Value and Momentum Everywhere

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Abstract

Value and momentum generate abnormal returns for individual stocks within countries, stock indices across countries, government bonds across countries, currencies, and commodities. We study jointly the returns to value and momentum and explore their common factor structure. We find that value (momentum) in one asset class is positively correlated with value (momentum) in other asset classes, and value and momentum are negatively correlated within and across asset classes. Macroeconomic risks such as recessions and long-run consumption risks are positively linked to both value and momentum, as is global recession risk to a lesser extent, while global liquidity risk is related positively to value and somewhat negatively to momentum. These patterns emerge from the power of examining value and momentum everywhere at once and are not easily detectable when examining each asset class in isolation.

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I. Introduction

Two of the most studied capital market phenomena are the relation between an asset's return and the ratio of its "long-run" (or book) value relative to its current market value, termed the "value" effect, and the relation between an asset's return and its recent relative performance history, termed the "momentum" effect. Value and momentum have captured the attention of financial economists due to their statistical and economic significance relative to standard asset pricing models (e.g., the CAPM), and their locus for discussions of market efficiency and asset pricing theory.

A long literature finds that, on average, value stocks (with high book or accounting values relative to market values) outperform growth stocks (with low book-to-market ratios) and stocks with high positive momentum (high 12-month past returns) outperform stocks with low positive momentum (Stattman (1980), Fama-French (1992), Jegadeesh and Titman (1993), Asness (1994), Grinblatt and Moskowitz (2004)). This evidence has been extended to stocks in other countries (Fama and French (1998), Rouwenhorst (1998), Liew and Vassalou (2000), Griffin, Ji, and Martin (2003), Chui, Wei, and Titman (2000)), and to country equity indices (Asness, Liew, and Stevens (1997), Bhojraj and Swaminathan (2006)). Momentum has also been studied for currencies (Shleifer and Summers (1990), Kho (1996), and LeBaron (1999)) and commodities (Gorton, Hayashi, and Rouwenhorst (2008)).

We broaden and extend this evidence by studying value and momentum in five major asset classes in a unified setting: (i) stock selection within four major countries, (ii) country equity index selection, (iii) government bond selection, (iv) currency selection, and (v) commodity selection. We provide ubiquitous evidence on the excess return to value and momentum, extending the existing evidence cited above by including government bonds and by considering value for currencies and commodities. Importantly, we study the links between value and momentum strategies universally *across* asset classes and their underlying economic drivers, including the link to global macroeconomic and liquidity risk. Our global and across-asset-class perspective adds significant statistical power, allowing us to document the statistical and economic strength of these strategies when built as a globally diversified portfolio, and to identify significant value and momentum exposures to liquidity and macro risks. Looking at value or momentum in isolation, or in one asset class at a time, fails to find the structure or power that our unified approach uncovers.

We emphasize as well that studying value and momentum simultaneously is more powerful than examining each in isolation. The low correlation between value and momentum strategies and their high expected returns makes a simple equal-weighted combination of the two a powerful strategy that produces a significantly higher Sharpe ratio than either stand alone. In addition, the combination portfolio is far more stable across markets and time periods than either value or momentum alone.

We show that a universal value and momentum strategy across all the asset classes we examine is statistically and economically stronger than any smaller subset, let alone the single effects often studied. Whether risk-based stories or behavioral stories are used to explain these effects, their task is greater when considering a diversified portfolio across markets and asset classes and when combining value and momentum into the same portfolio.

Our joint approach uncovers striking comovement patterns across asset classes. A long-short value strategy in one asset class is positively correlated with value strategies in other asset classes. Similarly, a momentum strategy in one asset class is positively correlated with momentum in other asset classes. Further, value and momentum are negatively correlated within and across asset classes.[2] Given the different types of securities that we consider and their geographic and market dispersion, the consistent correlation pattern makes a compelling case for the presence of common global factors.

Attempting to link the comovement structure we uncover to underlying economic risks, we consider the exposure of value and momentum strategies everywhere, as well as their common components, to various macroeconomic and liquidity risk indicators. We find that the global value and momentum portfolios, aggregated across asset classes, load positively on long-run consumption growth and, to a lesser but still significant extent, load negatively on a global recession indicator.[3] The link between value and momentum and long-run consumption is stronger when we look at globally aggregated portfolios and, indeed, the link between momentum and long-run consumption risk is new in that it cannot be detected from U.S. stock data alone. This result lends support to the recent literature attempting to link long-run consumption growth to asset prices (e.g., Parker and Julliard (2005), Bansal and Yaron (2004), Malloy, Moskowitz and Vissing-Jorgensen (2007), Hansen, Heaton, and Li (2007)). We extend the evidence supporting an asset pricing role for long-run consumption in value and momentum strategies globally and in four other asset classes. However, while we find some statistical relation between long-run consumption growth and value and momentum strategies, the economic magnitudes do not come close to explaining the entire value or momentum (or combination) effects.

To explore the role played by liquidity risk, we regress value and momentum returns on "funding liquidity" indicators such as the U.S. Treasury-Eurodollar (TED) spread, a global average of TED spreads, a global LIBOR-term repo spread, and a global illiquidity index that we construct as an average of these measures.[4] For both levels and changes in

[2]The first principal component of the covariance matrix of returns of all value and momentum strategies in all markets, explaining the largest fraction of common variation among these strategies, loads in one direction on momentum and loads in exactly the opposite direction on value in all asset classes and markets. This evidence suggests the presence of a common global value factor, a common global momentum factor, and the general negative correlation between value and momentum..

[3]We also find that value and momentum do not load significantly on short-term contemporaneous consumption growth, consistent with the literature, and only weakly on short-term contemporaneous GDP growth that is subsumed by our recession indicator.

[4]Use of the TED spread as a measure of banks' and traders' "funding liquidity" is motivated by Brunnermeier and Pedersen (2008) who show that funding liquidity is a natural driver of common market liquidity risk across asset classes and markets. Also, Moskowitz and Pedersen (2008) show empirically

these variables, we find a consistent pattern among value and momentum strategies everywhere. Specifically, value loads positively on liquidity risk, whereas momentum loads either negatively or zero on liquidity risk, depending on the measure. Said differently, value strategies do worse when liquidity is poor and worsening and momentum strategies seem to do slightly better during these times. A 50-50 combination of value and momentum in each market provides good diversification against aggregate liquidity exposure, exhibiting little relation to liquidity risk locally and globally. Conversely, the first principal component of the covariance matrix of all value and momentum strategies, which is long momentum everywhere and short value everywhere, loads strongly on liquidity risk. These results highlight that liquidity risk may be an important common component of value and momentum, and, help explain why value and momentum are correlated across markets and asset classes and why they are negatively correlated with each other within and across asset classes. While the liquidity risk exposure of value strategies may help explain part of their return premium under a liquidity-adjusted asset pricing model (see Acharya and Pedersen (2005) and Pastor and Stambaugh (2003)), the negative liquidity risk exposure of momentum only deepens the puzzle presented by their high returns.

While the data hint that macro and liquidity risks may be linked to the value and momentum comovement structure and their return premia, they leave unexplained a significant portion of both. Put simply, we find interesting correlations between value and momentum and these economic variables, but the economic magnitudes are too small to offer a full explanation for these phenomena. One possibility is that measurement error potentially limits the explanatory power of our macro and liquidity variables. Another possibility is that value and momentum partially reflect market inefficiencies due to limited arbitrage. Indeed, we do not adjust our returns for trading costs, which are larger for momentum due to its higher turnover, so an arbitrageur will realize lower net returns. Further, our results on liquidity risk suggest an interesting dynamic effect. We find that, during times of poor liquidity, value strategies not only perform badly but are also more correlated with each other. Explaining these patterns may provide the ingredients for a limited arbitrage explanation. For example, when liquidity is poor, arbitrageurs may be more limited in their activities (e.g., due to funding problems), which may force them to reduce their value positions, making value strategies perform poorly in the short run, and this may be a common effect to many value strategies at the same time. However, to be fully consistent with all of our findings, limited arbitrage must also lead to greater momentum returns at the same time, perhaps because arbitrageurs during these times fail to correct the under-reaction that may underlie momentum. We conclude by highlighting these patterns as challenges for any theory seeking to explain the ubiquitous returns to value and momentum strategies.

The paper proceeds as follows. Section II outlines our methodology and data. Section III documents new stylized facts on the performance of value and momentum within several

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that our funding liquidity measures based on TED spreads and other spreads are linked to the relative returns of liquid versus illiquid securities globally. Further, Brunnermeier, Nagel, and Pedersen (2008) show that the TED spread helps explain currency carry trade returns. Amihud, Mendelson, and Pedersen (2005) provide an overview of the liquidity literature.

major asset classes. We then study the global comovement of value and momentum in Section IV and their exposures to macroeconomic and liquidity risks in Section V. Section VI concludes the paper.

II. Portfolio Construction and Data

We describe our methodology for constructing value and momentum portfolios across markets and asset classes and detail the data sources we use.

A. Value and Momentum Portfolios

We construct value and momentum portfolios among individual stocks within four different equity markets (US, UK, Japan, and Continental Europe), which we refer to as "global stock selection" strategies, and among country equity index futures, government bonds, currencies, and commodities. We refer to these latter four strategies as "non-stock selection."

We construct a long-short portfolio within each asset class where we sort securities on, respectively, value and momentum signals. For each asset class, we consider the simplest and, to the extent a standard exists, most standard value and momentum measures.

To illustrate the construction of our portfolios, consider first the individual stock selection strategies. For stock selection, a common value signal is the ratio of the book value of equity to market value of equity, or book-to-market, *BM* (see Fama and French (1992, 1993) and Lakonishok, Shleifer, and Vishny (1994)).[5] We generate a long/short portfolio in which we go long stocks with "good" value characteristics, that is, high *BM,* and short those with low *BM*. We use book values lagged six months to ensure data availability to investors at the time, and use the most recent one month lagged market values to compute our *BM* ratios. For momentum, we use a similarly "standard" measure which is the past 12-month cumulative raw return on the asset (see Jegadeesh and Titman (1993) and Fama and French (1996)), skipping the most recent month's return, *MOM2-12*. We skip the most recent month, which is standard in the momentum literature, since there exists a reversal or contrarian effect in returns at the one month level which may be related to liquidity or microstructure issues (Jegadeesh (1990), Lo and MacKinaly (1990), Boudoukh, Richardson, and Whitelaw (1994), Asness (1994), Grinblatt and Moskowitz (2004)). We construct a momentum strategy that goes long the assets that recently performed relatively well and short those that performed relatively poorly.

[5] While research has shown that there are other value measures that are more powerful for stock selection (e.g., Lakonishok, Shleifer, and Vishny (1994), Asness, Porter, and Stevens (2000), Piotroski (2000)), we want to maintain a basic and simple approach that is somewhat consistent across asset classes and thus minimizes the pernicious effects of data snooping. Backtested performance of our value strategies can be enhanced, from data snooping or from real improvement, by including other value measures.

We construct long/short portfolios as follows. For any stock $i=1,\ldots,N$ at time t with signal $SIGNAL_{it}$ (*BM* or *MOM2-12*), we choose the position which is proportional to its cross-sectional rank of the signal minus the cross-sectional average rank:[6]

$$w_{it}^{SIGNAL} = c_t \left(\text{rank}(SIGNAL_{it}) - \Sigma_i \, \text{rank}(SIGNAL_{it}) / N \right)$$

The weights above sum to zero, representing a dollar-neutral long-short portfolio. We consider two choices of the scaling factor c_t : we choose c_t such that either (i) the overall portfolio is scaled to one dollar long and one dollar short, or (ii) the portfolio has an ex-ante annual volatility of 10%. The ex ante volatility is estimated as the past 3-year volatility of the current portfolio holdings using weekly returns.[7] The return on the portfolio is

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

We also consider the return on a 50/50 equal combination (*COMBO*) of value and momentum, which is

$$r_t^{COMBO} = s_t \;\left(0.5 \, r_t^{VALUE} + 0.5 \, r_t^{MOM2\text{-}12} \right)$$

where s_t is chosen to maintain the scale (either dollar long and short or ex-ante annual volatility equal to 10%).

For all other asset classes, we attempt to define similar simple and standard value and momentum measures. For momentum, we use the same measure for all asset classes, namely the return over the past 12 months, excluding the most recent month. While skipping the most recent month of returns is not necessary for some of the other asset classes we consider because they suffer less from liquidity issues (e.g., equity index futures, government bonds, and currencies), we do so to maintain uniformity across asset classes. Momentum returns for these asset classes are in fact weaker when skipping the most recent month, hence our results are conservative.

For value measures attaining uniformity is more difficult because not all asset classes have a measure of "book value." For these assets, we try to use simple and consistent measures of value. For country index stock selection, we aggregate up the individual stocks' *BM* ratios by computing the average value-weighted *BM* among the index constituents of the country. For commodity selection, our value measure is last month's price divided by its "book value," defined as the price 5 years ago, or, said differently, the value measure is the return over the last five years. Similarly for currency selection, our value measure is the 5-year return on the exchange rate, taking into account the interest

[6] Simply using ranks of the signals to form portfolio weights helps mitigate the influence of outliers. Portfolios constructed using the raw signals themselves are nearly identical and if anything generate slightly better performance.

[7] Holding constant the current portfolio weights and calculating volatility over the past three years is equivalent to using the variance-covariance matrix for the same 3 years of data to scale the portfolio's volatility. We use weekly returns to estimate the three year rolling volatilities.

earned measured using local 3-month LIBOR rates.[8] The currency value measure is equivalently the 5-year deviation from uncovered interest-rate parity, or, assuming that real rates are constant across countries, it is a 5-year change in purchasing power parity. These 5-year return measures of value are similar to that used by DeBondt and Thaler (1985) in the stock market, which Fama and French (1996) show generates a portfolio that is highly correlated with a portfolio formed on the book-to-market ratio.

For bond country selection, our value measure is the real bond yield, defined as the yield on the MSCI 10-year government bond index minus forecasted inflation for the next 12 months. We would prefer a 10-year inflation forecast but a reliable history of these does not exist. We interpret book value for bonds as the nominal cash flows discounted at the inflation rate, while price is the nominal cash flows discounted at the yield to maturity by definition, and we then interpret the difference between the nominal yield and inflation as a measure roughly proportional to book versus price. These expected return differences can be interpreted as representing risk (i.e., bonds with higher real yields face great inflation risk) or inefficiency (i.e., bonds with higher real yields are "too cheap" as investors are too frightened, perhaps from extrapolating recently bad news), or both.

B. Comment on Our Definition of Value

Our value measures, whether the ratio of the book-to-market value or last 5-year returns, use the most recently available price. Fama and French (1992), and others in the literature on stocks following them, lag both book value and price to measure them contemporaneously. We feel updating price as frequently as possible is a more natural measure of value. It is difficult to imagine there is not important information contained in current market prices, and while using a lagged measure of book value introduces some slight mismatching of book and market values through time, the variance in price is far greater than that of book and hence likely more important for capturing the true "value characteristic" of the asset. For example, if the price drops 50% today, all-else-equal we would argue it is likely, though not definite, that the asset got cheaper (or riskier in an efficient market).

The price going into our value measure (*BM* or 5-year past return) is close to one of the more recent prices going into our momentum measure (*MOM2-12*, they differ by 1 month), but with the opposite sign. All-else-equal a higher price leads to a poorer value measure and a better momentum measure. This effect naturally drives much of the negative correlation we later document between value and momentum within an asset class. However, the negative correlation is also present across asset classes, where the correlation cannot be attributed to anything mechanical.

To illustrate the robustness of our results, and to be more comparable to the literature, we also consider, in Appendix A.2, a value measure where we lag market prices by an additional 12 months. In this case, the beginning price in the *MOM2-12* measure

[8] More specifically, we take the average commodity price from between 4.5 and 5.5 years ago, and similarly for the exchange rate.

coincides with the price in the value measure, possibly leading to a smaller bias in the opposite direction: a "cheap" value stock a year ago might be expected to have good current momentum as value is a high expected return strategy, thus creating a positive correlation between value and momentum all else equal.

We focus on the current value measure since value investing means buying assets that are cheap now, not assets that were cheap a year ago. While doing so mechanically increases the negative correlation between value and momentum, we feel this is a point of emphasis rather than contention. Creating two strategies so opposite in spirit and opposite in construction, and therefore so negatively correlated with each other, and still having them both consistently produce positive average returns around the world and across asset classes (which we will show in the next section) is a rare feat. It is easy to construct strongly negatively correlated strategies. It is hard to have them both generate positive abnormal returns.

More importantly, whether one lags value or not, when value and momentum are viewed in combination, which is one of the themes of our paper, we obtain nearly identical results. Lagging value or not merely boils down to a choice of whether the economic strength of combining these two strategies comes from a higher Sharpe ratio of value stand-alone and a less negative correlation to momentum if value is lagged, versus a smaller Sharpe ratio of value stand-alone and a more negative correlation to momentum if value is measured with recent market prices. Either method leads to the same economic conclusions when viewed in combination. We provide an extensive discussion of the relation between our measures and the Fama-French measures in the appendix as well as evidence that our results are robust to using lagged value measures.

C. Data

Our data come from a variety of sources.

C.1 Global Stock Selection

The US stock universe consists of all common equity in CRSP (sharecodes 10 and 11) with a recent (6-month) book value from Compustat, and at least 12 months of past return history. We exclude ADR's, REITS, financials, closed-end funds, foreign shares, and stocks with share prices less than $1 at the beginning of each month. We also exclude the bottom 25 percent of stocks based on beginning of month market capitalization to exclude the most illiquid stocks that would be too costly to trade for any reasonable size trading volume. The remaining universe is then split equally based on market capitalization into a tradable but illiquid universe (bottom half) and a liquid universe (top half). To be clear, this procedure results in our "liquid" universe for which we conduct our main tests consisting of the top 37.5% of largest listed stocks.

For stocks in the rest of the world, we use all stocks in the BARRA International universe from the UK, Continental Europe, and Japan. Again, we restrict the universe in each market to those stocks with common equity, recent book value, and at least 12 months of past return history. We also exclude REITS, financials, foreign shares, stocks with share prices less than $1 USD at the beginning of the month, and the bottom 25 percent of stocks based on market capitalization. The remaining universe is then split equally based on market cap into a tradable illiquid and liquid universe. Data on prices and returns comes from BARRA, and data on book values is from Worldscope.

Since our value and momentum strategies outlined above do not value-weight securities in the portfolio, to be conservative we restrict our universe of stocks in every market to the liquid set of stocks (top half of tradable stocks based on market cap, corresponding to the top 37.5 percent of stocks in the entire market).[9] This universe comprises about 96% (98%, 92%, 96%) of the US (UK, Japan, Europe) total market capitalization. Although including the less liquid but tradable securities in our universe improves the performance of our strategies noticeably (results available upon request), restricting our tests to the most liquid universe provides reasonable estimates of an implementable set of trading strategies.

Appendix A and Table A1 provide a comparison of the returns of our value and momentum portfolios in the US to those of Fama and French that use the entire universe of CRSP stocks but value weight the stocks in the portfolios. The Fama and French value and momentum portfolios, HML and UMD, are obtained from Ken French's website along with a description of their construction. We report results for our value portfolios using both recent market prices and prices lagged an additional year. Appendix A shows that we obtain very similar results in the US over the same sample period to those of HML and UMD using our universe and portfolio construction methodology. While using a lagged measure of value increases the correlation of our portfolios with those of Fama and French, importantly, the 50/50 value/momentum combination is not sensitive to lagging value. This is because individually, HML looks like a combination of about 70% our value and 30% our momentum strategy (see Table A1), since HML is constructed from sorting stocks on 6-18 months lagged value measures, which effectively makes it more neutral to momentum. Put simply, viewed alone HML is a better strategy than our version of "current" value, because it is a combination of our "current" value and a little momentum. Hence, combining value and momentum results in nearly the same portfolio

[9]This percentage is chosen to correspond to a universe that is realistically liquid for say a $1 billion market-neutral hedge fund and to maintain uniformity across the four markets we examine. The liquid universe of stocks in the US corresponds to stocks that have a minimum market capitalization of at least 700 million $USD and a minimum daily dollar trading volume of 3 million in January, 2008. For the UK, the minimum market capitalization and daily dollar trading volume in January, 2008 is 200 million and 2 million $USD, and for Continental Europe and Japan, the minimum market caps and daily trading volume numbers in January, 2008 are 350 million and 2.5 million $USD and 400 million and 2 million $USD, respectively. We have experimented with other cuts on the data such as splitting each universe into thirds and using the top third of stocks in each market, as well as using different percentage cutoffs in each market to correspond to roughly similar minimum market caps and daily dollar trading volumes across markets. Results in the paper are unaltered by any of these sample perturbations.

whether value is current or lagged (though the total proportion of how much "value" and how much "momentum" you get can differ slightly).

The US stock sample covers the period February, 1973 to February, 2008. The UK sample covers December, 1984 to February, 2008. The Japanese sample covers January, 1985 to February, 2008. The Continental Europe sample is from February, 1988 to February, 2008. The minimum (average) number of stocks in each region over their sample periods is 451 (1,367) in the US, 276 (486) in the UK, 516 (947) in Japan, and 599 (1,096) in Europe.

C.2 Equity Country Selection

The universe of country index futures consists of the following 18 developed equity markets: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, U.K., and U.S. Returns and price data as well as book values are obtained from MSCI. The sample covers the period February, 1980 to February, 2008.

C.3 Bonds

We get data on bond index returns from Datastream, short rates and 10-year government bond yields from Bloomberg, and inflation forecasts from investment bank analysts estimates as compiled by Consensus Economics. We obtain government bond data for the following 10 countries: Australia, Canada, Denmark, Germany, Japan, Norway, Sweden, Switzerland, U.K., and U.S. The sample of returns covers the period January, 1990 to February, 2008.

C.4 Currencies

We get spot exchange rates from Datastream and IBOR short rates from Bloomberg, covering the following 10 exchange rates: Australia, Canada, Germany spliced with the Euro, Japan, New Zealand, Norway, Sweden, Switzerland, U.K., and U.S. The data cover the period August, 1980 to February, 2008.

C.5 Commodities

We cover 27 different commodity futures. Our data on Aluminum, Copper, Nickel, Zinc, Lead, Tin is from London Metal Exchange (LME), Brent Crude, Gas Oil is from Intercontinental Exchange (ICE), Live Cattle, Feeder Cattle, Lean Hogs is from Chicago Mercantile Exchange (CME), Corn, Soybeans, Soy Meal, Soy Oil, Wheat is from Chicago Board of Trade (CBOT), WTI Crude, RBOB Gasoline, Heating Oil, Natural Gas is from New York Mercantile Exchange (NYMEX), Gold, Silver is from New York Commodities Exchange (COMEX), Cotton, Coffee, Cocoa, Sugar is from New York Board of Trade (NYBOT), and Platinum from Tokyo Commodity Exchange (TOCOM). The commodities sample covers the period February, 1980 to February, 2008.[10]

C.6 Macroeconomic and Liquidity Variables

As passive benchmarks for global stocks, bonds, and commodities (there is no natural currency index equivalent), we use the MSCI World index. We also use several macroeconomic indicators in our analysis. Consumption growth is the real per-capita growth in nondurable consumption for each country obtained quarterly. Long-run consumption growth is the future 3-year growth in consumption, measured as the sum of log quarterly consumption growth from quarter t to $t+12$. GDP growth is the real per-capita growth in GDP for each country. We also employ a recession variable for each country which is a value between 0 and 1 where we linearly interpolate between ex-post peak dates (set equal to 0) and troughs (set equal to 1).

Macroeconomic data for the US is obtained from the National Income and Product Accounts (NIPA) and recession dates are obtained from the NBER. For UK, Japan, Europe, and global macroeconomic data we obtain information from Economic Cycle Research Institute (ECRI), which covers production and consumption data as well as business cycle dates using the same methodology as the NBER.

We also use several measures of general "funding liquidity" locally and globally to capture liquidity events (see Brunnermeier and Pedersen (2008) for a theoretical motivation of the importance of funding liquidity risk). We use the TED spread in each of four markets (US, UK, Japan, and Europe), which is the average over the month of the daily local 3-month interbank LIBOR interest rate minus the local 3 month T-bill rate, and take an average of TED spreads around the world as a global liquidity measure. When the TED spread is wide, bank's financing costs are large, signaling that capital is scarce, which also affects the funding of other traders such as hedge funds and other speculative investors. TED spreads are available from January, 1987 to February, 2008. Similarly, we also employ the spread between the local 3-month LIBOR rate and the local term repurchase rate in each market as another proxy for funding liquidity. These spreads are available from January, 1996 to February, 2008. The TED spread and LIBOR minus term repo rates are highly correlated in both levels and changes within each market.

We also plan on using a number of aggregate liquidity risk variables from the literature, namely those of Pastor and Stambaugh (2003), Acharya and Pedersen (2005), and Sadka (2006), albeit these are all for US stocks only.

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[10]We have also split the universe of commodities in half into a liquid and illiquid set based on open interest and trading volume and get consistent results using only the most liquid commodity contracts.

III. Performance

We first establish the powerful and consistent performance of value, momentum, and the 50/50 combo within each of the major markets and asset classes. While other studies provide evidence that value and momentum work in some of the asset classes we study, to our knowledge we are the first to study them in combination with each other, and simultaneously across asset classes. Hence, our results confirm the previous work, find new evidence on value and momentum in new asset classes (e.g., government bonds), and, most importantly, study the relation between value and momentum within and across asset classes to demonstrate the power of applying value and momentum everywhere.

We report in Tables 1 and 2 the average performance of the value and momentum strategies across markets and asset classes. The tables highlight that simple signals of value and momentum generate consistent excess returns in several markets and asset classes and that value and momentum are negatively correlated such that the portfolio combining the two has a higher Sharpe ratio than either one alone.

Specifically, Table 1 reports results for the strategies that go long \$1 and short \$1. Panel A of Table 1 reports the annualized mean return and *t*-statistic (in parenthesis), annualized standard deviation or volatility, and annualized Sharpe ratio of each of the stock selection strategies. The returns to the value strategies are very similar across the US, UK, and Europe and about twice as strong in Japan, all of which are statistically different from zero. Conversely, momentum in Japan is much weaker (and insignificant) than it is in the other countries. Interestingly, the 50-50 combination of value and momentum is more stable across the regions and more powerful in terms of performance. In the US, the 50-50 combo generates an annual Sharpe ratio of about 1.1, in Japan it is 1.2 and in the UK and Europe it is 1.6. In every region the value/momentum combo generates higher mean returns with lower volatility than either value or momentum stand alone strategies do. As the fourth column of Panel A of Table 1 indicates, the strength of the combination of these two strategies comes from their negative correlation with each other. In every region, the correlation between the simple value and momentum strategies ranges from -0.44 to -0.59.

The negative correlation between value and momentum also helps clarify some of the variation in value and momentum performance across these markets. For instance, previous research has attempted to explain why momentum does not seem to work very well in Japan (see Chui, Titman, and Wei (2002) for a behavioral explanation related to cultural biases). While not an explanation, the poor performance of momentum in Japan over this period is no more puzzling than the very strong performance of value during the sample period, since the two strategies are about -0.60 correlated. The fact that momentum did not lose money while being negatively correlated to the highly successful value strategy is itself an achievement. Moreover, over the same sample period, the 50-50 combo of value and momentum in Japan still dominates either stand alone strategy. That is, an optimal portfolio would want both value and momentum in Japan even over the period where momentum appears “not to work.”

Panel B of Table 1 reports the same performance statistics for the non-stock selection strategies. While value and momentum efficacy vary somewhat across the asset classes, again the combination of value and momentum is quite robust, due to a consistent negative correlation between value and momentum within each asset class.

To generate more power and to examine the commonality among value and momentum strategies, we also examine combinations of these strategies across regions and asset classes. However, as Table 1 highlights, the volatilities of the various strategies are vastly different across the asset classes, making it difficult to combine the strategies in a sensible way (e.g., commodity value has about 10 times the volatility as bond country value). To provide a more uniform set of strategies that have roughly equal volatility, we scale each strategy to have an ex-ante volatility of 10% per year as described in the previous section. This scaling essentially entails levering up or down various strategies based on an ex ante covariance matrix of the securities to achieve a 10% annual volatility. Hence, not only do the different strategies have the same ex-ante volatility, but also, unlike a constant dollar strategy, their volatility does not vary over time (to the extent that our volatility estimates are accurate).

Table 2 reports the results from the constant ex-ante volatility versions of our value and momentum portfolios. The performance of value and momentum when these strategies are scaled to constant ex-ante volatility is slightly stronger than in Table 1, consistent with our volatility estimates having some predictive power and the variance in volatility in the constant dollar portfolios not being associated positively with times of higher expected return.

Importantly, we can now combine the various strategies across asset classes into meaningful portfolios. For this reason, we focus on the constant volatility strategies for the remainder of the paper. We compute the equal-weighted average return of the four regional stock selection strategies, which we call "global stock selection," the equal-weighted average return of the four non-stock selection strategies, which we call "all non-stock selection," and the equal-weighted average return of all strategies, which we call "all asset selection."

The results in Table 2 highlight the power and robustness of combining value and momentum everywhere and, in particular, the power of combining value/momentum combo portfolios everywhere. Global stock selection value generates an annualized Sharpe ratio of 0.40, which is a little lower than the Sharpe ratio of the all non-stock selection value portfolio, which is 0.63. Momentum among stocks produces a 1.18 Sharpe ratio, which is a little higher than the Sharpe ratio for momentum among non-stock asset classes, which is 0.96. The negative correlation between value and momentum is also consistent across asset classes (save bond country selection at constant volatility) and evident among the average portfolios. Because of their positive average returns and negative correlation between them, the combination of value and momentum in every asset class produces powerful performance results, generating Sharpe ratios consistently greater than either of the stand alone strategies in all markets and asset classes. Combining the stock and non-stock combo strategies across asset classes produces even stronger results, generating a Sharpe ratio of 2.01 per year, which indicates that significant diversification benefits are being gained by combining different markets and asset classes.[11]

Table A2 in the appendix repeats Table 2 using value measures that are lagged by an additional year during portfolio formation. Lagging value by an additional year improves the stand alone Sharpe ratio of value strategies and reduces the negative correlation with momentum uniformly, since lagging a year avoids shorting momentum. However, the 50/50 value/momentum combo portfolios exhibit similar, though somewhat weaker, performance than those in Table 2. The weaker combo performance results in Table A2 indicate that some information is lost by lagging value an additional year (or the combination of value and momentum implied by lagging is slightly ex-post inferior).

Figures 1 and 2 show the time-pattern of the returns to value, momentum, and the 50-50 combo in each market and asset class. The benefit of combining the two negatively correlated strategies is evident from the graphs, even during times when one or both of the stand alone strategies experiences extreme performance (e.g., the "tech episode" for stocks in late 1999 early 2000). Figure 3 plots the cumulative returns to the average strategies that combine across markets and asset classes. The significant benefits of combining value and momentum as well as the diversification benefits of combining these strategies across markets and asset classes is evident from the figures.

To examine the abnormal returns to our strategies, Table 3 reports the alphas (intercepts) and betas (slope coefficients) from time-series regressions of our strategies' returns on the MSCI world equity index. The alphas are large and statistically significant for most strategies and highly significant once we combine strategies. Betas, for the most part, are very close to zero and insignificant except for the U.S. stock value strategy, which has a significant beta of -0.22. We consider further explanatory variables in Section V.

The increased power of combining value and momentum across asset classes and markets presents an even greater challenge to theories seeking to explain these phenomena in any single market or asset class. On the other hand, examining these phenomena across asset classes simultaneously provides an opportunity to identify common movements that may point to economic drivers of these effects. We investigate in the next section the common factor structure of value and momentum everywhere.

IV. Comovement Everywhere

In this section we examine the common components of value and momentum across markets and asset classes.

[11] Note, the somewhat stronger results for stock selection come at least partially from the fact that transactions costs, which are higher for stock selection than our non-selection strategies, are beyond the scope of this paper.

A. Correlations

Panel A of Table 4 reports the average of the individual correlations among the stock selection and non-stock selection value and momentum strategies. We first compute the correlation of all individual strategies (e.g., US value with Japan value) and then take the average for each group (e.g., stock selection value versus non-stock selection value). We exclude the correlation of each strategy with itself (removing the 1's) when averaging and also exclude the correlation of each strategy with all other strategies within the same market. For example, we exclude US momentum when examining US value's correlation with other momentum strategies in order to avoid any mechanical negative relation between value and momentum that might arise within the same market because the same set of securities might appear on the long (short) side of a value strategy and the short (long) side of a momentum strategy. (Recall that the correlations between value and momentum within the same market are reported in Table 2.) We report correlations for both monthly and quarterly returns. Quarterly returns are helpful if any non-synchronous trading problems exist (e.g. due to illiquid assets that do not trade continuously, or non-synchronicity induced by time zone differences for some of our strategies).

Panel A of Table 4 shows a consistent pattern, namely that value here is positively correlated to value elsewhere, similarly momentum in one place is positively related to momentum elsewhere, and value and momentum are negatively correlated everywhere. These patterns are stronger for quarterly returns. Stock selection value strategies using monthly (quarterly) returns are on average 0.38 (0.56) correlated across markets. Likewise, non-stock selection value strategies are positively correlated with other non-stock selection value strategies, though the effect is weaker than for stocks. The same pattern holds for momentum but now with equal strength. On average, stock selection momentum strategies are 0.36 (0.50) correlated with each other across regions monthly (quarterly) and non-stock momentum strategies are 0.15 (0.18) correlated across asset classes.

The cross-correlations are also interesting. The average individual stock selection value (momentum) strategy is positively correlated with the average non-stock selection value (momentum) strategy. This result is striking in that these are totally different asset classes, yet there is common movement in the value and momentum strategies across the asset classes.

Finally, value and momentum are negatively correlated everywhere. In stock selection, value in one region is on average -0.23 (-0.43) correlated with momentum in another region (recall, we exclude the within market correlation between value and momentum) and value in one asset class is on average -.10 (-0.15) correlated with momentum in another asset class monthly (quarterly). Again, the fact that value here is positively correlated with value there and momentum here is positively correlated with momentum there, while value and momentum are negatively correlated everywhere, cannot be explained by the correlation of the passive asset classes themselves (i.e., by construction).

Panel B of Table 4 reports the correlations of the averages, where we first take the average return series for a group (e.g., equal-weighted stock selection value across regions) and then compute the correlation between the two average return series. As Panel B indicates, looking at the correlations of the average return series is more powerful than the average of the individual correlations. The average stock selection value strategy is 0.17 (0.30) correlated with the average non-stock selection value strategy monthly (quarterly), the average stock momentum strategy is 0.47 (0.69) correlated with the average non-stock momentum strategy at a monthly (quarterly) frequency, and the negative correlation between value and momentum across asset classes is also stronger, ranging from -0.19 to -0.67 at a monthly frequency and -0.29 to -0.83 at a quarterly frequency. These results are stronger and more significant than those in Panel A of Table 4. We will see this pattern again in this paper. Looking at broader portfolios leads to more powerful statistical findings than the average finding among narrower portfolios.

Table A3 in the appendix repeats Table 4 using value strategies that are lagged an additional year. Lagging by an extra year avoids value and momentum being mechanically negatively related and, if anything, induces a positive mechanical correlation. As Table A3 indicates, value strategies are still positively correlated with value strategies elsewhere when using lagged value, but the correlations are a little weaker, suggesting some information about value is lost when we lag. The negative correlation between value and momentum is also still present, but the magnitudes are weaker. Nevertheless, the consistent correlation pattern for different value measures is compelling.

Finally, Panel C of Table 4 breaks down the correlations of the average stock selection series with each of the non-stock selection series. While not all of the correlations are statistically different from zero, it is quite compelling that all of the value strategies across asset classes are consistently positively correlated, all of the momentum strategies are consistently positively correlated, and all of the correlations between value and momentum are consistently negative across every asset class. This striking pattern is by no means obvious or built into the portfolio construction – on the contrary, these are long-short strategies in completely different asset classes. Again the results are all non-trivially stronger looking quarterly instead of monthly.

B. Common Components

As a first cut at looking at the common components of value and momentum strategies universally, we examine the first principal component of the covariance matrix of our strategies. Figure 4 plots the eigenvector weights associated with the largest eigenvalue from the covariance matrix of the stock selection strategies in each region (top figure) and all asset classes (bottom figure) including stocks, where we use an equal-weighted average of all the stock selection strategies globally to proxy for the stock selection asset class. Both figures show quite strikingly that the first principal component loads in one direction on all value strategies and loads in exactly the opposite direction on all momentum strategies. This result highlights the strong ubiquitous negative correlation between value and momentum everywhere as well as the positive correlation among value strategies themselves and among momentum strategies themselves. A simple proxy for the first principal component (which accounts for 45% of the stock selection covariance matrix and 25% of the all asset class covariance matrix) is therefore long momentum and short value in every market and asset class (or vice versa since principal components are sign invariant).

To further explore the common structure of value and momentum strategies universally, Table 5 reports estimates from time-series regressions of each value, momentum, and 50/50 value/momentum combo portfolio in every market and asset class on a two-factor model consisting of the average value strategy in every *other* market and asset class and the average momentum strategy in every *other* market and asset class. The regression equations are,

$$r_{i,t}^{value} = \alpha_i + \beta_i\left(\frac{1}{7}\sum_{k\neq i} r_{k,t}^{value}\right) + \gamma_i\left(\frac{1}{7}\sum_{k\neq i} r_{k,t}^{momentum}\right) + \varepsilon_{i,t}^{value}$$

$$r_{i,t}^{momentum} = \alpha_i + \beta_i\left(\frac{1}{7}\sum_{k\neq i} r_{k,t}^{value}\right) + \gamma_i\left(\frac{1}{7}\sum_{k\neq i} r_{k,t}^{momentum}\right) + \varepsilon_{i,t}^{momentum}$$

where we run the regressions for asset class *i,* that is, for each of the eight strategies across stock selection, country equity index, country bonds, currencies, and commodities. Clearly, there is no overlap of securities on the left and right hand side of the regression. For example, when examining the US value strategy as the dependent variable, we exclude the US value strategy from the right-hand-side value benchmark and exclude the US momentum strategy from the momentum benchmark. The non-overlapping design of these regressions to ensure no security appears on both sides of the regression simultaneously provides a clean interpretation of the betas and means that each regression of each asset being used as a dependent variable has slightly different right hand side benchmarks. However, because of this feature, one cannot interpret the intercepts from these regressions jointly as a test of mean-variance spanning (e.g., Gibbons, Ross, and Shanken (1989)).

Table 5 reports the coefficient estimates and *t*-statistics from these time-series regressions. The first eight rows report results for the value strategies on the value and momentum benchmarks elsewhere. In almost every case (except commodities) value strategies in one market or asset class load positively, and in the majority of cases significantly, on the average value strategy everywhere else. In addition, in almost every case, value strategies in one market load negatively on the average momentum strategy everywhere else. These results are consistent with the correlations reported in Table 4.

The time-series regressions also provide an intercept (alpha), which can be interpreted as the average residual return to each individual value strategy after accounting for its common exposure to other value and momentum strategies in other markets and asset classes. Intercept values are annualized in percent per year, though regressions are estimated from monthly returns. Other than the US and UK value strategies, each individual value strategy provides some positive alpha relative to value and momentum elsewhere that ranges from 1.7 to 6.2% per year. However, except for Japan, these alphas are largely statistically insignificant. Hence, from a statistical standpoint, the common component contained in value and momentum universally seems to capture a significant portion of an individual strategy's value premium, though economically there still appears to be some unaccounted for premium.

The next four rows in Table 5 report the average coefficient values across the stock and non-stock selection strategies compared to the coefficient estimates for the average return series for stock and non-stock selection, which is an equal-weighted return series across the individual strategies in each group. For the average return series, the time series regression is the average stock selection value ("global stock selection value") return regressed on the average non-stock selection value and non-stock selection momentum returns. We also regress the average non-stock selection value ("all non-stock selection") return on the average stock selection value and momentum returns. As Table 5 reports, the average alpha across the individual stock selection (non-stock selection) strategies is only 1.4% (3.9%) per year with an average *t*-statistic well below 2, but the alpha for the average stock selection (non-stock selection) return series is 4.9% (7.7%) and is significantly different from zero. This result again highlights the power of looking at the average return series rather than each strategy stand alone.

The next twelve rows report results for the same tests using the momentum strategies as dependent variables. Consistent with our previous results, momentum strategies load negatively on average value strategies everywhere else and positively on average momentum strategies everywhere else. The intercepts for stock selection momentum strategies indicate that about 3.9% per year on average is unaccounted for by value and momentum elsewhere, whereas for non-stock selection strategies, the average alpha is only 1.5% and statistically not different from zero. Again, the intercepts for the average return series are much larger than the average intercept for the individual return series. Global stock selection delivers a 7.2% alpha over non-stock selection value and momentum and all non-stock selection momentum has a 2.2% alpha with respect to global stock selection value and momentum (again we mention that because our tests are gross of transactions costs they naturally induce some small favoritism for stock selection).

The last column of Table 5 reports the R-squares from the time-series regressions. The R-squares are surprisingly high considering that the benchmark returns used to explain each strategy's returns are from completely different asset classes and markets. This result indicates again that there is significant common movement in value and momentum strategies globally.

Finally, the last twelve rows of Table 5 report the regression results for the 50/50 value/momentum combination strategies in every market and asset class. Here, the power of combining value and momentum is most striking. The combo portfolios each load positively on both value and momentum everywhere else. However, the alphas of the individual strategies are all positive and generally significant, and are on average much larger than the alphas generated by value and momentum alone. For example, the average stock selection (non-stock selection) alpha is 6.8% (3.7%) per year. Alphas increase more when examining the average combo return series: Global stock selection delivers a 15.4% alpha and all non-stock selection generates a 7.2% alpha.

Hence, while the combo strategies are also correlated with value and momentum everywhere else, the common component of value and momentum universally does not explain nearly as much of the return premium to a combo strategy as it does with either value and momentum alone. This result implies that some of the common structure to value and momentum is eliminated when you combine the two strategies. Since value and momentum are negatively correlated everywhere, if there is common structure imbedded in that negative correlation, combining the two strategies effectively provides a hedge on some of the common factors. We investigate in the next section what those common factors might be and which factor exposures are exaggerated or diminished when combining value and momentum.

V. Macroeconomic and Liquidity Risk

To gain further insight into the common variation of value and momentum strategies universally and their underlying economic drivers, this section investigates the relation between value and momentum and several macroeconomic and liquidity variables.

A. Macroeconomic and Liquidity Risk Exposures

Table 6 reports results from time-series regressions of the average value and momentum returns among all stock selection strategies globally (global stock selection), all non-stock selection strategies (all non-stock selection), and among all strategies in stock and non-stock selection (all asset selection), where strategies are equal-weighted within each of these groups, on various measures of macroeconomic and liquidity risks. Our macroeconomic variables are the global long-run (3 year forward) consumption growth measure and global recession variable described in Section II. We have also experimented with short and long-run GDP growth and with short-term (quarterly) consumption growth. These measures have weaker explanatory power and are subsumed by the long-run consumption growth and recession variables and are therefore omitted for brevity and better fit. Our liquidity risk proxy is the US TED spread, which is the average daily spread between 3-month LIBOR rates and 3-month Treasury Bill rates in the US over the month.

Panel A of Table 6 shows that value and momentum strategies are both positively related to long-run consumption growth and both negatively (though weaker) related to recessions. When value and momentum do well, future long-run consumption growth rises and, to a lesser extent, current economic conditions are strong. These results are consistent with and extend the literature on long-run consumption risks (Parker and Julliard (2005), Bansal and Yaron (2004), Malloy, Moskowitz, and Vissing-Jorgensen

(2007), and Hansen, Heaton, and Li (2007)) that finds a positive relation between the value premium in US stocks and long-run consumption risk. We find that the positive relation between value and long-run consumption risk is robust across a variety of markets and asset classes, lending further support to the empirical findings in the literature that have been based solely on US equities. Furthermore, we find a similar link between momentum strategies and long-run consumption risk that has not previously been found in the literature. Because the signs on consumption risk go the same way for value and momentum (and the "right" way to explain positive expected returns), and because of the strength across many strategies, the statistical significance of consumption for the combo is quite high (a t-statistic of 6.07). The negative coefficient on recessions is also consistent with a business cycle risk story where value and momentum strategies do poorly during tough times, when the marginal utility of wealth is likely to be high.

Panel A of Table 6 also shows that the liquidity variable loading is negative for value strategies, particularly for stock selection (though again the sign is preserved in the completely separate non-stock selection strategies), while the liquidity loadings are strongly positive for momentum strategies. Value performs poorly when the TED spread is high, which occurs during times when borrowing is difficult, while momentum performs well during these times (again, this could be related to their negative correlation). The fact that these results are strongest for stock selection strategies makes sense if individual stock strategies are likely more subject to liquidity and funding issues than futures/forwards on equity indices, government bonds, commodities or currencies which may have lower margins. Value securities are those that typically have high leverage (in the case of stocks) or have been beaten down over the past couple of years. Such securities, it would seem, would suffer more when funding liquidity tightens. Momentum securities, on the other hand, exhibit the opposite relation.

Pastor and Stambaugh (2003) and Sadka (2006) find opposite-signed results for US momentum equity strategies. We confirm those results using our portfolios, hence the measure of liquidity risk matters. To investigate this apparent discrepancy further and more generally the role of liquidity risk we examine a host of proposed aggregate liquidity risk variables in the literature. We find that the various liquidity measures are not very correlated to each other. We also find that the common component of all these measures loads consistently negatively on value and somewhat positively or zero on momentum. We plan on investigating the link between value and momentum and liquidity risk further.

One possible explanation for these patterns is that arbitrageurs who put on value and momentum trades may be restricted during times of low liquidity. Their reduced participation in the market may make "cheap" or value assets even cheaper, as arbitrageurs' price impact will be smaller. The same effect might lead to initial losses on momentum strategies, but, since this strategy quickly changes its postions, illiquidity may soon make the momentum effect stronger if momentum is the result of general under-reaction in markets and arbitrageurs play a less disciplinary role during these times. This explanation is consistent with limited arbitrage (Shleifer and Vishny (1997)) and slow moving capital (Mitchell, Pedersen, and Pulvino (2007)), though has to be considered conjecture at this point.

Taken together, the macro risk variables may help explain the common variation among value and momentum strategies and their respective return premia. However, the macro variables alone cannot explain why value and momentum are negatively correlated, since both strategies load in the same way on the macro risks. Liquidity risk, on the other hand, can help explain (part of) why value and momentum are negatively correlated, and the return premium to liquidity risk may help explain the return to value, but only deepens the puzzlingly high returns to momentum strategies as these strategies do *better* when the market is illiquid, presumably a characteristic investors would pay for in terms of lower expected returns.

To illustrate these patterns with more power, the last two columns of Panel A of Table 6 report results for the return to being long momentum and short value, (i.e., momentum return minus value return (mom-val)) as well as the value/momentum combo (i.e., their sum). Mom-val loads strongly positively on liquidity risk, but essentially hedges out exposure to macroeconomic risks. The combo, on the other hand, loads strongly on the macroeconomic risks, and essentially hedges out liquidity risk exposure.

Panel B of Table 6 repeats the regressions from Panel A using alternative liquidity risk measures in place of the US TED spread: US LIBOR minus term repo rate, global versions of the TED spread and change in TED spread, which are equal-weighted averages of these rates across the US, UK, Japan, and Europe, and levels and changes in an illiquidity index, which we construct as the first principal component weighted average of all the global TED spreads and LIBOR minus term repo rates. We also use a factor-mimicking portfolio return for liquidity risk which is a long-short portfolio of the most liquid securities in each region (top half based on market cap) minus least liquid securities (bottom half based on market cap). The other macroeconomic variables are also included in the regressions in Panel B, but not reported for brevity. As Panel B of Table 6 indicates, the relation between liquidity risk and value/momentum strategies is robust to a variety of liquidity proxies in both levels and changes. Once again, a long momentum short value portfolio maximizes exposure to liquidity risk while the 50/50 combination of the two immunizes liquidity risk exposure.

B. Average Exposure vs. Exposure of the Average

A key feature of the analysis in Table 6 is that we examine the average returns to value and momentum across a wide set of markets and asset classes together. The power of looking at the average return to value and momentum greatly improves our ability to identify common factor exposure. For example, if we examine each individual value and momentum strategy's exposure to macroeconomic and liquidity risks separately, we do not find very strong patterns. Figures 5 and 6 report the *t*-statistics of the betas of each of our individual value and momentum strategies on liquidity risk (using the illiquidity index we constructed) and long-run consumption growth, respectively. The average *t*-statistic from the individual strategy regressions on liquidity risk is -1.5 for value strategies and 1.6 for momentum – the right direction but hardly convincing. In contrast, when we regress the average value and momentum return series across all markets and regions on liquidity risk, we get a *t*-statistic of -3.8 for value and 3.0 for momentum. Likewise, Figure 6 shows that the average *t*-statistic on long-run consumption risk for value is only 1.1 and for momentum 0.8, whereas the *t*-statistics of the average value and momentum portfolios are 2.6 and 3.2. The average relation to liquidity and long-run consumption risk among the strategies is not nearly as strong as the relation of the average strategy to these risks. Naturally, by averaging across all markets and asset classes we mitigate much of the noise that is not common to value or momentum in general, and we identify a common component that bears a relation to macroeconomic and liquidity risks. Hence, when restricting attention to one asset class at a time, or worse to one strategy within an asset class, the patterns above are difficult to detect. The scope and uniformity of studying value *and* momentum *everywhere* at once is what allows us to identify patterns and links that are not detectable looking more narrowly at one asset class or strategy in isolation, which much of the previous literature has limited its attention to.

C. Economic Magnitudes

While the statistical relations between value and momentum strategies and macroeconomic and liquidity risks are strong, we also want to assess their economic magnitude. For example, how much of the abnormal returns to value and momentum can each explain? How much correlation structure can each explain?

To answer the first question, we start with the analysis from Table 5 where we examined the alphas of each of our strategies relative to value and momentum in all other markets and asset classes. We can think loosely of this exercise as the maximum that can be explained from the common components if we were to attribute all of the common variation to macroeconomic and liquidity risk. As Table 5 indicates, there are still substantial return premia to individual value and momentum strategies that are not captured by the common component to value and momentum, especially for the combination strategies. Hence, based on these results, we expect that macroeconomic and liquidity risk cannot explain all of the premia, but it is interesting to further quantify the economic magnitude of what can be explained.

To assess more directly what part of the returns can be explained, one can create factor-mimicking portfolios for the macroeconomic and liquidity risks. For liquidity risks, we use a portfolio of the liquid securities in each market (top half of market cap) minus the illiquid securities (bottom half of market cap). This portfolio has a strong positive correlation with the TED spread and other global liquidity factors (the correlation with our liquidity index is 0.4). In unreported results, we find that the fraction of returns explained by this liquidity factor-mimicking portfolio to be on the order of 10 percent of the return premia, leaving unexplained significant parts of the premia. For example, for the global stock selection value portfolio averaged across all four equity markets we study, about 0.62 percentage points of the annual 6.4 percent alpha of this strategy is captured by its exposure to global liquidity risk (as measured by our illiquidity factor-mimicking portfolio).

Lacking a reasonable factor-mimicking portfolio for long-run consumption growth, we simply estimate the Euler equation derived from a consumption based asset pricing framework for a representative investor (following Parker and Julliard (2005) under power utility or Malloy, Moskowitz, and Vissing-Jorgensen (2007) under recursive preferences). For the value/momentum combination strategies across global stocks, non-stocks, and all assets, we would need a rather large (and implausible) coefficient of relative risk aversion of 32, 60, and 45, respectively, to justify the Sharpe ratios of these strategies under a CCAPM framework. This result is not terribly surprising given the large Sharpe ratios of our combination strategies.

Finally, to investigate the importance of recession risk, in the next subsection we look at the performance of our strategies during recessions and find that, while the performance and Sharpe ratio are muted, they are still quite positive, implying that recession risk cannot fully explain the returns to our strategies.

In terms of how much correlation can be explained, macroeconomic and liquidity risk explain about 15 percent of the correlations among value strategies with other value strategies and momentum strategies with other momentum strategies (e.g., from about 0.38 correlation on average in raw returns to about 0.31 correlation on average in residual returns from macroeconomic and liquidity risks). Of course, the macroeconomic variables, consumption and business cycle, cannot explain the negative correlation between value and momentum (as they go the same direction for each). On the other hand, liquidity risk explains only about 10 percent of this negative correlation.

The bottom line is that while the data hint strongly toward a link between value and momentum and macroeconomic and liquidity risks, very little of the return premia or correlation structure is captured by our proxies for these risks. We view these findings as an interesting starting point for possible stories related to value and momentum phenomena, and of a statistical power that requires them to be part of any theoretical model that seeks to explain these effects, but emphasize that we are far from a full explanation of these ubiquitous effects at this point.

D. Dynamics during Macroeconomic and Liquidity Events

To gain further insight into the economic relation between macroeconomic and liquidity events and value and momentum strategies, we examine the dynamic performance and correlations of global value and momentum across different macroeconomic and liquidity episodes. Table 7 reports the Sharpe ratios and correlations among the value, momentum, and value/momentum combination strategies during the first half and second half of our sample period (1990 to 1999 and 2000 to 2008, respectively), for the 25% of observations around business cycle troughs and peaks, based on our global recession variable, for the 25% lowest and highest future consumption growth states, based on global long-run consumption growth, and for the 25% lowest and highest liquidity months based on monthly realizations of the global TED spread.

Panel A of Table 7 reports the results for the global stock selection strategies and Panel B reports the results for the non-stock selection strategies. First, the full-sample results are also borne out in both the first and second half of the sample. While value does much better in the latter period, momentum does better in the earlier period and consequently the 50/50 combination is quite stable and profitable over both periods. Interestingly, the average correlations among value, momentum, and combination strategies rise over time due perhaps to an increase in arbitrageurs such as hedge funds using or exploiting value and momentum through time.

Table 7 illustrates that value, momentum, and their combination fare better during times of favorable macro conditions as measured either by the business cycle indicator or by future consumption growth, though with a few exceptions.

Table 7 clearly illustrates the effect of liquidity risk: during times of low liquidity value strategies perform worse, in fact stock selection value strategies are unprofitable, while momentum strategies perform better than average. Interestingly, during times of low liquidity, the correlation between value strategies across markets is much larger, while the correlation among momentum strategies is the same, and the correlation between value and momentum is more negative. This result is also consistent with arbitrageurs who trade value and momentum globally affecting prices perhaps because they need to reduce positions during these times. This correlation structure, along with the performance of value and momentum, imply that the combo has a significantly higher return during times of high liquidity, consistent with liquidity risk explaining part of its return premium. These dynamic patterns present a further challenge to theory seeking to explain what drives value and momentum globally.

E. Not Everything Works Everywhere

One of the virtues of our unified approach of looking at value and momentum everywhere at once is the increase in statistical power that helps identify common themes associated with value and momentum. This feature can uncover links that are not easily detectable when examining only one asset class or strategy at a time, but it can also provide a more general test of patterns found in one asset class or market that may not exist elsewhere and hence may be idiosyncratic to that market.

Much of the literature on value and momentum focuses its attention on U.S. equities and typically examines these phenomena separately. One of the more robust findings from this literature is the strong positive performance of value in January (DeBondt and Thaler (1987), Loughran (1997), and Grinblatt and Moskowitz (2004)), which some argue captures all of the return premium to value (Loughran (1997)). A separate literature documents a very strong negative return to momentum in January (Jegadeesh and Titman (1993), Grundy and Martin (2001), and Grinblatt and Moskowitz (2004)). Much like our comments regarding value and momentum in Japan, we would make the obvious observation that these findings are related. We investigate the robustness of these patterns across markets and asset classes and whether our unified approach can shed further insight on them.

Table 8 reports the annualized Sharpe ratios of our value, momentum, and 50/50 value/momentum combo strategies in the months of January and the rest of the year. Panel A reports results for the stock selection strategies and Panel B for the non-stock selection strategies. As the first row of Panel A of Table 8 shows, we replicate the results in the literature for U.S. equities that value performs well predominantly in January and momentum does very poorly in January. However, the results across other markets for stocks are somewhat mixed, as value does very badly in the U.K. in January, and although value performs best in January for both Japan and Europe, there are still positive returns to a value strategy in February to December in these markets. Overall, stock selection value strategies do indeed perform better in January, but value returns are present in the rest of the year. Likewise, momentum strategies do tend to do better on average in non-January months, but the strength of January versus the rest of the year varies by country. In the U.K. and Europe, for instance, January momentum returns are stronger than the rest of the year. Overall, momentum is a better strategy from February to December on average, but momentum also generates positive returns in January. These results are far less striking than those documented in the literature for U.S. stocks.

Panel B of Table 8 reports the seasonal results for the non-stock selection strategies. Here, we find no discernable January versus non-January performance differences for value strategies and find only slightly better performance for momentum strategies outside of January.

The 50/50 value/momentum combination strategies are much more stable across seasons and across markets and asset classes. On average, the combination strategies do slightly better in non-January months. As the last two columns of Table 8 indicate, the negative correlation between value and momentum is relatively stable in January versus the rest of the year, save currencies where it dramatically switches sign. Aside from currencies, this implies that the combination of value and momentum will mitigate the prevalence of any seasonal patterns in each.

Finally, Panel C of Table 8 recomputes the average monthly return correlations among the stock and non-stock value and momentum strategies in January and non-January months separately to see if the often extreme January performance of value and momentum is largely driving the correlations across markets and asset classes documented in Table 4. As Panel C of Table 8 shows, however, the correlations across markets are stronger outside of January, inconsistent with this hypothesis. Value (and momentum) are more correlated across markets and asset classes from February to December and the negative relation between value and momentum across markets and asset classes is also stronger outside of January.

The sum of these results indicates that turn-of-the-year seasonal effects in value and momentum strategies in general are not nearly as strong or as important as they appear to be for U.S. stocks. Looking everywhere at once can obviously cut both ways.

VI. Conclusion

Value and momentum work in a variety of markets and asset classes, their combination works better than either alone, and the benefits of diversification across markets and asset classes are large, both in terms of the strategies' performance and in terms of the arising statistical power to detect economic exposures. The power of our unified approach allows us to uncover an intriguing global comovement structure.

We find that value (and momentum) strategies are positively related across markets and asset classes and that value and momentum are negatively related within and across markets and asset classes. This intriguing global factor structure is consistent with the presence of common underlying economic factors driving (part of) the returns to these strategies. We show that value and momentum are both positively correlated with future long-run consumption growth, and that liquidity risk is positively related to value and negatively related to momentum. Our examination of both value and momentum simultaneously and universally across markets and asset classes provides improved statistical power to detect these common economic exposures that are not easily detectable when examining any one strategy in isolation.

While the data hint strongly toward a link between value and momentum and macroeconomic and liquidity risks, much is left to be explained. Mispricing due to limited arbitrage in light of liquidity risk may also contribute to the prevalence of these phenomena, or a risk we have yet to include in a our study. Indeed, we find some intriguing dynamic patterns of value and momentum during liquidity events that may help provide the ingredients for an explanation of their underlying drivers. We speculate that part of the return to value might be that value assets are "cheap," even after adjusting for liquidity and macro risk, while growth assets are "expensive," and these mispricings may persist due to the trading costs and liquidity risks arbitrageurs face. Similarly, momentum returns could be partly due to under-reaction to news. Consistent with this story, arbitrageurs tend to load positively on value and momentum on average, and when liquidity is poor and arbitrageurs may be expected to reduce their position sizes, value performs poorly – consistent with the cheap assets getting cheaper – and momentum performs well – consistent with greater underreaction. Further investigation is required to corroborate or refute this story. At this point, we leave the ubiquitous evidence on the efficacy of value and momentum everywhere, its strong correlation structure, and intriguing dynamics as a challenge for future theory and empirical tests.

Our unified approach of examining value and momentum everywhere simultaneously may be helpful in future studies of asset pricing by helping to reduce noise and better identify common structure. However, the unified setting also highlights the large diversification benefits across assets and markets that generate economically potent strategies that raise the bar for any theory to accommodate.

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Appendix A: Current versus Lagged Measures of Value

We compare the performance and correlations of our value and momentum strategies that use current value measures to those that use lagged value measures.

A.1 Comparison to Fama and French Portfolios in U.S. Equities

We first compare the performance of our US equity value and momentum strategies (and 50-50 combo) to those of Fama and French. Panel A of Table A1 reports the Sharpe ratios of the Fama-French value (HML) and momentum (UMD) strategies, our (AMP) dollar long-short and constant volatility value and momentum strategies using both current and lagged measures of value, and the correlation between our portfolios and Fama-French's. The Sharpe ratios are similar, though our value portfolios do not perform as well as HML over the same period when we use current value. The correlations are all 0.74 or higher. We also report the same statistics for the 50/50 combination of value and momentum, which again is consistent with a 50/50 combo of HML and UMD.

The last column of Panel A of Table A1 reports the correlation between value and momentum for Fama and French and the AMP portfolios. Our correlations are much more negative than those for the Fama-French portfolios. The main driver for this difference is that we employ the most recent *BM* ratio we have by using the most recent 6-month lagged book value number and allowing the denominator (market value) to be updated every month, whereas Fama and French induce an additional 13-24 months lag in their book value measure (using the fiscal year end prior to June in the previous year) and only update the market value once a year, using the value from December of the year prior to the most recent June (which could be contemporaneous with the book value, depending on fiscal year for that company). This procedure makes our value portfolios more negatively correlated with momentum since, if a security has experienced an increase in value over the previous 12 months, its momentum characteristic increases and its value characteristic decreases. Fama and French essentially skip the most recent year's history of returns in forming their value measure, thus making HML more neutral to momentum. For this reason, our value portfolios are both more negatively correlated to momentum and exhibit lower Sharpe ratios (since they "fight" momentum). Employing a lag in our *BM* ratios similar to Fama and French by skipping an extra year we get much closer to the returns of Fama and French. However, the combination of value and momentum is relatively unaffected by lagging or not lagging, since whatever is gained in terms of Sharpe ratio for value, is offset by the less negative correlation to momentum.

Panel B of Table A1 reports time-series regression estimates of our constant volatility value and momentum portfolios on the four factor Fama and French model consisting of RMRF, SMB, HML, and UMD. The Fama and French factors explain 68-75% of the variation in our zero-cost portfolio returns. Our value portfolio provides a small, but insignificant intercept relative to the Fama and French four factor model, but our momentum and combination portfolios provide positive and significant alphas (not too surprising as Fama and French use value-weight portfolios which we believe is very conservative). Our value (momentum) portfolio also loads heavily on HML (UMD). Most telling, our current value portfolio loads heavily on HML but must then short Fama and French's UMD (UMD beta = -0.27 with a t-stat = -12.69) to restore it's "pure value" nature, whereas our lagged value portfolio is neutral to momentum (UMD beta = 0). Turning this regression around and regressing Fama and French's portfolios on our current value and momentum portfolios in Panel C of Table A1, we find that HML loads about 70/30 positively on value and momentum. By lagging their values in an effort to be conservative, Fama and French create a value portfolio that avoids being short momentum! To recreate Fama and French's value portfolio out of AMP's portfolios you need to go long our "current value" portfolio and long our momentum portfolio.

A.2 Performance and Correlation Using Lagged Value Measures

Table A2 replicates Table 2 in the paper regarding performance of our constant volatility portfolios using lagged measures of value across all of the asset classes. Each value measure used to construct portfolios in Table 2 is lagged by an additional year and the resulting performance results are reported in Table A2. Not surprisingly, Table A2 shows that the overall performance of value strategies improves, because they no longer short the profitable momentum strategy, and the within asset class correlations between value and momentum are much closer to zero and even positive in some cases. However, the combination portfolios of value and momentum are very similar to those obtained in Table 2, but exhibit slightly weaker performance. This result again highlights the tradeoff between improving value's stand alone Sharpe ratio versus benefiting from the larger negative correlation with momentum, but also suggests that some additional information is gained from using current value because the combo portfolios' Sharpe ratios are consistently better in Table 2 (using current value measures).

Table A3 replicates the results from Table 4 in the paper on the cross-correlations of value and momentum across markets and asset classes using lagged value measures. Table A3 shows two important facts. First, value in one market or asset class is still correlated with value in another market or asset class when using a lagged measure, but the correlation is weaker that it is for current value measures (Table 4). This result suggests that the current value strategies contain a larger common component among them than the lagged value strategies. Second, the negative correlation between value and momentum in different markets and asset classes is still there, but it is much weaker when using lagged value measures.

Table A1:
Comparison to Fama-French Portfolios (02/1973-02/2008)

Panel A reports the annualized Sharpe ratios of the US Value, Momentum, and 50/50 value/momentum Combo portfolios of Fama and French (obtained from Ken French's website and corresponding to HML, UMD, and an equal-weighted combination of HML and UMD), our (denoted AMP) dollar long-short portfolios, and our ex ante constant volatility scaled portfolios over the common period 02/1973 to 02/2008. We report two versions of our value portfolios: one that uses the most recent quarterly book values and most recent monthly market values, and one that uses an additional one year lag in the book-to-market ratio similar to Fama and French's construction of HML. Also reported in Panel A are the correlations between each value and momentum strategy as well as the correlations between our strategies and those of Fama and French. Panel B reports time-series regression coefficients and t-statistics of our constant volatility portfolios on the Fama-French portfolios/factors RMRF, SMB, HML, and UMD. Panel C reports the time-series regression results of the Fama-French portfolios HML and UMD (and their equal-weighted combination) on our value and momentum portfolios. The intercepts are reported in annualized percent. The R-squares from the regressions are reported at the bottom of each panel.

Panel A: Sharpe ratio comparison

	Value	Momentum	Combo	Corr(Val, Mom)
Fama-French	**0.54**	**0.69**	**0.92**	**-0.11**
Using most recent value measure available:				
AMP ($1 long-short)	**0.37**	**0.63**	**1.03**	**-0.55**
Correlation with FF	0.79	0.92	0.89	
AMP (constant volatility)	**0.21**	**0.78**	**1.13**	**-0.60**
Correlation with FF	0.74	0.85	0.84	
Using value measure lagged an additional year:				
AMP ($1 long-short)	**0.57**	**0.63**	**0.82**	**-0.06**
Correlation with FF	0.88	0.92	0.92	
AMP (constant volatility)	**0.41**	**0.78**	**0.92**	**-0.26**
Correlation with FF	0.86	0.85	0.82	

Panel B: Regression of AMP (constant volatility) on Fama-French portfolios

Dependent variable =	AMP Value	AMP Value (lag)	AMP Momentum	AMP Combo
Coefficient				
Intercept	1.80%	0.84%	2.16%	4.08%
RMRF	-0.10	-0.09	0.06	-0.05
SMB	0.03	-0.01	0.04	0.09
HML	0.63	0.83	-0.07	0.63
UMD	-0.27	0.00	0.61	0.46
t-statistic				
Intercept	1.66	0.82	2.18	4.12
RMRF	-4.63	-4.51	3.00	-2.40
SMB	1.11	-0.28	1.69	3.51
HML	19.27	27.99	-2.29	21.28
UMD	-12.69	0.06	31.20	23.80
R-square	68.0%	75.4%	72.7%	72.7%

Panel C: Regression of Fama-French portfolios on AMP portfolios

Dependent variable =	HML	UMD	HML+UMD
Coefficient			
Intercept	0.60%	-0.96%	-0.24%
AMP Value	0.95	0.17	0.56
AMP Momentum	0.36	1.27	0.81
t-statistic			
Intercept	0.50	-0.70	-0.21
AMP Value	25.67	3.89	19.68
AMP Momentum	9.66	28.62	28.44
R-square	63.0%	72.4%	66.3%

Table A2:
Replication of Table 2 Using Additionally Lagged Value Measures

Reported are results from the replication of Table 2 using value measures that are lagged by an additional year before portfolio formation.

	Value SR (t-stat)	Momentum SR (t-stat)	Combo SR (t-stat)	Cor(val,mom)
Panel A: Stock Selection				
U.S.	0.41	0.78	0.92	-0.26
03/73-02/08	(2.42)	(4.60)	(5.46)	
U.K.	0.80	1.26	1.57	-0.28
12/84-02/08	(3.84)	(6.08)	(7.55)	
Japan	0.86	0.23	0.92	0.03
02/85-02/08	(4.12)	(1.09)	(4.41)	
Continental Europe	1.08	1.12	1.69	0.02
02/88-02/08	(4.85)	(4.89)	(7.38)	
Global stock selection	**1.01**	**1.18**	**1.98**	**-0.29**
02/88-02/08	**(4.54)**	**(5.28)**	**(8.88)**	
Panel B: Non-Stock Selection				
Equity country selection	0.84	0.68	0.94	0.22
02/80-02/08	(4.47)	(3.62)	(4.99)	
Bond country selection	0.26	0.41	0.40	0.22
01/90-02/08	(1.13)	(1.73)	(1.69)	
Currency selection	0.57	0.45	0.56	-0.02
08/80-02/08	(3.02)	(2.35)	(2.95)	
Commodity selection	0.48	0.58	0.73	0.06
02/80-02/08	(2.57)	(3.05)	(3.85)	
All non-stock selection	**0.86**	**0.96**	**1.15**	**0.09**
01/90-02/08	**(3.67)**	**(4.09)**	**(4.90)**	
All asset selection	**1.21**	**1.22**	**1.84**	**-0.05**
01/90-02/08	**(5.16)**	**(5.21)**	**(7.82)**	

Table A3:
Replication of Table 4 Using Additionally Lagged Value Measures

Reported are results from the replication of Table 4 using value measures that are lagged by an additional year before portfolio formation.

Panel A: Average of individual correlations

	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				**Quarterly return correlations**			
Stock selection, value	0.32*	0.02	-0.13*	-0.02	0.44*	0.04	-0.18*	-0.05
Non-stock selection, value		0.02	-0.01	-0.03		0.03	-0.04	-0.04
Stock selection, momentum			0.36*	0.21*			0.50*	0.22*
Non-stock selection, momentum				0.15*				0.18*

Panel B: 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				**Quarterly return correlations**			
Stock selection, value	1.00	0.16*	-0.29*	-0.02	1.00	0.23*	-0.39*	-0.03
Non-stock selection, value		1.00	-0.08	-0.09		1.00	-0.14*	-0.18*
Stock selection, momentum			1.00	0.47*			1.00	0.69*
Non-stock selection, momentum				1.00				1.00

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

Figure 1: Performance of value and momentum strategies for stock selection globally

Plotted are the cumulative returns to value, momentum, and a 50-50 combination of value and momentum strategies among individual stocks in four markets: US, UK, Japan, and Continental Europe. Also reported on each figure are the annualized Sharpe ratios of each strategy and the correlation between value and momentum in each market.

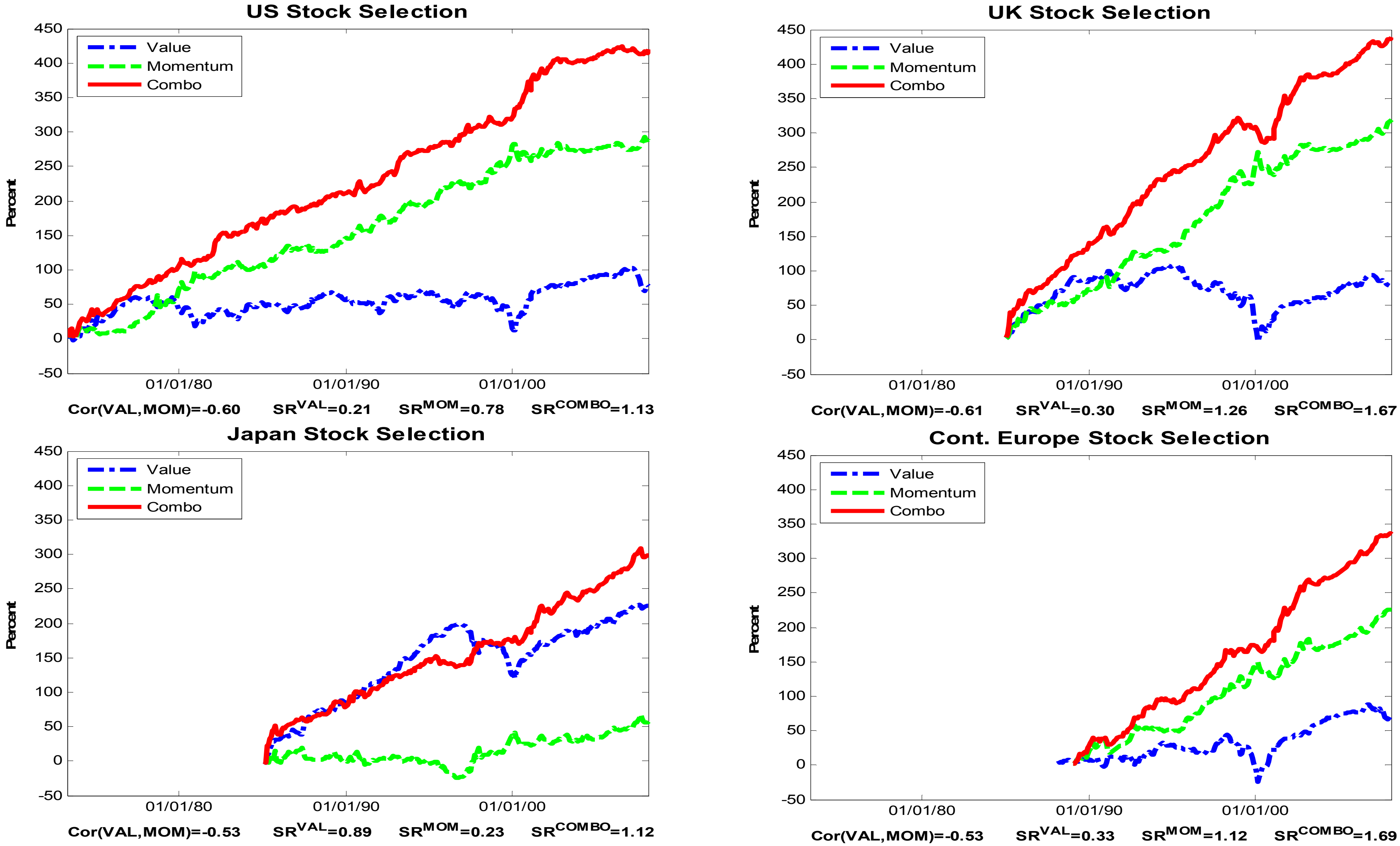


Figure 2: Performance of value and momentum strategies for non-stock selection

Plotted are the cumulative returns to value, momentum, and a 50-50 combination of value and momentum strategies among a cross-section of assets in four different asset classes: Country equity index futures, country bonds, currencies, and commodities. Also reported on each figure are the annualized Sharpe ratios of each strategy and the correlation between value and momentum in each asset class.

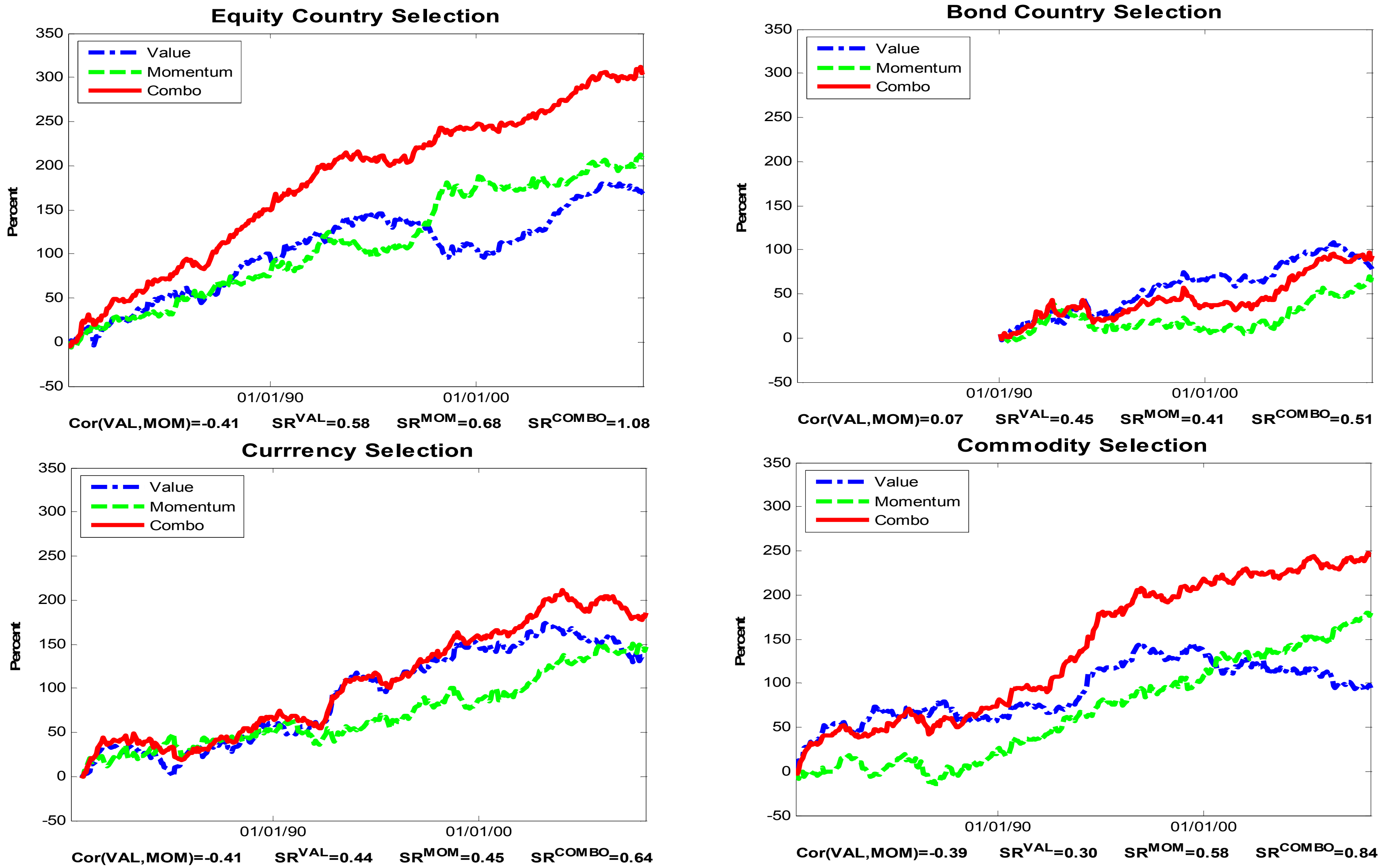


Figure 3: Performance of value and momentum strategies everywhere – combining markets and asset classes

Plotted are the cumulative returns to value, momentum, and a 50-50 combination of value and momentum strategies for the equal-weighted combination of all stock selection strategies, all non-stock selection strategies, and an equal-weighted combination of both. Also reported on each figure are the annualized Sharpe ratios of each strategy and the correlation between value and momentum.

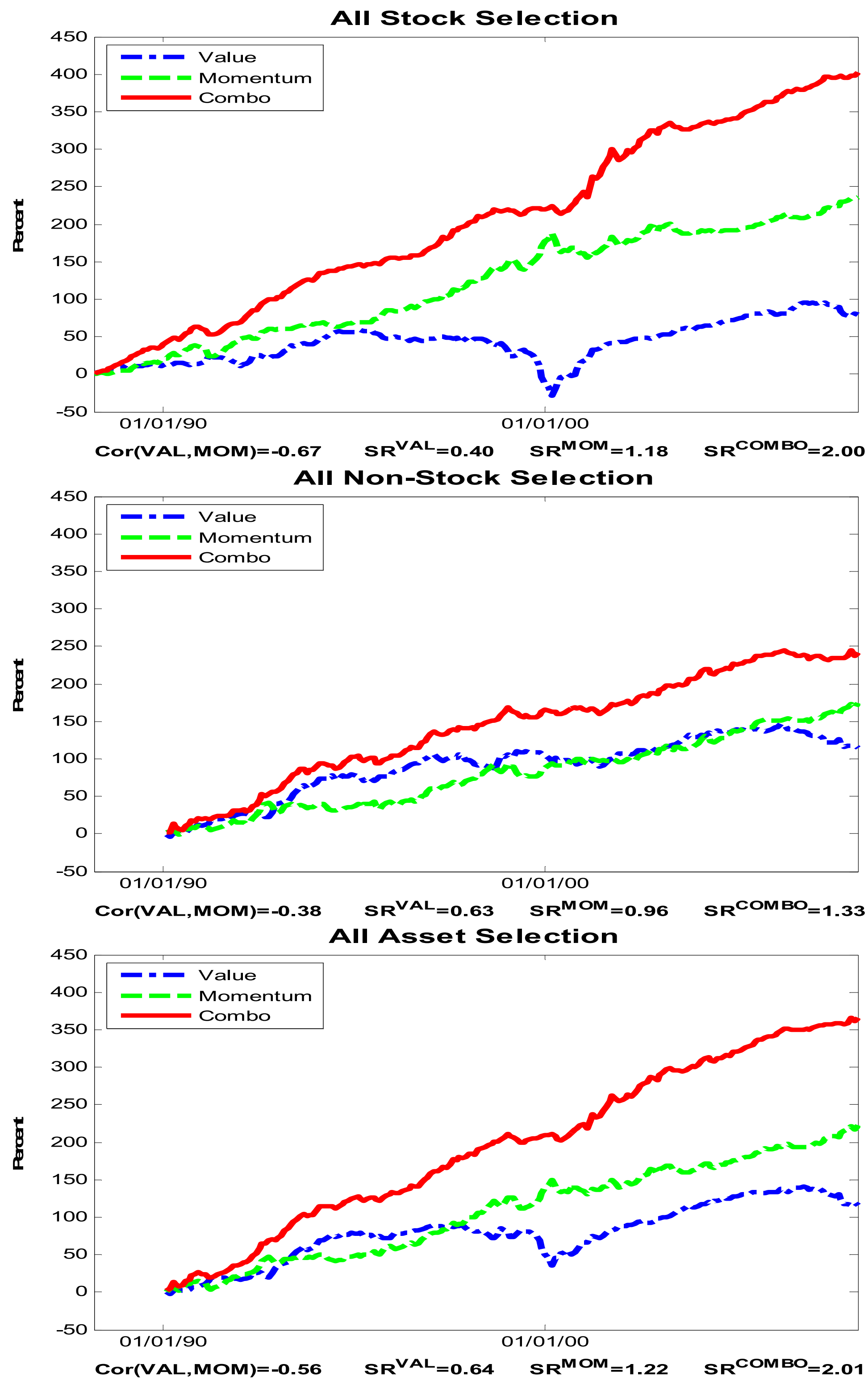
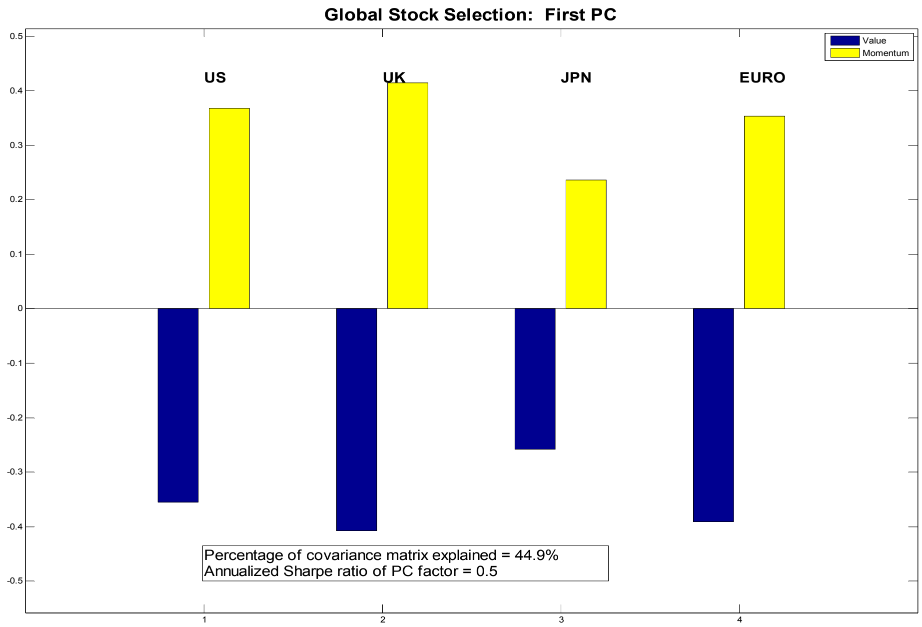


Figure 4: First principal component for value and momentum strategies

Plotted are the eigenvector values associated with the largest eigenvalue of the covariance matrix of returns to value and momentum in stock selection in four markets: US, UK, Japan, and Continental Europe (top graph) and in all asset selection in five asset classes: overall stock selection, country equity indices, country bonds, currencies, and commodities (bottom graph). Also reported on each figure are the percentage of the covariance matrix explained by the first principal component and the annualized Sharpe ratio of the returns to the portfolio of the assets constructed from the principal component weights.



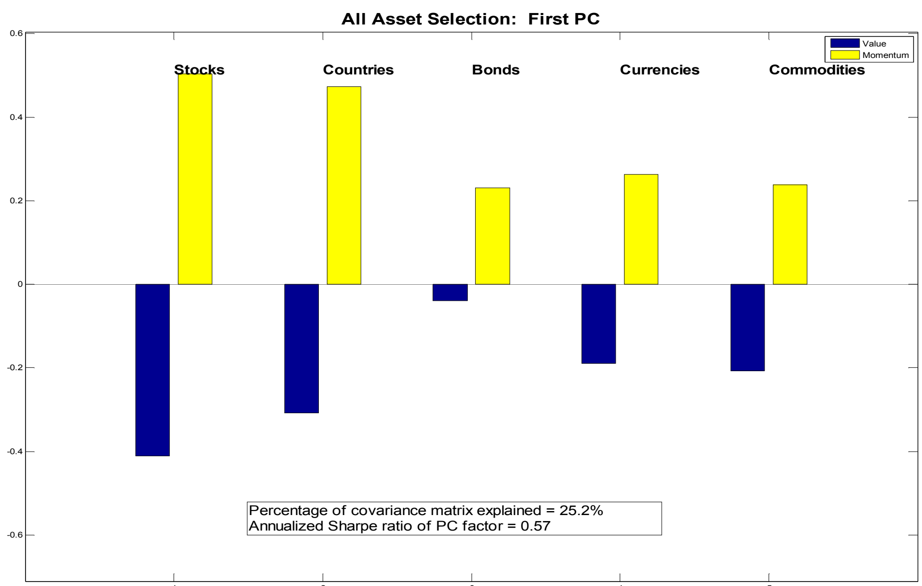


Figure 5: T-stats of Liquidity Risk Betas

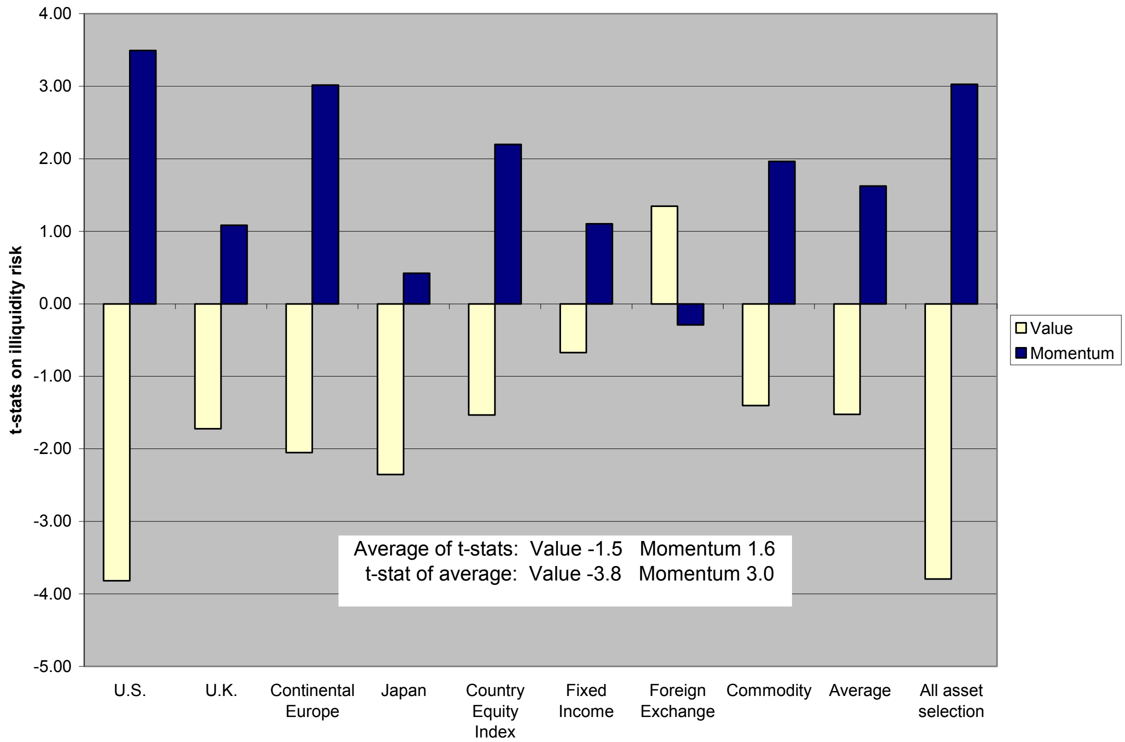


Figure 6: T-stats of Long-Run Consumption Risk Betas

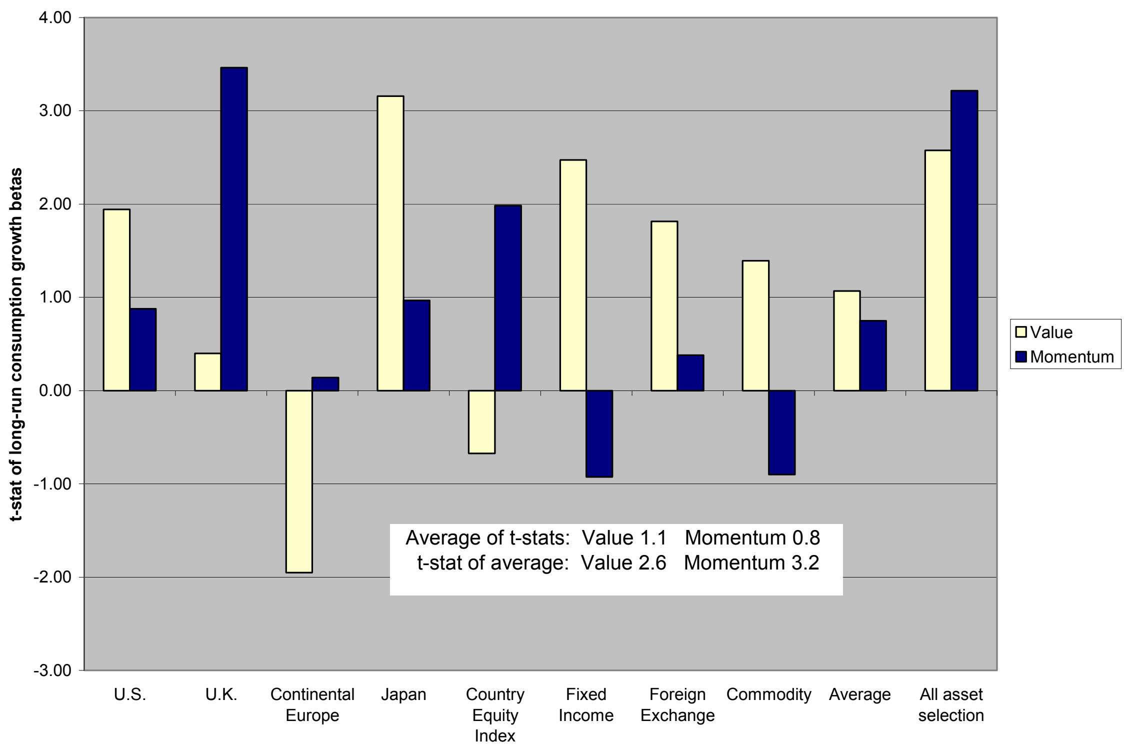


Table 1:
Performance of Value and Momentum Strategies Across Markets and Asset Classes

Reported are the annualized mean, t-stat (in parentheses), volatility, and Sharpe ratio of returns of value strategies, momentum strategies, and a 50/50 combination strategy of value and momentum in various markets and asset classes. Each strategy is scaled to be $1 long and $1 short. The time-series correlation between the value and momentum strategies in each market/asset class is also reported. The last column reports the average number of securities in each long-short portfolio. Statistics are computed from monthly return series but are reported as annualized numbers.

	Value	Momentum	Combo	Cor(val,mom)	Avg. # securities
Panel A: Stock Selection					
U.S. 02/73-02/08					
mean	5.0%	10.3%	11.4%	-0.55	1,367
(t-stat)	(2.04)	(3.77)	(6.30)		
volatility	14.5%	16.2%	10.8%		
Sharpe	0.34	0.64	1.06		
U.K. 12/84-02/08					
mean	4.8%	13.5%	14.1%	-0.59	486
(t-stat)	(1.75)	(4.42)	(7.46)		
volatility	13.2%	14.7%	9.1%		
Sharpe	0.36	0.92	1.55		
Japan 01/85-02/08					
mean	11.6%	3.5%	11.8%	-0.58	947
(t-stat)	(4.27)	(1.06)	(5.62)		
volatility	13.1%	16.0%	10.1%		
Sharpe	0.89	0.22	1.17		
Continental Europe 02/88-02/08					
mean	5.3%	12.1%	13.3%	-0.44	1,096
(t-stat)	(2.34)	(4.29)	(7.00)		
volatility	10.1%	12.3%	8.3%		
Sharpe	0.52	0.98	1.60		
Panel B: Non-Stock Selection					
Equity country selection 02/80-02/08					
mean	5.0%	5.1%	8.6%	-0.25	18
(t-stat)	(2.40)	(2.16)	(3.56)		
volatility	11.0%	12.5%	12.9%		
Sharpe	0.45	0.41	0.67		
Bond country selection 01/90-02/08					
mean	0.9%	-0.1%	0.6%	-0.14	10
(t-stat)	(1.41)	(-0.10)	(0.95)		
volatility	2.7%	2.6%	2.6%		
Sharpe	0.33	-0.02	0.22		
Currency selection 08/80-02/08					
mean	0.8%	4.2%	4.4%	-0.48	10
(t-stat)	(0.48)	(2.27)	(2.53)		
volatility	9.3%	9.7%	9.1%		
Sharpe	0.09	0.43	0.48		
Commodity selection 02/80-02/08					
mean	9.3%	6.0%	6.0%	-0.38	27
(t-stat)	(1.77)	(1.18)	(2.44)		
volatility	27.7%	27.0%	12.9%		
Sharpe	0.33	0.22	0.46		

Table 2:
Performance of Value and Momentum Strategies Scaled to Constant Volatility

Reported are the annualized Sharpe ratio of value strategies, momentum strategies, and a 50/50 combination strategy of value and momentum in various markets and asset classes. Each strategy is scaled to an ex ante 10% annual volatility using an estimated covariance matrix from the past 3 years of monthly returns for stocks and weekly returns for other asset classes. A t-statistic (in parenthesis) for whether the mean return of each strategy is different from zero is also reported as well as the time-series correlation between the value and momentum strategies in each market/asset class. The "all" strategies are a simple equal-weighted combination of the individual strategies across markets and/or asset classes, rescaled to 10% annual volatility ex post.

	Value SR (t-stat)	**Momentum SR (t-stat)**	**Combo SR (t-stat)**	**Cor(val,mom)**
Panel A: Stock Selection				
U.S.	0.21	0.78	1.13	-0.60
03/73-02/08	(1.23)	(4.60)	(6.69)	
U.K.	0.30	1.26	1.67	-0.61
12/84-02/08	(1.43)	(6.08)	(8.05)	
Japan	0.89	0.23	1.12	-0.53
02/85-02/08	(4.28)	(1.09)	(5.41)	
Continental Europe	0.33	1.12	1.69	-0.53
02/88-02/08	(1.49)	(4.89)	(7.41)	
Global stock selection	**0.40**	**1.18**	**2.00**	**-0.67**
02/88-02/08	**(1.78)**	**(5.28)**	**(8.97)**	
Panel B: Non-Stock Selection				
Equity country selection	0.58	0.68	1.08	-0.41
02/80-02/08	(3.08)	(3.62)	(5.70)	
Bond country selection	0.45	0.41	0.51	0.07
01/90-02/08	(1.92)	(1.73)	(2.19)	
Currency selection	0.44	0.45	0.64	-0.41
08/80-02/08	(2.30)	(2.35)	(3.38)	
Commodity selection	0.30	0.58	0.84	-0.39
02/80-02/08	(1.60)	(3.05)	(4.44)	
All non-stock selection	**0.63**	**0.96**	**1.33**	**-0.38**
01/90-02/08	**(2.67)**	**(4.09)**	**(5.67)**	
All asset selection	**0.64**	**1.22**	**2.01**	**-0.56**
01/90-02/08	**(2.73)**	**(5.21)**	**(8.58)**	

Table 3:
Alphas with Respect to Local and Global CAPM

Reported are the intercept (alpha) and slope coefficient (beta) and their *t*-statistics (in parentheses) from a time-series regression of each value, momentum, and 50/50 val/mom combination strategy in each market and asset class, as well as the average across markets and asset classes ("all" strategies) on the MSCI world equity index.

	Annual Alpha and Beta to Global Equities					
	Value		**Momentum**		**Combo**	
	alpha (t-stat)	**beta (t-stat)**	**alpha (t-stat)**	**beta (t-stat)**	**alpha (t-stat)**	**beta (t-stat)**
U.S. stock selection	2.95%	-0.22	8.05%	0.03	12.54%	-0.22
03/73-02/08	(1.71)	(-6.42)	(4.47)	(0.84)	(7.30)	(-6.37)
U.K. stock selection	3.23%	0.02	14.12%	-0.07	19.29%	-0.08
12/84-02/08	(1.36)	(0.43)	(6.19)	(-1.46)	(8.16)	(-1.64)
JP stock selection	10.23%	-0.07	2.53%	-0.01	13.56%	-0.10
02/85-02/08	(4.45)	(-1.52)	(1.11)	(-0.26)	(5.65)	(-2.04)
Cont. Europe stock selection	3.58%	-0.02	12.24%	-0.12	18.08%	-0.13
02/88-02/08	(1.51)	(-0.44)	(5.11)	(-2.37)	(7.70)	(-2.74)
All stock selection	4.39%	-0.10	12.03%	-0.09	20.81%	-0.23
02/88-02/08	(1.97)	(-2.08)	(5.38)	(-1.89)	(9.75)	(-5.17)
Equity country selection	6.44%	-0.08	7.27%	0.04	10.98%	-0.02
02/80-02/08	(3.31)	(-2.12)	(3.46)	(1.03)	(5.70)	(-0.47)
Bond country selection	4.02%	0.13	3.56%	0.02	4.67%	0.07
01/90-02/08	(1.81)	(2.85)	(1.56)	(0.38)	(1.99)	(1.51)
Currency selection	(0.05)	0.00	5.36%	-0.03	6.72%	-0.03
08/80-02/08	(2.30)	(0.05)	(2.35)	(-0.75)	(3.36)	(-0.70)
Commodity selection	3.39%	0.02	6.37%	-0.01	8.68%	0.02
02/80-02/08	(1.59)	(0.58)	(3.00)	(-0.29)	(4.37)	(0.47)
All non-stock selection	6.32%	0.05	9.38%	-0.03	13.12%	0.00
01/90-02/08	(2.69)	(1.10)	(4.00)	(-0.60)	(5.56)	(-0.10)
All asset selection	6.69%	-0.04	12.24%	-0.07	20.48%	-0.16
01/90-02/08	(2.84)	(-0.72)	(5.22)	(-1.49)	(8.88)	(-3.28)

Table 4:
Average Correlation of Value and Momentum Across Markets and Asset Classes

Reported are the average correlations among all value and momentum strategies across markets and asset classes. Panel A reports the average of the individual correlations, where we first compute the correlation of all individual strategies (e.g., US Value with JPN Value) and then take the average for each group (e.g., stock selection value versus non-stock selection value). Panel B reports the correlations of the averages, where we first take the average return series for a group (e.g., stock selection value, which is an equal-weighted index of all the stock selection value strategies) and then compute the correlation between the two average return series. Both panels exclude the correlation of each strategy with itself (e.g., removing the 1's) and exclude the correlation of each strategy with all other strategies within the same market (e.g., exclude US momentum when examining US value's correlation with other strategies). Panel C breaks down the correlations of the average stock selection series with each of the non-stock selection series. Both monthly and quarterly return correlations are reported for each panel.

Panel A: Average of individual correlations

	Monthly return correlations				Quarterly return correlations			
	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
Stock selection, value	0.38*	0.09	-0.26*	-0.11	0.56*	0.12	-0.43*	-0.16*
Non-stock selection, value		0.07	-0.10	-0.06		0.10	-0.15	-0.07
Stock selection, momentum			0.36*	0.21*			0.50*	0.22*
Non-stock selection, momentum				0.15*				0.18*

Panel B: Correlation of average return series

	Monthly return correlations				Quarterly return correlations			
	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
Stock selection, value	1.00	0.17*	-0.67*	-0.22*	1.00	0.30*	-0.83*	-0.40*
Non-stock selection, value		1.00	-0.19*	-0.38*		1.00	-0.29*	-0.56*
Stock selection, momentum			1.00	0.47*			1.00	0.69*
Non-stock selection, momentum				1.00				1.00

Panel C: Correlation of average stock selection with each non-stock strategy

	Country Selection value	Fixed Income value	Foreign Exchange value	Commodity value	Country Selection momentum	Fixed Income momentum	Foreign Exchange momentum	Commodity momentum
Monthly return correlations								
All stock selection, value	0.24*	0.05	0.06	0.04	-0.29*	-0.04	-0.07	-0.10
All stock selection, momentum	-0.19*	-0.03	-0.07	-0.13*	0.50*	0.18*	0.23*	0.19*
Quarterly return correlations								
All stock selection, value	0.40*	0.09	0.08	0.04	-0.46*	-0.04	-0.10	-0.16*
All stock selection, momentum	-0.34*	-0.05	-0.11*	-0.18*	0.69*	0.29*	0.38*	0.30*

*Indicates significantly different from zero at the 5% significance level.

Table 5:
Time-Series Tests of Value and Momentum Strategies Everywhere

Reported are the coefficient estimates, t-statistics, and R-squares from time-series regressions of each value, momentum, and 50-50 value/momentum combo portfolio in every market and asset class on a two-factor model consisting of the average value strategy in every other market and asset class and the average momentum strategy in every other market and asset class, where the average value and momentum strategies everywhere else always excludes the value and momentum strategies from the region or asset class being used as the dependent variable. Hence, the benchmarks vary for each strategy being used as the dependent variable. For example, when examining the US value strategy as the dependent variable, we exclude the US value strategy from the value benchmark and exclude the US momentum strategy from the momentum benchmark. The average value (momentum) benchmark elsewhere is the equal-weighted average of all other value (momentum) strategies in all other markets and asset classes. Also reported are the average coefficient values across the stock and non-stock selection strategies as well as the coefficient estimates for the average return series for stock and non-stock selection, which is an equal-weighted return series across the individual strategies in each group. Intercept values are annualized in percent per year. Regressions are estimated from monthly returns.

	Coefficient estimate			*t*-statistic			
	intercept	Value elsewhere	Momentum elsewhere	intercept	Value elsewhere	Momentum elsewhere	R-square
U.S. value	0.00%	0.59	-0.14	0.02	3.70	-0.98	11.4%
U.K. value	-2.28%	1.01	-0.32	-0.89	6.78	-2.50	30.9%
Japan value	6.24%	0.56	0.00	2.18	3.54	0.03	7.9%
Continental Europe value	1.68%	1.08	-0.24	0.71	7.69	-1.98	35.4%
Equity country selection value	3.60%	0.38	-0.11	1.37	2.65	-0.84	6.8%
Bond country selection value	2.40%	0.28	0.13	0.89	1.95	1.05	1.8%
Currency selection value	4.44%	0.17	-0.08	1.47	1.05	-0.59	1.6%
Commodity selection value	5.04%	-0.15	-0.36	1.73	-1.00	-2.62	3.2%
Average of stock selection value	1.41%	0.81	-0.17	0.50	5.43	-1.36	21.4%
Global stock selection value	**4.92%**	**0.10**	**-0.19**	**1.68**	**1.31**	**-2.31**	**5.5%**
Average on non-stock selection value	3.87%	0.17	-0.11	1.37	1.16	-0.75	3.3%
All non-stock selection value	**7.68%**	**0.06**	**-0.14**	**2.57**	**0.76**	**-1.60**	**4.0%**
U.S. momentum	2.64%	-0.12	0.75	0.97	-0.78	5.64	20.3%
U.K. momentum	8.88%	-0.43	0.94	3.74	-3.13	8.05	39.2%
Japan momentum	0.60%	-0.14	0.35	0.23	-0.92	2.79	7.5%
Continental Europe momentum	3.60%	-0.07	1.11	1.64	-0.51	9.95	41.8%
Equity country selection momentum	-0.12%	-0.02	0.98	-0.03	-0.14	7.45	28.6%
Bond country selection momentum	-0.48%	0.17	0.48	-0.16	1.21	3.75	7.1%
Currency selection momentum	0.96%	0.12	0.50	0.30	0.73	3.48	6.5%
Commodity selection momentum	5.52%	0.07	0.37	1.93	0.45	2.79	4.3%
Average of stock selection momentum	3.93%	-0.19	0.79	1.65	-1.34	6.61	27.2%
Global stock selection momentum	**7.20%**	**-0.01**	**0.49**	**2.72**	**-0.21**	**6.65**	**22.4%**
Average of non-stock selection momentum	1.47%	0.08	0.58	0.51	0.56	4.37	11.6%
All non-stock selection momentum	**2.16%**	**0.17**	**0.57**	**0.85**	**2.20**	**6.87**	**24.2%**
U.S. combo	5.28%	0.22	0.72	1.81	1.39	5.06	11.8%
U.K. combo	7.68%	0.57	0.96	2.96	3.77	7.46	20.6%
Japan combo	6.84%	0.35	0.52	2.55	2.31	4.09	7.2%
Continental Europe combo	7.44%	0.66	1.05	3.05	4.53	8.51	25.2%
Equity country selection combo	2.52%	0.26	0.69	0.98	1.91	5.39	12.8%
Bond country selection combo	0.12%	0.37	0.48	0.05	2.49	3.65	5.9%
Currency selection combo	2.88%	0.29	0.35	1.08	2.05	2.73	3.5%
Commodity selection combo	9.12%	-0.13	0.05	3.26	-0.89	0.40	0.9%
Average of stock selection combo	6.81%	0.45	0.81	2.59	3.00	6.28	16.2%
Global stock selection combo	**15.36%**	**0.05**	**0.44**	**6.53**	**0.80**	**6.96**	**16.5%**
Average of non-stock selection combo	3.66%	0.20	0.39	1.34	1.39	3.05	5.7%
All non-stock selection combo	**7.20%**	**0.22**	**0.44**	**3.00**	**2.90**	**6.25**	**12.4%**

Table 6:
Macroeconomic and Liquidity Risk Exposures

Reported are results (coefficient estimates and t-statistics in parentheses) from time-series regressions of the average value and momentum portfolio among all stock selection strategies globally, all non-stock selection strategies, and among all strategies in stock and non-stock selection, where strategies are equal-weighted within each of these groups, on various measures of macroeconomic and liquidity risks. The last two columns also report results for the return difference between value and momentum and their combination (sum). Panel A reports results from multivariate regressions of the value and momentum returns on the US Eurodollar minus US Treasury bill spread ("TED spread"), a measure of global long-run consumption growth, which is the three year future growth rate in per capita nondurable real consumption (quarterly) averaged across the US, UK, Japan, and Continental Europe, and a global recession variable, which is a linearly interpolated value between 0 and 1 between peak and troughs (0 = peak, 1 = trough) averaged across the US, UK, Japan, and Continental Europe, and the MSCI world equity index excess return. The macroeconomic variables are derived from data from NIPA and the NBER in the US and from the Economic Cycle Research Institute outside of the US. Panel B repeats the regressions from Panel A using alternative liquidity risk measures in place of the US TED spread: US LIBOR minus term repo rate, a global version of the TED spread, which is an equal-weighted averages of these rates across the US, UK, Japan, and Europe, an illiquidity index, which is the first principal component weighted average of all the global TED spreads and LIBOR minus term repo rates, the changes in these last two variables, and the returns of a long-short portfolio of the most liquid securities in each region (top half based on market cap) minus least liquid securities (bottom half based on market cap). The other macroeconomic variables are also included in the regressions in Panel B, but not reported for brevity. The intercepts from all regressions are not reported for brevity.

	Global Stock Selection		All Non-Stock Selection		All Asset Selection			
Dependent variable =	**Value**	**Momentum**	**Value**	**Momentum**	**Value**	**Momentum**	**Mom - Val**	**Combo**
Panel A: Multivariate regression results on macroeconomic and liquidity risk factors								
Long-run consumption growth	0.011	0.060	0.078	0.045	0.057	0.060	**0.003**	**0.122**
	(0.40)	(2.48)	(2.57)	(1.58)	(2.46)	(2.42)	**(0.07)**	**(6.07)**
Global recession	-0.012	-0.037	-0.006	-0.027	-0.012	-0.036	**-0.025**	**-0.057**
	(-0.68)	(-2.86)	(-0.53)	(-1.30)	(-0.89)	(-2.27)	**(-1.17)**	**(-2.74)**
Market excess return	-0.195	-0.058	0.105	-0.049	-0.058	-0.061	**-0.003**	**-0.160**
	(-2.80)	(-0.44)	(2.14)	(-0.76)	(-1.00)	(-0.56)	**(-0.02)**	**(-1.15)**
US TED spread	-0.033	0.027	-0.008	0.008	-0.026	0.020	**0.046**	**0.006**
	(-4.04)	(4.32)	(-0.76)	(1.49)	(-3.19)	(3.81)	**(3.64)**	**(1.50)**
R-square	21.2%	6.3%	5.5%	1.9%	9.8%	4.8%	6.0%	12.6%
Panel B: Alternative liquidity risk measures								
US Libor - term repo	-0.025	0.014	-0.017	0.011	-0.027	0.014	**0.041**	**-0.006**
	(-1.58)	(1.48)	(-2.57)	(1.52)	(-2.23)	(1.70)	**(2.20)**	**(-0.70)**
Global TED spread	-0.090	0.073	-0.017	0.021	-0.068	0.054	**0.122**	**0.017**
	(-3.61)	(3.18)	(-1.07)	(1.43)	(-3.64)	(2.83)	**(3.44)**	**(1.52)**
ΔGlobal TED spread	-0.053	0.057	0.024	0.030	-0.018	0.049	**0.068**	**0.033**
	(-2.48)	(2.48)	(1.56)	(1.30)	(-0.85)	(1.96)	**(1.56)**	**(1.98)**
Illiquidity index	-0.031	0.026	-0.009	0.012	-0.026	0.022	**0.047**	**0.008**
	(-2.70)	(2.63)	(-1.50)	(2.51)	(-3.17)	(2.74)	**(3.03)**	**(1.95)**
ΔIlliquidity index	-0.022	0.026	0.006	0.015	-0.010	0.023	**0.033**	**0.015**
	(-2.74)	(2.46)	(1.07)	(1.89)	(-1.35)	(2.35)	**(2.08)**	**(2.06)**
Liquid-Illiquid passive returns	-0.121	0.308	-0.098	0.144	-0.141	0.258	**0.398**	**0.206**
	(-1.55)	(2.79)	(-1.11)	(1.44)	(-2.17)	(2.36)	**(2.79)**	**(1.66)**

Table 7:
Dynamics of Value and Momentum

Reported are Sharpe ratios and correlations among the value, momentum, and value/momentum combination strategies during different macroeconomic and liquidity environments. We report the Sharpe ratio and correlations among the strategies for the first half and second half of our sample period (1990 to 1999 and 2000 to 2008, respectively), for the 25% of observations around business cycle troughs and peaks, based on our global recession variable, for the 25% lowest and highest future consumption growth states, based on global long-run consumption growth, and for the 25% lowest and highest liquidity months based on monthly realizations of the global TED spread. Panel A reports results on average for the stock selection strategies globally and Panel B for the non-stock selection strategies.

	Sharpe ratios			Average correlations, ρ			
	Value	Momentum	Combo	ρ(val,val)	ρ(mom,mom)	ρ(val,mom)	ρ(combo,combo)
Panel A: Stock selection strategies							
1990-1999	0.68	1.58	2.67	0.10	0.19	-0.25	0.11
2000-2008	0.27	0.95	1.65	0.55	0.49	-0.42	0.43
Near trough of business cycle	-0.28	0.87	1.37	0.43	0.34	-0.42	0.11
Near peak of business cycle	0.25	1.59	2.06	0.27	0.40	-0.23	0.26
Low future consumption growth	-0.72	1.63	1.81	0.22	0.29	-0.31	0.06
High future consumption growth	0.26	2.33	2.95	0.19	0.23	-0.30	0.05
Low liquidity	-0.34	1.21	1.68	0.59	0.40	-0.49	0.05
High liquidity	1.10	1.04	1.85	0.18	0.36	-0.22	0.29
Panel B: Non-stock selection strategies							
1990-1999	1.07	0.95	1.75	0.08	0.16	-0.11	0.03
2000-2008	0.11	0.96	0.89	0.05	0.16	-0.12	0.10
Near trough of business cycle	1.00	0.67	1.61	0.14	0.22	-0.18	0.02
Near peak of business cycle	1.67	1.01	2.02	0.01	0.18	-0.10	0.07
Low future consumption growth	1.00	-0.06	0.59	0.13	0.22	-0.13	0.10
High future consumption growth	0.29	1.26	1.09	0.01	0.12	-0.06	0.10
Low liquidity	-0.95	1.33	0.30	0.02	0.05	-0.06	0.10
High liquidity	0.71	1.45	2.07	0.15	0.21	-0.14	0.05

Table 8:
Seasonal Patterns to Value and Momentum Performance and Correlation

Reported are annualized Sharpe ratios of the value, momentum, and value/momentum combination strategies across markets and asset classes in the months of January and the other months of the year separately. The last two columns report the correlation between value and momentum within each market and asset class in January and non-January months. Panel A reports results for the global stock selection strategies and Panel B reports results for the non-stock selection strategies, along with the average of all strategies within and across groups. Panel C reports the average individual correlations (from monthly returns) across asset classes and markets in January and non-January months.

	Annualized Sharpe ratio							
	Value		Momentum		Combo		Cor(val,mom)	
	Jan.	Feb.-Dec.	Jan.	Feb.-Dec.	Jan.	Feb.-Dec.	Jan.	Feb.-Dec.
Panel A: Stock Selection								
U.S.	0.74	0.04	-0.22	0.81	0.19	1.12	-0.70	-0.61
U.K.	-1.24	0.05	2.37	1.12	1.20	1.54	-0.74	-0.70
Japan	1.81	0.58	-1.22	0.47	0.76	1.20	-0.78	-0.60
Continental Europe	0.63	0.28	1.16	1.05	2.70	1.54	-0.52	-0.53
Global stock selection	**0.86**	**0.31**	**0.69**	**1.17**	**1.66**	**1.93**	**-0.62**	**-0.67**
Panel B: Non-Stock Selection								
Equity country selection	0.72	0.36	1.81	0.54	2.41	0.72	-0.56	-0.41
Bond country selection	0.37	0.46	0.16	0.44	0.08	0.57	0.12	0.06
Currency selection	0.08	0.40	-0.84	0.57	-0.55	0.80	0.33	-0.48
Commodity selection	-0.25	0.20	0.25	0.83	0.08	0.93	-0.32	-0.41
All non-stock selection	**0.60**	**0.63**	**0.75**	**0.98**	**0.83**	**1.38**	**-0.07**	**-0.40**
All asset selection	**0.90**	**0.61**	**0.91**	**1.25**	**1.44**	**2.07**	**-0.29**	**-0.58**

Panel C: Average of individual correlations								
	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	0.24	0.13	-0.10	0.01	0.40	0.07	-0.30	-0.11
Non-stock selection, value		-0.05	-0.04	0.04		0.08	-0.08	-0.05
Stock selection, momentum			0.09	0.08			0.38	0.22
Non-stock selection, momentum				0.03				0.17