The Opportunity Set for Quants in 2011

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1 Introduction

Investors allocate capital not only to the *managers* they judge most skillful, but also to the *strategies* they judge most timely. Of course, assessing the timeliness of a strategy is far from easy. Thankfully for investors, the upside potential of many hedge fund strategies can be linked to concrete market phenomena. For instance, merger arbitrage may deserve additional capital when investors expect deal activity to increase. Convertible arbitrage may warrant more capital when investors expect credit spreads to tighten, and so on. **But when is the best time to allocate incrementally to quants? How might investors determine whether the opportunity set for quant investing is small or large?**

The idea that the macro-obsessed market of 2010 made stock selection less relevant has become commonplace. A recent Wall Street Journal article even featured the assertion that "stock picking is a dead art form."[1] According to this thinking, stocks are moving in response to macroeconomic sentiment rather than company-specific information. The ensuing high correlation among stocks—even stocks with diverging fundamentals—leaves little upside for systematic stock selection.

High correlation, however, is not necessarily good or bad for quants. Neither is high volatility. In this note **we show that the four states—high/low correlation, high/low volatility—have dramatically different, predictable implications for quant investing. Monitoring these states can actually help investors tilt towards the right styles at the right time.**

In Section 2 we elaborate the theoretical considerations and empirical results. Section 3 puts the transition from 2010 to 2011 into perspective, and Section 4 concludes.

[1] See "'Macro' Forces in Market Confound Stock Pickers" in the *Wall Street Journal*, printed September 24, 2010. Also available via http://online.wsj.com/article/SB10001424052748704190704575489743387052652.html

2 Quant Factors & Volatility-Correlation States

Quantitative Equity investing can be thought of as factor-based stock selection. The factors used to select stocks are proprietary, representing a source of differentiation among quants. And while important details vary from quant to quant, the factors collectively derive from one of four primary investment themes: momentum, mean reversion, value and quality.[2]

It is hard to say which themes will work when. This **factor timing** problem is difficult because past theme performance does not say much about future performance. For instance, the return of the price momentum factor was -14% in 2009 and +4% in 2010 (see Figure 1). **We present a conceptual framework that may help investors anticipate factor performance.** Specifically, we use, in a new way, information gleaned from levels of volatility and correlation.

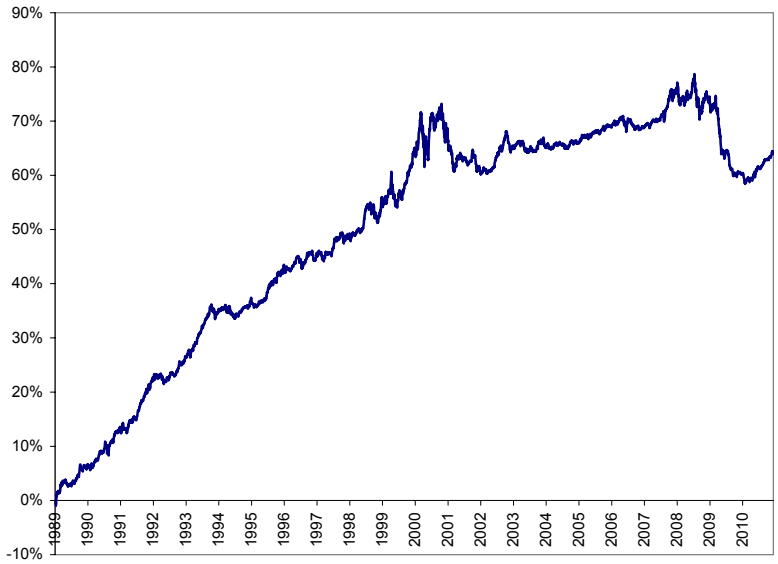

Figure 1: Cumulative Return of the 12-Month Price Momentum Factor

Conceptually, stock volatility and correlation *should* move together. This is because an increase in volatility across all stocks indicates an increase in some market-wide risk. And if common (i.e., systematic) risk increases while stock-specific risk stays constant, then correlation among stocks increases. Figure 2 shows the historical relationship between Realized Volatility and Realized Correlation.[3]

Generally speaking, the two series *do in fact* move together (see Figure 2). For example, in 2008 Realized Volatility and Realized Correlation were both high. In the mid-1990s both were low. Notice, though, that there are periods where the two series diverge. For instance, in the early 2000s we can see that Realized Volatility was high but Realized Correlation was low. More recently, in 2010 Realized Volatility was low but Realized Correlation was exceptionally high.

[2]See *Inside The Black Box: The Simple Truth About Quantitative Trading* by Rishi Narang, pages 21-48 for an instructive discussion and (different) grouping of common quant factors.

[3]Specifically, we calculate each month, for every stock (a) its realized volatility over the preceding 6 months, and (b) its average correlation with every other stock in our large-cap universe over the preceding 6 months. We then take the median of (a) and (b) (which we label 'Realized Volatility' and 'Realized Correlation', respectively).

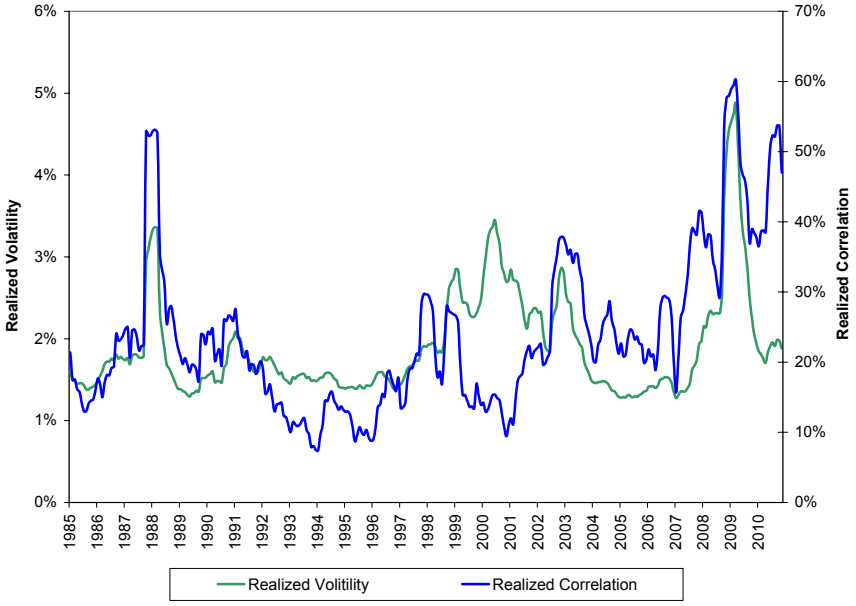

Figure 2: Median Rolling 6-Month Standard Deviation of Returns vs Average Cross-Stock Correlation

In fact, at each point in time we can classify Realized Volatility as high or low (relative to its past). We can also classify Realized Correlation as high or low. This implies that at each point in time we are in one of four states, which we label as follows:

	Vol Low	**Vol High**
Cor Low	v-c	V-c
Cor High	v-C	V-C

Table 1: Realized Volatility and Realized Correlation States

Some quant factors should make money in particular states, but not in others. Below we present our reasoning for which factors *ought* to do best in each state. Of course this reasoning may or may not be validated by historical data. So to test our hypotheses, we also tabulate how factors *actually* perform in each of the four states.[4]

[4]Historical factor returns are measured in the context of a cross-sectional risk model that we calibrate from 1985 onwards. The model has 18 style factors, including 10 GICS Sectors and 8 style factors. Exposures for all but 2 of the style factors (Mean Reversion and Quality) are taken from Barra.

State V-c: This state of high Realized Volatility and low Realized Correlation is exemplified by 2001-2002 (see Figure 2). An environment of excess volatility in stock returns can lead to *overreaction*, making this state good for mean reversion strategies. This state should be ideal for value strategies because low correlations imply that the market is differentiating among stocks, and high volatility indicates that stock moves are large relative to fundamentals. Empirically, the data (see Table to the right) show that Earnings Yield (+6.41%), Mean Reversion (+1.69%), and defensive value factors such as Quality (+5.12%) in fact outperform in this state.

State v-c: This state of low Realized Volatility and low Realized Correlation is exemplified by 1994-1996 (see Figure 2). An environment of depressed volatility suggests that stocks may be *underreacting* to company specific news, making this state ideal for momentum strategies. Momentum should be further bolstered by low correlations which imply that the market is differentiating among stocks. In addition, momentum in stock returns may induce lead-lag effects across stocks, generating profitability for mean reversion. Low volatility, however, will prevent outsized returns for the latter. The data show strong outperformance for Momentum (+6.02%), and weak positive performance for mean reversion and value-oriented factors.

State V-C: This state of high Realized Volatility and high Realized Correlation is exemplified by late 2008 and early 2009. Simultaneously high systemic risk and stock-specific risk indicates a crisis state leading to increased risk aversion and a flight to safe haven assets. In this environment, quality and defensive value factors should outperform because they select stocks with steady, recurring earnings that are less sensitive to economic downturn. The data confirm our intuition, as Quality (+6.14%) is the best performer, and Earnings Variability (-1.55%) is among the worst. The data also show that Mean Reversion (+4.47%) performs well. While we do not have a strong prior belief on mean reversion in this state, outperformance may result from the fact the strategy is providing liquidity at a time when the demand for liquidity is high.

State v-C: This state of low Realized Volatility and high Realized Correlation is exemplified by 2010. High correlations imply little differentiation among stocks, and indicate worries of some potential system-wide shock (in the case of 2010, a clear example is Euro-zone debt worries). Low volatility sends a contrary signal, namely that crisis has passed. Thus the market wavers between regimes of optimism and pessimism, between 'risk-on' and 'risk-off' states. The right strategy in this environment may be a multi-factor portfolio. One sensible choice is a barbell portfolio, consisting of a strategy that outperforms when risk is off (e.g. Quality) coupled with a strategy that outperforms when risk is on (e.g. Small-caps vs Large-caps). The data show that factor returns are clustered around 0, with both risk-seeking strategies and risk-averse strategies outperforming and underperforming. Low volatility contributes to Momentum outperformance (+3.39%).

Annualized Factor Returns By State, 1985-2010

V-c	
Volatility	-10.3
Size	-6.7
Momentum	-0.99
Earnings Variablitity	-0.45
Value	0.34
Mean Reversion	1.69
Quality	5.12
Earnings Yield	6.41
v-c	
Size	-2.18
Volatility	-0.43
Value	-0.04
Earnings Variablitity	0.67
Earnings Yield	1.73
Quality	2.59
Mean Reversion	2.79
Momentum	6.02
V-C	
Size	-2.73
Earnings Variablitity	-1.55
Value	-0.03
Earnings Yield	1.14
Momentum	1.63
Mean Reversion	4.47
Volatility	5.45
Quality	6.14
v-C	
Volatility	-3.86
Size	-1.57
Mean Reversion	0.8
Value	0.87
Earnings Variablitity	1.04
Earnings Yield	2.32
Quality	2.8
Momentum	3.39

	Vol Low	**Vol High**
Cor Low	Momentum	Mean Reversion/Value
Cor High	Barbell	Quality

Table 2: Predicted Winning Styles in Each Volatility-Correlation Quadrant

The preceding discussion laid out our beliefs for which factors are most likely to make money in each volatility-correlation state. Table 2 summarizes the discussion, showing our recommended factor in each state. **The information in Table 2 can be used to tilt portfolios towards the right styles at the right time.** To see this, notice that in order to calculate Realized Volatility and Realized Correlation at a specific point in time, we only need *prior* historical information. So it is possible to determine, in real-time, the volatility-correlation state we are in. We can then follow the recommendation in Table 2 and invest in the appropriate factor. The resulting portfolio will rotate among factors depending on the prevailing volatility-correlation state. Figure 3 shows hypothetical returns of this factor rotation strategy.

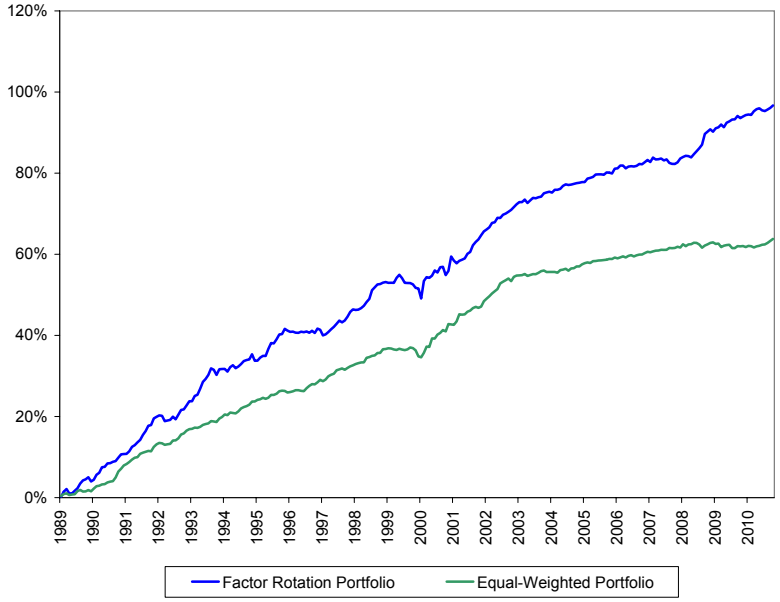

Figure 3: Factor Rotation Portfolio vs Equal-Weighted Factor Portfolio

We can see from Figure 3 that the dynamic factor rotation strategy earns higher returns than the static equal-weighted factor portfolio. It adds approximately 130 basis points of alpha per year. The reason it outperforms the static portfolio is clear: not all factors are suitable in all environments. Indeed, Figure 3 shows that from 2007 through 2010, the equal weighted portfolio has been flat. The dynamic portfolio, however, is able to adapt to changing environments and has shown good performance over that same window. **The moral of the story is that it has become increasingly important to incorporate, in a rigorous manner, environmental data into the quantitative investing process.**

3 From 2010 to 2011

Which volatility-correlation state held in 2010? And what might come next? We can see in Figure 2 that correlations were exceptionally high in 2010. What was truly unprecedented, though, was that these high correlations were accompanied by very low volatility. Indeed, the spread between the two lines in Figure 2 has never been larger than in 2010. **In other words, not only were correlations high, they were exceedingly high relative to volatility.**

Stated in the terminology we introduced above, 2010 was an extreme case of state v-C. Put into historical perspective, this state does not endure for long. Table 3 shows that over our historical window (i.e., 1985-2010), once state v-C begins, it typically lasts for 6.2 months. It is more ephemeral than state v-c, which typically lasts 8 months, and state V-C, which typically lasts 9.2 months.

	Vol Low	**Vol High**
Cor Low	8.0	3.5
Cor High	6.2	9.2

Table 3: Average Duration (in months) For Each State, 1985-2010

At a very basic level, it makes sense that state v-C cannot last for very long. For if correlations are high relative to volatility, then stocks are moving together more than their underlying fundamentals warrant. Over time, this creates compelling stock-specific value opportunities, as some stocks drift far away from fundamental values. This mispricing attracts arbitrage capital that causes value spreads to narrow and, consequently, correlations to decrease. Such a process takes us from state v-C to v-c.

Indeed, over the past few months, correlations have been declining rapidly. Both anticipated and actual QE2 news have contributed to the decline. In light of QE2, the market has rewarded some stocks and punished others. For example, stocks in industries that are sensitive to GDP growth or low short term interest rates (e.g., basic materials, capital goods) have significantly outperformed stocks in less cyclical industries (e.g., tobacco, health care). Worries that inflation may arise from either loose monetary policy or above-trend economic growth have also driven dispersion in industry performance. Our purpose is not to forecast which sectors will outperform, but rather to point out that QE2—by driving a wedge between industries—has caused correlation to decline.

If correlations continue to decline and volatility remains at current levels, 2011 would witness a transition from state v-C to v-c. Actually, this is the transition that history teaches us is most likely. Over our historical sample (1985-2010), we can count the number of times we have moved from state v-C to the other states. These *transition probabilities*, which represent the realized likelihood of moving from state v-C to the other states, are depicted in Table 4.

	Vol Low	**Vol High**
Cor Low	23%	0%
Cor High	65%	12%

Table 4: State Transition Probabilities, Starting From State v-C

Suppose that *this* month we are in state v-C. Then *next* month, according to Table 4, we have a 65% chance of remaining in state v-C. We have a 23% chance of moving to state v-c, a 12% chance of moving to state V-C, and a 0% chance of moving to state V-c. One interesting finding is that, if we move out of state v-C, we are twice as likely to move to state v-c (23%) as V-C (12%)!

We believe that a transition from v-C to v-c in 2011 is a reasonable base case. If this

does transpire, Table 2 recommends investing in momentum strategies. Momentum has actually been performing reasonably well recently, returning +2.4% since July (see Figure 1). In a paper published in January 2010, we cautioned readers that the price momentum portfolio would face econometric issues in the first half of 2010. The argument, in a nutshell, was that stocks make it into the momentum portfolio for stock-specific reasons *and* for beta reasons. If the preceding 12 month market move is large, the momentum portfolio will acquire a non-trivial market tilt. Over the course of 2010, in the wake of a large 2009 market move, the momentum portfolio did in fact acquire a significant positive market bias, validating our prediction. Now, as we begin 2011, with the market move over the preceding 12 months muted, **the momentum portfolio no longer has significant market beta**. This normalization is another positive sign for momentum strategies in 2011.

There are many scenarios other than this base case that must be analyzed carefully. System fragility is still high. Monetary policy in the US is arguably unprecedented. The materialization of an exogenous shock from, e.g., Euro-zone debt worries, bad fiscal policy, untimely rate hikes in Asia, etc. could send the markets into a state of heightened uncertainty. Mutual fund flows also bear monitoring, as the record inflows into bond funds over the past two years may reverse course if rates continue to rise.

Managers and investors will need to assess the possible outcomes in real-time as additional data arrives. The different outcomes will privilege different investing styles.

4 Conclusion

We have articulated an intuitive framework in which to understand and anticipate quant factor performance. This framework is rooted in the concept of volatility-correlation states. We argued that the different volatility-correlation states privilege different quant factors. We also showed how one might formulate a simple value-adding factor-rotation strategy around this insight.

Using the framework, we suggested a base case transition in 2011 from state v-C to v-c. Should this occur, the early stages of 2011 would see value strategies outperform (as correlations decline), followed by sustained outperformance for momentum strategies.

Such a scenario might signal an expanding opportunity set for quant investing. According to some estimates, after a few years of underperformance, quant AUM has declined by 61%, from $1.2 trillion in 2007 to $467 billion in 2010.[5] Furthermore, approximately 1 in 4 quant funds have closed down in the past four years.[6] Now, with fewer surviving participants, decelerating outflows, and a potential up-tick in momentum strategies, we should see an improving environment in 2011.

[5] See "Shrinking 'Quant' Funds Struggle to Revive Boom" in the New York Times, August 20 2010. Also available via http://www.cnbc.com/id/38783519/Shrinking_Quant_Funds_Struggle_to_Revive_Boom

[6] http://www.fiercefinance.com/story/quantitative-funds-shakeout-continues/2010-08-19.

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For the sake of clarification, a *factor return* is the return to a portfolio that has unit exposure to a particular risk factor, zero exposure to other risk factors in the risk model, and is the minimum variance portfolio with this property. Factor returns displayed in this report are derived from monthly rebalanced portfolios. Factor returns do not represent the performance of any Ellington managed fund or account.

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