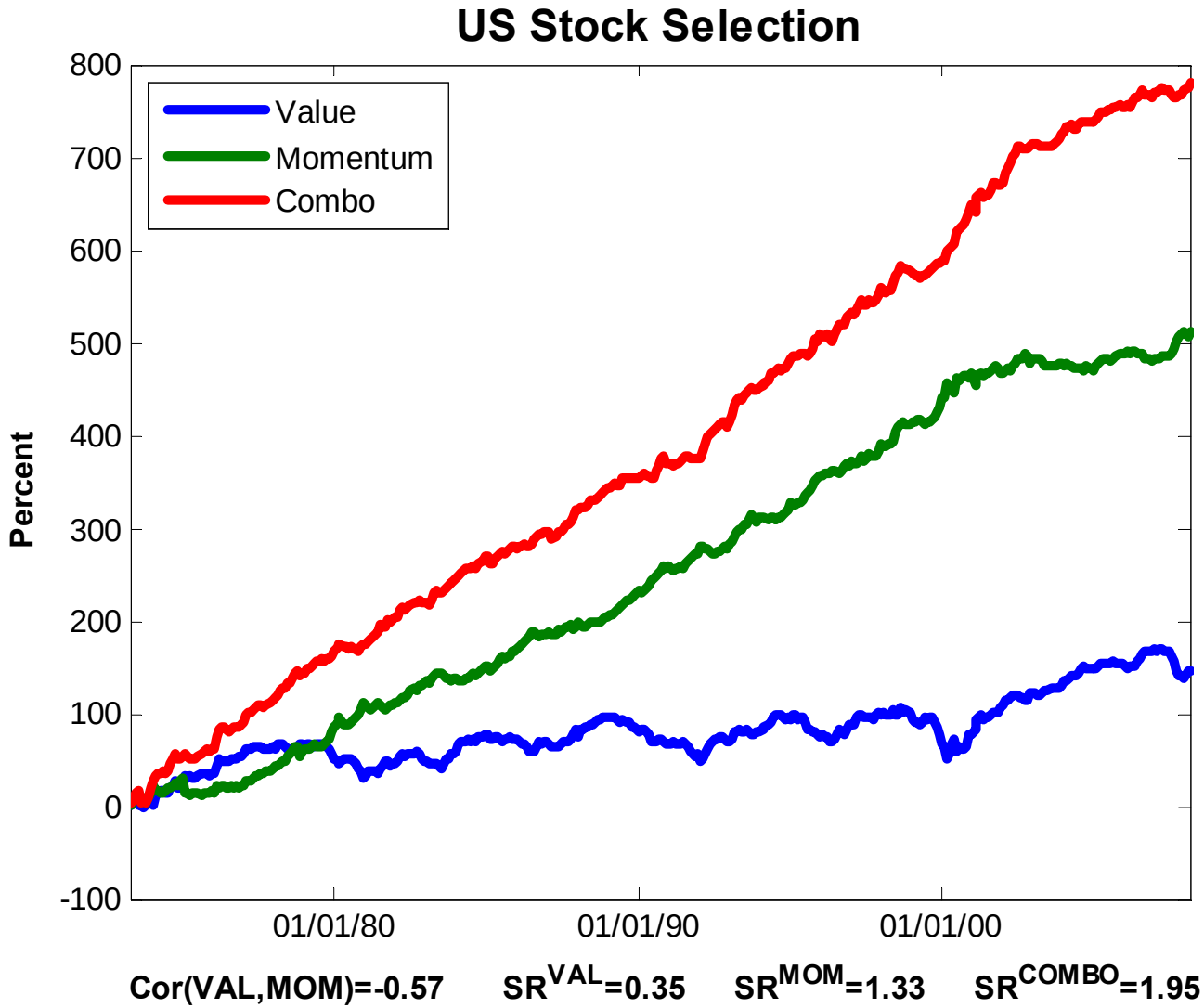
- One interpretation is a long/short investor
  - Returns are the profits/loss of the market-neutral strategy

- Another interpretation is a long-only investor
  - The positions are the overweight/ underweight relative to index
  - Returns are the amount by which the long-only strategy beats the market
  - We ignore here that a long-only investor can only underweight a security by its index weight; can also think of relaxed-constraint 130-30 account.

Performance

- We consider within each asset class
  - The return of
    - Value
    - Momentum
    - 50/50 combo
  - Correlation of value and momentum

Performance



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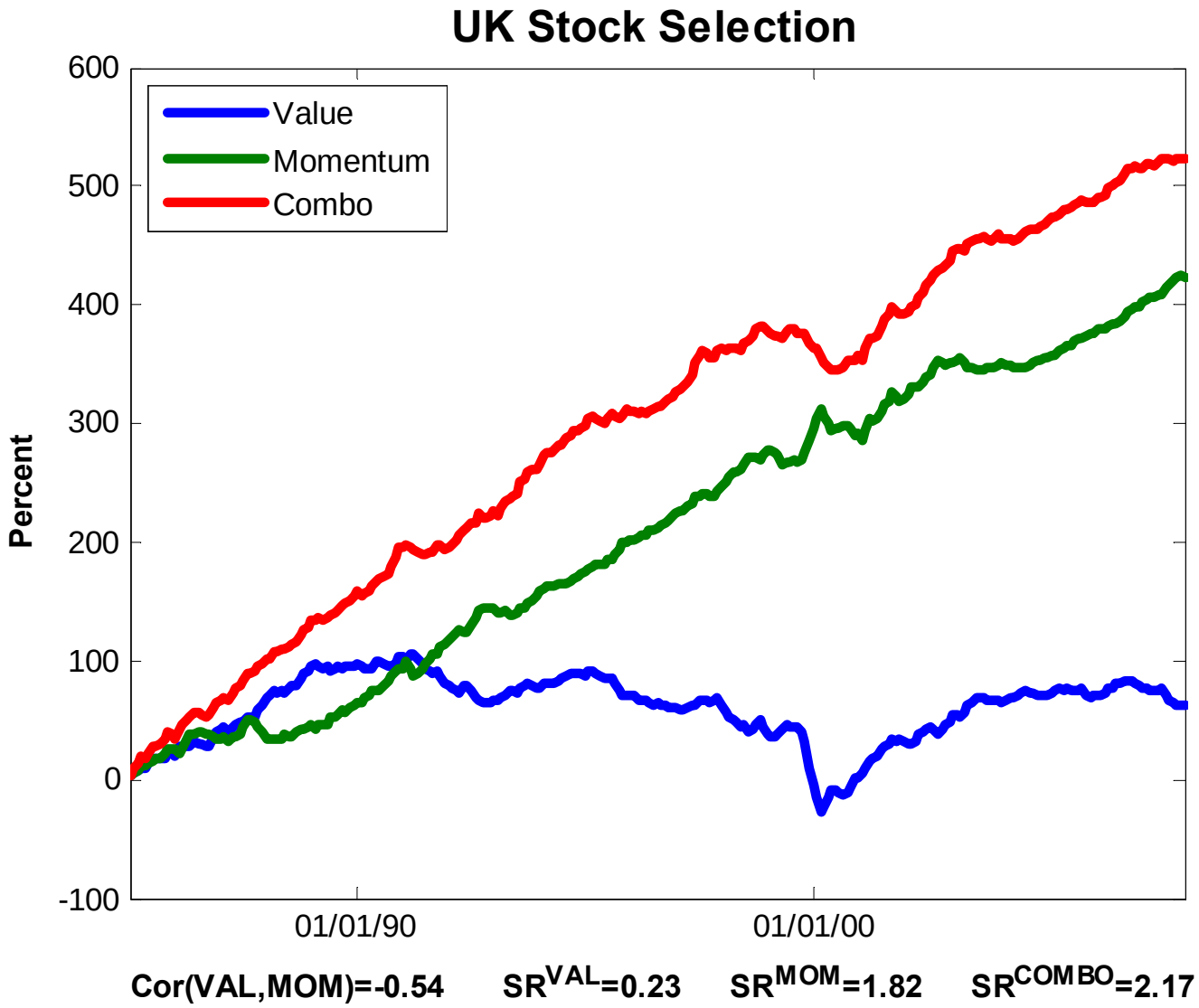

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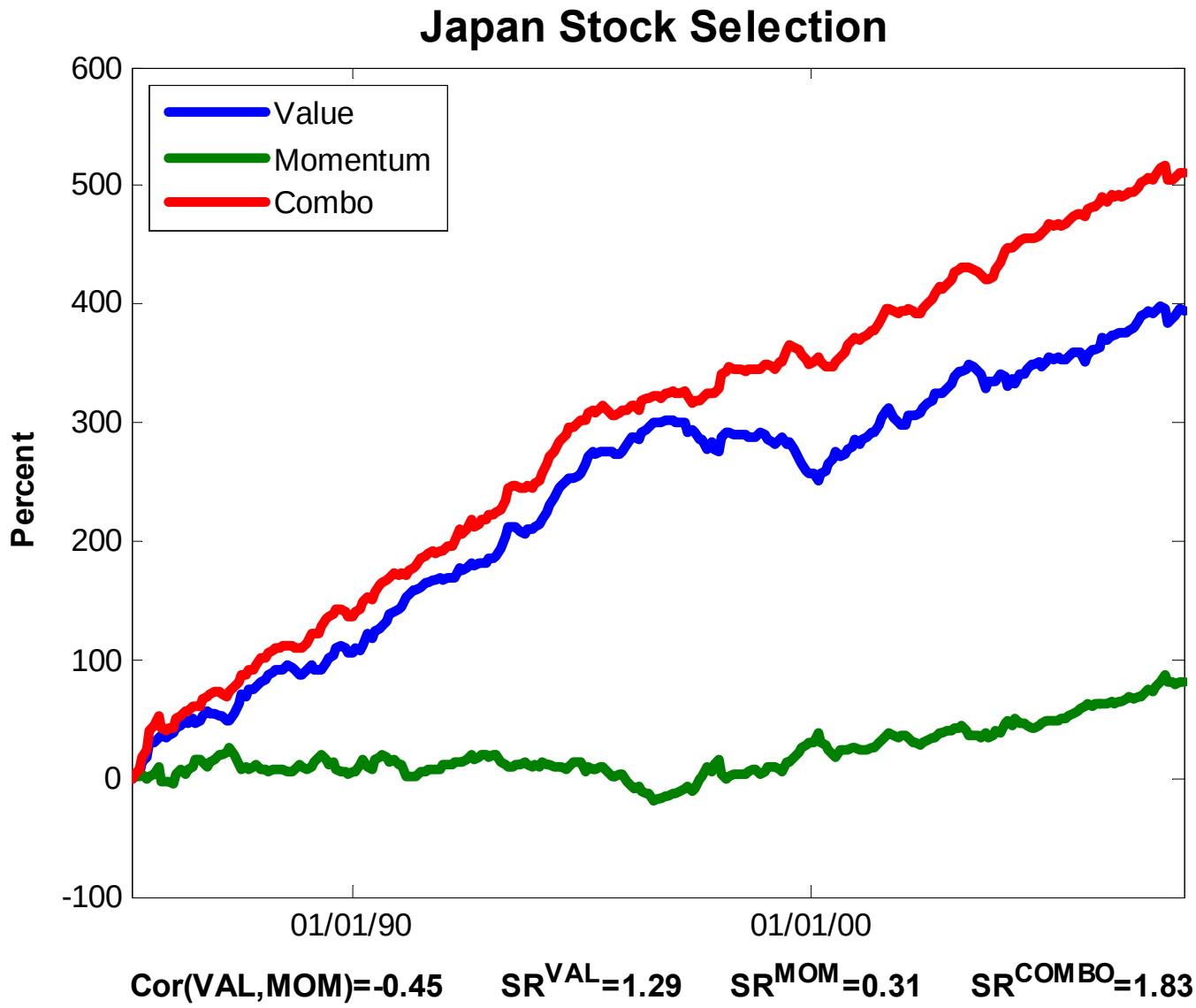

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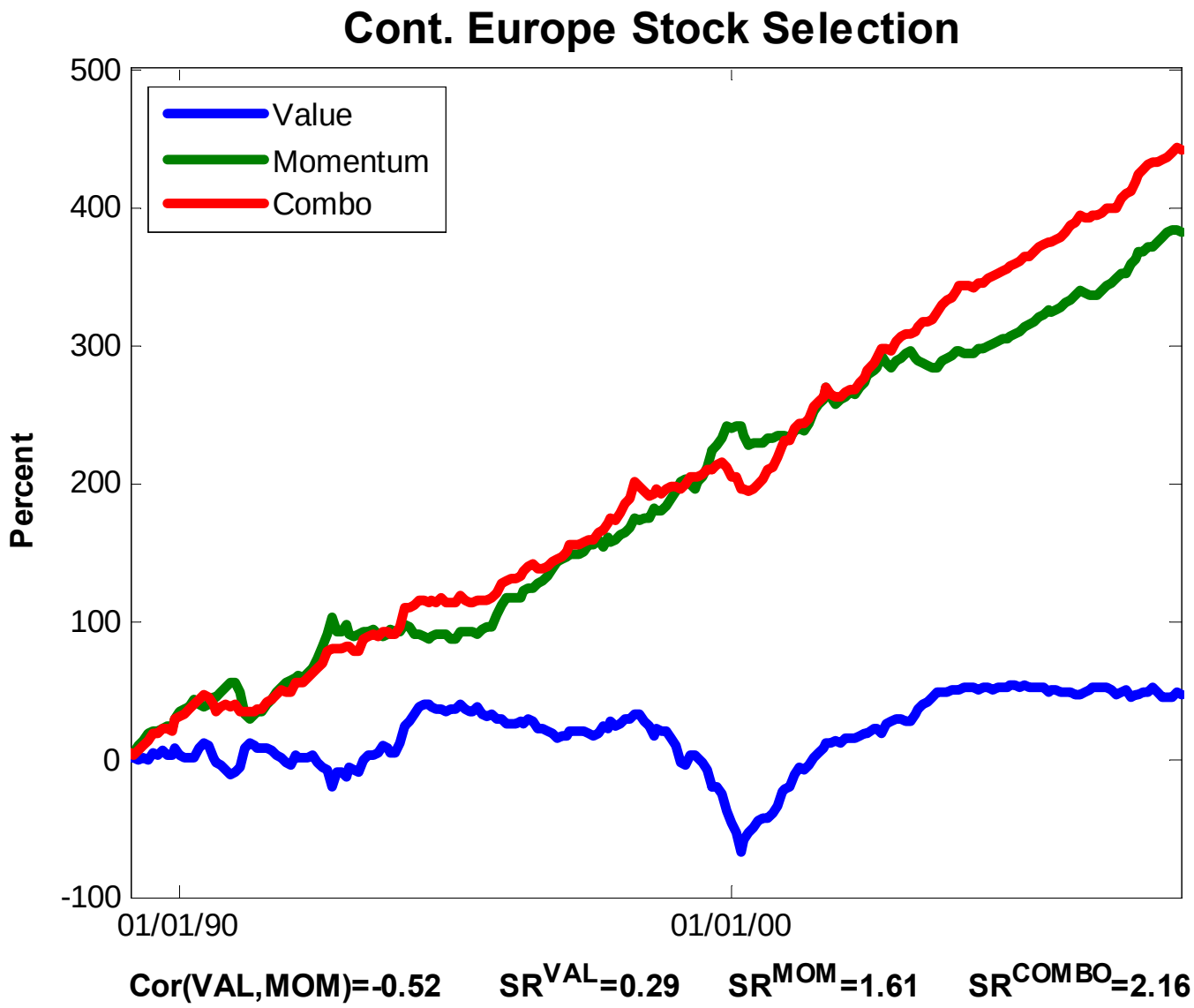

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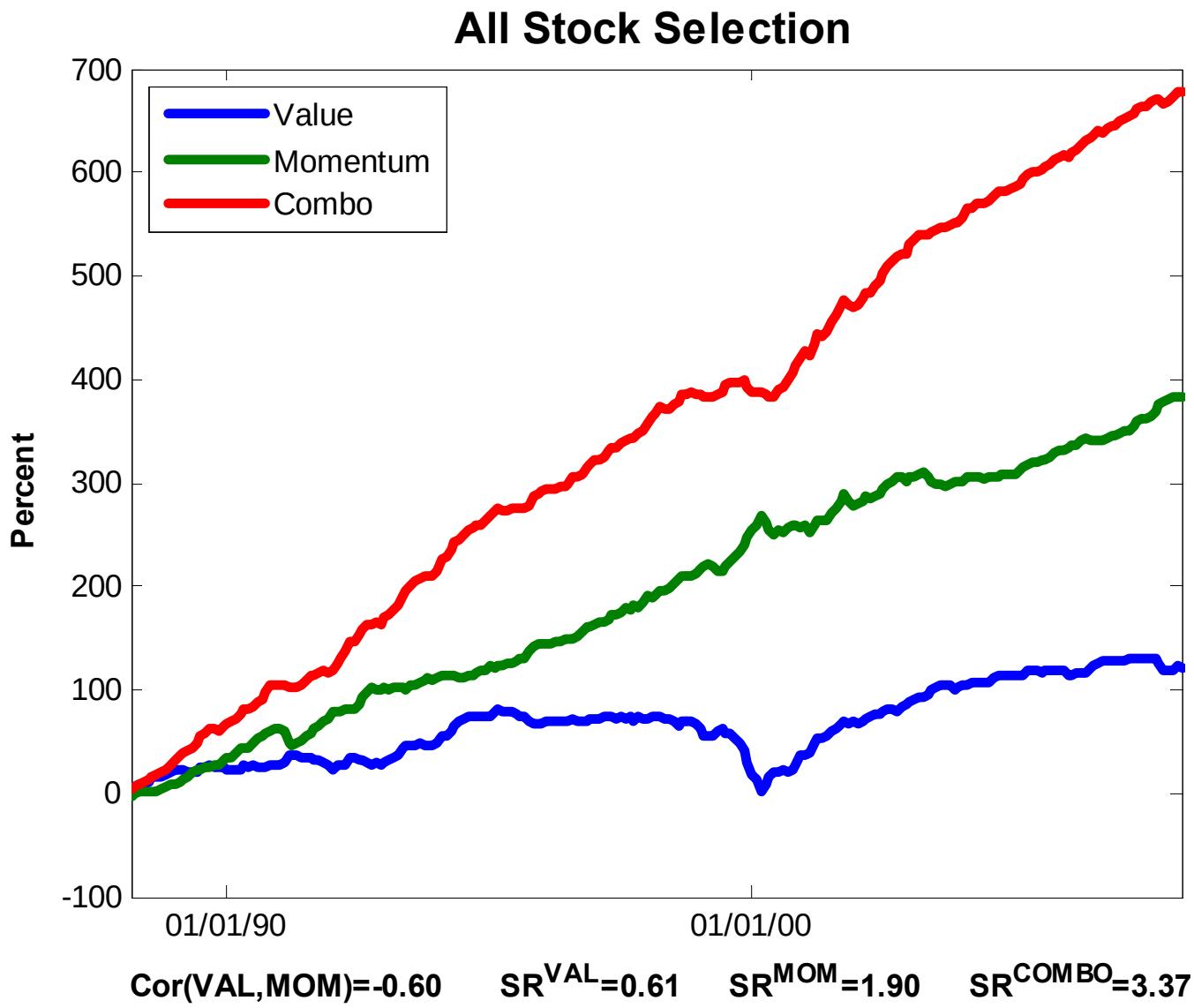

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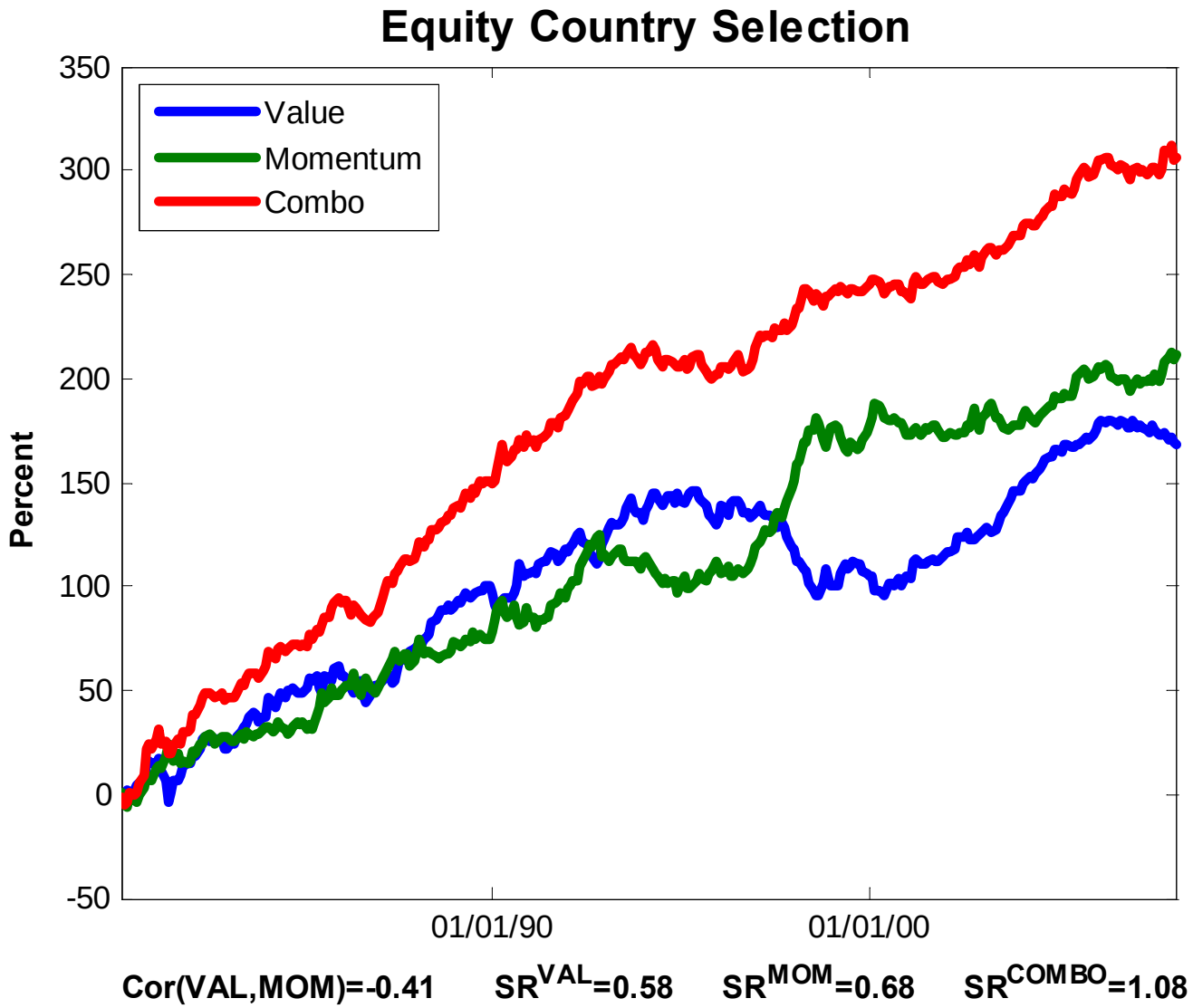

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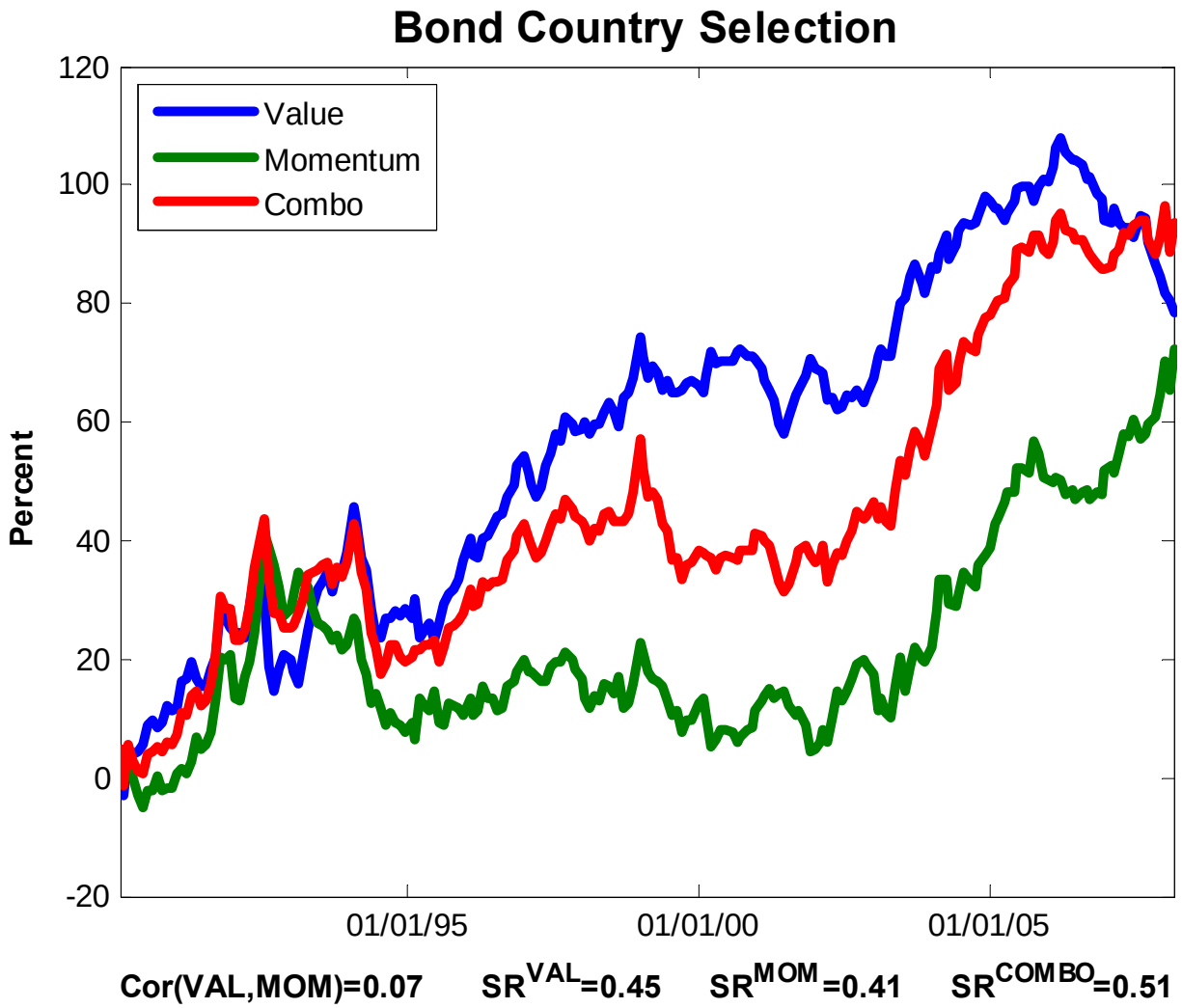
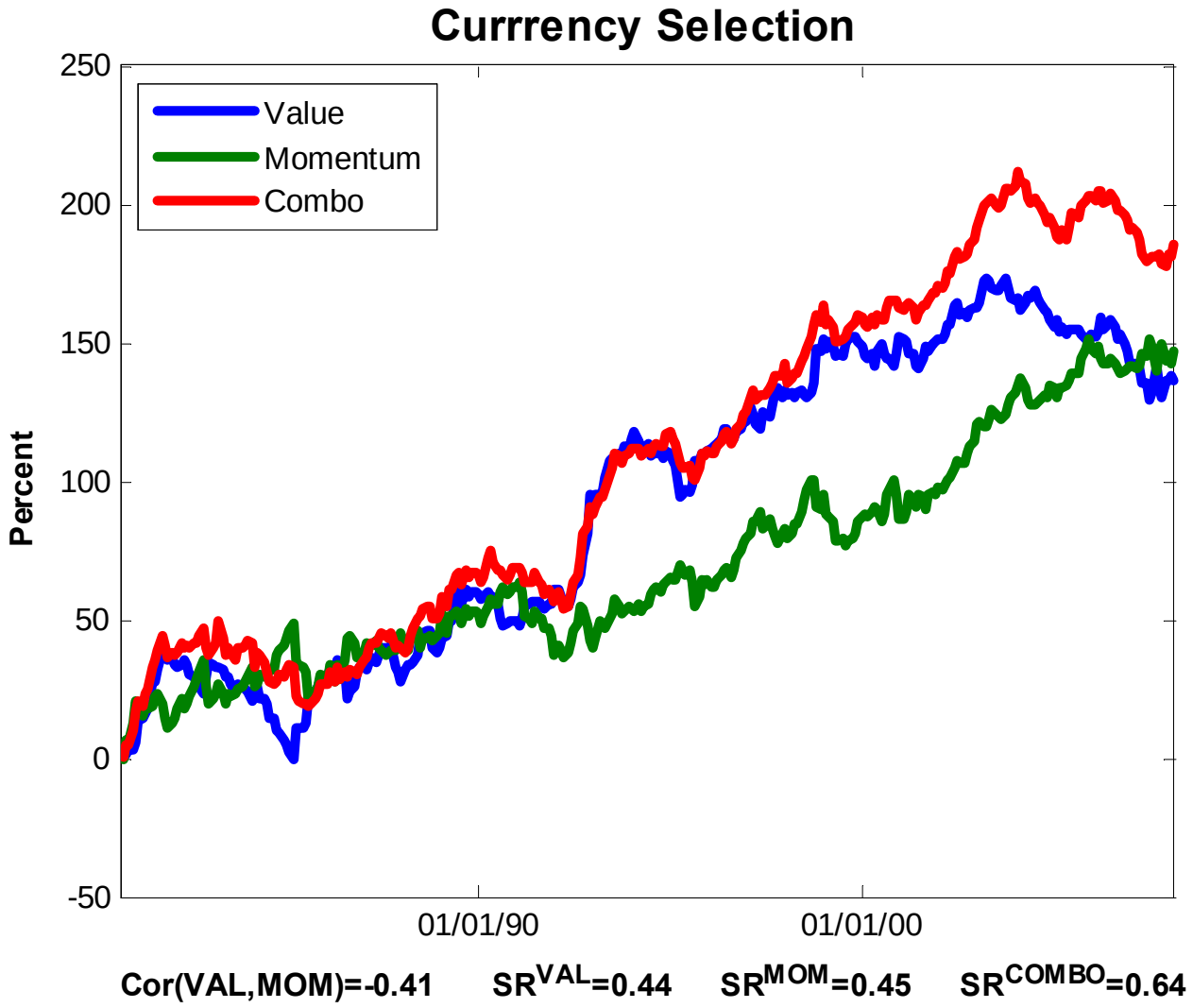


Note: This is the one place where the correlation is positive.

Performance



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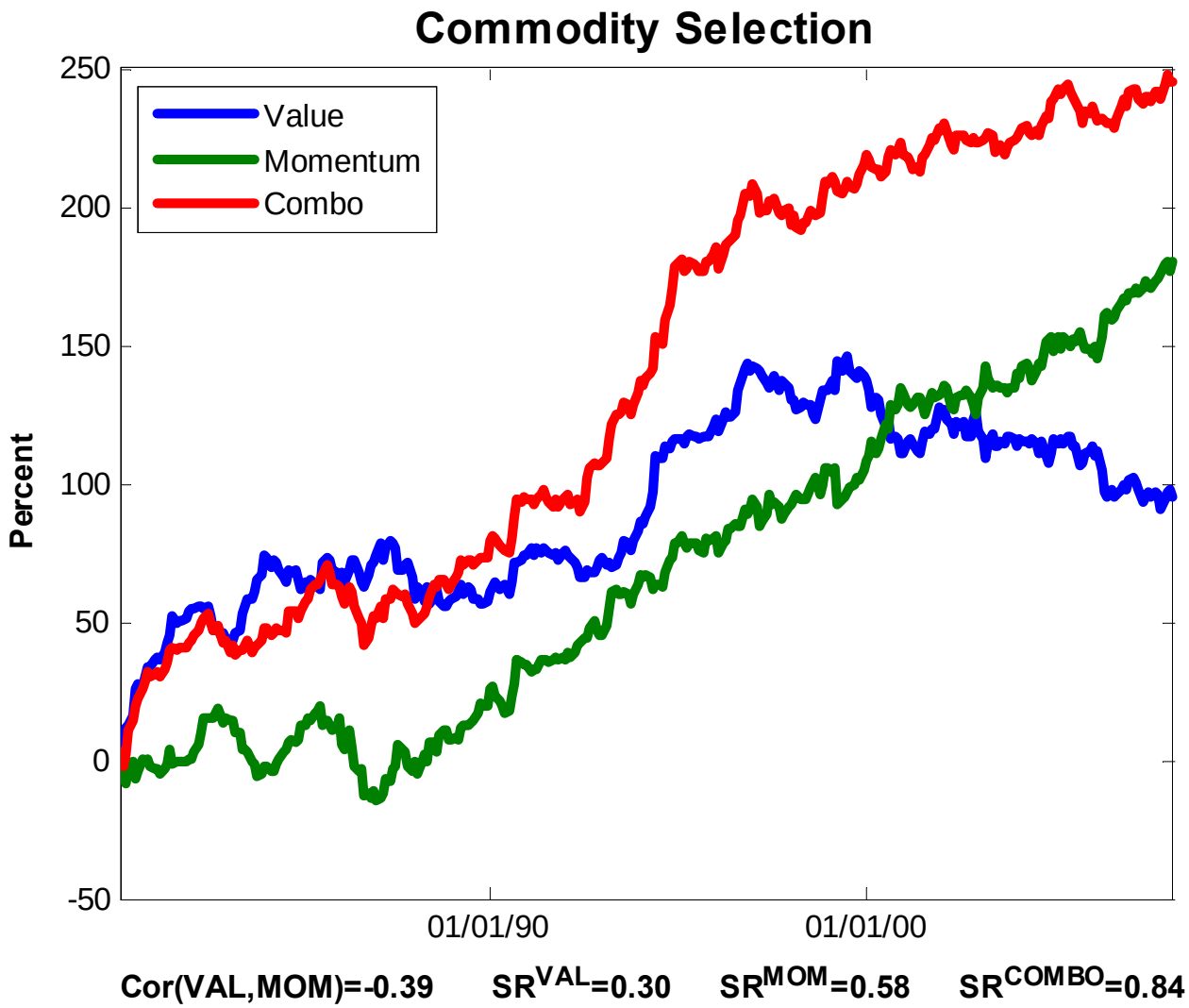

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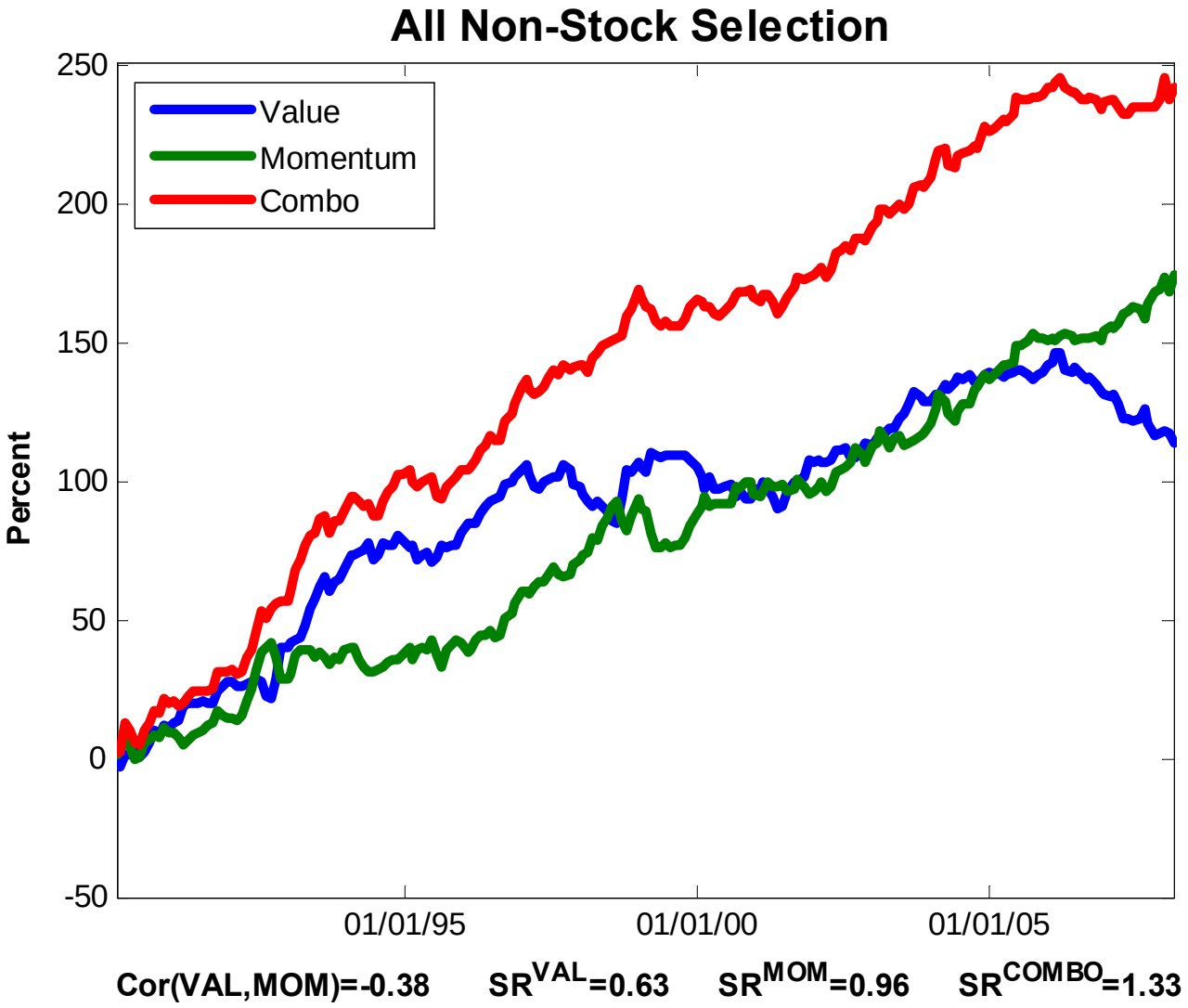

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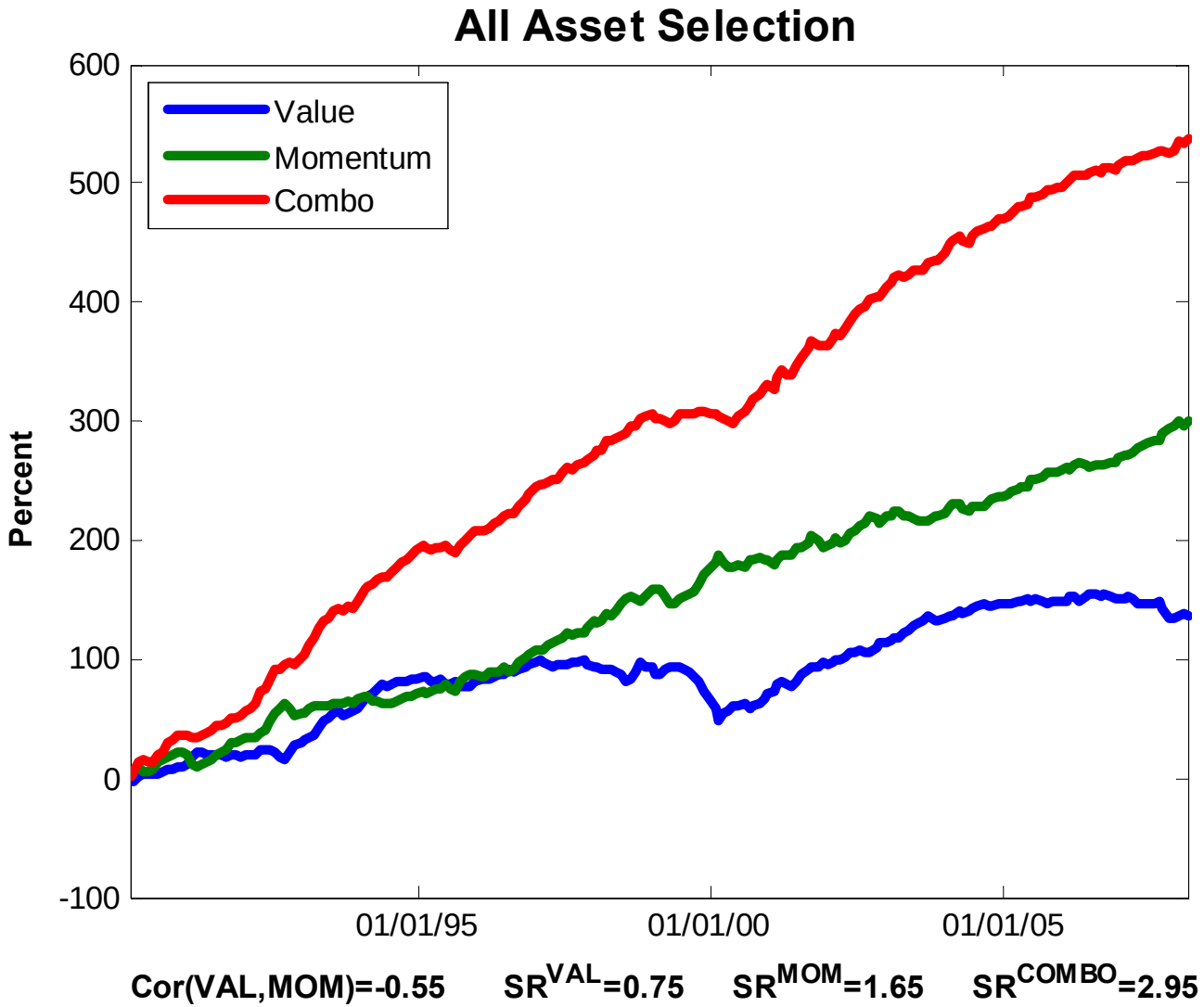


Co-movement Everywhere

	Average Correlation			
	Stock selection, value	Non-stock selection, value	Stock selection, momentum	Non-stock selection, momentum
Stock selection, value	0.35	0.09	-0.23 *	-0.11
Non-stock selection, value		0.06	-0.10	-0.05 *
Stock selection, momentum			0.32	0.18
Non-stock selection, momentum				0.11

** This excludes the correlation within the same market*

Co-Movement Everywhere, Continued

	Country Selection value	Fixed Income value	Foreign Exchange value	Commodity value	Country Selection momentum	Fixed Income momentum	Foreign Exchange momentum	Commodity momentum
Stock selection, value	0.19	0.04	0.04	0.05	-0.23	-0.05	-0.05	-0.08
Stock selection, momentum	-0.13	-0.06	-0.04	-0.08	0.32	0.12	0.16	0.13

What Explains Value and Momentum Everywhere?

Panel B: Multivariate regression results on levels						
	Global Stock Selection		All Non-Stock Selection		All Asset Selection	
Dependent variable =	Value	Momentum	Value	Momentum	Value	Momentum
Illiquidity index	-0.034	0.030	-0.007	0.013	-0.026	0.025
	(-3.27)	(4.30)	(-1.08)	(2.48)	(-3.67)	(3.97)
Long-run consumption growth	0.002	0.040	0.085	0.078	0.056	0.068
	(0.06)	(1.16)	(2.47)	(2.45)	(1.77)	(2.15)
Global recession	-0.031	-0.012	-0.009	-0.029	-0.026	-0.024
	(-1.63)	(-0.89)	(-0.73)	(-2.32)	(-1.84)	(-2.01)
R-square	19.4%	7.3%	3.6%	2.5%	12.2%	5.6%

The Power of Looking Everywhere

- We see consistency of result across markets

- We gain statistical power:

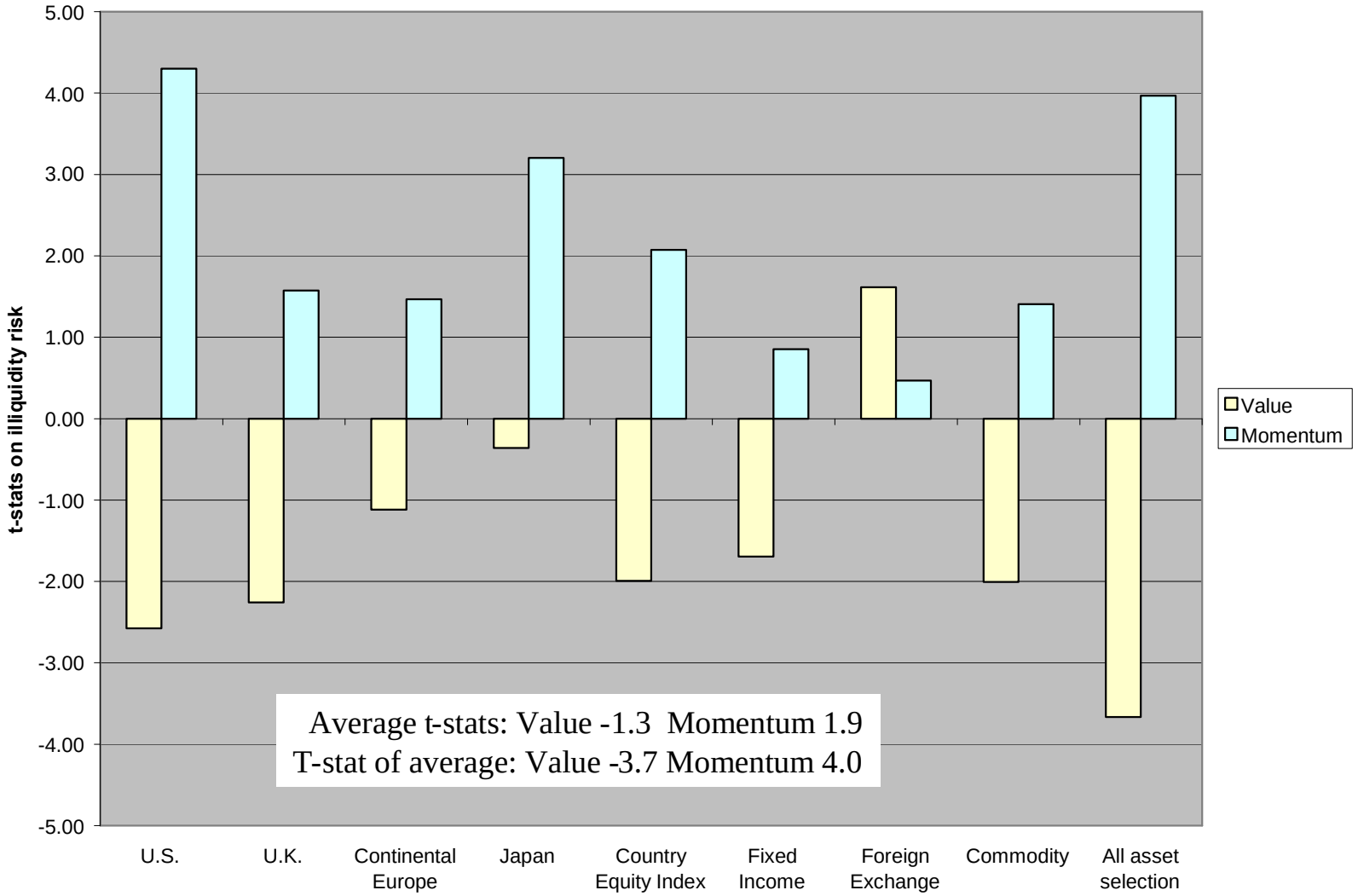
  average t-stat

  less than

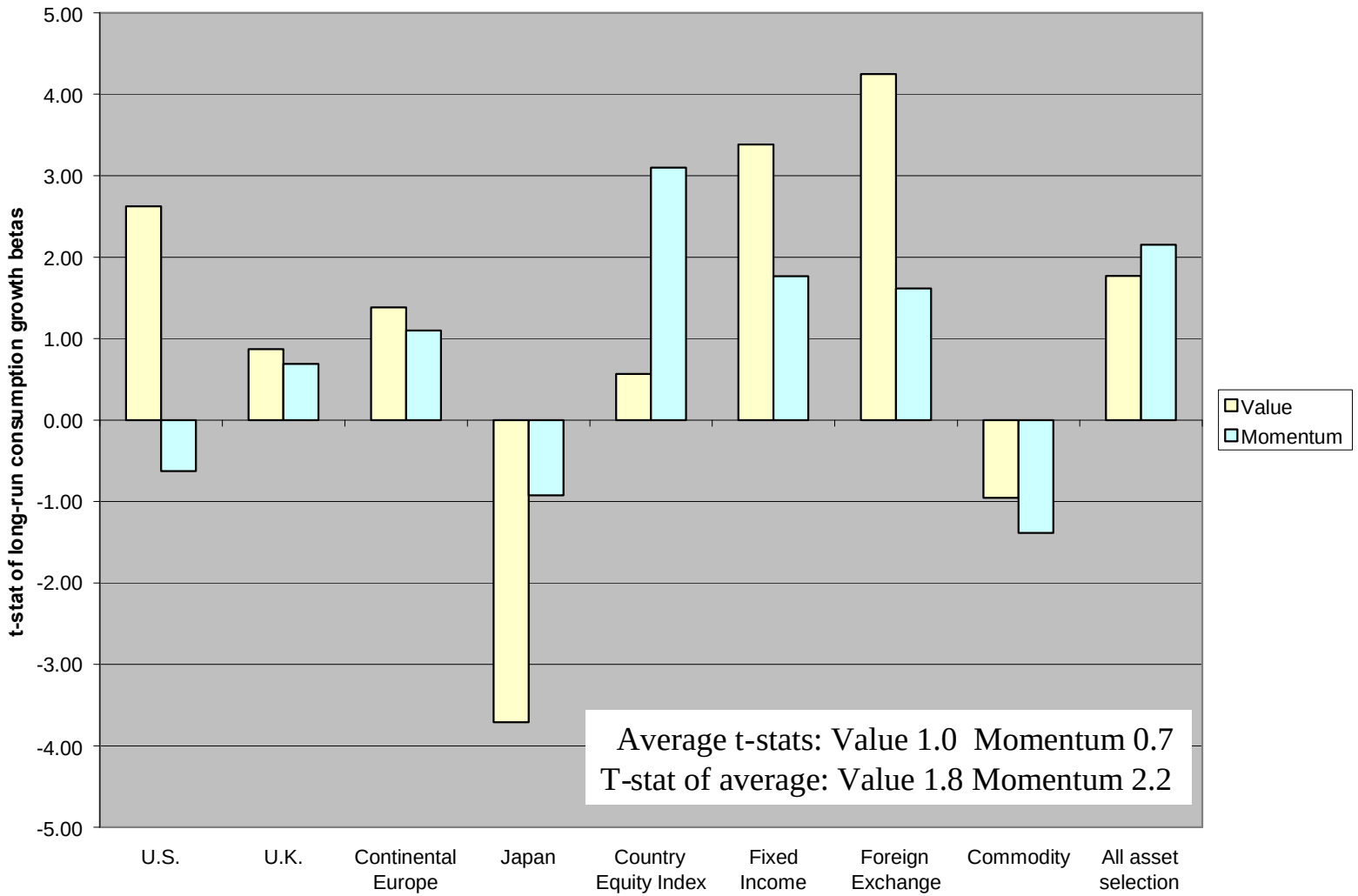
  t-stat of average

T-stats of Illiquidity Betas

(Level of illiquidity)



T-stats of Lon-Run-Consumption-Growth Betas



Are Our Tests Over-Optimistic or Pessimistic for Real-World Implementation?

- Over-optimistic
  - No transactions or financing costs!!
  - Going forward perhaps returns will be lower precisely because of products (and presentations) like ours (though I'm going to tactically take exact opposite view)
  - Backtests never hit a leverage problem, a crisis of confidence problem, etc. They are Vulcans without prime brokers.

- Over-pessimistic
  - This presentation has used only the simplest value and momentum measures; naively also 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), dynamically varying value vs. momentum, etc.
  - It "works" in quite a few other places we have not presented
  - Near term, quant equity spreads look very wide and quant macro is whatever the opposite of crowded is!!

Conclusion

- Value+momentum works everywhere
- They are negatively related: combo works even better than either
- Value and momentum related across asset classes
- Common factors:
  - Liquidity risk
  - Macro risk
    - Long-run consumption risk (CCAPM)
    - Recession exposure

Appendix

Alpha for Stock Selection

Alpha to Global Markets

	Alpha to benchmark (t-stat)					
	Value		Momentum		Combo	
	global, specific asset class	global, all asset classes	global, specific asset class	global, all asset classes	global, specific asset class	global, all asset classes
U.S. stock selection *03/73-02/08*	4.93% (2.57)	5.24% (2.68)	14.52% (7.78)	14.11% (7.56)	22.86% (12.29)	22.54% (11.64)
U.K. stock selection *12/84-02/08*	2.85% (1.16)	2.91% (1.17)	18.77% (9.00)	18.62% (8.80)	23.08% (10.66)	23.11% (10.54)
JP stock selection *02/85-02/08*	18.03% (6.53)	17.96% (6.39)	3.70% (1.59)	3.74% (1.59)	23.04% (9.16)	23.16% (9.06)
Cont. Europe stock selection *02/88-02/08*	4.29% (1.37)	4.68% (1.48)	20.38% (7.19)	20.03% (6.98)	23.48% (9.64)	23.24% (9.43)
All stock selection *02/88-02/08*	6.63% (2.99)	6.96% (3.09)	19.46% (8.72)	19.24% (8.46)	34.68% (16.12)	34.49% (15.27)

Alpha for Non-Stock Selection

Alpha to Global Markets

	Alpha to benchmark (t-stat)					
	Value		Momentum		Combo	
	global, specific asset class	global, all asset classes	global, specific asset class	global, all asset classes	global, specific asset class	global, all asset classes
Equity country selection *02/80-02/08*	6.44% (3.31)	5.94% (3.03)	7.27% (3.46)	7.08% (3.38)	10.98% (5.70)	10.44% (5.44)
Bond country selection *01/90-02/08*	2.63% (1.17)	3.52% (1.58)	2.34% (1.02)	3.31% (1.44)	2.93% (1.26)	4.27% (1.82)
Currency selection *08/80-02/08*		5.09% (2.33)		5.37% (2.35)		6.76% (3.38)
Commodity selection *02/80-02/08*	3.95% (1.90)	4.00% (1.88)	5.87% (2.84)	5.71% (2.71)	8.82% (4.46)	8.69% (4.37)
All non-stock selection *01/90-02/08*		6.41% (2.71)		8.96% (3.81)		12.98% (5.47)
All asset selection *01/90-02/08*		8.05% (3.40)		16.29% (6.85)		29.80% (12.54)

Beta

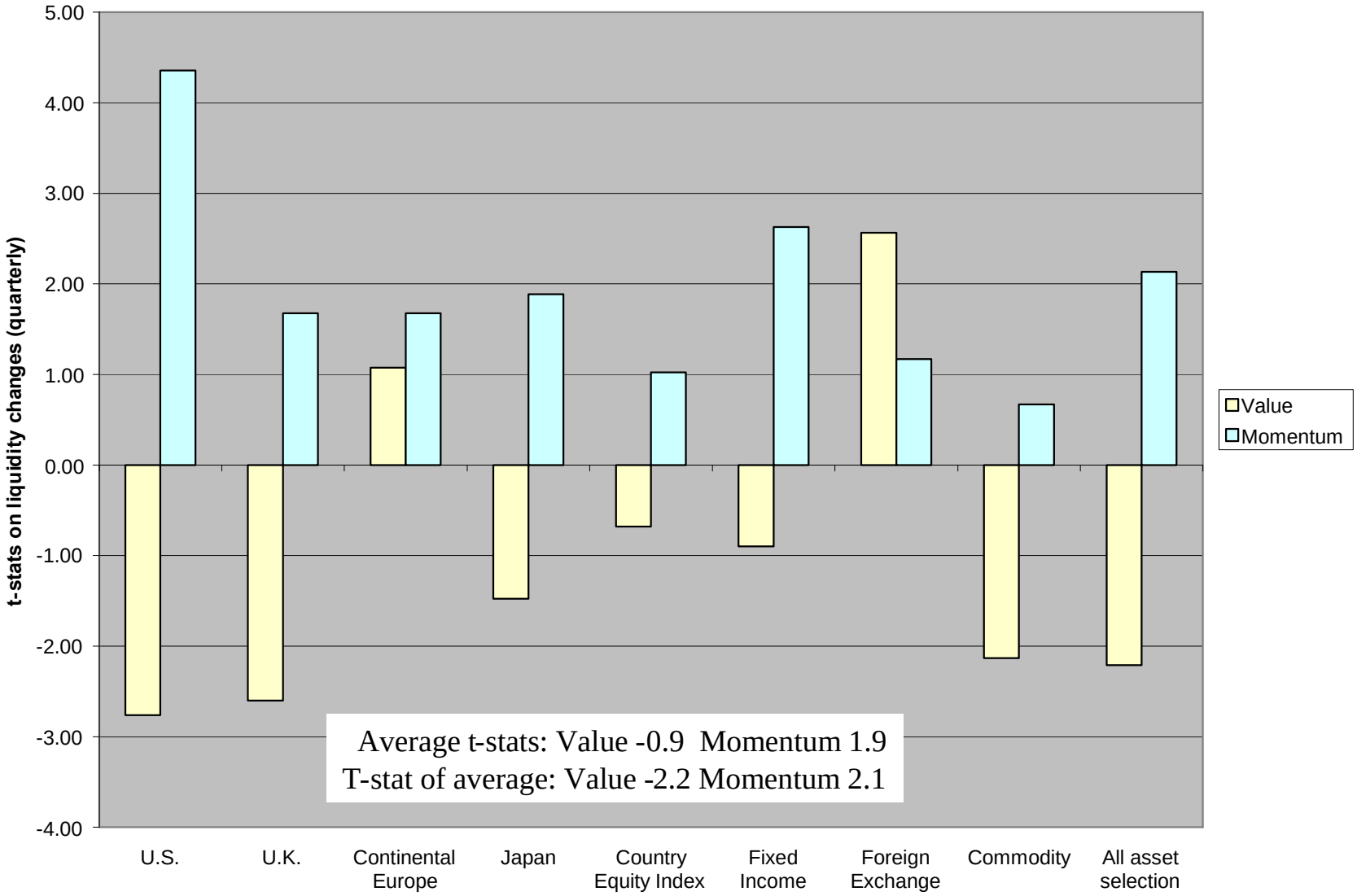
	Beta to benchmark (t-stat)					
	Value		Momentum		Combo	
	global, specific asset class	global, all asset classes	global, specific asset class	global, all asset classes	global, specific asset class	global, all asset classes
U.S. stock selection	-2.91	-3.30	-0.03	1.24	-2.62	-1.12
03/73-02/08	(-6.31)	(-5.05)	(-0.06)	(2.00)	(-5.87)	(-1.73)
U.K. stock selection	-0.28	-0.44	-0.89	-0.65	-0.90	-1.04
12/84-02/08	(-0.47)	(-0.46)	(-1.77)	(-0.79)	(-1.72)	(-1.22)
JP stock selection	-1.63	-1.58	-0.31	-0.41	-1.56	-1.89
02/85-02/08	(-2.45)	(-1.44)	(-0.55)	(-0.45)	(-2.57)	(-1.90)
Cont. Europe stock selection	-0.61	-1.51	-0.97	0.21	-0.80	0.02
02/88-02/08	(-0.77)	(-1.13)	(-1.37)	(0.17)	(-1.31)	(0.02)
All stock selection	-1.61	-2.19	-1.11	-0.34	-2.55	-1.61
02/88-02/08	(-2.91)	(-2.30)	(-1.98)	(-0.35)	(-4.72)	(-1.69)
Equity country selection	-1.00	0.34	0.52	1.28	-0.22	1.46
02/80-02/08	(-2.12)	(0.48)	(1.03)	(1.67)	(-0.47)	(2.10)
Bond country selection	9.12	3.18	6.41	1.05	9.95	2.18
01/90-02/08	(3.73)	(3.32)	(2.56)	(1.06)	(3.93)	(2.16)
Currency selection		-0.21		-0.58		-0.58
08/80-02/08		(-0.26)		(-0.67)		(-0.76)
Commodity selection	-1.59	-1.59	1.55	1.96	-0.19	0.24
02/80-02/08	(-3.95)	(-2.06)	(3.86)	(2.56)	(-0.49)	(0.33)
All non-stock selection		0.30		1.11		0.44
01/90-02/08		(0.30)		(1.10)		(0.43)
All asset selection		-1.39		0.29		-0.99
01/90-02/08		(-1.36)		(0.29)		(-0.96)

What Explains Value and Momentum Everywhere?
(Changes)

Panel C: Multivariate regression results on changes (quarterly)						
	Global Stock Selection		All Non-Stock Selection		All Asset Selection	
Dependent variable =	Value	Momentum	Value	Momentum	Value	Momentum
ΔIlliquidity index	-0.022	0.019	0.003	0.008	-0.012	0.016
	(-3.92)	(3.40)	(0.56)	(0.98)	(-2.21)	(2.13)
ΔLong-run consumption growth	-0.002	0.024	0.014	0.037	0.008	0.035
	(-0.04)	(0.93)	(0.31)	(1.32)	(0.15)	(1.37)
ΔGlobal recession	-0.008	-0.008	0.023	-0.020	0.010	-0.017
	(-0.24)	(-0.84)	(1.40)	(-1.95)	(0.35)	(-1.68)
R-square	3.9%	3.0%	2.5%	1.2%	2.0%	2.5%

T-stats of Illiquidity Betas

(Change in illiquidity)



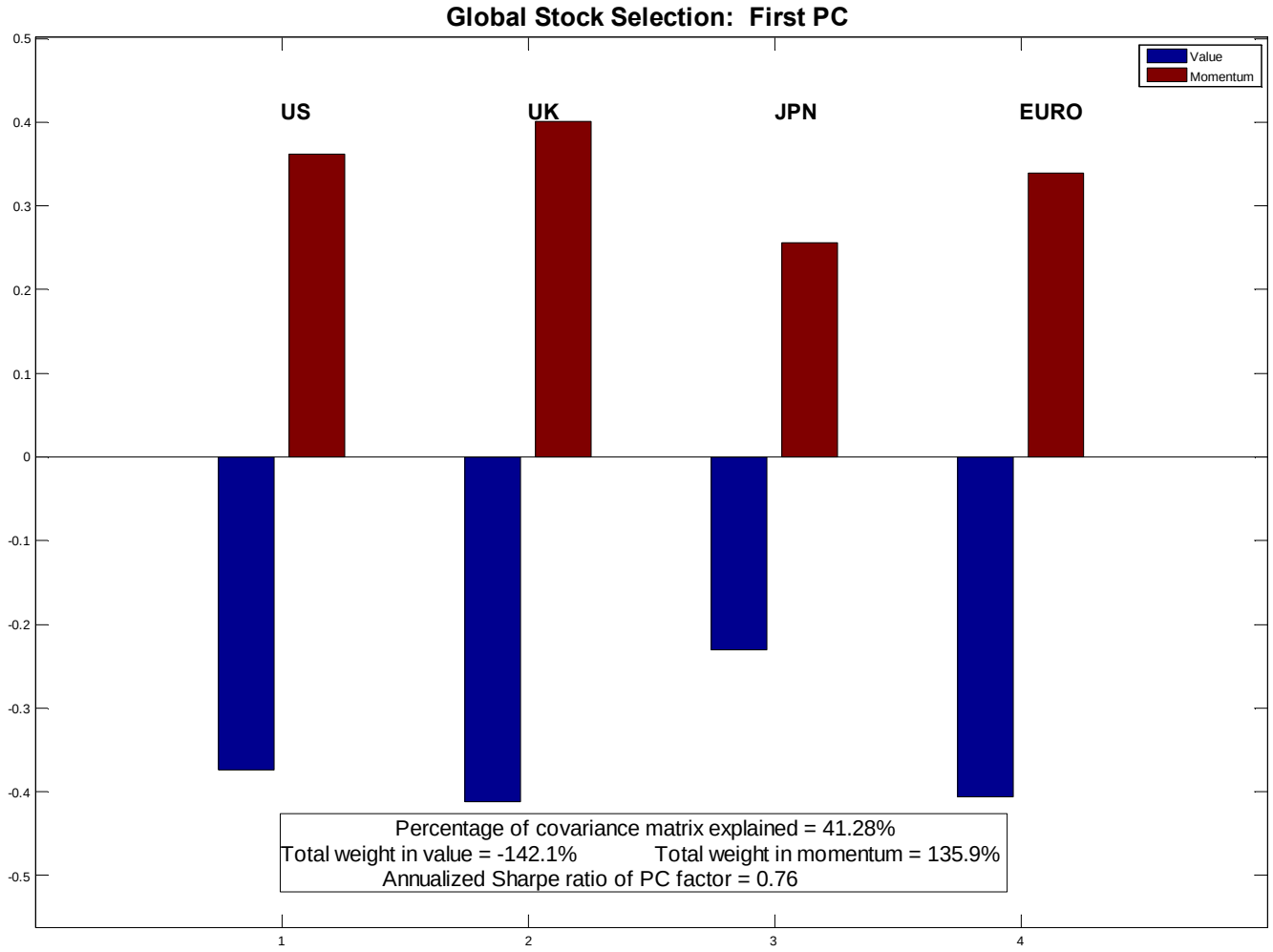
Robustness with Respect to Liquidity Measure

Panel D: Alternative liquidity measures (multivariate regression results on levels)						
	Global Stock Selection		All Non-Stock Selection		All Asset Selection	
Dependent variable =	Value	Momentum	Value	Momentum	Value	Momentum
Global TED spread	-0.103	0.082	-0.006	0.028	-0.070	0.063
	(-3.46)	(4.45)	(-0.32)	(2.36)	(-3.60)	(4.14)
Global libor - term repo	-0.027	0.073	-0.035	0.045	-0.039	0.068
	(-1.31)	(5.21)	(-2.48)	(1.84)	(-2.31)	(3.90)
US TED spread	-0.044	0.033	-0.004	0.010	-0.030	0.025
	(-6.57)	(5.20)	(-0.31)	(2.10)	(-3.27)	(4.61)
US libor - term repo	-0.031	0.019	-0.017	0.011	-0.030	0.017
	(-2.04)	(2.02)	(-2.57)	(1.52)	(-2.61)	(2.10)
Liquid-Illiquid passives	-0.140	0.361	-0.073	0.146	-0.136	0.291
	(-1.89)	(3.16)	(-0.73)	(1.65)	(-1.84)	(2.78)

Local or Global Explanations?

	Global stock selection panel regressions					
Dependent variable =	Value	Momentum	Value	Momentum	Value	Momentum
Global variables:						
Global illiquidity index	-0.037	0.024			-0.039	0.030
	-2.789	3.303			-3.205	3.139
Global long-run consumption growth	0.005	0.030			0.102	0.049
	0.089	0.924			2.215	1.192
Global recession	-0.035	-0.008			-0.072	-0.033
	-1.259	-0.657			-3.194	-1.472
Local variables:						
Local illiquidity index			-0.020	0.018	0.014	-0.002
			-1.340	2.432	0.846	-0.170
Local long-run consumption growth			0.000	0.005	-0.025	0.022
			-0.017	0.416	-0.603	0.858
Local recession			-0.011	-0.002	-0.006	-0.001
			-1.583	-0.421	-0.701	-0.184
R-square	7.4%	3.5%	2.1%	1.7%	11.2%	5.2%

First Principle Component for Value and Mom in Stock Selection



First Principle Component for Value and Mom Everywhere