MSCI

Research Insight

Index Performance in Changing Economic Environments

A Macroeconomic Framework

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Executive Summary

In this paper, the first in a series, we use our MSCI factor and sector index data and MSCI Macroeconomic and MSCI Asset Pricing models to explore the impact of macroeconomic scenarios on relative index performance and allocation to these indexes in a structured way. We build on:

1. Historical analysis using our 40+ years' history[1] of MSCI factor and sector indexes, and
2. Long-term analysis based on forecasts from MSCI Macroeconomic and MSCI Asset Pricing Models.

Our results show Industrials, Consumer Discretionary and Information Technology have been the three most cyclical sectors (highest correlations on average to the business cycle measured by the OECD's Composite Leading Indicator, CLI); and Health Care, Consumer Staples, and Utilities the most defensive (most negative correlations). In factor indexes, Equal Weighted and Value Weighted have been the most cyclical and Minimum Volatility and Quality the most defensive.

The models forecast that the MSCI Momentum, Value Weighted, and Equal Weighted Factor Indexes could exhibit the highest active returns following a large positive shock to trend growth in Developed Market (DM) economies (most "growth sensitive"). They also model that Minimum Volatility, High Dividend Yield and Quality could outperform following a large negative shock ("growth hedging"). Materials, Consumer Discretionary and Financials are the most growth sensitive sectors in the model, while Consumer Staples, Health Care, and Utilities are the most growth hedging. Here, short-term historical performance and long-term, model-based performance concur.

In our historical analysis we add a measure of inflation (CPI) and divide history into periods where CLI/CPI are rising/falling separately. The results are intuitive for the CLI, especially for the Minimum Volatility Factor Index and defensive sectors, although less conclusive for CPI. Our model-based analysis looks at the long-term sensitivity of the MSCI factor and sector indexes to inflation. Here, results differ from our historical analysis as inflation impacts equities in different ways over the short- and long-term. First, higher inflation generally has a negative impact on future long-term real GDP growth. Thus, Small Caps may see short-term outperformance as inflation rises, but be relatively more impacted by inflation in the long-term, as they are more sensitive to real GDP growth. Secondly, factors such as High Dividend Yield, and sectors such as Utilities, are generally long duration with stable nominal cash-flows. Higher inflation could have a more negative impact on their *real* cash-flows over time.

We classify regimes historically through a bivariate framework of CLI/CPI rising/falling, and examine the performance of our indexes across these regimes. We find Momentum and Equal Weighted Factor Indexes performed best in high growth regimes, and Minimum Volatility showed the largest outperformance in the presence of low growth and high inflation. Defensive sectors have outperformed best during periods of low economic growth and low inflation. Finally, we show the historical performance over the last forty years of the MSCI factor and sector indexes through regime *transitions*. We find that when growth has remained positive or strengthened then the Equal Weighted Factor Index has historically outperformed and Minimum Volatility underperformed. On the other hand, in an environment of slowing growth an investment in Quality has generally outperformed, and when coupled with low inflation then Minimum Volatility has outperformed. In sectors, Utilities have generally underperformed in environments of strong growth, but when growth has fallen then a Consumer Staples overweight has historically outperformed. If this drop in growth comes with increasing inflation then Energy has been the standout performer.

Our frameworks and models have important implications for asset allocation: deviations away from the market cap portfolio could depend on an investor's macroeconomic views and tolerance for

[1] Please refer to Appendix I for details of the start dates and simulation dates of the index data used.

macroeconomic uncertainty. For an uncertainty tolerant investor assuming DM economic growth returns quickly to its trend, the models indicate allocating towards indexes that are the most sensitive to economic growth. In contrast, if slow growth and low inflation are believed to persist, the models indicate allocating towards the least growth sensitive indexes[2].

[2] The results presented in this paper are based on the MSCI Macroeconomic, Asset Pricing and Asset Allocation Models. The models are statistical, data driven models, and do not contain investment choices or recommend any specific investments.

Introduction

From "Abenomics" to "taper tantrums", soaring home and energy prices igniting inflation to a lack of consumer spending driving deflation, a recurrent theme of the last few years among investors has been concern over the changing state of the economy and its impact on their investments.

As a result, institutional investors have started explicitly accounting for macroeconomic conditions in their asset allocation decisions, and as part of that shift have tried to create a process for designing macroeconomic-sensitive portfolios. Our paper attempts to give this process a framework, building on past (Kouzmenko and Nagy, 2009) and recent (Winkelmann et al., 2013) MSCI research.

The two pillars we build this framework on are:

1) Historical analysis using our 40+ years' history[3] of MSCI factor and sector indexes to show to what degree economic intuition has been borne out historically in the short-term, and
2) Long-term analysis based on forecasts from the MSCI Macroeconomic and MSCI Asset Pricing Models.

We base our historical analysis on the observation made in our December 2013 paper, "Deploying Multi-Factor Index Allocations in Institutional Portfolios", that factor returns have historically been highly cyclical, and that their periods of underperformance have not been identical. Systematic factors have historically been sensitive to macroeconomic and market forces but not in the same way. So, there seems to be strong empirical evidence that factors have performed differently over different parts of the business cycle. Some factors such as Value, Momentum, and Size have historically been pro-cyclical, outperforming when economic growth and volatility are rising. Quality and Low Volatility have been more defensive, outperforming in a weak macro environment.

We recognize that asset allocation and investment policy should reflect forward-looking views. An emerging consensus in the Macro-Finance academic literature is that macroeconomic risks are persistent shocks to trend growth and inflation. This literature suggests that investors should care about quarter-to-quarter shocks to macro variables (such as real GDP growth or inflation) *only because* they may carry signals about persistently higher (or lower) growth in the future. Very large shocks (either positive or negative) may signal the potential for meaningful changes in trend more than relatively muted shocks. Although recently reported growth and inflation figures have been muted, many institutional investors are concerned about a very significant positive/negative shock sometime in the future, that is indicative of significantly higher or lower average growth and inflation rates in the future.

Our analytic framework and models suggest that portfolios differ in their sensitivity to trend growth and inflation shocks. Nominal bonds are driven predominantly by inflation risk, although real growth risk also matters. In contrast, equities are mostly driven by real economic growth risk. The impact of inflation on equities could depend on both the type of equity portfolio and the length of investment horizon. Within bonds, high duration bonds could be more impacted by macro shocks relative to short duration bonds. Equity strategies could also exhibit varied sensitivity to real growth shocks. For example, the models suggest that Value, Small Cap, and cyclical sectors could be more sensitive than Growth, Large Cap, and defensive sectors.

Designing macro-sensitive portfolio strategies relies on the definition of macroeconomic risk and measuring the link between asset prices and this risk. To this end, we have developed a framework and models to provide institutional investors with a structure to:

- Classify investment strategies along their short-term and long-term exposures to macroeconomic shocks

[3] Please refer to Appendix I for details of the exact start dates and simulation dates of the index data used.

- Generate scenarios of macroeconomic factors, such as GDP and inflation
- Evaluate the impact of macroeconomic scenarios on strategy returns and asset allocation

The rest of the paper proceeds as follows:

We first start by classifying the MSCI factor and sector indexes based on their historical short-term and model-based long-term responses to economic growth and inflation. Next, using historical data, we classify economic regimes through a bivariate framework which groups economic regimes into four quadrants, depending on whether the CLI and the CPI are rising or falling. We then examine the differential performance of the MSCI index universe across these regimes, and the relative performances of the indexes through *transitions* from one regime to another.

Finally, we apply the MSCI Asset Pricing and Asset Allocation Models to assess the likely performance of these indexes under statistically plausible macroeconomic scenarios, and to derive combinations of MSCI factor and sector indexes that could potentially benefit from or offer protection under changing economic regimes[4].

[4] The results presented in this paper are based on the MSCI Macroeconomic, Asset Pricing and Asset Allocation Models. The models are statistical and data driven models, and do not contain investment choices or recommend any specific investments.

Equity Factors and Sectors Capture Premia or Hedge Risk

Both our short-term historical analysis and the long-run analysis using the MSCI Macroeconomic and Asset Pricing Models suggest that MSCI factor and sector indexes differ in their sensitivity to real economic growth and inflation. In this section, we classify the MSCI factor and GICS 10 sector indexes based on their historical short-term and model projected long-term responses to economic growth and inflation.

We focus on MSCI World factor and sector indexes, although our approach can be applied across other universes for which the requisite macroeconomic data are available. For factor index data we use the current family of seven MSCI Factor Indexes: Minimum Volatility (optimized in USD), Risk Weighted, Value Weighted, Momentum, Quality, High Dividend Yield and Equal Weighted. The earliest start dates for these indexes are in Exhibit 19 of the Appendix. For the Minimum Volatility Factor Index we generated a proxy to simulate data before the official start of May 1988. A description of this proxy is given in Exhibit 20 of the Appendix. Sectors are defined in our analysis by the top-level layer of the Global Industry Classification Standard (GICS®) that assigns companies to one of ten economic sectors. Before 1994, these definitions are extended by mapping the Barra model industry classification to the GICS sectors to create historical notional sector indexes. The mapping table is shown in Appendix III. All our analyses use USD Gross Total Return Indexes, and month-end returns.

Our historical studies use two different data series to classify economic regimes: the OECD CLI to measure the overall state of the economy, or point in the business cycle, the OECD All Items CPI to assess the rate of inflation. Further details on the data chosen and their construction are given in the Appendix.

Classification Based on Short-Term Historical Analysis

Equity factor and sector indexes can be classified as cyclical or defensive

Exhibit 1: Correlation coefficient between the year-on-year (YoY) relative performance of regional factor and sector indexes versus parent index and YoY change of the corresponding OECD CLI index. Based on returns from 1975 through December 2013 including simulated data. Please refer to Appendix I for details of exact start dates and simulation dates of the index data used.

MSCI World Universe - Correlation with OECD-Total CLI

Sectors	Correlation	Factors	Correlation
Energy	-0.24	Equal Weighted	0.14
Materials	0.23	High Dividend Yield	-0.25
Industrials	0.36	Minimum Volatility**	-0.50
Consumer Discretionary	0.27	Momentum	-0.11
Consumer Staples	-0.51	Quality	-0.43
Health Care	-0.57	Risk Weighted	-0.19
Financials	0.12	Value Weighted	0.05
IT	0.25		
Telecom	-0.19		
Utilities	-0.47		

As an extension of our 2009 paper "Sector Performance Across Business Cycles", we updated data through end-2013, and added factor indexes to the sector indexes previously studied. We have

restricted the results in our paper to the MSCI World Index universe although our analysis could be extended to other regions and countries (e.g. we have already performed the same analysis for the USA) given the availability of data. As per the previous study, we expect the "cyclical" factors' relative performance to the market to be positively correlated with the rate of change of the CLI, and the "defensive" factors' relative performance to the market to be negatively correlated. In other words cyclical factor/sector indexes outperform the market in a growing economy, while defensives outperform in a slowdown.

We evaluate this relationship by calculating correlation coefficients between the year-on-year (YoY) relative performance of each factor and sector index with its parent index and the YoY change of the CLI. Exhibit 1 above shows these results for MSCI World factor and sector indexes.

Concentrating on sector indexes initially (we highlight the top/bottom three in terms of correlation level), we find that Health Care, Consumer Staples and Utilities (in increasing order of correlation) were the most "defensive" (most negative correlation of annual active return to YoY CLI changes) and Industrials, Consumer Discretionary and IT were the most "cyclical". These results are intuitive.

For the factor indexes, the defensive nature of four: Minimum Volatility, Quality, High Dividend Yield and Risk Weighted, is very clear. However, the supposedly cyclical factor indexes (Equal Weighted, Value Weighted and Momentum) are more of a puzzle, with only the Equal Weighted Factor Index showing a high positive correlation to the CLI, and the sensitivity of the Momentum Factor Index to economic conditions actually appearing to be negative. We see later that splitting the economic regime into periods of economic growth/decline and then adding a second variable such as CPI helps to discriminate performances in these cyclical indexes.

Examining differential short-term index performance in periods of decreasing/increasing economic activity and inflation

Our previous analysis described the response of MSCI World factor and sector indexes to movements in the CLI *as a whole* by looking at the correlations of annual changes. We did not divide periods of rising or falling CLI, nor show the actual magnitude of any differential return.

Institutional investors are increasingly questioning the effect of inflation on their portfolios as well as growth (perhaps splitting economic outcomes, albeit crudely, into "good growth" and "bad growth" scenarios). This leads us to add CPI to the explanatory variables. We now partition economic regimes into rising and falling levels of CLI and CPI *separately*, as defined in Exhibit 2 below.

Exhibit 2: Definitions of "rising" and "falling" variable used for CLI and CPI in univariate tests

Univariate Analysis	**CLI**	**CPI**
Test for whether variable is Rising/Falling	MoM Change	3m-36m Moving Average

Results for these univariate tests are shown in Exhibit 3 below for the MSCI World factor and sector indexes. The average monthly gross active returns to each index in the rising/falling variable states is shown and the higher return by index for each variable is highlighted in green, and the lower return in yellow. Where the average active return differential is less than 10bps we use a black border.

Looking first at CLI (first two columns), results are similar to the previous section, except Momentum, which is now "cyclical" (higher active return in times of increasing CLI than decreasing).

For the sector indexes, results are more clear with half of the sectors "defensive" (higher active return in times of decreasing CLI), and half of them "cyclical", with the defensive sectors – Utilities, Consumer Staples and Health Care, showing large differentials with respect to changes up or down in CLI.

Exhibit 3: Univariate analysis of differential performance of factor and sector indexes in regimes of rising/falling economic variables – MSCI World Index.

Univariate Analysis

	CLI		CPI	
Index - MSCI World	**Decreasing**	**Increasing**	**Decreasing**	**Increasing**
Equal Weighted	0.0%	0.3%	0.2%	0.0%
High Dividend Yield	0.2%	0.1%	0.2%	0.2%
Minimum Volatility**	0.3%	-0.3%	0.0%	0.1%
Momentum	0.2%	0.3%	0.2%	0.3%
Quality	0.3%	-0.1%	0.0%	0.2%
Risk Weighted	0.2%	0.2%	0.2%	0.1%
Value Weighted	0.0%	0.2%	0.1%	0.0%
Energy	0.1%	0.3%	0.1%	0.4%
Materials	-0.3%	0.3%	0.0%	0.0%
Industrials	-0.3%	0.2%	0.0%	-0.1%
Consumer Discretionary	-0.2%	0.1%	0.0%	-0.2%
Consumer Staples	0.8%	-0.4%	0.1%	0.4%
Health Care	0.8%	-0.4%	0.0%	0.5%
Financials	0.1%	0.0%	0.1%	-0.1%
Information Technology	-0.4%	0.5%	0.1%	-0.1%
Telecom Services	0.2%	-0.2%	0.2%	-0.5%
Utilities	0.8%	-0.7%	0.1%	-0.1%

Average Monthly Gross Active Returns relative to MSCI World from Dec 1975 to Dec 2013.
** Based on official Index Levels from May 1988; Low Volatility Tilt Index prior to that includes simulated data. Please refer to Appendix I for details of exact start dates and simulation dates of the index data used.
Indexes where the return differential is less than 10 basis points are boxed.

Looking next at performances in decreasing/increasing CPI states (middle two columns), there is no large differentiation between the factor indexes' responses. For example, there is no change in sign for periods of rising versus falling CPI. Later results show that using CLI and CPI together, and focusing on transitions, gives more differentiated responses between factor indexes.

For sectors, performances are more varied than factors, with the split of indexes similar to that for CLI (comparing periods of increasing CLI to periods of increasing CPI) except Health Care and Consumer Staples now show higher active return in times of increasing CPI than decreasing, and Industrials, Consumer Discretionary and IT "swap sides" with higher returns in decreasing CPI.

Exhibit 4 below summarizes the results of the MSCI World Index univariate analyses by Top 2 factor and Top 3 sector indexes in terms of absolute return differential across decreasing and increasing states of the independent macroeconomic variable.

Having started our historical analysis by looking at the correlation of factor and sector indexes to a single variable (CLI) across time, we next showed how dividing responses by rising and falling CLI and

CPI separately can give a more granular sensitivity to these indexes. While this analysis focused on short-term performance and sensitivity to changes in economic growth and inflation, the next section applies our analytic framework and models to study the long-term sensitivity of MSCI World factor and sector indexes to real GDP growth and inflation.

Exhibit 4: Summary of results for univariate analysis by top factor and sector indexes – MSCI World Index

Most Responsive*	CLI	CPI
Factors	Minimum Volatility** (0.6%)	Equal Weighted (0.2%)
	Equal Weighted (-0.4%)	Quality (-0.2%)
Sectors	Utilities (1.4%)	Telecom Services (0.6%)
	Health Care (1.2%)	Health Care (-0.5%)
	Consumer Staples (1.2%)	Energy (-0.3%)

*Shown as average active monthly gross returns in periods of decreasing variable minus periods of increasing variable.

** Based on official Index Levels from May 1988; Low Volatility Tilt Index prior to that includes simulated data. Please refer to Appendix I for details of exact start dates and simulation dates of the index data used.

Classification Based on the Long-Term MSCI Asset Pricing Model

The MSCI Asset Pricing Model[5] follows the basic principle of modern asset pricing that the competitive equilibrium value of an asset equals the expected discounted value of current and future asset cash flows. The application of this fundamental principle of asset valuation leads to the conclusion that macro risk has an impact on valuation and risk via two channels: cash flows and discount factors.

Our principal finding is that the cash flows earned by different equity portfolios can respond differently to persistent shocks to real output, and that these differences can emerge over longer time horizons. The discount factor that the model uses is itself sensitive to macro risks. As the model's discount factor is estimated from bond market data, this introduces inflation risk as a source of macro risk.

We now apply the model to show how factor and sector indexes differ in their long-term sensitivity to real GDP growth and inflation. Exhibit 5 summarizes the results of the long-term analysis. The long-run response of equity factor and sector cash flows to pervasive macro shocks suggests that macro shocks are associated with undiversifiable financial risk. Because asset cash flows respond only over a long horizon, this risk is a *long-term risk*. As with all undiversifiable risk, this risk must be priced. Because portfolios respond differently to macro shocks, they will have different exposures to long-run risk, and consequently have different prices.

As expected from our previous studies[6], the model shows Momentum, Value Weighted, Equal Weighted, Risk Weighted, and Small Cap exhibiting high sensitivity to real GDP growth risk relative to the capitalization weighted index in the long-run. Among the sectors, the model shows Cyclicals such as Materials, Consumer Discretionary and Financials as carrying higher exposure to real economic growth relative to the market portfolio, while defensives exhibit lower exposure.

[5] See "Pricing and Analyzing Macro Risk" MSCI Market Insight April 2013 for more details about the MSCI Asset Pricing Model.

[6] See "Macroeconomic Risk and Asset Cash-Flows", MSCI Research Insight, March 2013, and "Pricing and Analyzing Macro Risk", MSCI Market Insight, April 2013.

Exhibit 24 in the Appendix shows that, according to the model, large positive shocks to economic growth could have a greater positive long-term impact on the return to these indexes relative to the market. This suggests these indexes could potentially command higher long-run average returns or premia. We label these portfolios as "growth sensitive" portfolios.

The model indicates that Minimum Volatility, Quality and High Dividend Yield, and defensive sectors such as Consumer Staples, Health Care and Utilities are less sensitive to real GDP growth relative to the market. This suggests these portfolios could potentially help hedge large negative shocks to real economic growth relative to the market portfolio. We label these portfolios as "growth hedging" portfolios.

Thus, in terms of sensitivity to economic growth, the long-term model-based analysis broadly agrees with the historical short-term analysis presented in the previous section.

Exhibit 5: Equity strategies exhibit varied long-run sensitivity to macroeconomic risk

Macro Risk	Growth/Inflation Sensitive Indexes	Growth/Inflation Hedging Indexes
Real GDP Growth Risk	**Growth Sensitive**	**Growth Hedging**
	Equal Weighted	High Dividend Yield
	Momentum	Quality
	Risk Weighted	Minimum Volatility
	Value Weighted	Energy
	Small Cap	Industrials
	Materials	Consumer Staples
	Consumer Discretionary	Health Care
	Financials	Information Tech
		Telecom Services
		Utilities
Inflation Risk	**Inflation Sensitive**	**Inflation Hedging**
	Equal Weighted	Energy
	Momentum	Financials
	High Dividend Yield	Telecom Services
	Quality	Utilities
	Risk Weighted	Minimum Volatility
	Small Cap	
	Materials	
	Industrials	
	Consumer Discretionary	
	Consumer Staples	
	Healthcare	
	Information Tech	

The Exhibit classifies the MSCI World factor and sector indexes along their positive or negative sensitivity to real GDP growth and inflation over long horizons, relative to the MSCI World Index.

However, the results suggest that inflation impacts equities in different ways over the short- and long-term. Exhibit 5 and Exhibit 25 in the Appendix show that equity factor and sector indexes may also be differentiated according to their long-term sensitivity to inflation. Sectors such as Energy, Utilities and Telecom Services may benefit from higher inflation relative to the market, as profits to these sectors are either hedged against potential upside risks to inflation, or increase with inflation. Overall though, inflation could have a negative impact on equities. There could be two reasons for this. The first explanation relies on the observed negative impact of higher inflation on future long-term real GDP growth. Thus, Small Cap and the Consumer Discretionary sector may be more adversely impacted by inflation relative to the market as they are also more sensitive to real GDP growth risk in the long-term. The second explanation is related to equity duration. Factor indexes such as High Dividend Yield and Quality, and sector indexes such as Consumer Staples, are characterized as high equity duration portfolios with stable nominal cash-flows. In turn, higher inflation could have a negative impact on these portfolios' *real* cash-flows and returns.

This classification analysis carries important implications for strategic and medium term macro-sensitive asset allocation. Indeed, as we will see in the final section of this paper, our framework and models indicate that an investor's investment horizon, macroeconomic views and willingness to tolerate macroeconomic uncertainty could inform asset allocation decisions. Observed historical premia on strategies such as Value and Size could be compensation for persistent shocks to trend growth. These premia are also consistent with the *hypothetical* investor holding the market portfolio. However, *specific* investors could reasonably deviate from holding market capitalization weights. In particular, long-horizon investors that have greater tolerance for macroeconomic uncertainty might consider tilting towards high growth sensitive portfolios relative to the capitalization weighted portfolio, especially if they perceive the outlook for real economic growth to be positive.

Before turning to the implications for macro-sensitive asset allocation, in the following section, we explore the historical performance of factor and sector indexes during historically plausible economic regimes. In particular, using historical data, we classify economic regimes through a bivariate framework that groups them into four quadrants, depending on whether the CLI and the CPI are rising or falling, and examine the differential performance of the index universe across these states, and the relative performances of the indexes through *transitions* from one regime to another.

Equity Factors and Sector Performance Differed During Regimes and Through Regime Transitions

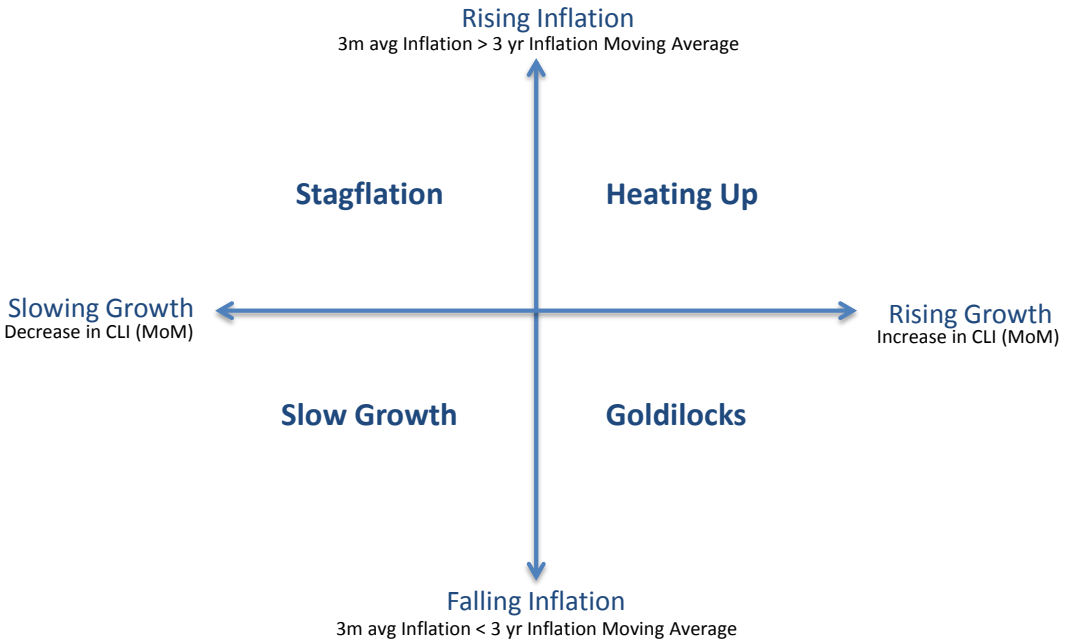
Index Performance during Economic Regimes Classified Using CLI and CPI

The motivation for this research came from requests from institutional investors to better understand how their portfolios of factor and sector indexes behave in different economic regimes. So far, we have sought to answer that question using single macroeconomic variables in isolation and have shown how our indexes respond when these single variables are rising or falling. In other words, we tried to answer the question: "I think economic activity/inflation is going to increase/decrease over the near term – how has this historically affected my portfolio?"

While we hope this is both interesting and useful, a more realistic analysis that fits better with institutional investors' views of the world is to look at variables *in conjunction*. However, there is a panoply of economic variables for investors to choose from, and so a huge number of possible combinations exist. In this section, we err once again on the side of parsimony, and focus our analysis on a pair of variables that institutional investors naturally think of in conjunction: the

Business Cycle and Inflation. When assessing possible future economic conditions, institutional investors look not only at economic growth (e.g. using the CLI), but also divide growth into "good" and "bad" regimes depending on accompanying inflation. A more realistic question is: "I think economic growth is going to dip **and** inflation is going to pick up – what has happened to portfolios like mine under stagflation in the past?"

Exhibit 6: Schematic of economic regime classification using CLI and CPI



We try to answer this question by dividing economic regimes into four outcomes, depending on whether economic growth is strong or weak and whether inflation is rising or falling, as shown in Exhibit 6 above. We name these four regimes:

1. "Goldilocks" – Rising Growth and Falling Inflation
2. "Slow Growth" – Slowing Growth and Falling Inflation
3. "Stagflation" – Slowing Growth and Rising Inflation
4. "Heating Up" – Rising Growth and Rising Inflation

Our definitions of "Slowing/Rising" Growth and "Falling/Rising" Inflation correspond exactly to the definitions of Decreasing/Increasing CLI/CPI that we used in the univariate analysis in the previous section (see Exhibit 2). Similarly, for "Falling/Rising Inflation" we use the exact same definitions as for our univariate analyses. When classifying regimes we require that each regime must persist for a minimum of three months, before being classified as a new state of the economy.

Using these definitions we arrive at the graph in Exhibit 7 which shows the persistence and frequency of these changing regimes over time:

Exhibit 7: Economic regimes classified by using OECD-Total CLI and CPI

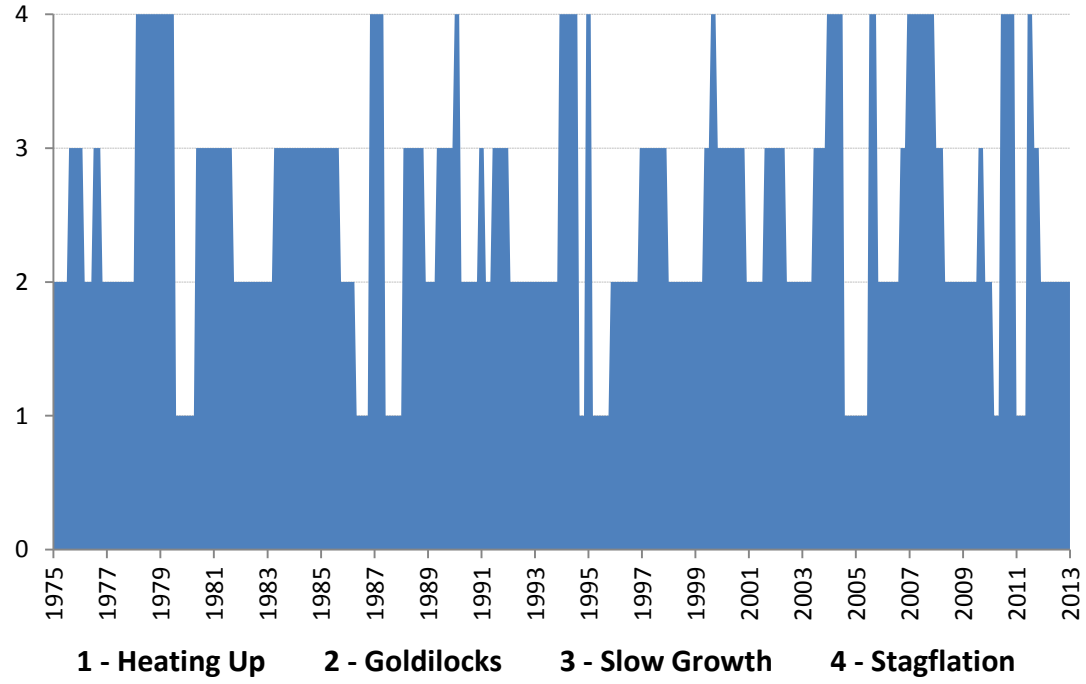


Exhibit 8 below shows the relative frequency of these four regimes over approximately 38 years of analysis. We see that "Goldilocks" (Rising Growth and Falling Inflation) has been the most common regime, followed by "Slow Growth", "Stagflation", and finally "Heating Up":

Exhibit 8: Relative frequency of economic regimes using bivariate classification: OECD-Total

Macro-Economic States	State Likelihood
Heating Up	11%
Goldilocks	40%
Slow Growth	32%
Stagflation	17%

Exhibit 9 below shows the historical results of the bivariate analysis for the MSCI World factor and sector indexes. We work our way through the results, from the least frequently observed economic regimes ("Heating Up") to the most historically likely ("Goldilocks").

In "Heating Up", for factor indexes, Momentum and Minimum Volatility are the standouts in terms of relative performance, with Momentum delivering its largest average active monthly return in this regime. Both these results are intuitive, as are the relative intransigence of Risk Weighted, High Dividend Yield and Quality, and the outperformance of Equal Weighted and Value Weighted.

On the sector front for "Heating Up", the results are also rather intuitive, with Materials and IT leading the way, and Utilities followed by Telecom Services firmly bringing up the rear.

Moving next to "Stagflation", Minimum Volatility is again the standout, showing the mirror of its active return in "Heating Up", with the more cyclical Equal Weighted and Value Weighted Factor Indexes performing the worst. On the sector front there is a very clear differentiation between Energy (with the highest active return in this regime through all scenarios over all sector and factor indexes) and the defensive Consumer Staples, Health Care and Utilities sectors showing strong outperformance. The more cyclical sectors all underperform, with Consumer Discretionary having the worst relative performance (again intuitive in an environment of rising prices but slowing economic growth).

Exhibit 9: Bivariate analysis of performance of factor and sector indexes in economic regimes classified by rising/falling OECD-Total CLI and All Items CPI – MSCI World Index

Bivariate Analysis

Index - MSCI World	Heating Up	Goldilocks	Slow Growth	Stagflation
Equal Weighted	0.2%	0.4%	0.0%	-0.1%
High Dividend Yield	0.0%	0.1%	0.2%	0.2%
Minimum Volatility**	-0.4%	-0.3%	0.3%	0.4%
Momentum	0.3%	0.3%	0.2%	0.3%
Quality	0.1%	-0.1%	0.3%	0.3%
Risk Weighted	0.0%	0.2%	0.2%	0.1%
Value Weighted	0.1%	0.2%	0.1%	-0.1%
Energy	-0.1%	0.3%	-0.2%	0.9%
Materials	0.5%	0.3%	-0.4%	-0.4%
Industrials	0.2%	0.2%	-0.3%	-0.2%
Consumer Discr	0.2%	0.1%	0.0%	-0.5%
Consumer Staples	0.0%	-0.5%	0.8%	0.6%
Health Care	0.2%	-0.5%	0.8%	0.6%
Financials	-0.1%	0.0%	0.3%	-0.2%
Information Tech	0.3%	0.6%	-0.4%	-0.4%
Telecom Svc	-0.5%	-0.2%	0.6%	-0.4%
Utilities	-1.0%	-0.5%	0.8%	0.6%

Average Monthly Gross Active Returns relative to MSCI World from Dec 1975 to Dec 2013.

** Based on official Index Levels from May 1988; Low Volatility Tilt Index prior to that includes simulated data. Please refer to Appendix I for details of exact start dates and simulation dates of the index data used.

"Slow Growth" sees a positive outperformance for all the MSCI World factor indexes, and the differentiation in this regime comes through the sector indexes with the classically defensive Utilities, Health Care and Consumer Staples outperforming at the expense of the cyclical IT, Materials and Industrials.

Exhibit 10: Summary of results for bivariate analysis by top factor and sector indexes – MSCI World

Most Responsive	Heating Up	Goldilocks	Slow Growth	Stagflation
Factors	Minimum Volatility** (-0.4%)	Equal Weighted (0.4%)	Minimum Volatility** (0.3%)	Minimum Volatility** (0.4%)
	Momentum (0.3%)	Momentum (0.3%)	Quality (0.3%)	Momentum (0.3%)
Sectors	Utilities (-1.0%)	Information Tech (0.6%)	Consumer Staples (0.8%)	Energy (0.9%)
	Materials (0.5%)	Utilities (-0.5%)	Utilities (0.8%)	Health Care (0.6%)
	Telecom Svc (-0.5%)	Health Care (-0.5%)	Health Care (0.8%)	Consumer Staples (0.6%)

Average Monthly Gross Active Returns relative to MSCI World from Dec 1975 to Dec 2013

** Based on official Index Levels from May 1988; Low Volatility Tilt Index prior to that

Includes simulated data. Please refer to Appendix I for details of exact start dates and simulation dates of the index data used.

Finally, the most common "Goldilocks" macroeconomic scenario sees Equal Weighted as the top performer among factor indexes, closely followed by Momentum, whereas Minimum Volatility and Quality underperform. From the sector indexes, IT, Energy and Materials are the clear winners, with

the defensive trifecta of Utilities, Health Care and Consumer Staples once again underperforming. Exhibit 10 above summarizes the results of the MSCI World Index bivariate analyses by Top 2 factor and Top 3 sector indexes in terms of absolute active return per quadrant.

Looking at correlation between indexes through different economic regimes

Our December 2013 paper, "Deploying Multi-Factor Index Allocations in Institutional Portfolios" observed the cyclical nature of factor returns historically, and suggested that institutional investors could potentially smooth out some of this cyclicality through diversification by intelligently combining factor indexes. In that paper we looked at the long-run average correlations of active returns between factors, but given our observations above on the variability of factor returns through different economic regime classifications, we wanted to show as well how factor return correlations behaved in different economic regimes.

Exhibit 11: Active factor return volatilities and correlations in four economic regimes

	Annualised Tracking Errors								
Index - MSCI World	Benchmark (Volatility)	Equal Weighted	High Dividend Yield	Minimum Volatility**	Momentum	Quality	Risk Weighted	Value Weighted	Average Pairwise Correlation
Full History	15.0%	5.4%	6.1%	6.0%	8.8%	5.9%	5.7%	3.8%	0.27
Heating Up	10.1%	4.5%	5.8%	4.1%	9.0%	6.0%	4.7%	3.3%	0.22
Goldilocks	12.7%	5.1%	6.0%	5.1%	7.5%	6.1%	5.5%	3.3%	0.23
Slow Growth	16.3%	5.8%	6.8%	6.4%	8.7%	5.7%	6.2%	3.7%	0.29
Stagflation	18.9%	5.6%	5.4%	7.6%	11.1%	5.2%	5.4%	4.6%	0.32

**Based on official Index Levels from May 1988

Results are shown in Exhibit 11 above. In more volatile economic regimes (i.e. into "Slow Growth" and "Stagflation"), average tracking errors tended to increase for the more cyclical indexes (e.g. Equal Weighted, Momentum and Value Weighted), whereas there was no clear pattern for the more defensive indexes. Average pairwise factor index active return correlations tended to increase with market volatility, a commonly observed phenomenon.

Looking at Index Performance through Historical Regime Transitions

Our previous set of analyses classified the current state of the economy into one of four economic regimes, based on the levels and co-movement of the OECD CLI and CPI indicators, and showed the average monthly active return in each regime.

For the final part of our historical analysis we look not just at relative factor and sector index performances within a single regime, but at how indexes perform in relative terms when we move from one regime to another (regime transitions). An example of the type of question we are seeking to answer is: "I believe the global economy is in a state of 'Slow Growth' *now*, and I'm worried that growth will remain low but inflation will pick up. How has my index portfolio performed historically through such transitions into a 'Stagflation' scenario?"

Exhibit12: Regime transition historical frequency matrix for OECD-Total CLI and CPI indicators

Likelihood of transitioning between regimes over 3 months		TO			
		Heating Up	**Goldilocks**	**Slow Growth**	**Stagflation**
FROM	**Heating Up**	55%	6%	11%	28%
	Goldilocks	3%	73%	20%	3%
	Slow Growth	0%	27%	65%	8%
	Stagflation	23%	8%	12%	58%

Exhibit12 above shows the historical frequencies of transitions from 1976 to 2013 between each of our four economic regimes to each other, over a three-month period.

The first point that is clear from these results is that the most likely state to be in after three months is the same state you are in now (the diagonal elements of the table). Also, this regime persistence (an embodiment of the statistical phenomenon of autocorrelation) is higher for the more common ("Goldilocks" and "Slow Growth") than the less common ("Stagflation" and "Heating Up") regimes.

Secondly, the chances of radical regime shifts where both the CLI **and** CPI indicators change sign (so moving more than two states up or down in Exhibit 7 above), e.g. from "Slow Growth" to "Heating Up" or from "Goldilocks" to "Stagflation", are relatively rare. In fact, the particular example of moving from "Slow Growth" (low growth and low inflation) to "Heating Up" (high growth and high inflation) over three months has historically never happened in our sample from 1976 to 2013. Again, this is intuitive, if one imagines the macroeconomic environment following a continuous path around the quadrants of Exhibit 6 above, then diagonal jumps should be less likely, but not necessarily impossible.

Looking back at our initial results for the bivariate analysis (Exhibit 9) we can think of these single-regime results as being similar to a frequency weighted combination of the results as we move from one regime to the other. In other words, if we focus on the "Heating Up" column of results from Exhibit 9 they could be seen as a combination of returns observed when we start in the "Heating Up" state, and then either remain in "Heating Up" (the most common 'transition') or move to "Stagflation" (next most common), "Goldilocks", or "Slow Growth" (least common). In essence, each column in Exhibit 9 will now generate a transition table in its own right, the columns of which will be the resulting regimes over three months, and the values of which will be the active returns to the factor and sector indexes over these transitions. In total, Exhibit 9 will be represented by four such tables. These four tables are shown for the MSCI World Index in Exhibit 13 below.

Exhibit 13: Active returns for MSCI World factor and sector indexes over regime transitions

From Heating Up To

	Heating Up	Goldilocks	Slow Growth	Stagflation
Equal Weighted	0.8%	-2.2%	0.6%	-1.9%
High Dividend Yield	-0.2%	5.5%	0.5%	1.4%
Minimum Volatility**	-1.4%	-0.6%	0.2%	2.3%
Momentum	0.6%	1.0%	-1.9%	2.2%
Quality	0.0%	4.1%	-1.0%	-0.3%
Risk Weighted	0.3%	-1.2%	0.3%	-0.4%
Value Weighted	0.4%	1.6%	0.9%	-1.0%
Energy	-0.1%	5.0%	-5.6%	-1.6%
Materials	1.3%	-4.6%	1.8%	-2.5%
Industrials	1.0%	-3.9%	1.6%	-1.2%
Consumer Discr	0.7%	-2.5%	5.5%	-1.1%
Consumer Staples	-0.2%	-0.1%	0.4%	4.1%
Health Care	0.0%	3.9%	1.5%	4.2%
Financials	0.4%	0.8%	-0.7%	-0.2%
Information Tech	-0.3%	6.0%	1.7%	-4.2%
Telecom Svc	-2.4%	1.2%	5.5%	3.4%
Utilities	-2.2%	0.3%	-2.0%	4.7%

From Slow Growth To

	Heating Up	Goldilocks	Slow Growth	Stagflation
Equal Weighted	1.8%	-0.1%	0.5%	
High Dividend Yield	0.8%	0.9%	0.3%	
Minimum Volatility**	-2.0%	1.1%	0.2%	
Momentum	-0.7%	1.0%	0.1%	
Quality	-0.8%	0.6%	0.6%	
Risk Weighted	0.1%	0.9%	0.8%	
Value Weighted	1.1%	0.2%	0.5%	
Energy	-1.6%	-0.4%	-0.7%	
Materials	0.9%	-1.8%	0.0%	
Industrials	0.8%	-1.2%	1.0%	
Consumer Discr	2.1%	0.1%	-2.8%	
Consumer Staples	-2.7%	2.4%	2.9%	
Health Care	-3.8%	2.2%	1.0%	
Financials	1.0%	0.9%	2.7%	
Information Tech	3.7%	-1.9%	-0.8%	
Telecom Svc	-0.8%	2.4%	-3.2%	
Utilities	-2.0%	2.8%	4.7%	

From Goldilocks to

	Heating Up	Goldilocks	Slow Growth	Stagflation
Equal Weighted	-0.4%	1.1%	-0.5%	-0.9%
High Dividend Yield	-1.2%	-0.3%	1.3%	1.4%
Minimum Volatility**	-2.4%	-0.8%	1.9%	0.5%
Momentum	-0.4%	1.0%	0.7%	-2.8%
Quality	-3.8%	-0.7%	2.0%	1.9%
Risk Weighted	-1.4%	0.5%	0.8%	-0.8%
Value Weighted	-0.7%	0.3%	0.1%	0.6%
Energy	6.0%	0.7%	1.8%	3.4%
Materials	2.6%	0.8%	-2.0%	0.6%
Industrials	-0.5%	0.7%	-0.3%	-2.7%
Consumer Discr	-1.8%	0.1%	-1.3%	-2.3%
Consumer Staples	-1.9%	-1.3%	3.3%	0.1%
Health Care	-2.4%	-1.3%	3.3%	3.2%
Financials	2.7%	0.0%	0.0%	-1.3%
Information Tech	-0.6%	1.7%	-1.5%	4.1%
Telecom Svc	-2.5%	-0.9%	1.0%	-1.3%
Utilities	-8.9%	-1.8%	2.9%	-1.6%

From Stagflation To

	Heating Up	Goldilocks	Slow Growth	Stagflation
Equal Weighted	1.0%	1.0%	2.0%	-0.1%
High Dividend Yield	-0.2%	0.2%	2.6%	0.5%
Minimum Volatility**	-1.5%	-0.4%	3.2%	0.7%
Momentum	2.0%	1.8%	-1.8%	1.6%
Quality	0.9%	1.6%	1.6%	1.5%
Risk Weighted	0.1%	0.8%	3.4%	0.2%
Value Weighted	0.4%	0.5%	1.8%	-0.2%
Energy	1.7%	-2.5%	3.2%	4.0%
Materials	2.3%	0.8%	3.6%	-0.8%
Industrials	0.6%	0.0%	0.7%	-1.2%
Consumer Discr	0.6%	2.2%	-0.8%	-1.6%
Consumer Staples	-1.5%	-0.1%	8.1%	1.1%
Health Care	-0.6%	-0.3%	8.2%	1.6%
Financials	-1.3%	0.3%	-0.4%	-1.4%
Information Tech	3.2%	0.0%	-6.9%	-0.6%
Telecom Svc	-2.0%	1.9%	1.1%	-1.9%
Utilities	-3.2%	-1.4%	5.4%	0.3%

Average Quarterly Gross Active Returns relative to MSCI World from Feb 1976 to Dec 2013.

** Based on official Index Levels from May 1988; Low Volatility Tilt Index prior to that includes simulated data. Please refer to Appendix I for details of exact start dates and simulation dates of the index data used.

Looking at the regime transition results and starting this time with the most common historical regime, "Goldilocks" (bottom-left table in Exhibit 13), and focusing first on the most common 'transition' – remaining in "Goldilocks" – we see that the factor indexes that outperform the most are Equal Weighted and Momentum, and those that underperform the most are Minimum Volatility and Quality. Within the sector indexes, IT is the clear outperformer, and the now familiar defensive triumvirate of Utilities, Health Care and Consumer Staples strongly underperforms. Comparing these transition results to the overall "Goldilocks" results (second column of Exhibit 9) we see the results are similar in rank and sign, but, for the transition, are greater in magnitude. This fits with our explanation that the results in Exhibit 9 are an average over all transitions, and staying in the same state is the most likely 'transition'.

When in a "Goldilocks" state, the second most common transition is to move into "Slow Growth". When we look at the results for this transition we see that it largely features the same indexes as for "Goldilocks"→"Goldilocks" but with greater magnitude and opposite sign. For example the returns to the Minimum Volatility and Quality factor indexes flip from negative to positive and for the Equal Weighted factor index *vice versa*. Similarly, Consumer Staples and Health Care move from underperforming to outperforming, and IT now underperforms.

For the least common transitions, to "Heating Up" and "Stagflation" (3% historical frequency each) results become more dispersed by index and larger in absolute terms. Summary results are shown for the MSCI World Index in Exhibit 14.

Exhibit 14: Summary of highest absolute active returns by index split by transitions – MSCI World

Starting Regime		Most responsive		Ending Regime: Heating Up – Index	Heating Up – Response*	Goldilocks – Index	Goldilocks – Response*	Slow Growth – Index	Slow Growth – Response*	Stagflation – Index	Stagflation – Response*
Stagflation	Factors	1		Momentum	1.97%	Momentum	1.77%	Risk Weighted	3.41%	Momentum	1.64%
		2		Minimum Volatility**	-1.53%	Quality	1.63%	Minimum Volatility**	3.15%	Quality	1.55%
	Sectors	1		Utilities	-3.24%	Energy	-2.48%	Health Care	8.16%	Energy	3.96%
		2		Information Tech	3.22%	Consumer Discr	2.16%	Consumer Staples	8.09%	Telecom Svc	-1.87%
		3		Materials	2.29%	Telecom Svc	1.87%	Information Tech	-6.94%	Consumer Discr	-1.63%
Slow Growth	Factors	1				Minimum Volatility**	-2.00%	Minimum Volatility**	1.10%	Risk Weighted	0.83%
		2				Equal Weighted	1.75%	Momentum	0.97%	Quality	0.55%
	Sectors	1				Health Care	-3.84%	Utilities	2.79%	Utilities	4.70%
		2				Information Tech	3.66%	Consumer Staples	2.40%	Telecom Svc	-3.18%
		3				Consumer Staples	-2.72%	Telecom Svc	2.36%	Consumer Staples	2.92%
Goldilocks	Factors	1		Quality	-3.80%	Equal Weighted	1.06%	Quality	2.00%	Momentum	-2.75%
		2		Minimum Volatility**	-2.36%	Momentum	0.99%	Minimum Volatility**	1.92%	Quality	1.91%
	Sectors	1		Utilities	-8.92%	Utilities	-1.82%	Consumer Staples	3.30%	Information Tech	4.12%
		2		Energy	5.96%	Information Tech	1.68%	Health Care	3.30%	Energy	3.45%
		3		Financials	2.75%	Consumer Staples	-1.32%	Utilities	2.93%	Health Care	3.19%
Heating Up	Factors	1		Minimum Volatility**	-1.43%	High Dividend Yield	5.52%	Momentum	-1.95%	Minimum Volatility**	2.29%
		2		Equal Weighted	0.77%	Quality	4.12%	Quality	-0.98%	Momentum	2.15%
	Sectors	1		Telecom Svc	-2.38%	Information Tech	6.01%	Energy	-5.62%	Utilities	4.67%
		2		Utilities	-2.22%	Energy	5.04%	Telecom Svc	5.51%	Health Care	4.21%
		3		Materials	1.28%	Materials	-4.58%	Consumer Discr	5.49%	Information Tech	-4.21%

Average Quarterly Gross Active Returns relative to MSCI World from Feb 1976 to Dec 2013.

** Based on official Index Levels from May 1988; Low Volatility Tilt Index prior to that includes simulated data. Please refer to Appendix I for details of exact start dates and simulation dates of the index data used.

To summarize the key results for the most common "Goldilocks" as the starting scenario, and working our way from "Heating Up", through "Goldilocks" and "Slow Growth" to "Stagflation" as the ending scenarios we see the following commonalities:

1. If you think the economic regime is remaining benign or strengthening, then historically the Equal Weighted Factor Index has outperformed and Minimum Volatility has underperformed in such transitions in the past.
2. On the other hand, if you think growth is slowing then an investment in the Quality Factor Index has generally outperformed, and if you think inflation is also staying low (moving to "Slow Growth") then Minimum Volatility has also outperformed historically.
3. In terms of sector indexes, an underweight to Utilities has generally outperformed in environments where growth has remained strong, but when growth has fallen then a Consumer Staples overweight has historically outperformed. However, if this drop in growth is accompanied by a pickup in inflation (i.e. move to "Stagflation") then Energy has been the standout performer historically.

Differences become more marked as we move into the less frequent economic regimes, which potentially argue for a more local approach to asset allocation in unusual or rapidly changing economic environments. This local approach is taken up in the next section, where we show how to identify plausible scenarios for GDP growth and inflation with the help of the MSCI Macroeconomic Model, and explore the impact of these macroeconomic forecast scenarios on selected equity index returns and allocations to these indexes.

Macro Views Inform Equity Strategy Returns and Asset Allocation Decisions

So far, we have shown how factor and sector indexes have differed historically in their short-term performance, under different economic growth and inflation regimes, and during regime transitions. We have also shown, using the MSCI Asset Pricing Model, how to classify factor and sector indexes along their exposure to long-term economic growth and inflation risk. Together, the analyses of the previous sections are a first step towards establishing a structured framework to help institutional investors to explicitly incorporate macroeconomic views into their asset allocation decisions.

We now take a forward-looking and longer-term perspective. Institutional investors are also interested in assessing their portfolio response to unprecedented macroeconomic shocks that potentially carry an uncertain, long-term impact on trend growth and inflation. For example, since 2008, investors remain uncertain about the time required for DM economies to revert back to their long-term trend, and about the impact of a slower or faster recovery on factor and sector returns, and asset allocation. Another example is the uncertain consequence of unprecedented "Quantitative Easing" monetary policy, and its reversal.

This section shows how our framework and models could help institutional investors address these questions in a structured way. We first apply the MSCI Macroeconomic Model to identify plausible macroeconomic forecast scenarios, and assess their likelihood relative to a baseline. We then apply the MSCI Asset Pricing and Dynamic Asset Allocation Models to assess the likely performance of growth sensitive and growth hedging indexes under these scenarios, and to derive combinations of MSCI factor and sector indexes that could potentially benefit from, or offer protection under the same scenarios.

Identifying Plausible Macroeconomic Forecast Scenarios

Macroeconomic forecast scenarios can be evaluated in a structured way. The first step in this process is to define a baseline and the investment horizon. The aim of the baseline scenario is to set bands against which stress scenarios can be measured. In this paper, we use the three-years out baseline (median) forecasts from the MSCI Macroeconomic Model shown in Exhibit 15. The MSCI Macroeconomic Model is an innovative statistical model used to generate forecasts and scenarios over different horizons of selected macroeconomic variables, such as real GDP growth and inflation[7].

According to the model's baseline forecasts, both real economic growth and inflation for DM economies are projected to remain persistently well below their long-term average, at about 1.5 percent, even three-years out.

While declines in inflation may be usually attributable to declines in energy prices, other factors may be at work behind the recent declines and persistence of low rates. An important question is whether the low realized and projected inflation is a consequence of a prolonged period of sub-par growth since 2008, and will eventually recover as economic growth returns to trend, or whether it signals a slower recovery.

[7] The MSCI Macroeconomic Model is an innovative Bayesian Vector Autoregressive model (BVAR). BVARs are a standard statistical tool for multivariate time series analysis. They have widespread application in macroeconomic analysis. A benefit of BVARs is that they produce forecasts over many periods, and calculate confidence bands over those same periods. The MSCI Macroeconomic Model builds on the long-run risk model for real GDP growth described in our previous paper ("Macroeconomic Risk and Asset Cash Flows"). In addition to real GDP growth and corporate profits, only observed on a quarterly basis, typically with a lag, the model also applies latest advances in academic research to combine these quarterly variables with variables available on a timely, monthly basis. The monthly variables are: CPI inflation, term spread (10-Year minus 3 month), money growth (M2), Fed base rate, the SPGS Commodity Index, unemployment rate, exports, capacity utilization, and labor unit cost. Last, we impose restrictions (Bayesian priors) based on empirical regularities found in the observed time series of these variables. Further details on the MSCI Macroeconomic Model can be found in Appendix IX.

Exhibit 15: World (DM) real GDP Growth and CPI inflation forecasts from the MSCI Macroeconomic Model

	Long-Term Trend Through 2007	Last Four Quarters	MSCI Year-Ahead Forecasts			MSCI Three-Years Out Forecasts		
			Baseline	Low	High	Baseline	Low	High
World (DM) Real GDP Growth	3.2	1.5	1.6	0.2	3.1	1.5	-0.2	3.1
World (DM) Consumer Price Inflation	3.3	1.4	1.3	0.5	2.1	1.5	0.6	2.5

The Exhibit shows the long-term trend growth and inflation rates through 2007, and compares these rates to the current rates, and to the MSCI Macroeconomic Model's Baseline, Low, and High growth and inflation forecasts for the year-ahead and three years out. The Low and High forecasts provide the 30-70 confidence bands around the Baseline. All rates are annualized percentage rates.

One of the benefits of the MSCI Macroeconomic Model is that it also provides confidence bands for the forecasts. The confidence bands for the baseline forecasts, also from Exhibit 15, suggest that a faster return to the long-term average trend growth of 3.2 percent, together with benign inflation, is plausible. More precisely, the model assigns about a 30% chance for real GDP growth for DM economies overall to exceed the long-term trend three-years out. In particular, the recently observed and continued improvements in industrial production, retail sales, and unemployment in the US (see Appendix VIII) could help quicken the pace of recovery in DM (and EM) economies, should they persist.

Turning to inflation, the model confidence bands suggest that high inflation seems an unlikely outcome. In fact, the model suggests that there is even a 30% chance of a significant further decline in inflation three years out, down from 1.5% to 0.6%. In turn, a widespread deflation may also deteriorate real growth[8].

Following these observations, we choose to focus on the following three plausible medium term (three years) macroeconomic scenarios for DM economies:

- MSCI Model Baseline scenario (persistence of below long-term trend growth and inflation)
- Return to Long-term Trend Growth, coupled with moderate inflation
- Slow Growth (slower growth and lower inflation)

[8] The realized inflation figure over the last four quarters from Exhibit 28 in the Appendix suggests that deflation has already gained ground in Italy and Spain.

Exhibit 16: Three plausible macroeconomic scenarios based on the MSCI Macroeconomic Model

Three-Year Horizon Macroeconomic Scenario	MSCI Macroeconomic Model Implied Probability	MSCI Macroeconomic Model Forecasts (Three-Year Horizon, Annualized)	
		DM Real GDP Growth	DM Inflation
Current		1.5%	1.4%
MSCI Model Baseline	50%	1.5%	1.5%
Return To Long-Term Trend Growth	10%	3.1%	2.5%
Slow Growth	10%	-0.2%	0.6%

The Exhibit shows, in the second column, the probability implied by the MSCI Macroeconomic Model for the MSCI Model Baseline, Return to Long-term Trend Growth, and Slow Growth scenarios. The last two columns show the three-year horizon MSCI Macroeconomic Model forecasts for real GDP growth and inflation for DM economies, conditional on the current economic conditions, and each of the three scenarios. All rates are annualized percentage rates.

The likelihood for these scenarios and the model implied real GDP growth and inflation forecasts under these scenarios are summarized in Exhibit 16. The following sections apply the MSCI Asset Pricing and Dynamic Asset Allocation Models[9] to assess the impact of these three plausible scenarios on the three-year horizon performance of the MSCI World Index (the "market"), a growth sensitive and a growth hedging combination of MSCI factor and sector indexes, and macro-sensitive asset allocations to these indexes.

Forecast Macro Scenarios Could Impact Strategy Returns and Asset Allocation

As we saw in the first section, factor and sector indexes can be grouped into growth sensitive and growth hedging categories based on both historical and model-based analyses. In this section, we focus on two equally weighted portfolios of these factor and sector indexes. The first portfolio blends all the growth sensitive indexes. We label it as "Growth Sensitive Strategy". The second portfolio blends all the growth hedging indexes. We label this portfolio as "Growth Hedging Strategy".

Exhibit 17 shows that macroeconomic scenarios could have varied implications for equity market and strategy returns. Under the MSCI Model Baseline scenario, real GDP growth and inflation forecasts are projected to remain persistently low through 2014. In turn the implied returns from the MSCI Asset Pricing Model are projected to remain broadly stable under this scenario.

At the same time, the MSCI Asset Pricing Model suggests that a faster return to trend growth in DM economies is positive for equities. As shown in Table 4, the model implied annualized return on the MSCI World Index could increase by 1.4% per year over three years. Exhibit 17 also shows how equity strategies could differ in their response to a positive shock to trend growth. While the growth sensitive strategy could experience a larger increase in returns of 1.9% per year over three years, the return to the growth hedging strategy could only increase by the much lower amount of 0.7% per year over the same horizon.

[9] See the Appendix for a detailed description.

In contrast, the Slow Growth scenario could be negative for equities, with annualized returns down from 5.3% to 3.8%, and could reverse the relative performance of growth sensitive and growth hedging strategies.

Exhibit 17: Three-year horizon MSCI Asset Pricing Model projected real returns, conditional on macroeconomic scenarios

	MSCI Asset Pricing Model Projected Real Return (Three-Year Horizon, Annualized)		
Three-Year Horizon Macroeconomic Scenario	**MSCI World Index**	**Growth Sensitive Strategy**	**Growth Hedging Strategy**
Current	5.3%	6.3%	5.3%
MSCI Model Baseline	5.2%	6.2%	5.2%
Return To Long-Term Trend Growth	6.7%	8.2%	6.0%
Slow Growth	3.8%	4.0%	4.5%

The Exhibit shows the annualized, three-year horizon projected real returns from the MSCI Asset Pricing Model conditional on the current economic conditions, the MSCI Model Baseline, the Return to Long-term Trend Growth, and Slow Growth scenarios.

Macroeconomic scenarios could also impact asset allocation decisions. Indeed, the MSCI Dynamic Asset Allocation Model[10] suggests that deviations away from the cap-weighted market portfolio are dictated by an investor's tolerance for macroeconomic uncertainty, investment horizon, and macro views. In our analysis, investors care about both the risk inherent in their current investment opportunity set, and also the uncertainty about the evolution of investment opportunities over time. It is the evolution of investment opportunities over time that is most sensitive to persistent shocks to current economic conditions. Investors could be uncertainty tolerant or uncertainty averse. Uncertainty tolerant investors could be long-term institutional investors with the willingness or capacity to withstand the short-term effects of pervasive shocks to the economy.

At the same time, as discussed in the first section, observed premiums on growth sensitive indexes are compensation for potential and persistent shocks to trend growth. Thus, in the long-term, assuming that economic growth could eventually revert to its long-term average, the model indicates that a strategic tilt towards the growth sensitive indexes could allow uncertainty tolerant institutional investors to benefit from growth sensitive premiums[11]. However, if negative shocks to trend growth are believed to persist for a longer time than expected, the model indicates that uncertainty tolerant investors could benefit from a tactical tilt towards growth hedging indexes[12].

[10] See Exhibit 29 in Appendix X for a description of the equilibrium asset allocation concept underpinning the MSCI Dynamic Asset Allocation model.

[11] For more details on this point and the implications of our framework and models for long-term strategic asset allocation, see "Macro Risk and Strategic Asset Allocation: Deconstructing Risk Parity Portfolios." MSCI Market Insight, June 2013.

[12] The results presented in this paper and in Exhibit 18 are based on MSCI Macroeconomic, Asset Pricing and Asset Allocation Models. The models are statistical and data driven models, and do not contain investment choices or recommend any specific investments.

Exhibit 18: Three-year horizon macro-sensitive allocations to growth sensitive and growth hedging strategies, conditional on macroeconomic scenarios

Three-Year Horizon Macroeconomic Scenario	Three-Year Horizon Macro-Sensitive Asset Allocations		
	MSCI World Standard Index	Growth Sensitive Strategy	Growth Hedging Strategy
Current MSCI Model Baseline	48%	0%	52%
	46%	0%	54%
Return To Long-Term Trend Growth	53%	47%	0%
Slow Growth	0%	0%	100%

The Exhibit shows, for an uncertainty tolerant institutional investor, the optimal three-year horizon optimal asset allocations from the MSCI Dynamic Asset Allocation Model, conditional on the current economic conditions, the MSCI Model Baseline, Return to Long-term Trend Growth, and Slow Growth scenarios.

Exhibit 18 illustrates this point, for a particular uncertainty tolerant institutional investor. If this investor believes in the MSCI Model Baseline scenario, where growth and inflation could remain below trend, the model calculates an optimal 54% tilt towards the growth hedging strategy. In contrast, if this same investor rather believes that economic growth in DM economies could quickly return to its trend, the model calculates an optimal 47% tilt towards the growth sensitive strategy over the growth hedging strategy tilt of the baseline scenario. Last, if this investor assumes that growth and inflation could decline further relative to the Baseline scenario ("slow growth"), the model indicates allocating fully to the growth hedging strategy.

Taken together, the historical analysis of the previous section and the model-based analysis of this section illustrate how the impact of macroeconomic scenarios on factor and sector index performance, and optimal allocations to these indexes could be assessed in a structured way. The results outlined in this paper open up a number of important questions. In particular, one question is how to evaluate and back-test strategies that are conditioned on macroeconomic views. Another question is how these strategies can be implemented in a cost effective fashion. These issues will be explored in subsequent papers in the series.

Conclusion

A recurrent theme of the last few years among investors has been concern over the changing state of the economy and its impact on their investments. As a result, many institutional investors have started explicitly accounting for macroeconomic conditions in their asset allocation decisions and as part of that shift are trying to create a process for identifying macroeconomic-sensitive portfolios.

In this paper, the first in a series, we attempt to give this process a framework. We build both on a historical analysis using our 40+ years' history of MSCI factor and sector indexes and a long-term analysis based on forecasts from the MSCI Macroeconomic and MSCI Asset Pricing Models.

We start by classifying the MSCI factor and GICS 10 sector indexes based on their historical short-term and model-based long-term responses to economic growth and inflation. Next, using historical data, we classify economic regimes through a bivariate framework that groups economic regimes into four quadrants, depending on whether the CLI and CPI are rising or falling, and examine the differential performance of our index universe across these states, and the relative performances of the indexes through regime *transitions*. Finally, we apply the MSCI Asset Pricing Model to assess the likely performance of these indexes under statistically plausible forecasts and macroeconomic scenarios, and to derive combinations of MSCI World factor and sector indexes that could potentially benefit from or offer protection under changing economic regimes.

Our results suggest that factor and sector indexes exhibit varied sensitivity to the economy. The historical analysis show Industrials, Consumer Discretionary and Information Technology as the three most cyclical sectors (highest correlations on average to the business cycle); and Health Care, Consumer Staples, and Utilities as the most defensive (most negative correlations). In factor indexes Equal Weighted and Value Weighted have been the most cyclical, and Minimum Volatility, and Quality the most defensive.

The long-term models forecast that the Momentum, Value Weighted, and Equal Weighted Factor Indexes could exhibit the highest active returns following a large positive shock to trend growth in Developed Market (DM) economies (most "growth sensitive"). They also model that Minimum Volatility, High Dividend Yield and Quality could outperform following a large negative shock ("growth hedging"). Materials, Consumer Discretionary and Financials are the most growth sensitive sectors in the model, while Consumer Staples, Health Care, and Utilities are the most growth hedging. Here, short-term historical performance and long-term, model-based performance concur.

Our historical analysis adds a measure of inflation (CPI) and divides history into periods where CLI/CPI are rising/falling separately. The results are intuitive for the CLI, especially for the Minimum Volatility Index and defensive sectors, although CPI results are less conclusive.

However the results suggest inflation impacts equities in different ways over the short- and long-term. The model-based analysis looks at the long-term sensitivity of equity factor and sector indexes to inflation. Inflation could impact equities in two ways. Firstly, higher inflation generally has a negative impact on future long-term real GDP growth. Thus, Small Caps may see short-term out-performance as inflation rises, but be relatively more impacted by inflation in the long-term, as they are more sensitive to real GDP growth. Secondly, factors such as High Dividend Yield and Quality and sectors such as Consumer Staples, are generally long duration with stable nominal cash-flows. Higher inflation will have a more negative impact on their *real* cash-flows over time.

The behavior of factor and sector indexes may also be sensitive to economic regimes and regime transitions. We classify economic regimes through a bivariate ('Quadrant') framework of CLI/CPI rising/falling, and find that the Momentum and Equal Weighted Factor Indexes have performed best in "Heating Up" and "Goldilocks" scenarios, while the Minimum Volatility Index showed the largest positive relative performance in a 'Stagflation' environment. Our results also suggest that defensive sectors have outperformed most in "Slow Growth". Turning to regime transitions, in an economic regime where growth is remaining positive or strengthening then the Equal Weighted Factor Index

has historically outperformed and Minimum Volatility underperformed. On the other hand, in an environment of slowing growth an investment in Quality has generally outperformed, and when coupled with low inflation then Minimum Volatility has outperformed also. In sectors, Utilities have generally underperformed in environments of strong growth, but when growth has fallen then a Consumer Staples overweight has historically outperformed. If this drop in growth comes with increasing inflation ("Stagflation") then Energy has been the standout performer.

Our framework and models have important implications for asset allocation: deviations away from the market cap portfolio depend on an investor's macroeconomic views and tolerance for macroeconomic uncertainty. For institutions that have their own views on short-term changes in macroeconomic conditions that could have persistent effects on trend growth and inflation, the analysis above could help lead to tactical asset allocation between factor and sector indexes. For an uncertainty tolerant investor assuming DM economic growth returns quickly to its trend, the models indicate allocating towards growth sensitive indexes. In contrast, if slow growth and low inflation are believed to persist, the models indicate allocating towards growth hedging indexes[13]. Subsequent papers in the series will further explore cost effective implementations of macro-sensitive strategies based on MSCI Factor, Sector, and Thematic Indexes.

[13] The results presented in this paper are based on the MSCI Macroeconomic, Asset Pricing and Asset Allocation Models. The models are statistical, data driven models, and do not contain investment choices or recommend any specific investments.

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Appendix

I. Start Dates for Equity Data

Exhibit 19: Start dates of factor and sector index data

Index Name	Gross Index Start Dates	Live Date (if different)	
Cap Weighted Indexes			
MSCI World Index (Large+Mid Cap)	Dec 31, 1969		
Factor Indexes			
MSCI World Equal Weighted Index	May 31, 1973	Jan 22, 2008	
MSCI World High Dividend Yield Index	Nov 28, 1975	Oct 31, 2006	
MSCI World Minimum Volatility Index (USD)	May 31, 1973	Apr 14, 2008	*
MSCI World Momentum Index	May 31, 1973	Dec 11, 2013	
MSCI World Quality Index	Nov 28, 1975	Dec 18, 2012	
MSCI World Risk Weighted Index	May 31, 1973	Apr 06, 2011	
MSCI World Value Weighted Index	May 31, 1973	Dec 07, 2010	
Sector Indexes			
MSCI World Sector Indexes	May 31, 1975		**

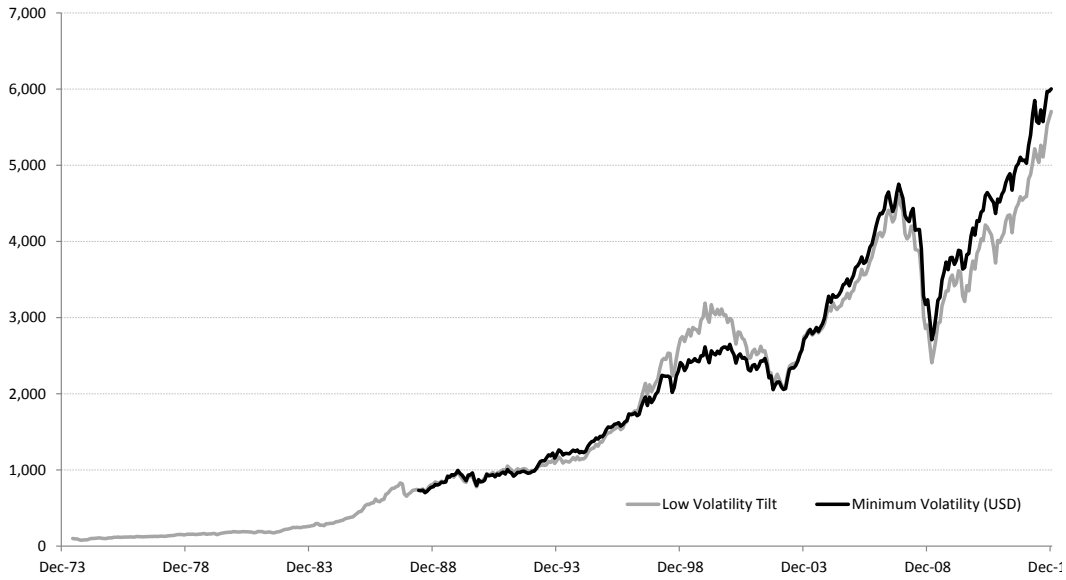
* Official history from May 31, 1988: Simulated using top-300 risk-weighted stocks prior
** Official history from December 31, 1994: Simulated using sector mapping (Exhibit 21) prior

II. Generation of Minimum Volatility Index Proxy

Simulation of Low Volatility Index data prior to 1988

For the MSCI Minimum Volatility (USD) Index, MSCI has official data available publicly back to the end of May 1988, which is when the first instance of the Barra risk model used to perform the optimization for the index was created. For the purposes of our study we have simulated a proxy for the MSCI Minimum Volatility Indexes for World and USA prior to May 31, 1988. The simulated proxy selects the top 300 stocks by lowest 3-year weekly variance from the MSCI World Index, constructs a 'score' which is the inverse of this variance, and then weights stocks in proportion to this score × market capitalization. Exhibit 20 compares the performance of our simulated Low Volatility Tilt Index with the official MSCI Minimum Volatility (USD) Index on the MSCI World universe. The historical tracking error between the two has been 4.40%.

Exhibit20: Historical Performance of MSCI World Minimum Volatility (USD) Index and simulated World Low Volatility Tilt



III. Barra →GICS® Sector Mapping

(to simulate GICS Sectors pre-1994)

Exhibit 21: Barra Industry to GICS Sector mapping

GICS Sector	Barra Industry Classification
ENERGY	ENERGY SOURCES
	ENERGY EQUIPMENT & SERVICES
MATERIALS	BUILDING MATERIALS & COMPONENTS
	CHEMICALS
	FOREST PRODUCTS & PAPER
	METALS - NON FERROUS
	METALS - STEEL
	MISC. MATERIALS & COMMODITIES
	CONSTRUCTION & HOUSING
	GOLD MINES
INDUSTRIALS	AEROSPACE & MILITARY TECHNOLOGY
	INDUSTRIAL COMPONENTS
	MACHINERY & ENGINEERING
	TRANSPORTATION - AIRLINES
	TRANSPORTATION - ROAD & RAIL
	TRANSPORTATION - SHIPPING
	WHOLESALE & INTERNATIONAL TRADE
CONSUMER DISCR	APPLIANCES & HOUSEHOLD DURABLES
	AUTOMOBILES
	RECREATION, OTHER CONSUMER GOODS
	TEXTILES & APPAREL
	BROADCASTING & PUBLISHING
	LEISURE & TOURISM
	MERCHANDISING
CONSUMER STAPLES	BEVERAGES & TOBACCO
	FOOD & HOUSEHOLD PRODUCTS
HEALTH CARE	HEALTH & PERSONAL CARE
FINANCIALS	BANKING
	FINANCIAL SERVICES
	INSURANCE
	REAL ESTATE
INFORMATION TECH	DATA PROCESSING & REPRODUCTION
	ELECTRICAL & ELECTRONICS
	ELECTRONIC COMPONENTS,INSTRUMENTS
	BUSINESS & PUBLIC SERVICES
TELECOM SVC	TELECOMMUNICATIONS
UTILITIES	UTILITIES - ELECTRICAL & GAS

IV. Further Details on Economic Data Series

OECD CLI

The starting point of our study was to use some measure of the overall state of the economy to classify the current economic regime. Some of the existing literature on this topic defines economic expansions and contractions according to changes in gross domestic product (GDP) or references the National Bureau of Economic Research (NBER) business cycle definitions. This literature finds that the excess returns of a sector rotation strategy are not significant (for example, Stangl et al. (2009)).

We chose to start our historical analysis by extending earlier MSCI work[14] which classified sectors as defensive or cyclical based on the strength of their co-movement with the business cycle. In that study, we used the Organization for Economic Cooperation and Development's (OECD) Composite Leading Indicator (CLI) series to define expansions and contractions (as stock prices usually anticipate economic up-and downturns). When defining business cycles in this way, we find that performance differentials between cyclical and defensive sectors are important.

As described by the OECD, the system of CLIs is designed to provide early signals of turning points in business cycles - i.e. fluctuation of the economic activity around its long term potential. Details on the data series chosen by country, the weighting schemes used, and the data filtering employed are available in the OECD's "System of Composite Leading Indicators" methodology document.

We compare the MSCI World factor and sector indexes to the OECD – Total CLI series using monthly observations.

CPI

Having looked at factor and sector performance based on overall response to changes in the OECD CLI, we wanted to add an extra dimension of discrimination using inflation firstly as a separate univariate variable and then also as a second independent variable in conjunction with CLI.

Once again we turned to the OECD to source our measure of inflation. The measure of inflation we chose was the annual inflation rate, i.e. the movement of the Consumer Price Index (CPI) from one month to the same month of the previous year expressed as percentage over time.

Within the family of six CPIs calculated by the OECD we use 'CPI All items'. In a similar fashion to CLI, further details on the OECD's CPI dataset and calculations are available in the OECD's Methodological Notes. As with CLI, we compare MSCI World sector and factor Indexes to OECD – Total CPI using monthly observations.

[14] Kouzmenko, R. and Z. Nagy, 2009, "Sector Performance Across Business Cycles," MSCI Research Bulletin

V. Stress Tests

Stress tests – Using actual historical economic regime changes

In this paper we have tried to help investors understand how their equity factor and sector investments have performed historically in the presence of macroeconomic uncertainty by characterizing their responses as various macroeconomic variables have changed. One frequent question we receive from investors is: "How would my portfolio have performed through [for example] the 1990-91 economic slowdown?" Such scenario analyses are commonly called stress tests, and we have taken a subset of those used in our BarraOne risk management software and shown how the MSCI factor and sector indexes have performed over these in Exhibit22.

Exhibit22: (a) MSCI World factor indexes, and (b) MSCI World sector indexes active returns and (c) scenario dates for historical market stress periods

(a)

Event	MSCI World Return	Equal Weighted	High Dividend Yield	Minimum Volatility**	Momentum	Quality	Risk Weighted	Value Weighted	Change in Adjusted CLI	Change in Rolling Inflation	Change in VIX
1987 Market Crash (Aug. to Nov.)	-16%	-4%	-7%	-2%	8%	-9%	-4%	-5%	0.02	0.9%	28.28
1990 - 1991 Economic Slow Down	-13%	0%	15%	1%	7%	19%	4%	7%	-1.83	1.1%	4.01
1994 US Rate Hike	-1%	-1%	-4%	-1%	-7%	1%	-1%	0%	0.88	1.0%	2.55
1997 - 1998 Asian Financial Crisis	3%	-14%	6%	3%	6%	7%	-6%	0%	-0.01	0.0%	0.47
2001 Dot-com Slowdown	-37%	4%	11%	15%	11%	12%	15%	2%	-0.48	-1.1%	1.22
2007 - 2008 Oil Price Rise	-1%	-5%	-10%	-4%	17%	9%	-5%	-6%	-0.88	2.1%	12.09
2007 - 2008 Subprime Mortgage Meltdown	-6%	-3%	-3%	3%	5%	5%	-1%	-3%	-0.67	1.5%	-0.99
2010 Peripheral European Debt Crisis	-10%	2%	3%	9%	1%	2%	5%	0%	0.17	-0.5%	6.42
2011 US Debt Ceiling Act	-18%	0%	6%	13%	7%	7%	6%	0%	-0.91	0.5%	28.21

(b)

Event	MSCI World Return	World Energy	World Materials	World Inust.	World Cons. Discr.	World Cons. Staples	World Health Care	World Fins.	World Info. Tech.	World Telco.	World Utils.	Change in Adjusted CLI	Change in Rolling Inflation	Change in VIX
1987 Market Crash (Aug. to Nov.)	-16%	-11%	2%	1%	-7%	0%	-3%	5%	-4%	3%	17%	0.02	0.9%	28.28
1990 - 1991 Economic Slow Down	-13%	9%	-8%	-8%	-3%	18%	23%	-7%	11%	5%	4%	-1.83	1.1%	4.01
1994 US Rate Hike	-1%	2%	7%	0%	0%	5%	7%	-6%	16%	-5%	-9%	0.88	1.0%	2.55
1997 - 1998 Asian Financial Crisis	3%	-2%	-18%	-11%	-3%	2%	11%	1%	3%	16%	9%	-0.01	0.0%	0.47
2001 Dot-com Slowdown	-37%	16%	14%	-2%	-1%	30%	14%	1%	-20%	-16%	-1%	-0.48	-1.1%	1.22
2007 - 2008 Oil Price Rise	-1%	50%	46%	2%	-19%	7%	-8%	-27%	3%	0%	19%	-0.88	2.1%	12.09
2007 - 2008 Subprime Mortgage Meltdown	-6%	13%	16%	-2%	-7%	11%	3%	-11%	-5%	2%	12%	-0.67	1.5%	-0.99
2010 Peripheral European Debt Crisis	-10%	-2%	-1%	1%	4%	7%	1%	-2%	-2%	12%	8%	0.17	-0.5%	6.42
2011 US Debt Ceiling Act	-18%	-2%	-6%	-4%	2%	10%	7%	-6%	7%	8%	12%	-0.91	0.5%	28.21

(c)

Event	Start Date Used	End Date Used
1987 Market Crash (Aug. to Nov.)	31-Jul-87	30-Nov-87
1990 - 1991 Economic Slow Down	29-Dec-89	31-Jan-91
1994 US Rate Hike	31-Jan-94	30-Dec-94
1997 - 1998 Asian Financial Crisis	30-Jun-97	30-Jan-98
2001 Dot-com Slowdown	28-Feb-01	31-Oct-02
2007 - 2008 Oil Price Rise	29-Dec-06	30-Jun-08
2007 - 2008 Subprime Mortgage M	31-Jul-07	31-Mar-08
2010 Peripheral European Debt Cr	31-Mar-10	31-Aug-10
2011 US Debt Ceiling Act	29-Apr-11	30-Sep-11

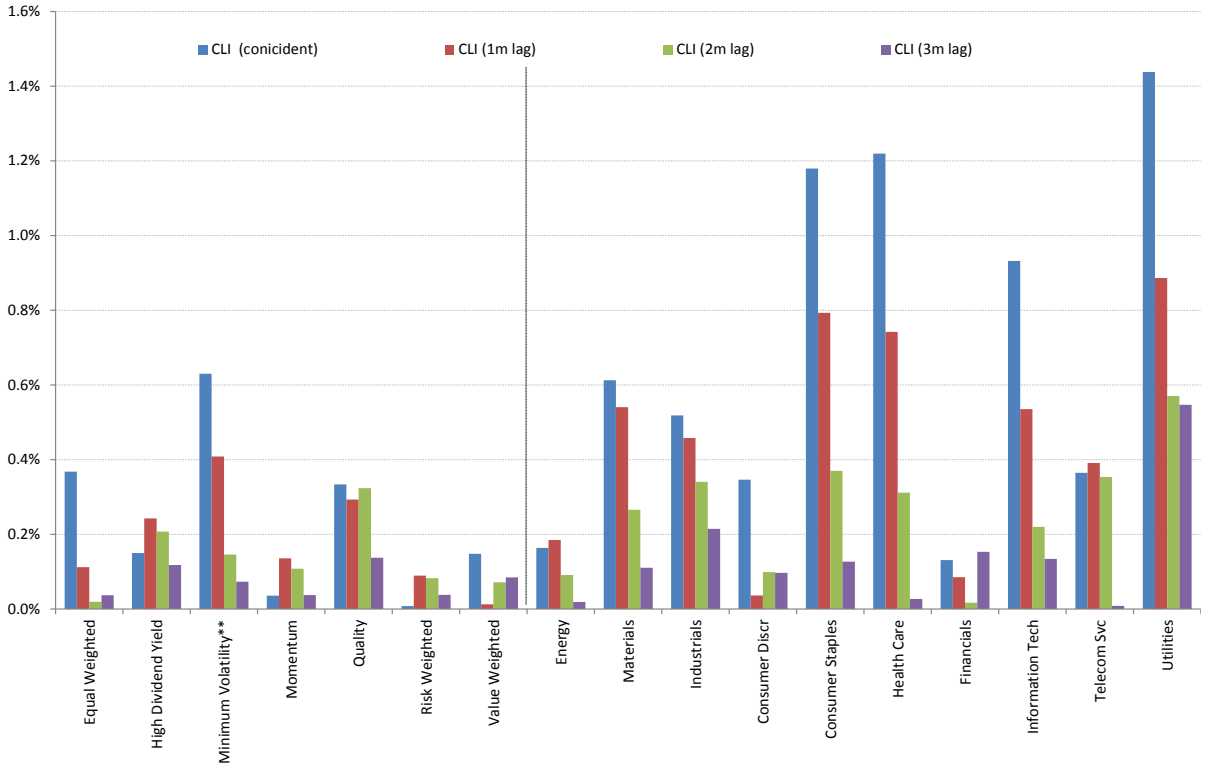
VI. A Note about our Lack of Perfect Foresight

Our historical analysis has been built by looking back in time and classifying economic regimes via the levels of and changes in two variables, the CLI and CPI, and then seeing how equity factor and sector index returns have historically moved. Our historical analysis ended in December 2013, and it is March 2014 at time of writing, so all the historical data we have needed has been available to us.

However, economic data is rarely, if ever, available at the same time as the period which it attempts to describe, and can also be subject to revision. For example, OECD CLI and CPI data is generally produced with a two-month lag (so January but not February 2014 data is available now). In short, we only have enough data *now* to tell us which state we were in *two months ago*.

One solution to avoid this *look-ahead bias* would be to lag our OECD data by two months, but as Exhibit 23 shows, the index responses decay as we lag the leading indicators. The equity markets respond to leading indicators without a lag.

Exhibit 23: Absolute active return differential between periods of increasing and decreasing CLI as data is lagged



Another idea would be to assume that the market can anticipate some of the components of these leading indicators, even though they aren't officially observed or recorded until later and use the various forecasts which exist, but the predictive capability of these forecasts is hard to prove.

So, while we don't find lagging our data or using economic forecasts useful, we do feel that we can give investors the comfort that this is not simply an exercise in historical data crunching, but can be useful in making forward looking investment decisions, for the reasons explained below:

Firstly, as shown in Exhibit12 above, knowing which regime we were in two months ago can give us reasonable certainty of the regime we are in now, as transitions happen gradually and smoothly.

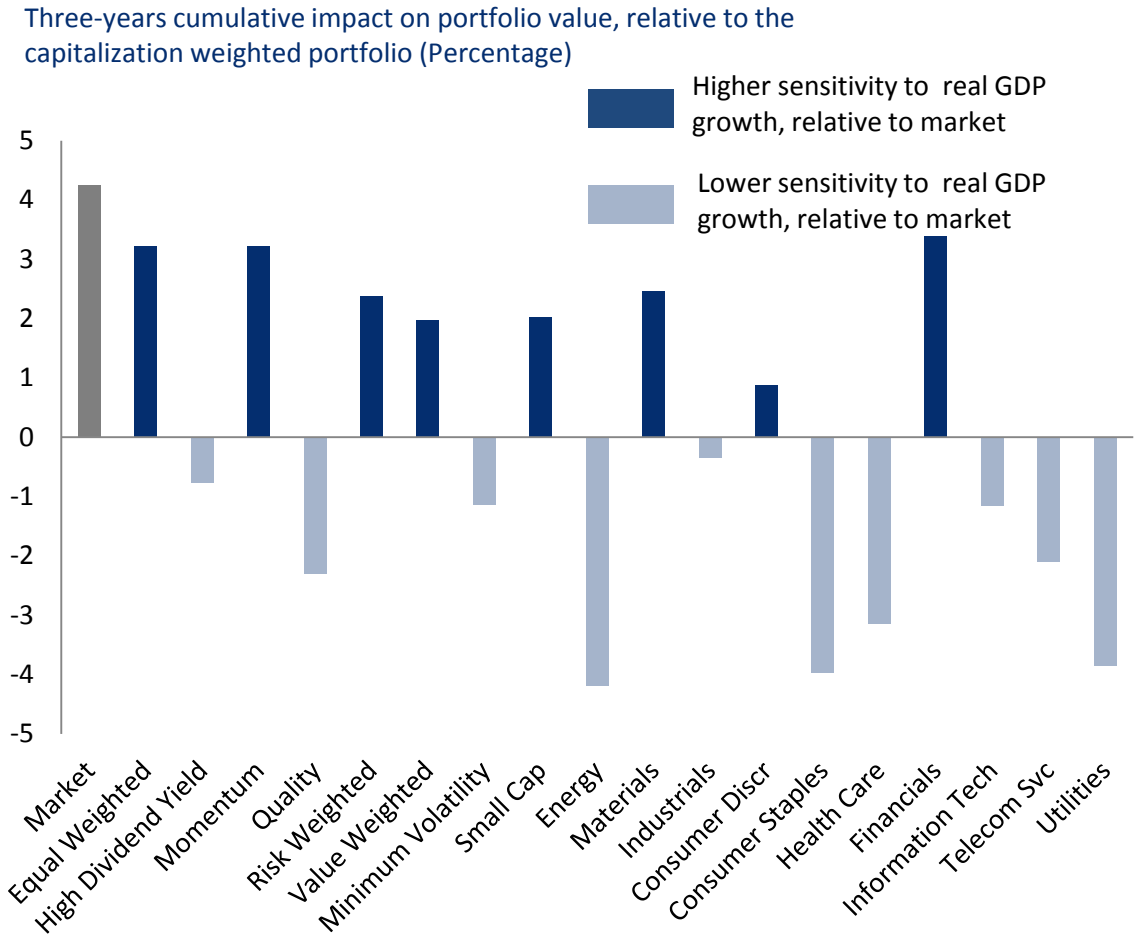
Secondly, we believe investors can use equity returns over the periods between economic variable observations to anticipate regime transitions (including the 'transition' of staying in the same state). It is clear that there is a relationship between stock returns and leading indicators although we don't claim that there is predictive value. Examining actual returns and comparing these to those observed historically over regime transitions can give us an indication on the likelihood and direction

of an upcoming state change, although we will never be able to say *with certainty* which regime we are in *now* or where we will be in the future.

Finally, as shown in the long-term model-based analysis section of this paper, in the long run stocks tend to react slowly to GDP shocks. It can take up to five years or longer for such a shock to be incorporated into returns. Whereas, the aim of our historical analysis was to show the relationship between economic variables and short-term equity index returns, investors thinking strategically about long-term equity allocations under economic regime shifts should focus on this framework.

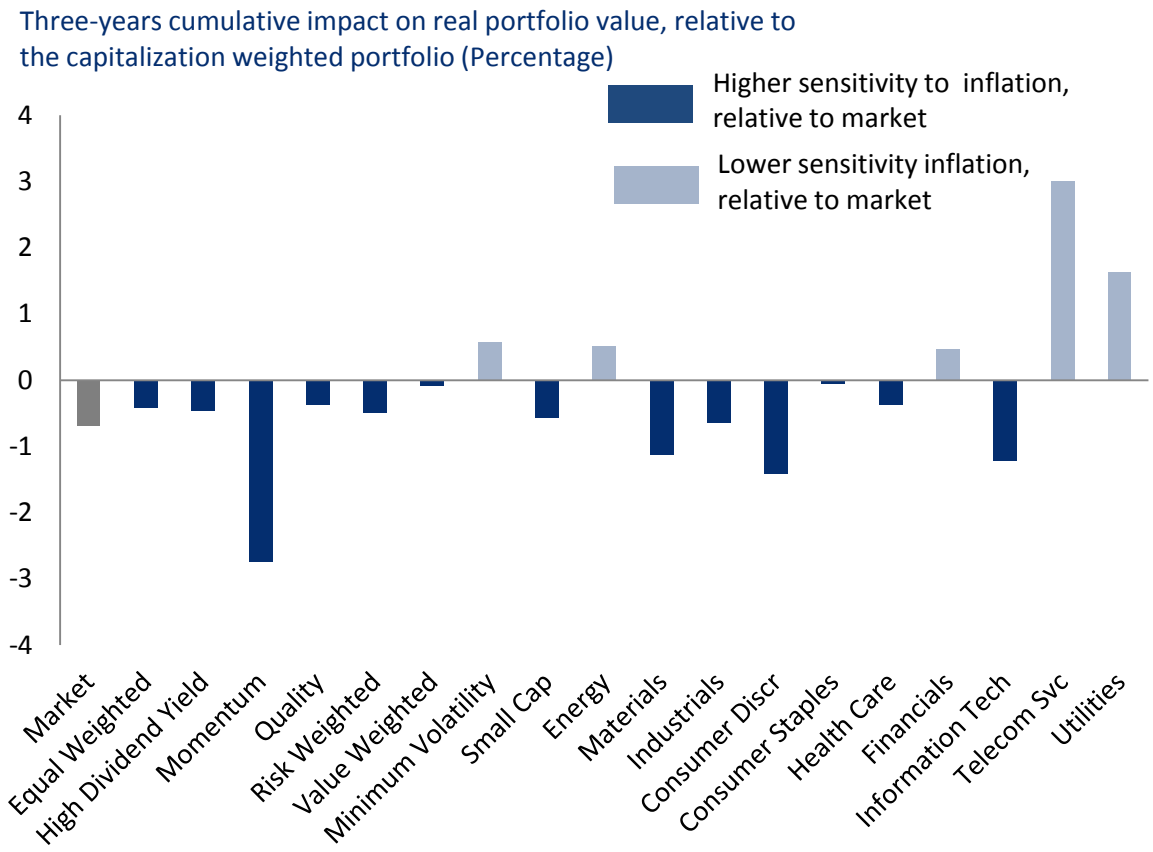
VII. Equity Portfolios Returns Differ in Their Long-Run Sensitivity to Macroeconomic Shocks

Exhibit 24: A return to trend growth in DM economies is positive for equity real returns



The Exhibit shows the three-year cumulative impact of a 1.5 percent positive shock to real GDP growth on the MSCI World Index ("Market"), MSCI World factor and sector indexes real returns. Return responses are relative to the baseline three-years out growth forecast for DM economies of 1.5 percent.

Exhibit 25: High inflation is negative for equity factor and sector returns



The Exhibit shows the three-year cumulative impact of a 1.5 percent positive shock to inflation on the MSCI World Index ("Market"), MSCI World factor and sector indexes real returns. Return responses are relative to the baseline three-years out inflation forecast for DM economies of 1.5 percent.

VIII. Monthly Macroeconomic Indicator Heat-Map

Exhibit 26: Monthly macroeconomic indicator heat-map

As of 03/02/2014	Industrial Production	Retail Sales	Unemployment	CPI Inflation	Unit Labor Cost	Trade Balance	Exports
US	0.40	0.24	**-1.08**	**0.67**	**0.23**	**-0.06**	**-0.01**
Canada	**0.44**	**-3.75**	-0.36	**-0.25**	0.10	**0.77**	0.13
UK	0.44	**0.18**	**-0.59**	**-0.27**	**0.00**	**0.04**	**-0.26**
Germany	**0.16**	**0.25**	0.20	**-0.65**	0.11	**0.48**	0.01
France	**0.24**	**0.11**	**0.19**	**-1.03**	0.05	0.14	-0.11
Spain	0.23	**-0.55**	**-0.26**	**-0.53**	-0.24	-0.01	**-0.15**
Italy	0.04	**-0.02**	**0.85**	**-2.88**	**0.01**	**1.26**	**0.04**
Japan	**0.75**	**0.45**	**-0.63**	**1.10**	**-0.65**	**-1.49**	0.60
China	-0.07	0.08	-0.18	**0.05**	0.18	**1.26**	**0.41**

The heat map shows, for each variable, the change in their realized value over previous quarter's trend, normalized by their historical standard deviation. Shaded figures indicate above one standard deviation changes (positive or negative). Red colored scores contribute to a potential decline in real GDP relative to previous quarter trend. Green colored scores contribute to a potential increase in real GDP relative to previous quarter trend. Bold figures indicate scores that remain in positive/negative territory.

IX. The MSCI Macroeconomic Model: Measuring Macroeconomic Risk

The MSCI Macroeconomic Model is a collection of single country models that are related to one another through global growth and global inflation. Each country-specific model is a mixed-frequency Bayesian Vector Autoregressive model (BVAR) that aims to generate timely forecasts of macroeconomic variables (such as real GDP growth, CPI inflation), and forecast scenarios for these macroeconomic variables.

Introduced by Sims (1980a, 1980b), BVARs are commonly used, data driven statistical models that explain the joint behavior of observable time series of multiple variables. These models are parsimonious devices to capture the complex relationships between different macroeconomic variables, and their evolution over time. In a BVAR model, each variable mechanically depends on its own lagged values, and the lagged values of all the other variables. A joint probability distribution (or prior) is specified for the time series of macroeconomic variables, and systematically updated based on available information using Bayes rule.

The specification of prior distributions for the time series of macroeconomic and financial variables is standard in the academic literature, following the work of Doan, Litterman, and Sims (1984). These distributions impose statistical restrictions in models employing a large number of variables with few observations. These restrictions avoid over-fitting the model to the data. The prior distribution employed in the MSCI Macroeconomic Model is grounded on observed long-run empirical regularities in macroeconomic variables.

An attractive feature of our model is that it produces timely forecasts. In particular, it overcomes the important problem of delays in macroeconomic data releases by applying the statistical methodology developed in Schorfheide and Song (2012). This methodology efficiently combines monthly macroeconomic indicators observed in a timely fashion, together with the typically lagging quarterly macroeconomic variables. For example, in addition to real GDP growth and corporate profits, that are only observed on a quarterly basis, typically with a lag, the MSCI Macroeconomic Model also made efficient use of variables available on a more timely, monthly basis, such as CPI

inflation, term spread (10-Year minus 3 month), money growth (M2), Fed base rate, the SPGS Commodity Index, unemployment rate, exports, capacity utilization, and labor unit cost.

Given observed historical time series on macroeconomic variables, and the data-driven prior distribution assumption, Monte Carlo simulation techniques are used to estimate the parameters of the model. Macroeconomic forecasts and forecast scenarios are mechanically derived using the estimated lead-lag dynamic structure of the model. As an example, Exhibits 27 and 28 show the model's forecasts as of March 2, 2014 for the year ahead and three-years out, and confidence bands for these forecasts.

Exhibit 27: Global trend growth is projected to remain below long-term average

Country	Long-Term Trend Through 2007	Last Four Quarters	MSCI Year-Ahead Forecasts			MSCI Three-Years Out Forecasts		
			Baseline	Low	High	Baseline	Low	High
Global	3.8	2.5	2.4	0.7	4.0	2.3	0.4	4.2
US	3.4	2.4	2.3	0.9	3.8	2.3	0.8	3.9
Canada	3.5	2.2	1.9	0.6	3.0	1.8	0.3	3.2
UK	2.8	2.7	2.3	1.0	3.6	1.6	0.3	3.2
France	3.4	1.2	1.1	-0.1	2.2	1.0	-0.3	2.3
Germany	1.8	1.8	2.3	0.5	4.1	2.0	0.0	4.1
Spain	4.0	0.2	1.7	0.6	2.8	1.8	0.2	3.4
Italy	3.0	-1.1	-0.5	-2.2	1.2	-0.7	-2.8	1.2
Japan	3.5	2.0	1.1	-1.2	3.5	0.8	-1.8	3.1
Australia	3.5	2.3	2.5	1.4	3.6	2.6	1.4	3.7
China	7.5	7.8	8.4	6.7	10.0	8.6	6.6	10.6
South Korea	7.5	4.1	3.1	0.7	5.5	2.8	0.3	5.4
India	6.3	3.4	5.0	2.5	7.1	4.7	1.6	7.4
Brazil	2.7	0.2	-0.4	-3.8	2.7	1.5	-2.8	4.6
Russia	6.9	0.0	0.3	-4.9	5.7	1.0	-6.1	7.6

The Exhibit shows year-ahead and three-years out forecasts for real GDP growth from the MSCI Macroeconomic Model, and compares these forecasts to the historical long-term trend through 2007 and the past year's average. All growth rates are annualized percentage rates. "Low" and "High" forecasts represent the 30-70 confidence bands around the baseline forecasts.

Exhibit 28: Global inflation is projected to remain persistently low and low long-term average

Country	Long-Term Trend Through 2007	Last Four Quarters	MSCI Year-Ahead Forecasts			MSCI Three-Years Out Forecasts		
			Baseline	Low	High	Baseline	Low	High
Global	3.8	1.8	1.7	1.0	2.4	1.8	0.9	2.7
US	4.0	1.7	1.7	1.3	2.0	1.7	1.2	2.3
Canada	2.5	1.3	1.4	0.8	2.0	1.4	0.8	2.1
UK	2.7	1.6	2.5	1.2	3.7	2.7	1.5	4.0
France	1.8	0.5	0.7	-0.2	1.5	1.0	0.0	2.1
Germany	2.0	1.1	1.5	0.7	2.3	1.6	0.7	2.5
Spain	3.3	0.7	0.0	-0.8	0.8	0.8	-0.4	2.2
Italy	6.4	1.2	1.1	0.0	2.1	1.2	0.0	2.3
Japan	3.5	1.7	0.7	-0.1	1.5	0.8	-0.1	1.6
Australia	3.4	2.6	2.3	1.6	3.1	2.5	1.8	3.2
China	0.4	2.3	2.5	0.8	3.9	2.6	0.5	4.6
South Korea	6.6	1.9	2.0	1.1	2.9	2.0	0.9	3.1
India	7.2	7.9	8.6	5.8	11.7	9.5	6.0	13.1
Brazil	7.2	3.1	5.5	3.3	7.6	5.6	3.2	7.9
Russia	13.1	6.2	4.5	1.8	7.3	5.5	1.1	9.7

The Exhibit shows year-ahead and three-years out forecasts for consumer price inflation from the MSCI Macroeconomic Model, and compares these forecasts to the historical long-term trend through 2007 and the past year's average. All inflation rates are annualized percentage rates. "Low" and "High" forecasts represent the 30-70 confidence bands around the baseline forecasts.

X. MSCI Equilibrium Asset Allocation Model

The asset pricing model that we use to establish long-run returns is based on assumptions about a "representative" investor. In our analysis, this 'stand-in' investor cares about both the risk inherent in today's investment opportunity set, and also the uncertainty about the evolution of investment opportunities over time. It is the evolution of investment opportunities over time that is most sensitive to shocks to economic conditions. Our research shows how an investor's investment horizon and willingness to tolerate macroeconomic uncertainty informs asset allocation decisions.

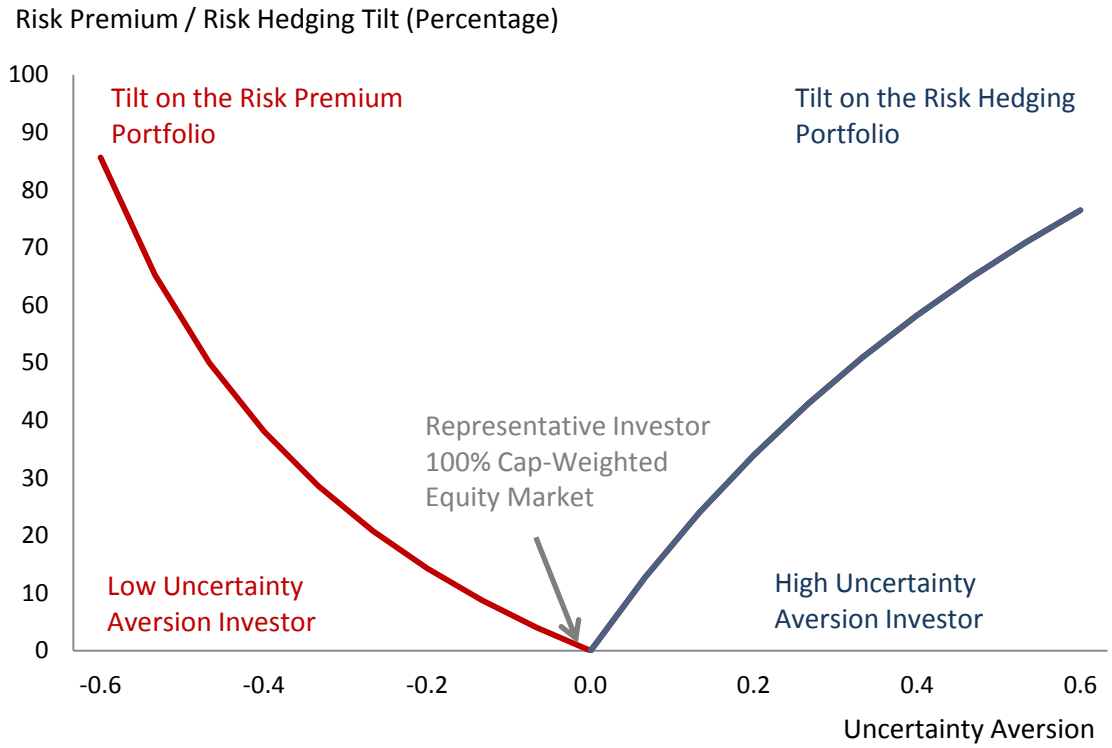
Our framework and models suggest that the observed historical premiums on strategies such as value and small cap are compensation for persistent shocks to trend growth. These premiums are also consistent with the *hypothetical* investor holding the market portfolio. However, *specific* investors can reasonably deviate from holding market cap weights. The issue is: what would cause investors to deviate from holding the market portfolio?

In the usual CAPM framework, investors care about risk aversion. Differences in risk aversion among investors lead to adjustments in the split between risky and risk-free assets, but not in the composition of the risky portfolio; in equilibrium, the risky portfolio for all investors is the market portfolio. In our analysis, investors are both risk averse *and* uncertainty averse. Aversion or tolerance to uncertainty is what dictates an investor's aversion to, or preference for, high cash flow beta portfolios. Preferences for high cash flow betas, in turn, drive allocations to either the risk premium portfolio or the risk hedging portfolio.

Exhibit 29 illustrates these points. In the graph, the representative investor holds the market portfolio where all strategies and assets are held in their capitalization weights. Now suppose that an investor can tilt towards either risk premium or risk hedging portfolios. For this example, the risk premium portfolio is assumed to be a value-weighted portfolio of US value, small cap, consumer discretionary, financials, real estate and materials, while the risk hedging portfolio is assumed to be a value-weighted portfolio of US growth, large cap, utilities, health care, industrials, telecoms, energy, information technology, and consumer staples.

What happens to the strategy mix as uncertainty aversion changes? As Exhibit 29 illustrates, the uncertainty averse investor (represented by a high uncertainty aversion parameter) tilts away from the market portfolio and allocates a larger proportion of the portfolio to the risk hedging portfolio. By contrast, the uncertainty seeking investor (represented by a low uncertainty aversion parameter) tilts away from the market portfolio and allocates a larger proportion of the portfolio to risk premium assets.

Exhibit 29: Portfolio holdings change with uncertainty aversion



The Exhibit shows how long-run portfolio holdings change with an investor's uncertainty aversion. The representative investor holds the 100 percent capitalization-weighted equity market portfolio. The uncertainty aversion (UA) scale is normalized so that the representative investor has an UA of 1. For example, an investor with an UA of 1.2 is 20% more uncertainty averse than the representative investor, and an investor with an UA of 0.8 is 20% more uncertainty tolerant. The representative investor's uncertainty aversion was calibrated to match the observed equity market average return of 7.9 percent from 1950 to 2011. Investors that are more uncertainty averse tilt towards the Risk Hedging portfolio, while investors that are more uncertainty tolerant tilt towards the Risk Premium portfolio.

The asset allocation differences in Exhibit 32 raise the question: why does uncertainty aversion vary among investors? One possibility is that there are classes of investors for whom short-run horizon effects are important. These investors may not be willing to tolerate large short-term swings in portfolio value, nor have the patience for the long-term resolution of uncertainty. An example of

such an investor class could be individual investors. By contrast, other classes of investors may exist for whom short term effects are less relevant. They may be long-lived organizations whose short term spending needs are not driven by portfolio value. Consequently, they may have the patience required for the long-term resolution of uncertainty.

While investor attitudes about uncertainty can vary by investor class, it is important to recall that the *aggregate of all investor holdings must equal the market portfolio*. Looking again at Exhibit 29, the differences in asset allocation illustrate how an equilibrium, where the representative investor holds the market portfolio, can be compatible with differences in asset allocations across investor classes.

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[1] *As of September 30, 2013, as reported on January 31, 2014 by eVestment, Lipper and Bloomberg* *Feb 2014*