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A Macroeconomic Switchboard for Risk Factor Allocation

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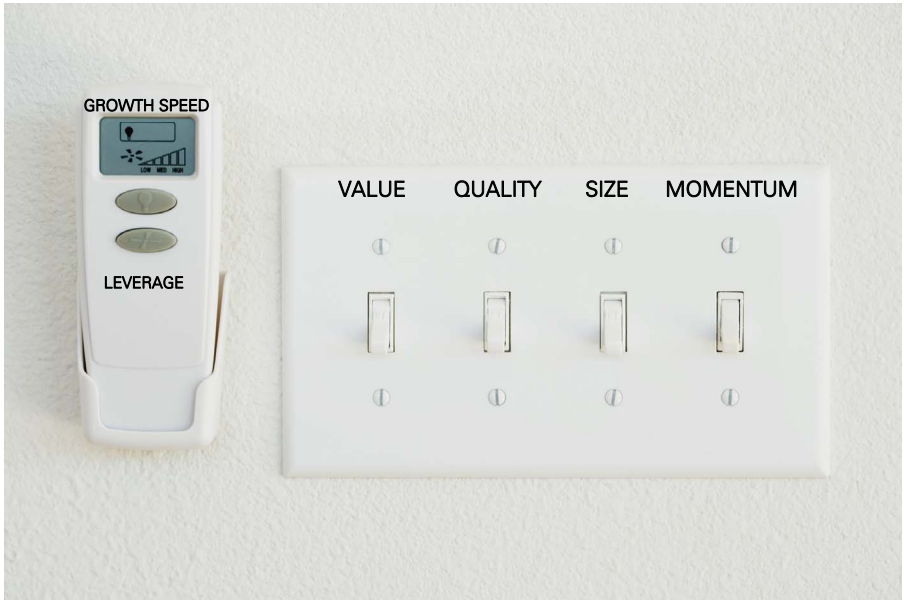
Utilizing Macroeconomic Dynamics in Risk Factor Investing

In this report we introduce a taxonomy of macroeconomic and financial market conditions, which draws from the interaction of the business cycle with the leverage cycle. We believe that changes in growth and leverage dynamics drive risk-pricing behavior, which, in turn, influence expected risk factor performance.

Starting from a qualitative thought process to identify the distinct 'macro-financial states' of the economy, which is formalized into a quantitative framework, we arrive at a Switchboard model for Risk Factor selection. With US macroeconomic/financial and equity risk factor data stretching back to the 1960s, we are able to verify empirically that our framework adds value from a short- to medium-term perspective for tactical risk premium allocation.

Apart from equity factors like Value, Quality, Size, and Momentum, risk factors from other asset classes are also analyzed within this framework, with some promising results. We believe this model can be a useful top-down decision tool for risk premium investing for quant and non-quant investors alike.



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A Letter to our Readers

Designing portfolios that can deliver good returns in different economic environments rests, on the one hand, on a fundamental understanding of the macroeconomic sensitivities inherent in the equilibrium pricing structure of assets, and, on the other hand, on the underlying drivers behind business cycle fluctuations. The basic principle of asset pricing - which advocates that the competitive equilibrium price of an asset equals the discounted value of current and expected future cash flows - suggests that changes in macroeconomic conditions influence asset prices through the impact they have on expected cash flows, and/or the discount rates applied to those cash flows. To "size" that impact, investors need to understand what stage of the business cycle they are in, or about to move to next. A non-trivial undertaking in its own right…

In this report, we try to develop an understanding of the variation in the performance and risk profile of style premia during different economic scenarios. To get to a reliable answer, we avoid dwelling on historical relationships between asset prices and certain macroeconomic time series. Correlations tend to be unstable, while most measures of risk do not adequately reflect the possibility of encountering sustained adverse economic environments that can have a prolonged, unfavorable effect on factor returns. After all, if a risk factor represents compensation for some type of economic risk, or can act as a "hedge" against it, then the pricing of risk in different economic environments should have implications for the magnitude and persistence of the risk premium in the prevailing regime. As the environment and expectations change, the risk pricing behavior will change accordingly.

We believe that dividing the world into business cycle phases, such as High/Low Growth and High/Low Inflation, or into a quadrant scheme comprised of Recovery, Expansion, Slowdown, and Recession, with indicators pointing towards each phase, is not adequately informative of the risks priced in markets at each stage of the cycle, and thus of expected asset/risk factor performance. In addition, a thorough analysis of the fundamental drivers behind each business cycle phase is required: for example, a Recession may be the result of balance sheet deleveraging by the government or the corporate sector, or may be the result of an exogenous shock. There can be different implications for asset pricing in otherwise similar business cycle phases, which are driven by different fundamentals.

Using both quantitative and qualitative tools, we build a framework that relates the nature of the risks embedded in factor-based portfolios to the risks that are likely to be priced at different stages of the business cycle, as characterized by the drivers of leverage and investment demand. Essentially we try to explain factor performance through the nature of the leverage build-up and unwind cycle, which is typically behind shifts in economic fundamentals that ultimately get reflected in performance and the degree of correlation between risk assets.

It is a complex task, and we do not claim to find all the answers, but the fact that we formalize a differentiated view of macroeconomic risks and study how these relate to risk premia capture, we hope, will be helpful in your search of a solid framework to shed light on factor performance and risk in different economic environments.

We hope you enjoy the report and we certainly look forward to discussing it with you.

Introduction

The last five years have been particularly challenging for portfolio managers that rely on investment styles and their historical performance patterns, or the momentum exhibited by such styles over short horizons, to make allocation decisions. Although the finger has been pointed at the "risk-on/risk-off" nature of markets since the onset of the Global Financial Crisis of 2008, we believe that, fundamentally, one of the main reasons underlying observed factor performance in recent years is the role that economic fundamentals, and in particular leverage dynamics, have played in driving the returns to style-based strategies. In particular, investors focusing on Value and Momentum styles have found it difficult to outperform during an extended period of de-leveraging, driven by the slow adjustment in the balance sheets of consumers, and despite ultra-loose monetary policies by Central Banks word-wide.

In previous economic cycles in the US and Europe, a (relatively) fast adjustment in the business sector was sufficient for the economy to bounce back to a growth cycle fueled by recovering leverage on the part of households and governments, which was additionally supported by incessant financial innovation. With all those pillars of support damaged in the post-2007 era, investors were required to have exposure either to short-term contrarian, or defensive and quality factors to benefit from the slow macro-adjustment environment underpinned by a regime of higher volatility.

Our thesis revolves around our conviction that it is important to monitor the changes in the growth and leverage dynamics, which drive risk-pricing behavior, in order to adjust asset and style exposures from a tactical perspective. Style premia strategies likely offer compensation for some type of risk, or act as a "hedge" against it. Understanding what drives risk-pricing behavior in financial markets (as opposed to only figuring out the current stage of the cycle) should be informative of the likely future outcomes with respect to factor performance and volatility.

We would expect our analysis to be more impactful along the Value-Growth axis, or the Small Cap –Large Cap axis, as well as in the case of Quality; the aforementioned factors are related to the attitude towards pricing of risk in equity markets. We also expand our analysis in a cross-asset framework and evaluate certain risk premium strategies we believe are relevant within the proposed framework.

The main outcome of this study is a macroeconomic timing framework for risk premia strategies, which succeeds in addressing drawdowns effectively. Our macroeconomic Switchboard is a significant input to our thought process regarding economic dynamics and consequent asset/style exposure variation. Valuation considerations and careful modelling of liquidity dynamics can also contribute to the enhancement of the signals originating from the macro Grid.

Macroeconomic Conditions and Style Factor Performance

Do business cycles matter for factor performance?

The answer is not straightforward: Current valuations should reflect investor projections about medium- to long-term economic growth, the level and trajectory of which should be expected to impact cash flow generation and the future level of interest rates. Nevertheless, the empirical evidence suggests that asset returns are not correlated with the real economy. Univariate regressions of excess stock market returns on real economic growth tend to have low explanatory power and statistically insignificant outcomes. Moreover, extreme events in equity markets cannot be explained systematically by extreme events in the real economy (Winkelmann et al., 2012).

Factor risk premia are linked to business cycle through risk pricing behavior in different states, not through the measures of economic activity.

Going one step further, we would argue that a one-dimensional correlation analysis that links a certain macroeconomic time series to style factor performance may even lead to misleading conclusions regarding the interaction of risk factors with macroeconomic dynamics. Reducing the macroeconomic environment to one-dimensional observations of some flow measures (like national accounts and trade data) and/or a set of state variables (eg. unemployment, inflation, interest rates), leads to two challenging interpretation issues, in our view.

A correlation analysis that links a certain macroeconomic time series to style factor performance may lead to misleading conclusions

First, although some macroeconomic variables may give an adequate representation of the *stage* of economic growth at a certain point in time, they do not necessarily tell us much about the dominant drivers behind that particular growth stage, which is important in deciphering the risks posed to prevailing macroeconomic trends, and potentially, asset prices. A simple example helps to clarify our point: 1999 and 2006 were two "similar" years for the US equity market, in the sense that they both preceded historical highs, followed by epic crashes and corporate scandals. Comparing US economic indicators like the GDP growth rate, the slope of the yield curve, the CPI inflation rate, and the unemployment rate, in 1999 and 2006, we find that they hovered around similar levels (see Figure 1). However, the drivers behind corporate growth in those two time periods were rather different, and equity investors were faced with dissimilar cyclical risks. Different "sources" of risk ended up being rewarded, which becomes apparent when comparing the Value versus Glamour trade during the two aforementioned time periods. It is difficult to make any informed predictions of style leadership or performance at "similar" points in the cycle if we cannot measure how comparable the sequential cycles are in terms of the distribution of risks and rents in the economy.

We need to detect how comparable the sequential cycles are in terms of the distribution of risks and rents in the economy

Figure 1: Similar Macro figures in 1999 and 2006 despite very different underlying risks

Source: Deutsche Bank, Bloomberg Finance LP

The second issue is that not all style factors show a consistent relationship with business cycle dynamics. For some styles, such as Size and Quality, one could probably utilize the cyclical nature of liquidity and credit market access to make inferences about whether the macroeconomic environment is conducive to the outperformance of the respective styles. A Value investor, however, would not trade the risk of the Value portfolio to express a view on the macroeconomic cycle per se, but more to express a view on the price of risk relative to the optimism about the future returns of glamour stocks. Although, as a consequence, there may be some exposure of the Value style to cyclical risks, the significance and direction of these risks can vary significantly at different times. Therefore, to link style performance to an economy that is reduced to a cycle of macroeconomic time series may yield sub-optimal results. Even theoretically, the rational, behavioral, and structural drivers of style factors, which are subject to an age-old discussion among academics as well as practitioners, do not elicit the position in the macroeconomic cycle as a major determinant of the variation in risk premiums.[1]

Not all factors show a consistent relationship with business cycle dynamics

Instead, we believe that what matters most is not the 'position' in the cycle per se but the interaction of the drivers of financial leverage with risk factors. In what follows, we set out to incorporate information about 'the nature of the cycle' in the analysis of style performance.

What matters most is not the 'position' in the cycle per se but the interaction of the drivers of financial leverage with risk factors

Economic cycles matter for Risk Premia only through their influence on pricing of financial risk

Using macroeconomic flow variables to define the cyclical economic dynamics relevant for the pricing of equity market risks is a misguided task, as we have argued above. For instance, reactionary fiscal and monetary policies (in the latter case, of the type witnessed in the last few years), can easily dislodge financial risks from economic fundamentals. Variables such as credit expansion, leverage build-up, money supply growth, and the rate of profit growth relative to investment growth, may be much more relevant for the risk-pricing behavior of financial markets.

Variables such as credit expansion, leverage build-up, money supply growth, and the rate of profit growth may be more relevant for the risk-pricing behavior

Our framework incorporates such indicators to distinguish between different **'states of economic and financial conditions'** rather than to impose cyclical dynamics to our model. The distinct 'states' of the world that that we define can fit into a business cycle framework, but more to the purpose, they can be utilized to draw inferences during

[1] Of course, some risk-based explanations for the Value premium (for instance), like default risk and cash flow volatility, do suggest a certain influence of business cycle dynamics on style factor performance

periods when the cyclicality of growth fades away, as for example, we have seen in China and Japan in the past two decades and in most of the developed economies in the past-2008 era. Our attention focuses on the nature of risk pricing that may drive trends in leverage, alongside economic growth indicators. Therefore, we construct a framework to monitor macroeconomic conditions that we believe are most relevant for the risks embedded in factor-based equity portfolios.

Macro-Financial conditions mapped onto a two-dimensional Grid

Economic and financial conditions are represented by a two-dimensional grid. Columns reflect broad economic conditions, and Rows distinguish between the drivers of (de-)leverage

Economic and financial conditions are represented by a two-dimensional grid. In the first dimension, we try to distinguish between broad macro-financial conditions and find our approximate position in the "cycle". In the second dimension, we try to identify and distinguish between the underlying drivers of the (de-)leveraging trend in the overall economy: this way, we aim to learn more about the nature of financial risks being accumulated or unwound. While the first dimension helps us determine our proximity to cyclical risks, the second dimension helps us to decipher the link between the cyclical risks and financial markets.

For example, in an economy where the plentiful supply of credit and debt-financing boosts financial leverage and fuels a strong growth cycle, cyclical risks start to build up in stocks that can take advantage of the flow of credit at a favorable price. This is because when decreasing marginal returns to investment set in and the growth cycle starts to turn, the stocks that have benefitted from easy credit conditions will be those most exposed to the ensuing contraction of credit growth.

Not all growth cycles are driven by the same leverage channels

However, not all growth cycles are driven by the same leverage channels. Government financing (like in the case of China), or equity financing (like we saw in the dot-com frenzy of the late 1990s), for example, can also fire up growth and investment activity. On the other hand, a clogging of leverage channels, as we have been seen in Europe over the last five years, can cause prolonged sub-par growth. The nature of the (de-) leveraging trend should helps us to make sense of the likely pricing of the risks conveyed by style factors as a function of distinct macro-financial states.

The Six Phases of Growth

The taxonomy of economic conditions is comprised of six Growth phases.

To help us decide on the taxonomy of economic growth conditions, we first consider three different, broadly defined, phases of the economic cycle (Growth, Recession and Recovery), and subsequently divide each one of them into two segments that capture the relative speed of adjustment/progression within each phase. Our macroeconomic grid is thus comprised of the six sections as listed below:

1. GROWTH with LEVERAGE BUILD-UP

   1.1. **Around or Above Potential:** Robust growth with private sector leverage build-up, and profit margin expansion. Little/no headwinds from the credit market, labor market or from monetary policy

   1.2. **Deceleration**: Marginal return to investment peaks and profit margins start to narrow; growth impetus from labor and monetary conditions fades as monetary policy becomes less accommodative and the labor market saturates. Growth skepticism starts to emerge.

2. SLOWDOWN / RECESSION with LEVERAGE UNWIND

2.1. **Fast adjustment**: Disappointing realized returns to investment or exogneous shock trigger a volatile adjustment in financial prices and build pressure to reduce excesses.

2.2. **Market Trough**: Volatility subsides. Actions by economic agents to counter the recession; dust-settling phase.

3. RECOVERY with or without LEVERAGE BUILD-UP

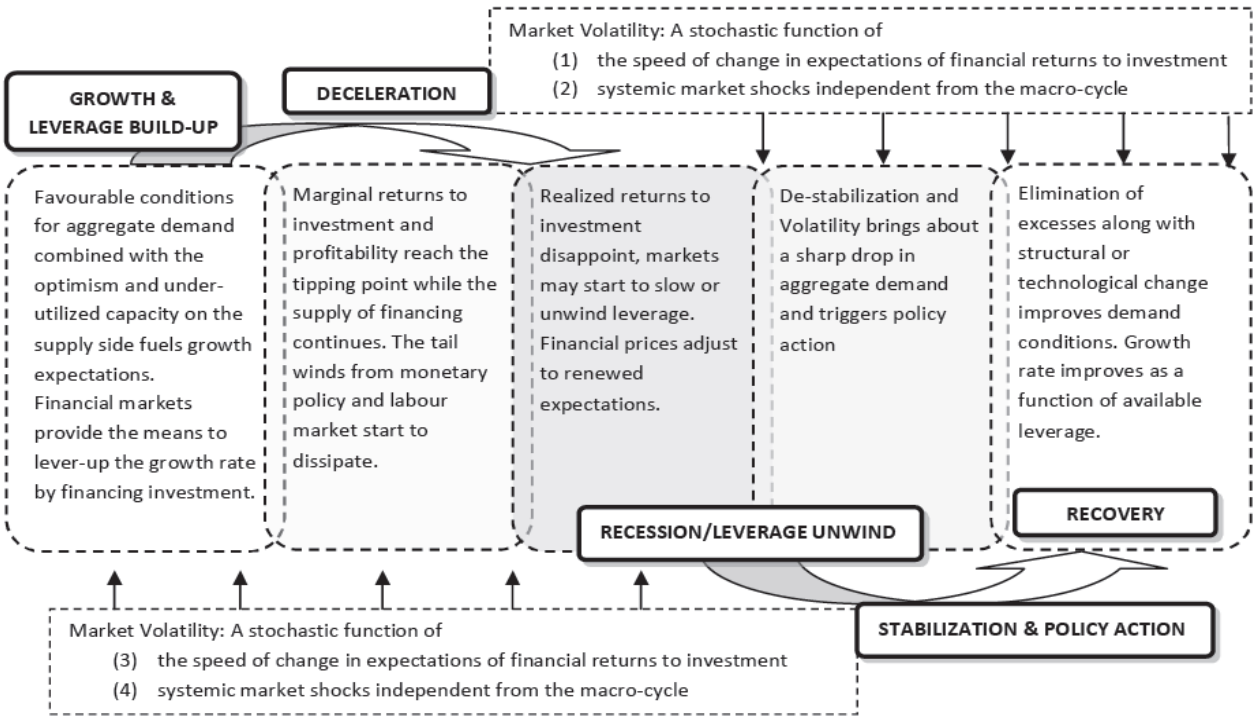
3.1. **Fragile/Slow**: Flow indicators show positive signs but the impetus from leverage demand, labor demand or monetary policy is weak, structural issues still linger.

3.2 Strong: Revived demand for leverage combined with "easy" financial conditions facilitates a bounce in economic activity.

We believe that the above growth phases can lay the groundwork for the analysis of risks that are likely to be priced in financial markets over time. We neither suggest that these states of the world are the only, or most comprehensive, list of possible macroeconomic conditions, nor do we assume that they should follow a given sequence or pattern at all times. However, we believe it is reasonable to expect a sequence of growth and correction cycle in a fashion shown in Figure 2 below, during normal economic and financial conditions.

The phases of economic growth lay the groundwork for the analysis of risks likely to be priced in financial markets

Figure 2: A likely sequence of developments during a normal business cycle



Source: Deutsche Bank

Although the flowchart above is able to give a simple summary of macroeconomic dynamics, it does not indicate when and how financial markets would reflect these cyclical changes. Normally, we would expect to see benign volatility conditions in an environment where growth indicators give encouraging signals about future prospects, and we would expect higher volatility as the skepticism about growth and returns to investment rises. However, risk aversion in financial markets is also affected by exogenous factors (eg. geopolitical) and is not tied to any specific phase of growth out of the six that we have defined. Therefore, we combine the six macroeconomic growth phases that we introduced above with a separate monitor of extreme volatility moves to define the column position in our macroeconomic grid.

Financial markets do not always reflect cyclical macroeconomic dynamics, as risk aversion may take precedence

Let us remind the reader that our aim is not to forecast economic growth but to build a framework to analyze the risk-pricing behavior of risky assets in conjunction with prevailing macro-financial conditions. Therefore, in our macro-financial grid, we monitor the evolution of macroeconomic indicators and the dynamics of leverage along with any significant changes in market risk. We use volatility spikes - in either direction - as a potential circuit-breaker in the factor Switchboard that we develop to guide us with respect to risk premia allocation along the business-leverage cycle.

Our aim is not to forecast economic growth but to build a framework to analyze risk-pricing behavior

The Switchboard structure and the suggested position of style switches at each point in time are explained in detail in the following Sections. Before discussing the main components of the Switchboard, however, let us first explain the second dimension in our macro-financial grid that our switching decision relies on.

Incorporating the Leverage Cycle into the Growth map

Every boom and bust cycle is driven by leverage of some sort, which stretches beyond realizable returns. A significant concentration of leverage in the broad sectors of the economy is likely to convey some information about expectations of agents and the attitude of financial markets towards risk. By monitoring the drivers of leverage/deleverage behind a given business cycle, we may be able to infer which risks are likely to be rewarded by financial markets going forward.

Every boom and bust cycle is driven by leverage of some sort which stretches beyond realizable returns.

For example, the outperformance of higher dividend yield/dividend growth stocks in recent years has stemmed from the search for yield in a low-growth, low-yield environment. Such a persistent macroeconomic environment has certain implications for factor performance. If we can identify macro-conditions that are conducive to sticky style performance trends emerging, we can navigate our factor exposures accordingly. The main drivers of the leverage cycle can be helpful in that respect:

By monitoring the drivers of leverage/deleverage, we infer which risks are likely to be rewarded by financial markets going forward

1. High business investment taking advantage of favorable borrowing and equity financing

2. High consumer spending and/or household & business investment taking advantage of favorable credit pricing;

3. Increasing government expenditure taking advantage of non-binding budget constraints.

All of the three leverage channels above provide impetus for growth as long as realized returns meet expectations. If decreasing returns to investment start to emerge, the leverage cycle may slow or start to reverse.

We combine the three different leverage channels with the growth phases introduced above to create a grid of GROWTH & LEVERAGE conditions (Figure 3). We believe that our likely position in the grid may be informative of short- to medium-term style factor performance trends.

We combine the three different leverage channels with the growth phases

Figure 3: The Grid of macro-financial states

Driver of Aggregate Demand Growth & Leverage	LEVERAGE BUILD-UP & GROWTH		LEVERAGE UNWIND & RECESSION		RECOVERY	
	Trend Around or Above Potential	Deceleration	Fast Adjustment&Volatility	Trough	Fragile/Slow	Strong
Household Credit and Residential Investment	**1**: Strong consumer demand drives margin expansion; debt markets are in high supply, financial & operational leverage fuels profits and economic grwoth expectations	**2**: Decreasing Returns to Investment and the cylical sketicism: Profit Margins trend down, sustained investment growth with decreasing returns generate cyclical risks while monetary policy accomodation fades	**7**. Fast Adjustment: Cash returns to investment dissappoint, financial market goes through structural adjustment to eliminate excesses; credit/equity losses accompany high volatility	**8.** Policy action and dust settling phase in financial markets	**9.** Scarred business confidence depending on the depth of the trough; weak private demand conditions, long deleveraging cycle	**10**: Improved demand conditions as financial losses are digested quickly; and rising demand for credit with improved outlook, household/consumer leads credit demand
Business Credit and Business Fixed investment	**3**: High Growth/Positive Structural Change Being Priced, High Corporate Spending Financed Cheaply, High Tobin's Q Environment favors Expansion of Multiples	**4**: Decreasing Returns to Investment and cylical sketicism: Profit margins and profit growth rate peak, marginal return to investment starts to decline, monetary policy not so accomodative				**11**: Improved demand conditions as financial losses are digested quickly; and rising demand for credit with improved outlook, business capex leads credit/investment demand
Government Borrowing and Fiscal Spending	**5**: Government stimulus fires up demand, corporate budget constraints become blurry, capital market discipline weakens	**6**: Decreasing Returns to Investment: Profit margins squeezed, earnings quality deteriorates along with the government budget constraints				**12**: Improved demand conditions as the financial losses are digested quickly; and rising leveraging with improved outlook, government debt leads the credit demand

Source: Deutsche Bank

Position in the Grid: A combination of common Macro variables with Leverage indicators

To determine our likely position in the grid, we first resort to well established indicators of economic activity to figure out the prevailing business cycle stage **(Column position)**, and then narrow down this broad categorization by focusing on variables related to leverage dynamics, in conjunction with the prevailing volatility regime **(Row position)**. The latter part of the analysis should help us understand the attitude of market participants towards risk and pricing behavior that feeds into factor performance.

To determine our likely position in the grid, we first resort to well established indicators of economic activity in conjunction with the prevailing volatility regime

At this point in our research, we only incorporate US data, although in future research we intend to expand into a country-specific framework. Arguably, US economic cycles have been the major driver of the global economy over our sample period and the USD has been the reserve currency with which to fund risk trades in global markets. From a data point of view, we have consistent US macroeconomic data series going back many decades, which implies that we can start our back-test from at least 1960 and cover a number of business cycles dominated by different demand/supply conditions, monetary policies, inflation-disinflation scenarios, etc.

The list macroeconomic indicators that we use in the construction of the Grid is given below, along with a brief explanation of the information that they signal about the macro-financial state of the economy. We provide the list of data items and sources in Appendix A.

The macroeconomic indicators we use to decide the ***Column*** position in the grid:

Macroeconomic indicators guide us with respect to the Column and Row position in the Grid

1. **GDP Growth Rate and the ISM Manufacturing and Non-Manufacturing Indices:** These variables combine the national accounts and the survey data to confirm if we are in a broad Growth or Recession phase.

2. **Monetary conditions:**
   a. Policy: Fed Funds rate relative to 10Y Rate: Policy rate relative to the long-term growth/inflation outlook; indicating the status of monetary accommodation relative to growth prospects being priced in by bond markets

   b. Money supply: M1 Growth rate- picks up significant money supply shocks and when compared to GDP and credit growth, indicates the fragility/strength of the demand side of the economy

3. **Credit Demand Conditions**: Credit growth in the private sector relative to money supply growth in the past quarter; a measure of the monetary transmission mechanism and the strength of credit demand which captures the level of optimism towards growth and investment returns.

4. **Labor demand and supply**: The unemployment rate relative to NAIRU estimates in the past month. This is a good indicator of potential inflationary pressures (if unemployment is below NAIRU) that determine the tipping point in profit margins in a mature growth cycle.

5. **Corporate Profit Margin:** Aggregate corporate profit margin, calculated by taking the ratio of profits of nonfinancial industries to the aggregate nonfinancial value-added (a measure of contribution of total corporate sales to GDP), is a good proxy for the maturity of the growth-leverage cycle. If margins are widening, the supply side of the economy is able to gain higher returns from additional sales, and is more inclined to invest and lever-up the operations. In the opposite case, the marginal returns to further investment in the business sector are in decline.

The ***Row*** position will be determined by the following macroeconomic indicators:

1. **Government leverage**: Government debt growth relative to private sector debt growth: An indication of the potential lack of investment demand/supply from the private sector and the perceived safe distance from the fiscal budget constraints.

2. **Household leverage**: Household credit growth relative to non-financial business credit growth. An indicator of whether the leverage cycle is primarily driven by consumer demand (70% of US GDP), or by business investment demand.

Of course, as mentioned before, bursts of volatility can impact risk aversion and the behavior of market participants irrespective of our position in the Grid as suggested by economic data (effectively bringing about a shift in the Grid position).

Step-by-Step Guide to the Location in the Macro-Financial Grid

The variables that comprise the grid of macro-financial states are organized into two broad categories: 1: Growth, Volatility & Policy measures to guide us with respect to the Column position; 2. Credit growth and leverage build-up data to locate the Row position. In other words, the cyclical states of the economy and the sources of aggregate demand (namely households, businesses, or the government) together determine the prevailing regime. Each position in the grid has certain ramifications for factor performance.

Growth, Volatility & Policy measures guide us with respect to the Column position
Credit growth and leverage build-up data to locate the Row position

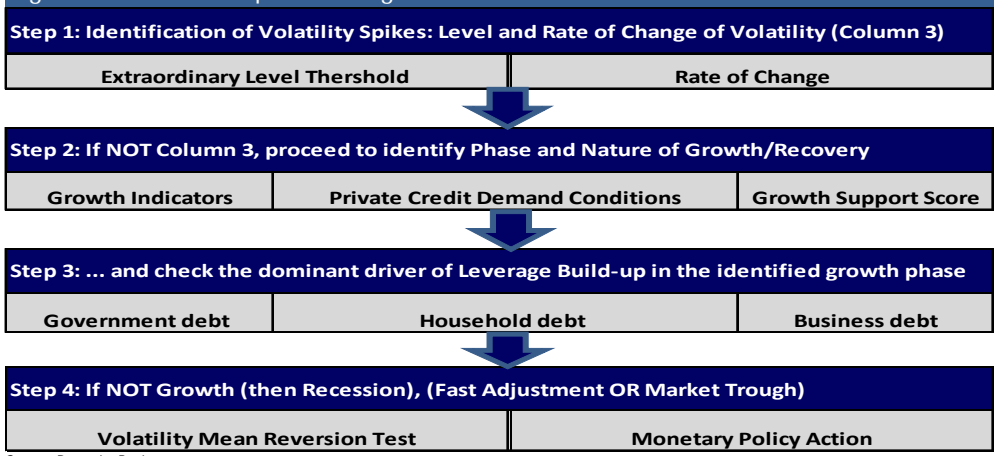
Figure 4: The grid Row-Column setup

Broad Cyclical Position >>>	GROWTH		VOLATILITY & RECESSION		RECOVERY	
Speed/Phase of Cyclical Position>>>	Strong	Deceleration	Volatility	Market Trough & Recession	Fragile/Slow	Strong
Driver of Leverage	Column1	Column2	Column3	Column4	Column5	Column6
Row 1 Household Credit and Residential Investment	R1C1	R1C2	R1C3	R1C4	R1C5	R1C6
Row 2 Business Credit and Business Fixed investment	R2C1	R2C2	R2C3	R2C4	R2C5	R2C6
Row 3 Government Debt and Fiscal Spending	R3C1	R3C2	R3C3	R3C4	R3C5	R3C6

Source: Deutsche Bank

Finding our way around the grid requires combining economic and financial market data via a stepwise process to narrow down the phases into distinct, identifiable parts. The data is employed in a hierarchical fashion and a process of elimination is used, with volatility conditions at the top of the chain. Figure 5 shows the outline of the decision process. We start by assessing whether Column 3 is the prevailing state.

Figure 5: The Roadmap to locating our Grid location



Source: Deutsche Bank

Start with identifying Volatility/Panic conditions

Equity market volatility may spike during any stage of the cycle as a function of the speed of adjustment in the expectations of market participants, or as a result of an exogenous shock. A speedy adjustment of expectations accompanied by high market volatility usually serves as a leading indicator of a recessionary period; there are, however, instances where economic growth might just continue on its path; the LTCM crisis in 1997 can be considered as such a case.

Market volatility may spike during any stage of the cycle as a function of the speed of adjustment in expectations, or due to exogenous influences

Bursts of volatility cab actually "break" the cyclical sequence and normal course of events which would typically take us from Growth, to Recession, to Recovery, and then back again. Although heightened volatility can be an aberration to the expected progression of the business cycle, it cannot be ignored, even if economic data is supportive of benign conditions: At extreme levels of volatility, and when, in addition, liquidity gets scarce, defensive allocations override any risk premia exposures.

STEP 1: Identify whether Volatility rises sharply and reaches levels rarely witnessed before, irrespective of other economic data

There are two measures that we combine to identify volatility conditions:

1. Extraordinary level threshold [*N(t)*]: 90th percentile of the 30-day Realized Volatility of the S&P 500 Index [*V(t)*] over an expanding window starting from June1959.

2. Rate of Change: Z-score of volatility [*Z(t)*]: Ratio of the deviation of volatility [*V(t)*] from its 3-month moving average, relative to the 3-month standard deviation of V(t)

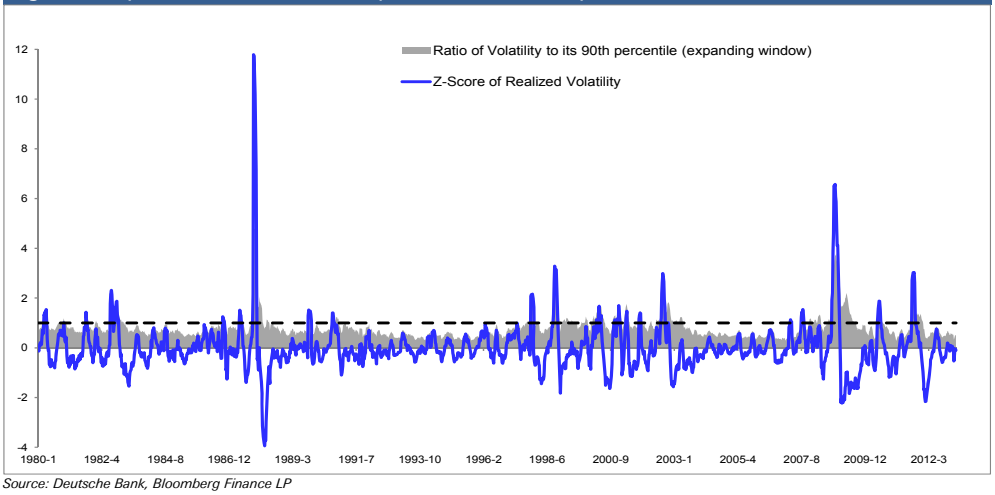
$$Z(t) = \frac{V(t) - MA[V(t)]}{std[V(t)]} > 1$$
$$\&$$
$$V(t) > N(t)$$

⇒ **Column 3 of the grid: Fast Adjustment / Volatility Shock** (irrespective of other measures)

We use weekly realized volatility data for the S&P 500 to construct the measures above as the monthly averages of the weekly statistics.[2] The time series of the two measures back to 1980 are shown in Figure 6 below. The dotted line is the threshold value (equal to 1) for the two criteria shown below.

We use weekly realized volatility data for the S&P 500 to construct the measures

Figure 6: Spikes and extraordinary levels in Volatility



Source: Deutsche Bank, Bloomberg Finance LP

[2] Implied Volatility data do not go back to the 1960s when our sample period starts. In any case, our focus on extreme volatility events does not affect our grid classification if implied volatility data is used instead since becoming available in the early 1990s. We also checked whether our proprietary Sentiment Index, which takes into account stress in other asset classes, along with equities, results in superior classification outcomes. However, having observed that the identification of extreme volatility cases does not change, we decided to stick with realized volatility data that allows us to go back to the beginning of the sample period.

We can now decide whether we are in Column 3 or not. If not, the possible column locations have now been reduced from six to five

Identify the existence and strength of Growth/Recovery

STEP 2: Identify the Phase and Nature of Growth/Recovery

Next, we try to identify whether we are in a strong Growth/Recovery phase, but first need to rule out a Fragile Growth scenario

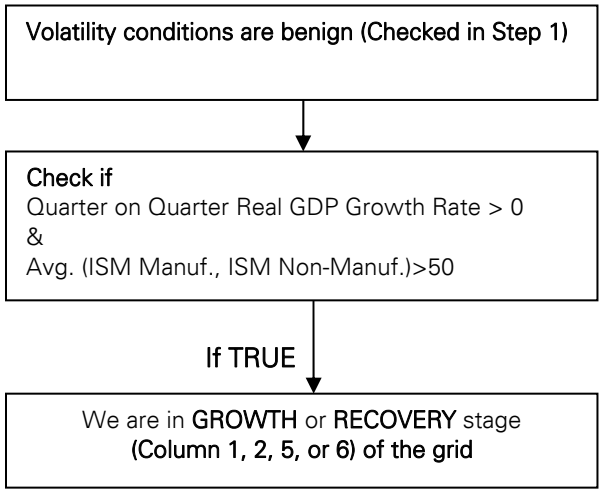
Next, we try to identify whether we are in a strong Growth/Recovery phase, but first we need to rule out a Fragile Growth scenario. If the economic data points to growth and there is evidence of palpable private credit demand along with support from at least two of the following three factors, namely: 1. monetary policy, 2. Labor market, 3. Corporate profit margins, we assign this stage as a Strong Growth or Strong Recovery period (= Column 1 or Column 6 of the grid).

Basically, the distinction between Growth and Recovery in our framework serves the purpose of identifying the strength of the fresh Growth phase we are entering, after a Recession has taken place. For factor allocation purposes, there is no difference in recommendations between Column 1 and Column 6 classifications.

If we are within 6 months of a recent recessionary phase, we qualify this as a Strong Recovery (=Column 6), otherwise we classify it as Strong Growth (=Column 1). For example, 2003 was a Strong Recovery phase which was followed by strong Growth until mid-2006.

Of course, if the Strong Growth/Recover conditions are not satisfied, we need to differentiate between a Growth Deceleration (Column 2), or a Fragile Growth scenario (Column 5).

A. Identify Growth Phase



If Volatility conditions from Step 1 are benign, and GDP/ISM data point to Growth, the next step is to check the state of private sector credit demand as an indicator of how Fragile the current Growth phase is..

B. Which Column? Check Private credit demand conditions: Column 5 or Not?

Private credit demand is used to characterize Fragile Growth (Column 5 of the Grid), or *NOT*

Variables used:

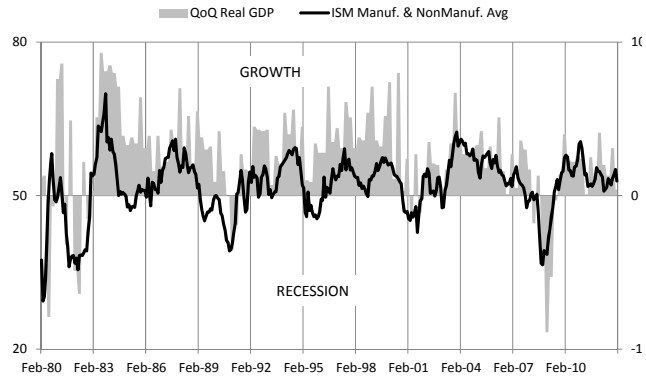
1. Year-on-Year (YoY) Growth Rate of Private sector credit demand, comprised of Household Debt (LHH)+ Nonfinancial Corporate Debt (LBB)

2. Year-on-Year (YoY) Growth Rate of M1 Money Supply (M1) = Proxy for expanding/shrinking monetary base for credit supply, a measure of the degree of monetary accommodation

If YoY Growth of (LHH+LBB) < YoY Growth Rate of M1
&
QoQ Real GDP Growth Rate > 0
&
Avg. (ISM Manuf. , ISM Non-Manuf.)>50

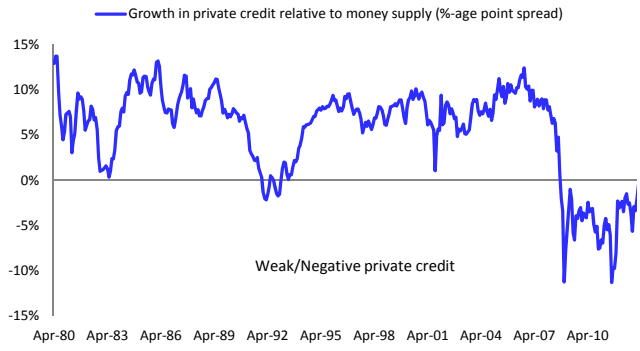
⇨ FRAGILE GROWTH/RECOVERY
(Column 5 of the grid)

Figure 7: Identification of Growth and Recession



Source: Deutsche Bank, Bloomberg Finance LP

Figure 8: Identification of Fragile Growth through Private Credit demand



Source: Deutsche Bank, Bloomberg Finance LP

If we establish that we are *NOT* in a in a Fragile Growth stage as private demand appears strong, i.e. if YoY Growth of (LHH+LBB) > YoY Growth Rate of M1, then we check if other factors are supportive of a strong Growth or Recovery classification (Column 1 or Column 6, remember that Column 6 just indicates the prior phase was a Recession), or whether Growth is decelerating (Column 2).

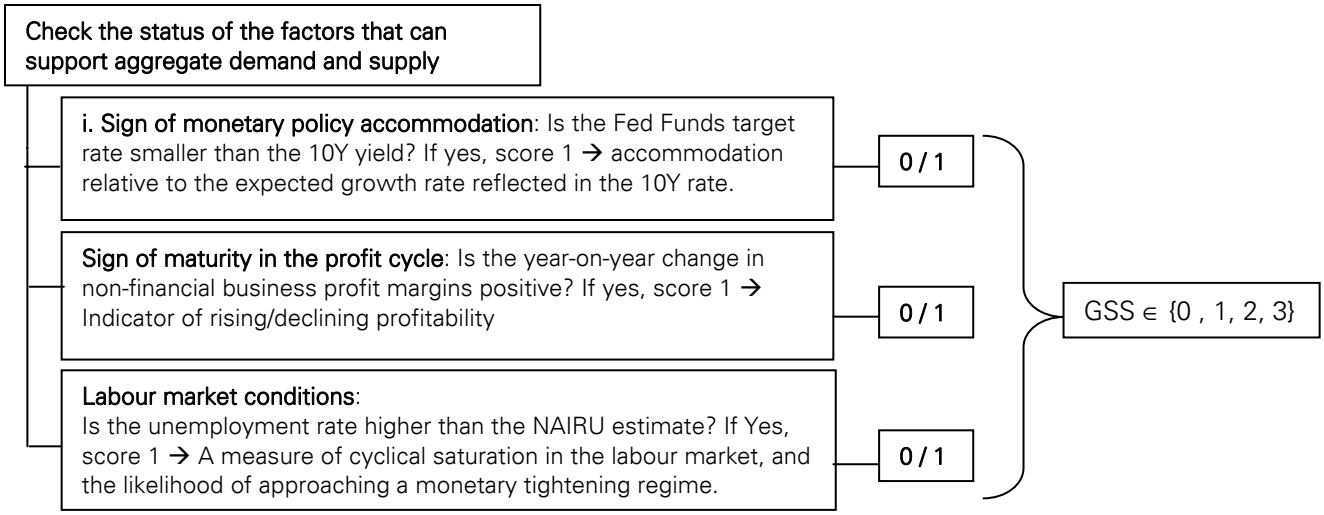
If YoY Growth of (LHH+LBB) > YoY Growth Rate of M1
&
QoQ Real GDP Growth Rate > 0
&
Avg. (ISM Manuf. , ISM Non-Manuf.)>50

⇨ Strong Growth/Recovery or
Deceleration Phase?
Column 1/Column 6 Versus Column 2

C. **Calculate the Growth Support Score (GSS) to discriminate between Strong Growth/Recovery and Deceleration phase.**

To decide between a Strong Growth phase and a mature, phase vulnerable to deceleration, we formulated a simple Growth Support Score which is based on factors from three main channels: 1. Monetary policy; 2. Labour Market; 3. Nonfinancial corporate profit margins.

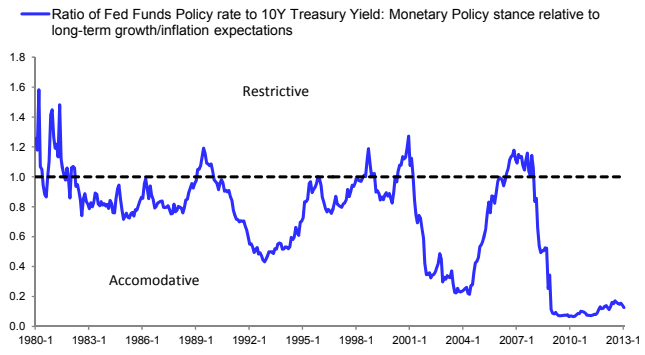
We formulated a simple Growth Support Score which is based on factors from three main channels



Growth Support Score ≥ 2 → **Strong Growth/Recovery** with potential to absorb more productive leverage → Classifying in **Column 1 or Column 6** (depending on the proximity to the past recession)

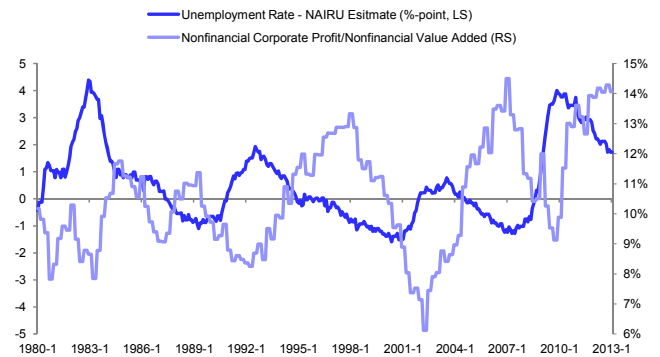
Growth Support Score ≤ 1 → **Slowing Growth** with weak potential to absorb more leverage → Classifying in **Column 2**

Figure 9: Policy rate above 10-year rate signals restrictive stance relative to growth and inflation expectations



Source: Deutsche Bank, Bloomberg Finance LP

Figure 10: Combination of **low** unemployment and declining margins is negative for future growth potential



Source: Deutsche Bank, Bloomberg Finance LP

An example of a period we would have classified as Strong Growth in our grid is the 2003-2006 period which was marked by rising profit margins, increasing but unsaturated employment, and accommodative policy. Most of 2003 was actually classified as a Strong Recovery (Column 6) as a fresh growth phase had sprang the

economy out of recession; with 2004 to mid-2006 qualifying to appear under Column 1. By the second half of 2006, the policy rate crossed over the 10Y rate and unemployment reached very low levels. We picked that period as a Growth Deceleration stage (Column 2), although aggregate profit margins continued to expand well into 2007.

Once we identify the growth phase, determine which aggregate sector is driving leverage build-up:

Determining the Row position in the grid

STEP 3: Check for the dominant driver of Leverage – Row Location in the Grid

We consider three broad options: 1. **Government leverage**; 2. **Household leverage**; 3. **Business leverage**:

We define 3 variables:

1. LGG: Ratio of Federal Government Debt to Private Credit (Households+Businesses)

   If **Year-on-Year Growth of LGG>0**, the government is the main driver of leverage build-up in the economy → **ROW 3- Government Leverage is driving aggregate demand growth**.

When we are in Row 3, credit growth in the household and business sectors may also be positive but they do not qualify as the dominant driver of leverage build-up

2. LBB: Ratio of Corporate Business Credit to Household Credit

   If **Year-on-Year Growth of LBB>0 & YoY Growth of LGG<0**, the corporate sector is leading the build-up of leverage ahead of households and the government → **ROW2- Corporate credit is driving aggregate demand growth.**

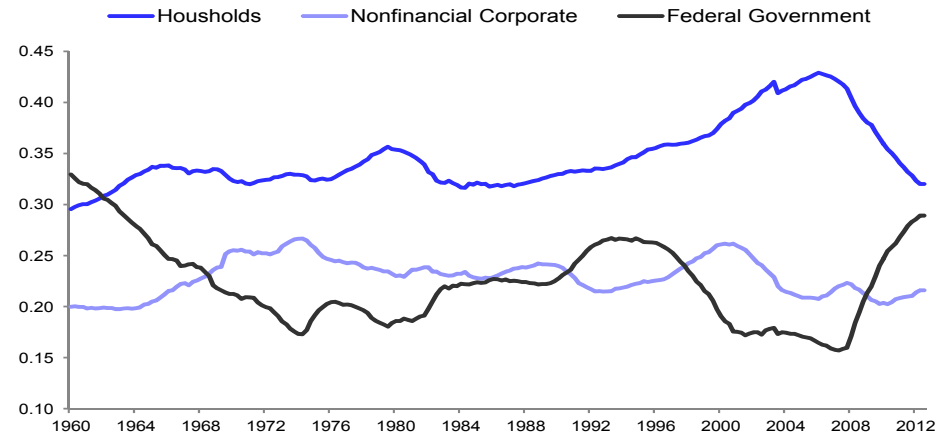
Row 2 is a special case because it is relatively rare that business sector surpass the households and the government in driving overall credit growth. The marginal propensity to spend by the household sector is likely to be higher than that of the corporate sector in an ordinary growth cycle, and private consumption is roughly 70% of the US economy. Significant increase in business credit demand relative to overall credit growth within a growth phase, is a signal of extraordinary (but not necessarily irrational) optimism about future profitability, and an associated strong growth of business investment. The late 1990s is a rare example of such a growth phase where business optimism blended with equity financed investment led the overall economic growth.

3. LHH: Ratio of Household to Corporate Business Credit (=1/LBB)

   If **YoY Growth of LHH>0 & YoY Growth of LGG<0**, the household sector is leading leverage build-up → **ROW1- Consumers are driving aggregate demand growth.**

Row1 is a representation of a rather normal growth-leverage cycle where expansion of credit is driven by the biggest part of US aggregate demand.

Figure 11: The change in concentration of leverage in the main US sectors of aggregate demand: Ratio relative to total domestic debt



Source: Deutsche Bank, Bloomberg Finance LP

The periods that do not qualify for any Growth phase fall into Recession

Following the hierarchical scheme above we are able to identify almost all columns. The remaining options point to outright recession with negative growth readings or an ambiguous mix of indicators registering border-line growth. For example, if positive GDP growth co-exists with sub-50 ISM values, the period in question does not qualify as recession in its standard definition, but we consider it as a non-growth phase not identified by the distinct states mapped onto the grid.

The remaining options point to outright recession with negative growth readings or an ambiguous mix of indicators registering border-line growth

During the Recession periods, we do not switch factor exposures if Volatility or Monetary Policy Indicators do not cross the threshold values. We continue with the existing positions. The important consideration in the Recession, in terms of risk factor allocation, is whether we are in a highly volatile, fast moving market regime or a dust-settling phase (Column 4) that is mostly done with the pricing of the Recession and focusing on the policy reactions.

STEP 4: Check for correction in volatility and significant monetary policy reaction

Correction in volatility and significant monetary policy reaction defines the Trough following a volatile period

This time we check two indicators that can signal improving or settling market expectations regarding cyclical dynamics and financial risk.

1. Mean-reversion and relatively benign volatility conditions following fast market adjustment.

$$Z(t) = \frac{V(t) - MA[V(t)]}{std[V(t)]} < -1$$
$$\&$$
$$V(t) < N(t)$$
$$\&$$
$$V(t-1) > N(t-1)$$

Sharp move down in volatility, which falls below the 90th percentile from a level above the 90th percentile

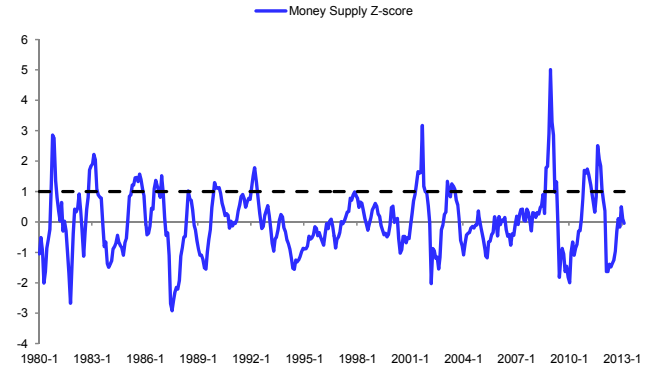
2. Sharp increase in quarter-on-quarter money supply growth rate (M1): Calculate the Z-score in the same fashion as done for the Z-score of volatility. Check for the existence of more than 10std moves.

$$Z_M(t) = \frac{M(t) - MA[M(t)]}{std[M(t)]} > 1$$
$$\&$$
$$V(t-1) > N(t-1)$$

Sharp move in M1 above 1-stdev: Significant monetary expansion as a reaction to recent volatility

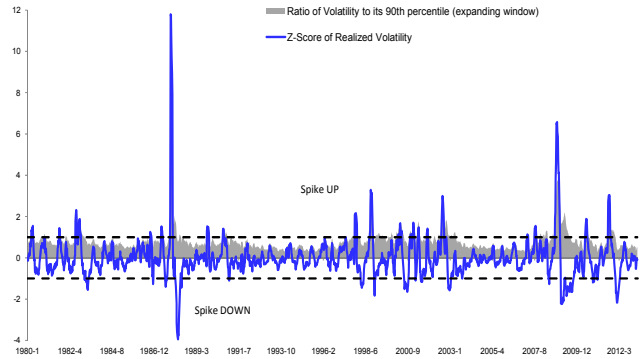
If both of the above conditions hold, we are in **Column 4 – Market Trough/Settling phase with no-growth.** We keep the same status as long as volatility or the Growth indicators do not signal a move to another grid location, according to the hierarchical process explained in the preceding pages.

Figure 12: Monetary policy reaction captured by significant jumps in M1 growth rate



Source: Deutsche Bank, Bloomberg Finance LP

Figure 13: Panic and dust-settling phase captured by volatility spikes and level relative to historical norm



Source: Deutsche Bank, Bloomberg Finance LP

The Growth and Leverage phases since the 1980s; Moving around the Grid

After the 'Junk Bond Bonanza' in the 1980's and the ensuing 'Savings and Loans Crisis', the US economy dipped into recession in 1990. The 1980's had been a decade of noteworthy credit growth fuelled by the deregulation of S&L's and the government-led overall leverage build-up. The failure of S&L's brought about a significant slowdown in the financial sector and pushed the economy into recession by the end of the decade. The federal government had to rescue some major financial institutions and the Fed was forced to cut the policy rate.

The 1980's had been a decade of noteworthy credit growth

Government leverage in the 1980s with broad credit growth in all sectors- (Row 3)

The credit growth data of the 1980s indicated that the cycle was driven by the credit boom and that aggregate leverage was mainly concentrated in the government sector (ie. Row 3). By the start of 1987, nonfinancial corporate profit margins had gone into decline and the unemployment rate was below NAIRU, while credit growth continued to move along with the help of the momentum created by the S&L's and fiscal spending. The grid would indicate that we would be in a deceleration phase (Row3/Column 2), which would signal the coming bear market for the Value factor, which had been buoyed by the high tide of subsidized credit in the preceding years.

The credit boom and that aggregate leverage was mainly concentrated in the government sector

The equity market crash in 1987, triggered by the Japanese melt-down, was a major spike in volatility which instigated the unwinding of positions closely tied to extrapolative expectations associated with credit growth. The volatility spike during the deceleration phase would have shifted us to Column 3 – the fast adjustment phase. Subsequently, the Fed cut its policy rate and shifted us to Column4, briefly. However, monetary policy accommodation subsided quickly (the curve started to invert). The GDP and ISM readings did not show outright recession, but the support from profit margins, employment, or monetary accommodation, was not there to prevent the economy from sliding into recession. (See Figures 7 to 10 on the previous pages.)

Volatility and Deceleration in the late 1980s: Transition from strong growth and leverage build-up to market correction, financial stress and recession

Late 1980s: Transition from strong growth and leverage build-up to market correction, financial stress and recession

The occasional volatility spikes in the equity market priced in the slowdown and the policy uncertainty ahead. The grid location mostly moved between Columns 2 and 3 until 1990. (See the historical grid locations in Appendix B). The aggressive easing trend adopted by the Fed in 1991 established the bottom of the economic downturn and we moved to a Recovery phase (Column 4 and then Column 5) because the ISM/GDP numbers turned to growth, the unemployment rate diverged from NAIRU and monetary accommodation set in, with the help of the steep yield curve after the policy rate was pulled below 4% from over 8%.

Leverage is transferred from one sector to another in consecutive cycles

During the early recovery period, we did not see any growth in private credit demand. Therefore, we marked this as a Fragile Recovery phase, from mid-1991 to 1993. Then, we start to see private credit demand starting to recover in 1993, but federal government debt growth remains the main driver of credit growth; therefore we assign Row 3 to the new growth phase. Private credit demand starts to accelerate in 1996 and turns into a corporate investment driven cycle in 1997 (Row2, Column 1). This growth phase makes a transition to the Deceleration phase (Row 2, Column 2) in 1999, as the yield curve started to flatten, and profit margins started to turn down. We have had some jumps to Column 3 because of the extreme market stress during the Asian Crisis and the LTCM crisis which were countered by further easing, and subsequently we moved back to the growth columns until the mid-2000s.

Leverage build-up was transferred from one aggregate sector to the other in consecutive cycles

Leverage build-up was transferred from one aggregate sector to the other. The collapse of corporate leverage in 2001, paved the way for the household sector to take the lead amid very low rates and strong household balance sheets. Harnessing additional support from "financial innovation", the leverage-growth-investment cycle led by household credit demand went into full swing (Row 1 Growth cycle). Of course, this particular credit cycle ended badly for household balance sheets post the deceleration phase that started in mid-2006, and which was successfully picked up with our data.

At the current fragile recovery phase dominated by an unprecedented degree of monetary easing amidst a state of weak private credit demand, the government sector is operating the leverage levers (Row 3), However, the corporate sector looks to be in great shape in terms of balance sheet strength. We discuss the current position in detail in the concluding section of this report.

Moving on to the style switchboard

Given that we have explained the different macro-financial states, extensively, we now move on to relate these states to risk factor performance. We start with the Value style which, we think, has the most interesting characteristics in terms of the interaction of the embedded risk premium with the growth-leverage cycle.

The Value Switch

There is a vast amount of literature on the drivers of the Value premium, with the long-term empirical evidence favoring Value over Growth, eg. Basu(1983), Fama and French(1992, 1998) and Lakonishok, Shleifer and Vishny (1994). Although the evidence on the returns of the multi-decade long back-tests is relatively uncontroversial, the explanation for the differences in the performance of Value and Growth portfolios is far from being settled in the literature. We would classify the likely explanations of the Value premium into three main categories: Risk-based, Behavioral, and Institutional. In this section, we are taking a step in trying to understand when the macroeconomic environment is likely to be conducive to the outperformance of Value versus Growth with a rather practical approach, without diving deep into the age-old academic discussions.

The evidence on the returns is relatively uncontroversial, but the explanation for the differences in the performance of Value and Growth portfolios is far from being settled

Value outperforms when the business cycle is buoyed by favorably priced debt

Value stocks benefit disproportionately from economic cycles during which credit supply and the relative attractiveness of debt financing form a two-way causality between the pricing of financial risk and economic growth. In such a growth environment, financial markets start to behave like an LBO (leveraged buyout) underwriter for Value stocks that can utilize balance sheet leveraging much more effectively than Growth stocks that are better able to tap into equity financing. This happens partly because a low P/E company with good, stable cash flow (especially the likes of utilities and retailers) can collateralize current cash flows in the debt market to finance a turnaround. On the other hand, a high P/E company with low or negative earnings can take better advantage of investors seeking opportunities in future cash flows through equity ownership. (Technology and high sunk-cost industrial & energy companies are typical examples).

Value stocks benefit disproportionately from economic cycles during which credit supply and debt financing fuel growth expectations

It is not a plain coincidence that waves of LBO deals occurred during periods dominated by easy credit conditions, coinciding with strong performance for the Value style in the equity space. As we discussed above, a value investor partly takes advantage of the favorably priced risk in cheap stocks in a similar fashion to LBO financiers: If financial markets are able to mediate a two-way relationship between the favorably priced credit and the growth cycle, the equity market starts to price risks in a similar fashion to how private equity behaves towards LBO deals.

In contrast, when equity financing for new structural or technological growth stories is fueling investment growth, Value tends to underperform. This is because Value stocks are less likely to benefit from the emergence of new growth opportunities that are attracting investment appetite. To suggest an analogy to the LBO example above, the stock market starts to behave like a venture capitalist towards glamour stocks. Such a phenomenon is likely to occur when a significant technological shock brings about a positive shift in future cash flow expectations. Financial markets, in effect, provide equity financing to growth stocks at an increasing rate; or alternatively, Value stocks start to look increasingly stagnant, in a relative sense.

In contrast, when equity financing for new structural or technological growth stories is fueling investment growth, Value tends to underperform

If 'venture capitalist' sentiment starts to impact stock prices significantly, it would generate a seemingly high Tobin's Q environment which can be detected via the wave of equity financed M&A activity, increasing capital expenditure, R&D, etc… The occurrence of such an environment is relatively rare compared to a consumer demand or government demand driven leverage and growth cycle. Nevertheless, a Value investor should make adjustments to their portfolio during periods when a growth or technological shift story is being financed through publicly traded stocks: An extreme example of such a scenario would be the Nasdaq bubble period in the late 1990s.

Again, it is not a simple coincidence that the equity financed AOL-Time Warner merger in 2000, and the debt-financed RBS-Abn Amro merger in 2007 (potentially landmark examples of leverage and extrapolative over-valuation), marked the peaks of the stock market and credit bubbles, respectively. These transactions are indicative of what risks were being favorably priced within the circular relationship of economic cycle with financial leverage in those times. In our macro-financial grid we try to distinguish those distinct periods that are likely to show different risk-pricing behavior and allocate the factor risk exposures accordingly.

To detect what risks are being favorably priced within the circular relationship of economic cycle with financial leverage is critical

Leverage driven by government blurs risk-pricing behavior, but tends to favor Value

A growth cycle driven by fiscal stimulus is also relatively favorable to the Value style. Fiscal debt and spending is a way to circumvent dysfunctional or non-existent credit markets, or to compensate for the lack of private demand. However, the relationship between the economic growth cycle and the pricing of financial risks becomes blurry relative to a scenario where financial leverage at the aggregate level is driven by private demand. Investment risks are not priced in a setting of economic rationality based on private interests, but instead, there is a 'public good' approach blended into the investment process. If growth is sustained through fiscal leverage, the business cycle moves in a phase where aggregate demand becomes reliant on subsidized credit. Therefore, we believe, Value can find a sweet spot in such a cycle: it all depends on how much aggregate demand growth can be sustained to achieve an 'escape velocity' for a convincing recovery in aggregate demand.

A growth cycle driven by fiscal stimulus is also relatively favorable to the Value style

During a fiscal stimulus driven cycle, policy makers are likely to find themselves in a position where any expectation of unwinding existing policies will bring down recovery prospects. Therefore, governments will run the risk of being pulled deeper into deficit unless a new technological or structural story is able to fuel further demand growth in the economy.

In brief, fiscal stimulus driven growth is similar to subsidized credit, therefore, if the macro data points to Row3, Column1, then Value should be in a better position than Growth, unless there are specific targeted transfers to companies.

Figure 14: Value style is affected by the nature of leverage build-up during a growth phase

Strong Growth with Leverage Build-up: Column 1 or Column 6 of the Grid	
Driver of Demand Growth through Leverage	
Household Credit and Residential Investment	LONG VALUE: Credit driven growth creates fertile environment for leverage driven profit surprises, disproportionately favors for value stocks' multiples -
Business Credit and Business Fixed investment	LONG GROWTH: High corporate investment rate indicative of low cost of investment relative to expected growth; Positive structural change is being priced; supports the divergence of multiples in a high Tobin's Q environment
Government Borrowing and Fiscal Spending	LONG VALUE: Macro data trending up after government budget put forward to backstop the structural worries; the structural break that was priced in the Value Basket starts to dissipate

Source: Deutsche Bank

Value "jumps" as part of the contrarian theme during trough and bounce periods

The periods when Value blends with the short momentum leg, provide the best opportunities for the value investor

The left tail of the distribution of the payoffs to Value investing typically under-weights momentum, because de-rated companies, almost by definition, should be those that lagged the market for some time. A company with high price performance and very low valuations is a relatively less likely case.[3] Therefore, in a period like a "dust-settling" trough (Column 4 in the grid) or a strong bounce (Column 6 in the grid), Value stocks are very likely to outperform, typically accompanied by a crash in Momentum. One of two things, or both, tend to happen during the "trough" and "bounce" periods: Either the systematic risks priced aggressively in the Value portfolio start to dissipate; and/or the stocks that made their way into the Value basket as a result of the portfolio liquidation during the prior uncertain period are now bouncing back, being the obvious, attractive, value opportunities. In fact, the periods when Value blends with loser stocks (the short momentum leg), provide the best opportunities for the value investor, especially when the market bounce actually precedes a sustained period of recovery and optimism. Therefore, when our macroeconomic data signals that we are likely to be in the Trough phase, we would like to turn the switch on the Value style.

Market corrections led by the unwinding of Glamour portfolios would also favor Value on a relative basis

Additionally, market corrections led by the unwinding of Glamour portfolios would also favor Value on a relative basis. A market correction following a growth cycle marked with optimism that had generated a high Tobin's Q environment (Row 2 in the grid), may trigger the unwinding of positions in highly valued stocks. The burst of the Nasdaq bubble is the most dramatic example of such a phenomenon.

Based on the sensible qualitative conjectures discussed above, we set up our switchboard for the Value style on the macroeconomic grid as shown below. However, before we go ahead and implement the switchboard, we should first check if our analysis is supported by the data.

Figure 15: The switchboard for the Value Factor

VALUE	LEVERAGE BUILD-UP & GROWTH		LEVERAGE UNWIND & RECESSION		RECOVERY	
	Trend Around or Above Potential	Deceleration	Fast Adjustment&Volatility	Trough	Fragile/Slow	Strong
Driver of Aggregate Demand Growth & Leverage						
Household Credit and Residential Investment	✓	✗	!	✓	!	✓
Business Credit and Business Fixed investment	✗	!	✓	✓	!	✗
Government Borrowing and Fiscal Spending	✓	✗	!	✓	!	✓

(✓) *ON* (!) *OFF* (X) *REVERSE*

Source: Deutsche Bank,

The historical evidence on the interaction of Value with the Leverage-Growth cycle

So far, we have theorized on the possible interaction of the economic cycle with the Value factor. In this section, we put those arguments to test: First, using data from the Fama-French factor library,[4] we go back to the 1960s to test whether various growth-leverage combinations during a number of different business cycle phases over the past 50 years were linked with the performance of the Value style in a way our analysis would predict.

[3] Such a case may reflect accelerating profits significantly beyond market expectations – thus valuation multiples do not improve despite price performance. It may just be a case of substantial price bounce from an extremely low valuation base.

[4] Available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

We initially run a set of preliminary regressions related to our argument about the interaction growth and the nature of leverage

We initially ran a set of preliminary regressions related to our argument above about Growth and the nature of leverage. We suggested that a Growth cycle led by credit growth in the business sector in excess of the household and government sectors, is a reflection of a growth story that is likely to help the expansion of valuation multiples. A rather normal cycle buoyed by the relative expansion of leverage in the household and government sectors is more supportive of Value. We are able to identify the Growth cycles driven by household and government leverage through the LGH metric, the ratio of the sum of the Household and Government credit, to Business credit, and test whether there is any significant relationship with the performance of the Value factor.

We regress the quarterly return of the Value factor on the trailing 3-quarter moving average of LGH, as well as on the quarterly growth rate of real GDP over the full sample (1960-2013). The regression results provide some preliminary empirical evidence in favour of the hypothesis we have laid out so far (see Figures 16 and 17 for OLS and Logit regressions respectively). The interaction variable of the Real GDP Growth rate with the Relative Government and Household Leverage Growth suggests that when growth is fuelled by government balance sheet expansion and/or household spending, Value tends to signficantly outperform going forward. It should be noted that on a stand-alone basis, neither economic growth, nor the LGH variable, appear to be significant drivers of the Value premium.

Figure 16: Interaction of Household + Government leverage with GDP growth is a significant driver of the Value Premium

		Dep. Var: Quarterly Return (%)		
Sample: Jun-1960-2013-Jan, quarterly	Coef.	Std.err	t	P-Value
LGH: Relative Gov. & Household Leverage Build-up (%)	0.32	0.71	0.46	0.65
Real GDP Growth (%)	0.11	0.12	0.95	0.34
Interaction: GDP x LGH	0.45	0.17	2.62	0.01
Constant	0.74	0.56	1.31	0.19

Source: Deutsche Bank

Figure 17: Probability of positive return to Value investing rises when Economic Growth and Household + Government Leverage rise together

		Dep. Var: Quarterly Return>0 [0,1]		
Sample: Jun-1960-2013-Jan, quarterly				
Dep. Var: Quarterly Return >0	Coef.	Std.err	z	P-Value
LGH: Relative Gov. & Household Leverage Build-up (%)	0.04	0.14	0.28	0.78
Real GDP Growth (%)	0.03	0.02	1.17	0.24
Interaction: GDP x LGH	0.08	0.04	1.99	0.05
Constant	0.060	0.12	0.50	0.62

Source: Deutsche Bank

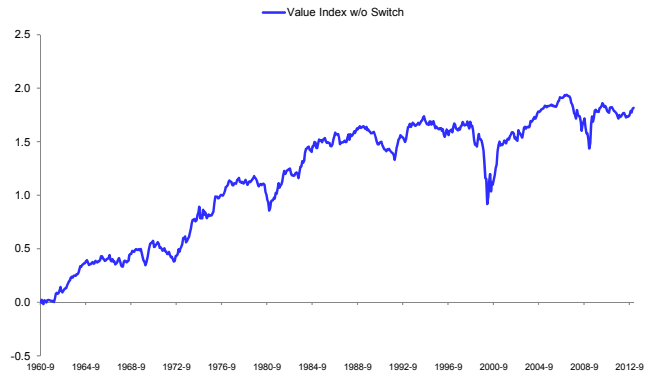
Preliminary results that support our conjectures

Motivated by the above results that appear supportive of our conjectures regarding the Value Premium and its interaction with the Economic and Leverage cycles, we proceed to testing the Switchboard structure using the available history of Fama-French US Value returns since 1960. In addition, we also construct backtests using the S&P 1500 and MSCI World constituents since 1995. Although our construction of the Value premium follows a different procedure to that of Fama and French, the correlation between the the two factors is rather close (see Figure 18-19).This gives us comfort in using the Fama-French series to expand our backtest sample to 1960.

We would like to investigate whether we can, at least partly, avoid those loss-making periods and take advantage of the long-term upward trend for the Value premium by

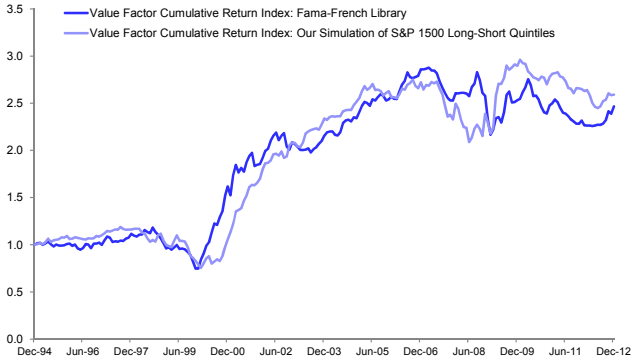
monitoring macroeconomic indicators. It is comforting for our set-up that periods of outperformance for Value seem to coincide with growth periods supported by ample supply of debt-financing (like the 1981-1986 and 2003-2006 periods..).

Figure 18: Value factor cumulative return index, US data, Fama-French factor library



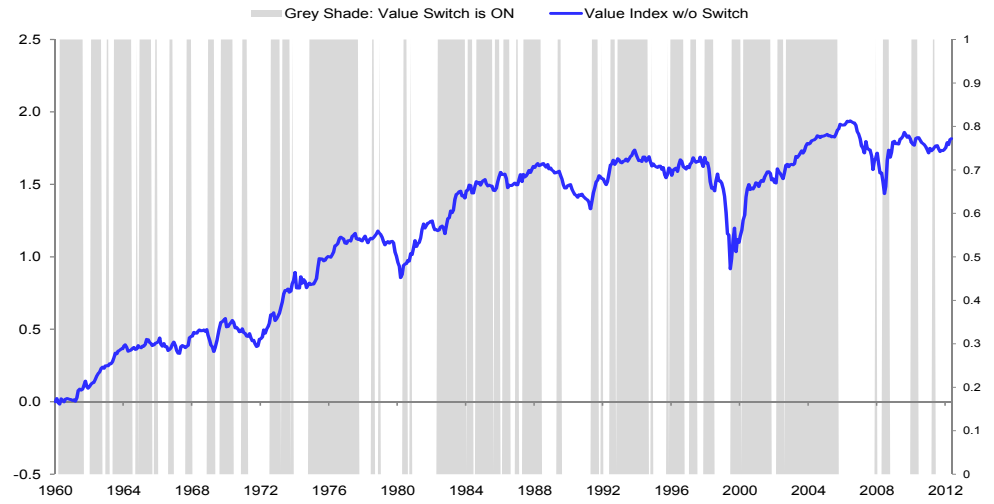
Source: Deutsche Bank, Bloomberg Finance LP

Figure 19: Fama-French Value factor versus our long-short Value factor in the S&P 1500



Source: Deutsche Bank, Bloomberg Finance LP

Figure 20: Fama-French Value Factor (log scale) and the and the ON signal from the macroeconomic grid (grey shade)



Source: Deutsche Bank, Bloomberg Finance LP

A test for the Value switch over the past 50 years

In essence, we are dealing with a set of latent variables that we believe determine the performance of the Value factor. Our conjecture is that the macroeconomic grid, by creating a summary indicator for a combination of variables, reduces the number of dimensions in the vector of latent variables, and provides a categorical measure that is correlated with the probability of observing a return above a certain value. If we denote the return of the value factor at time t as r(t) such that

Our switch is a categorical measure that is expected to be correlated with the probability of observing a return above a threshold.

$$r(t) = \alpha + \beta X_t + \varepsilon_t \qquad (1)$$

where $\beta > 0$ and $X_t = [z_t^1, \ldots z_t^n, S_{t-1}] = [Z_t, S_{t-1}]$

such that $prob\ [X_t > k \mid S_t = 1] > prob\ [X_t > k \mid S_t \neq 1]$, $k \in R$

where *S(t)* is the categorical variable that summarizes macro conditions, *Z(t)* is the vector of latent variables that affect the demand for the Value risk premium, and *Z* is assumed to follow an auto-regressive process. This assumption would be in accordance with the temporary momentum trends in the performance of styles and with the diffusion of shocks (systemic or idiosyncratic) that affect the demand for Value versus Growth. To incorporate the auto-regressive diffusion process in conjunction with macroeconomic conditions, we include the lag returns of the Value style and re-write Eq(1) as

$$r_t = \alpha + \phi r_{t-1} + \lambda S_{t-1} + \beta Z_t + \varepsilon_t \quad (2)$$

Such that

$$\frac{prob[r(t) > 0]}{prob[r(t) < 0]} = \frac{p_t}{1 - p_t} = \lambda S_{t-1} + \phi r_{t-1} + \varepsilon_t \quad (3)$$

We can estimate Eq.2 with a logit model and the test whether *S*, the signal from the macroeconomic grid, can influence the odds of outperformance of the Value factor. To examine the significance of *S(t)*, we split the data into two non-overlapping periods and carry out some regression analysis.

First, we ran a regression over the sample that does not coincide with the period that we run our final back-tests

First, we ran a regression over the sample that does not coincide with the period that we run our final back-tests. Our back-tests that combine all the factors (to be presented in the later sections) cover 1995:1 to 2013:1 period. We would like to see if we were in 1994, we would have seen any statistical motivation for the value switch that we designed. We would like to demonstrate that the empirical relations are not driven by the data of the last two decades that we run the back-tests on

Our grid signal was able to capture a statistically significant relationship with forward Value factor returns

The results for the 1960:1-1994:1 period are presented below. As seen in Figure 21, our grid signal was able to capture a statistically significant relationship with forward Value factor returns. The odds of having a positive return in the next month (ie. p/(1-p)) when the grid signals position 1, instead of 0, is 1.36, which corresponds roughly to a probability of 58 per cent (p=0.58). This means that the odds of the Value factor outperforming over the following quarter can be shifted significantly away from a coin-toss when we use macroeconomic information along with the prior month's performance.

Figure 21: Logit regression results of the predictive ability of the Macroeconomic Grid for the Value Premium (1960-1994)

1960-1994 sample, monthly	Dep. Var: Fwd. Monthly Return >0			
	Coef.	Std.err	z	P-Value
Signal from the Macro Grid (-1, 0, 1)	0.31	0.15	2.08	0.04
Current Monthly Return	0.11	0.04	2.38	0.02
Constant	0.23	0.11	1.92	0.06
Odds Ratio				
Signal from the Macro Grid (-1, 0, 1)	1.36	0.19	2.08	0.04
Current Monthly Return	1.11	0.05	2.38	0.02

Source: Deutsche Bank

When we include the past two decades in the sample, the role of the macroeconomic grid strengthens further

When we include the past two decades in the sample, the role of the macroeconomic grid strengthens further, becoming more significant than the autocorrelation in returns. This is quite encouraging as it suggests that the success of our framework is not dependent on any specific time period. Although the current factor return is still statistically significant, the marginal contribution to the odds of Value registering a positive return in the following month is not strong. Instead, the odds of having a positive return over the next month when the grid signal is ON for Value (i.e. position 1) rises to about 60 per cent over the full sample.

Figure 22: Logit regression results of the predictive ability of the Macroeconomic Grid for the Value Premium (1960-2013)

1960-2013 sample, monthly	Dep. Var: Fwd. Monthly Return >0			
	Coef.	Std.err	z	P-Value
Signal from the Macro Grid (-1, 0, 1)	0.40	0.12	3.35	0.00
Current Monthly Return	0.07	0.03	2.53	0.01
Constant	0.07	0.09	0.77	0.44
Odds Ratio				
Signal from the Macro Grid (-1, 0, 1)	1.50	0.18	3.35	0.00
Current Monthly Return	1.07	0.03	2.52	0.01

Source: Deutsche Bank

To confirm our findings, we ran a simple OLS regression with the same variables as above to find that the signal coming from the grid assignment is statistically significant, meaning that, on average, not only are we more likely to achieve higher odds of positive returns, but also a higher average return with the with the help of the grid. The monthly return to the Value factor when the switch is turned ON from an OFF position is 35 basis points higher than the unconditional expectation of 0.1%.

Figure 23: OLS Regression of Value factor return on the Switch position

1960-2013 sample, monthly	Dep. Var: Fwd. Monthly Return (%)			
	Coef.	Std.err	t	P-Value
Signal from the Macro Grid (-1, 0, 1)	0.45	0.19	2.42	0.02
Current Monthly Return	0.15	0.04	3.69	0.00
Constant	0.10	0.15	0.69	0.49

Source: Deutsche Bank

We repeat the previous exercise but, this time, restricting the Value switch to be ON (long Value) or OFF (no Value factor position). In other words, we refrain from going Long Growth (which would be signaled by the Grid pointing to -1). We see that the odds of a positive monthly return for Value rises to 1.78, an associated 65% probability. Also, the OLS regression shows an increased marginal effect for the switch when the positions are restricted to only 0 and 1. Actually, the simple OLS results indicate that, without the switch and the autoregressive factor, expected monthly return to the Value premium would have been substantially lower.

Figure 24: Logit regression results for Value, with ON/OFF Switch only, 1960-2013

1960-2013 sample, monthly	Dep. Var: Fwd. Monthly Return >0			
	Coef.	Std.err	z	P-Value
Signal from the Macro Grid (0, 1 ONLY)	0.58	0.16	3.35	0.00
Current Monthly Return	0.07	0.03	2.46	0.01
Constant	-0.06	0.12	-0.53	0.59
Odds Ratio				
Signal from the Macro Grid (-1, 0, 1)	1.78	0.29	3.50	0.00
Current Monthly Return	1.07	0.03	2.46	0.01

Source: Deutsche Bank

Figure 25: OLS regression results for Value, with ON/OFF Switch only, 1960-2013

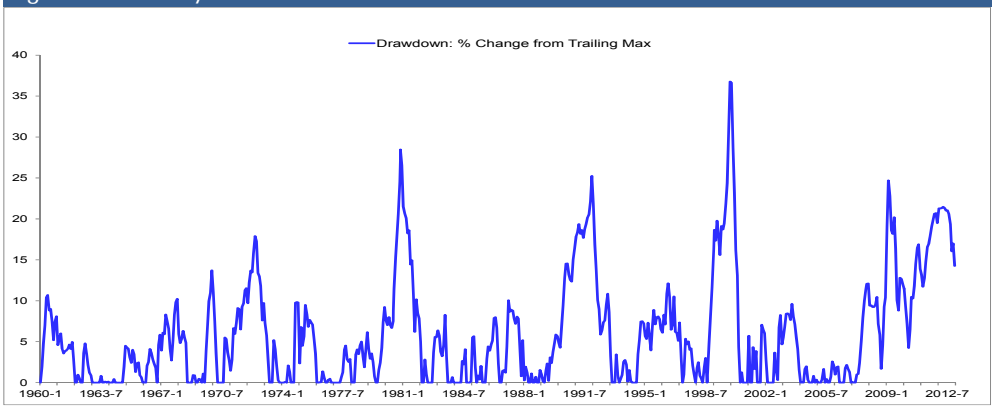
1960-2013 sample, monthly	Dep. Var: Fwd. Monthly Return (%)			
	Coef.	Std.err	t	P-Value
Signal from the Macro Grid (-1, 0, 1)	0.61	0.25	2.41	0.02
Current Monthly Return	0.15	0.04	3.64	0.00
Constant	-0.03	0.18	-0.19	0.85

Source: Deutsche Bank

These regression results imply that we are in the right direction for formulating a macroeconomic decision framework for the Value factor. However, it seems that our conjecture about the interaction of growth-leverage dynamics with Value is more about eliminating big draw-downs than providing a forecast model for month-to-month returns. This is not all that surprising given that our framework depends on low frequency macroeconomic data. We define drawdown as the percent gap from the trailing maximum of the Value cumulative return index. According to this definition, the drawdown of the Fama-French Value factor over time looks as in Figure 26, below.

These regression results imply that we are in the right direction in formulating a macroeconomic decision framework

Figure 26: History of Drawdown of Fama-French Value factor



Source: Deutsche Bank, Bloomberg Finance LP

We assign the periods exhibiting greater than 10% drawdown as the 'bear market' for the Value factor. We find that the probability of being exposed to drawdowns above 10% is significantly reduced by adopting the signal from the macroeconomic grid. Figure 27 shows the estimated likelihood of facing a significant drawdown as a function of the signal based on the macro states we have defined. The probability of having a big drawdown is reduced by about 32% with each move of the switch (i.e. odds ratio=0.57).

The probability of being exposed to drawdowns above 10% is significantly reduced by adopting the signal

Figure 27: Logit regression results for Value factor drawdown

1960-2013 sample, monthly		Dep. Var: Value Factor Drawdown >10%		
	Coef.	Std.err	z	P-Value
Signal from the Macro Grid (-1, 0, 1)	-0.55	0.12	-4.47	0.00
Constant	-0.51	0.10	--5.28	0.00
Odds Ratio				
Signal from the Macro Grid (-1, 0, 1)	0.57*	0.07	-4.47	0.00

Source: Deutsche Bank, (*) An odds ratio smaller than 1 corresponds to a negative coefficient.

When we focus on the periods where the Value switch is ON (=1) only, we find that the odds of a drawdown bigger than 10% is only 0.34, which corresponds to a sample probability of 25% (Figure 28).

Figure 28: Logit regression results for Value factor drawdown, ON/OFF switch only

1960-2013 sample, monthly		Dep. Var: Value Factor Drawdown >10%		
	Coef.	Std.err	z	P-Value
Signal from the Macro Grid = [0, 1]	-1.07	0.17	-6.09	0.00
Constant	-0.20	0.12	-1.69	0.09
Odds Ratio				
Signal from the Macro Grid = [0,1]	0.34*	0.05	-6.09	0.00

Source: Deutsche Bank, (*) An odds ratio smaller than 1 corresponds to a negative coefficient

Encouraged by the results, we implemented our grid structure to back-test the Value risk premium. The results are presented in the following pages. At this stage, we are not proposing this as a stand-alone strategy but as a potential component of a more comprehensive style-rotation engine.

Encouraged by the results, we implemented our grid structure to back-test the factor performance

In accordance with the regression results above, we can see that the risk/return profile of the Value factor would be significantly improved if we were able to implement our switchboard for the long history of the value factor returns available in the data library of Prof. Kenneth French.

Figure 29: Performance of Value under 3 different switch positions; ON, OFF and REVERSE- Sample: Jun:1960 to Jan:2013, Fama-French Value Benchmark Returns

Monthly Return (%)	Value ON	Value OFF	Value REVERSE
Mean	0.8	-0.2	0.0
Stdev	3.4	3.1	2.0
5th percentile	-3.5	-4.7	-3.3
95th percentile	5.8	4.8	3.1
Minimum Monthly Ret	-20.8	-13.5	-4.3
Maximum Monthly Ret	19.7	8.3	4.9
Monthly Ret %: mean/stdev	0.24	-0.08	0.01
t-stat		3.00	0.32

Source: Deutsche Bank

Figure 30: Performance of Value under 2 different switch positions; ON and OFF only
Sample: Jun:1960 to 2013:1, Fama-French Value Benchmark Returns

Monthly Return (%)	Value ON	Value OFF
Mean	0.8	-0.2
Stdev	3.4	2.9
5th percentile	-3.5	-4.5
95th percentile	5.8	4.6
Minimum Monthly Ret	-20.8	-13.5
Maximum Monthly Ret	19.7	8.3
Monthly Ret %: mean/stdev	0.24	-0.06
t-stat	3.42	

Source: Deutsche Bank

The efficacy of the Macro-Grid signal in the past two decades:

By implementing the switch, based on the signals that indicate our location in the macroeconomic grid, we calculate the relevant performance statistics and present the results in the following tables for US and Global universes. Our Value score is an equally weighted combination of Book-to-Price and Trailing Earnings Yield normalized by the broad GICS identifier.[5] Our sample covers January 1995 to January 2013. We construct the equally-weighted quintile baskets at the end of each month and generated the top-bottom return spreads and the ICs. The performance statistics corresponding to the months where the switch is ON (i.e. long Value) compared to the months when the switch is OFF or in REVERSE (i.e. long Glamour) show a clear, statistically significant decline in returns and ICs for Value as one moves from ON to REVERSE, in line with our expectations of the efficacy of the Grid in capturing the variations in the Value premium.

By implementing the On/Off switch, based on the signals that indicate our location in the macroeconomic grid, we calculate the relevant performance statistics

S&P 1500 Universe, January 1995 to January Jan2013 back- test sample, Long-Short Quintile Monthly Return Statistics

Figure 31: Performance of Value under 3 different switch positions; ON, OFF and REVERSE

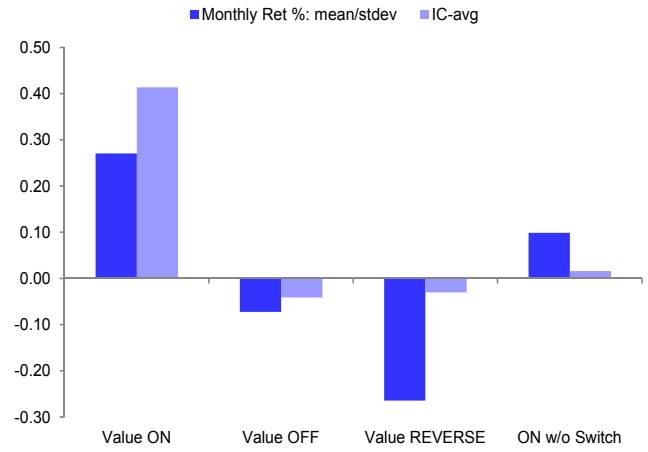
Monthly Return (%)	Value ON	Value OFF	Value REVERSE	Value Factor w/o Switch
Mean	0.84	-0.21	-0.50	0.29
Stdev	3.09	2.95	1.89	3.00
5th percentile	-3.36	-5.05	-3.80	-4.64
95th percentile	4.49	5.86	1.46	5.09
Minimum Monthly Ret	-8.86	-6.95	-5.82	-8.86
Maximum Monthly Ret	16.51	8.35	2.78	16.51
Monthly Ret %: mean/stdev	0.27	-0.07	-0.26	0.10
T-stat of the Switch (ON/OFF/REVERESE)		t-stat:2.66		
IC- mean/stdev	0.41	-0.04	-0.03	0.18

Source: Deutsche Bank

Figure 32 plots the ratio of mean monthly return to its standard deviation for the Value factor under the switching regime and Figure 33 shows that our framework allows us to avoid the major drawdowns associated with the Value premium over the last 18 years.

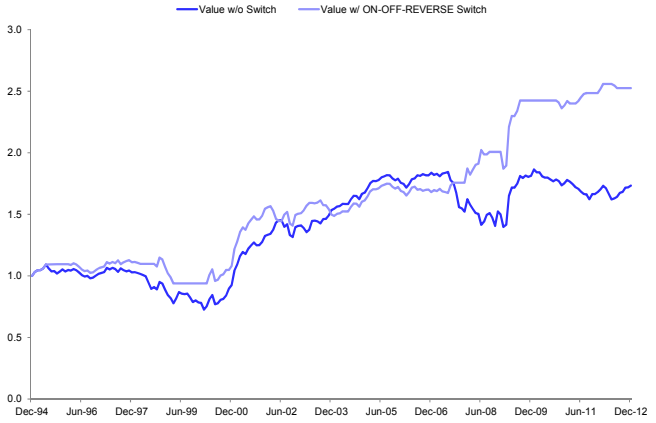
[5] The fact that the Value factor is sector-neutral places a bigger hurdle on macroeconomic drivers of the premium, as sectors would be expected to respond themselves to changes in macroeconomic conditions.

Figure 32: The switch is able to distinguish the better performing Value months, on average



Source: Deutsche Bank

Figure 33: The switch is able to avoid major drawdown periods for the Value Premium



Source: Deutsche Bank

In the case where reversing the Value trade is not considered as an option, and instead the portfolio manager would choose to move to other premia, Figure 34 indicates that there should be a statistically significant degree of confidence in differentiating between good and less attractive periods for Value.

Figure 34: Performance of Value under 2 different switch positions; ON and OFF

Monthly Return (%)	Value ON	Value OFF	No Switch
Mean	0.84	-0.27	0.29
Stdev	3.09	2.78	3.00
5th percentile	-3.36	-5.05	-4.64
95th percentile	4.49	5.11	5.09
Min	-8.86	-6.95	-8.86
Max	16.51	8.35	16.51
Mean/Stdev	0.27	-0.10	0.10
T-stat of the Switch (ON/OFF)		t-stat:2.76	
IC- mean/stdev	0.41	-0.04	0.02

Source: Deutsche Bank

The efficacy of the macro-grid based signal: MSCI World Universe

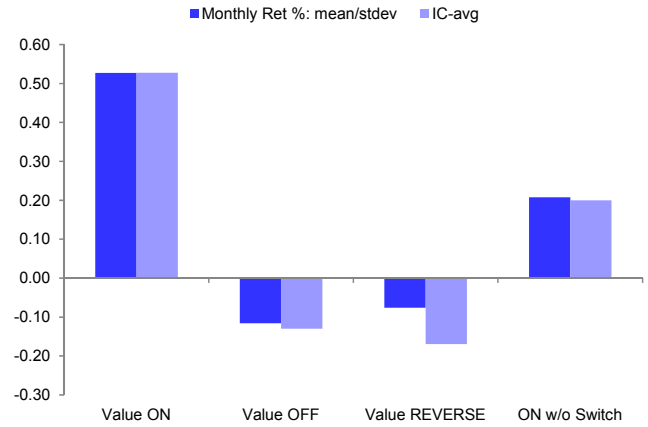
Jan-1995:Jan2013 back- test sample, Long-Short Quintile Monthly Return Statistics

Figure 35: Performance of Value under 3 different switch positions; ON, OFF and REVERSE

Monthly Return (%)	Value ON	Value OFF	Value REVERSE	ON w/o Switch
Mean	1.41	-0.32	-0.14	0.01
stdev	2.68	2.75	1.89	0.03
5th percentile	-2.14	-4.51	-2.89	-0.04
95 %-tile	5.79	3.64	2.14	0.05
Min	-7.26	-8.02	-5.15	-0.08
Max	11.38	10.05	3.83	0.11
Mean/Stdev	0.53	-0.12	-0.08	0.21
T-stat of the Switch (ON/OFF/REVERESE)		t-stat:3.28		
IC-avg	0.53	-0.13	-0.17	0.20

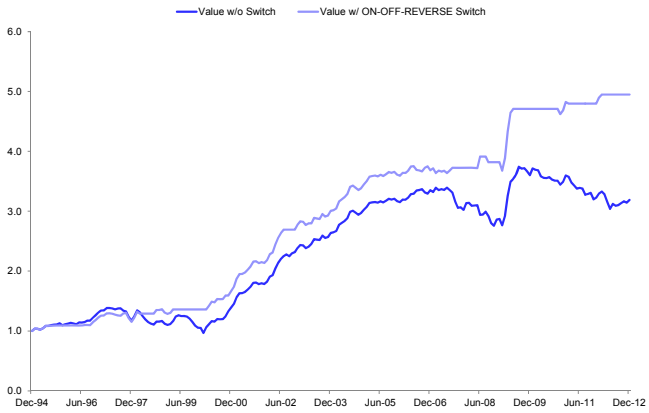
Source: Deutsche Bank

Figure 36: The switch is able distinguish the better performing months, on average



Source: Deutsche Bank

Figure 37: The switch is able to avoid major drawdown periods



Source: Deutsche Bank

Figure 38: Performance of Value under 2 different switch positions; ON and OFF

Monthly Return (%)	Value ON	Value OFF	ON w/o Switch
Mean	1.41	-0.32	0.58
Stdev	2.68	2.75	2.77
5th percentile	-2.14	-4.51	-4.00
95th percentile	5.79	3.64	4.70
Min	-7.26	-8.02	-8.02
Max	11.38	10.05	11.38
Mean/Stdev	0.53	-0.12	0.21
T-stat of the Switch (ON/OFF/REVERESE)		t-stat:4.88	
IC: mean/std	0.53	-0.13	0.20

Source: Deutsche Bank

The Quality Switch

After a long discussion about the Value premium, we tackle the relatively easier cases where economic risks are more transparent. By the nature of the factor itself, Quality steers clear of speculative leverage, and therefore tends to underperform in times when financial leverage, through debt or equity, provides a significant fuel for growth which, in turn, feeds back to leverage build-up.

Quality steers clear of speculative leverage, and therefore tends to underperform in times when financial leverage fuels strong growth

To build the Quality factor we take a simple approach to identify stocks, within each GICS sector, with lower accruals, stable free cash flow streams relative to sales, higher ROIC and higher net profit margins. We combine such measures with balance sheet information that accounts for financial gearing. We create a rank score based on the combination of the Debt/Equity ratio and the proportion of short-term to long-term debt, and an equally-weighted average of the aforementioned four factors. As a result, the Quality factor is intended to encompass companies that are able to sustain profit streams with less dependence on financial leverage. Therefore, the Quality long-short portfolio provides a partial hedge for the cyclical risks that can be accumulated in other styles.

We assign the Deceleration (Column 2 of the grid) and Fragile Recovery (Column 5 of the grid) as the periods that clearly favor the Quality factor. The Deceleration phase which is still associated with positive GDP growth and credit growth, but with signs of declining profitability in the business sector, is a period during which financial markets typically become more skeptical about the extrapolative projections of returns. Risk appetite starts to moderate and financial markets start to unwind some of the preceding growth themes. In such a scenario, the demand for stable and quality profit streams start to increase.

The Deceleration phase is a period when financial markets typically become more skeptical about the extrapolative projections of returns

A similar type of skepticism drives a preference for the Quality factor in the Fragile Growth periods preceded by a recession. In Column 5 of the grid, economic indicators register positive numbers but private credit growth continues to be negative. The demand for leverage at the macro level is quite low, and the link between the pricing of financial risks and macroeconomic growth weakens.

A similar type of skepticism drives a preference for the Quality factor in the Fragile Growth periods

In addition to the periods when we have deceleration or fragility in the cycle, the volatile, fast adjustment periods also favor the Quality factor due to its defensive nature. If such fast-adjustment periods occur after a deceleration or fragility phase, our Grid gives timely signals in favor of the Quality factor before market volatility spikes up.

Figure 39:The switchboard for the Quality Factor

QUALITY	LEVERAGE BUILD-UP & GROWTH		LEVERAGE UNWIND & RECESSION		RECOVERY	
	Trend Around or Above Potential	Deceleration	Fast Adjustment&Volatility	Trough	Fragile/Slow	Strong
Driver of Aggregate Demand Growth & Leverage						
Household Credit and Residential Investment	(!)	(√)	(√)	(!)	(√)	(!)
Business Credit and Business Fixed investment	(!)	(√)	(√)	(!)	(√)	(!)
Government Borrowing and Fiscal Spending	(!)	(√)	(√)	(!)	(√)	(!)

(√) *ON* (!) *OFF*

Source: Deutsche Bank

The results below in both US and Global universes indicate that, on average, the Grid can help us distinguish between the better- and less well-performing months for Quality, although statistical significance is not as strong as in the case of Value. This is because between 1995 and the end of 1997, although our framework was pointing towards Column 1 (Strong Growth), Quality stocks actually performed very well. From

the late 1990s onwards, the calls made using the Grid structure have been timely, and, for example, the underperformance of the Quality factor between mid-2002 and late-2006 is avoided.

We hope to integrate data on Quality going further back in time in the near-future to assess the robustness of the Grid with respect to the Quality factor.

The efficacy of the macro-grid based signal: S&P 1500 Universe

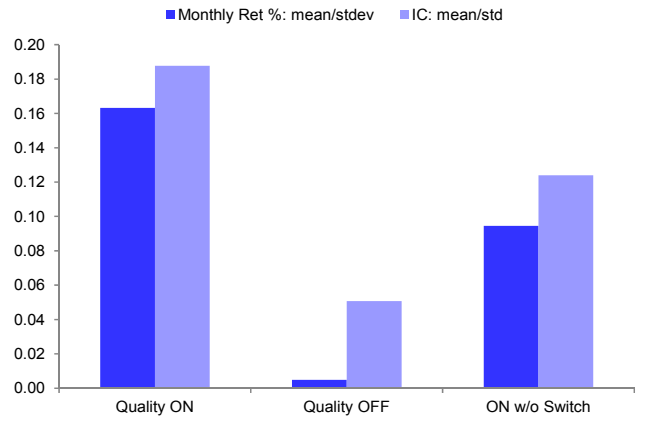
Jan-1995:Jan2013 back- test sample, Long-Short Quintile Monthly Return Statistics before transaction costs

Figure 40: Performance of quality under 2 different switch positions; ON, and OFF

Monthly Return (%)	Quality ON	Quality OFF	Quality w/o Switch
Mean	0.44	0.01	0.24
Stdev	2.69	2.29	2.51
5 %-tile	-3.82	-3.68	-3.78
95 %-tile	4.32	3.16	3.72
Min	-9.14	-11.50	-11.50
Max	8.60	4.13	8.60
Mean/Stdev	0.16	0.00	0.09
T-stat of the Switch (ON/OFF)		t-stat: 1.66	
IC-avg	0.19	0.05	0.12

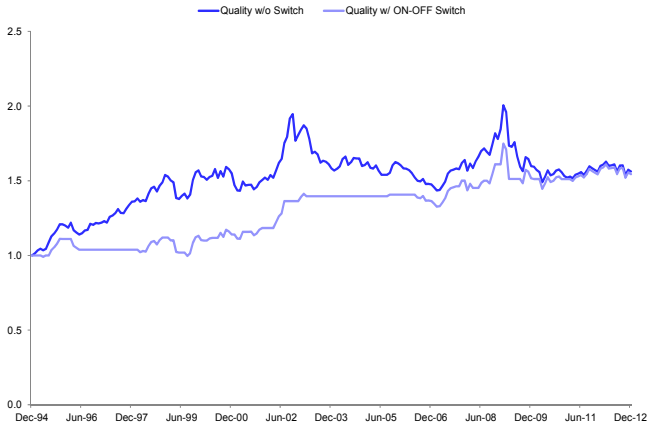
Source: Deutsche Bank

Figure 41: The switch is able distinguish the better performing months, on average



Source: Deutsche Bank

Figure 42: The switch is able to avoid major drawdown periods



Source: Deutsche Bank

The Quality Switch in the MSCI World Universe

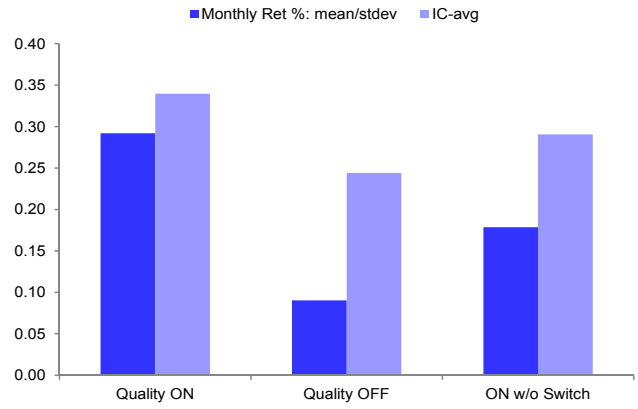
Jan-1995:Jan2013 back- test sample, Long-Short Quintile Monthly Return Statistics before transaction costs

Figure 43: Performance of Quality under 2 different switch positions; ON, and OFF

Monthly Return (%)	Quality ON	Quality OFF	ON w/o Switch
mean	0.69	0.30	0.50
stdev	2.36	3.27	2.82
5th percentile	-3.08	-5.32	-3.95
95th percentile	4.58	5.81	4.73
Min	-5.29	-12.06	-12.06
max	6.38	9.19	9.19
Mean/Stdev	0.29	0.09	0.18
T-stat of the Switch (ON/OFF)		t-stat: 0.21	
IC-avg	0.34	0.24	0.29

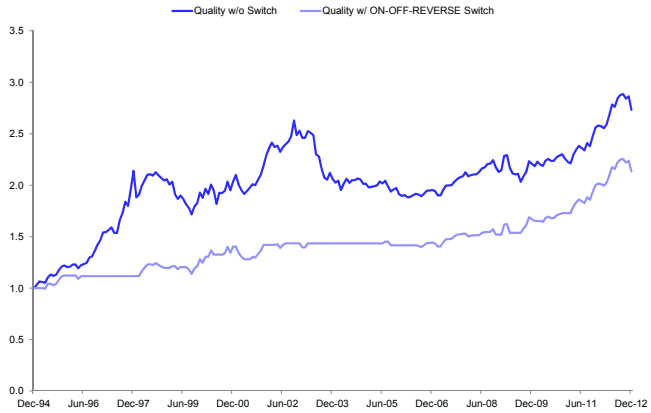
Source: Deutsche Bank

Figure 44: The switch is able distinguish the better performing months, on average



Source: Deutsche Bank

Figure 45: The switch is able to avoid major drawdown periods



Source: Deutsche Bank

The Size Switch

The relationship between the nature of leverage and Size is not straightforward.

The Size factor is a proxy for growth opportunities, blended with liquidity and credit market risks. The relationship between the nature of leverage and Size is not straightforward. The upside risks to the Size factor can be driven by idiosyncratic growth elements, but downside risks would be typically triggered by cyclical worries, credit market access, or liquidity conditions around volatile periods. Better credit market conditions together with improving growth prospects and/or the elimination of systemic risks by aggressive policy actions should generally be supportive for the Size factor.

Reversing the Size factor would serve as a leverage reduction strategy against over-optimistic growth trends

We find it intuitive that during a Growth Deceleration phase (Column 2), when the cyclical or systemic risks start to rise as skepticism about the future sustainability of growth and leverage builds up, investors would start to shift towards large-capitalization stocks. In effect, reversing the Size factor in such an environment (i.e. long large, short small) would serve as a leverage reduction strategy against over-optimistic growth trends, in light of declining strength of factors that support economic growth.

If, actually, a Deceleration phase (Column 2) leads to a Fast Adjustment phase with high volatility (Column 3), our switchboard helps us position Size factor risks in a timely manner. In that case, we keep the switch in REVERSE position (long Large Cap, short Small Cap), as we did during the Deceleration phase. However, in other cases, where volatility shocks take us to Column 3 without being preceded by a Deceleration phase, we do not assume that we shift to Large Cap stocks, financing this trade through the sale of Small Cap positions. This way, we are conservative about the performance of Size investing, in an environment likely to be associated with a scarcity of liquidity

We also keep the Size factor switch in the OFF position during a Fragile Recovery phase (Column 5). We acknowledge that aggressive counter-cyclical fiscal and monetary policies can potentially favor the size factor in fragile growth conditions, but we refrain from adopting such a strategy that requires monitoring the incremental changes in fiscal spending or monetary easing. Such a strategy would inherently take a positive view on the ability of fiscal and monetary policies to generate a sustainable growth and leveraging cycle. Instead of adopting an implicit macroeconomic view, we prefer to remain prudent regarding the Size factor during times of Fragile Growth marked by weak private credit demand.

Figure 46: The switchboard for the Size Factor

SIZE: LONG SMALL-SHORT LARGE	GROWTH		RECESSION		RECOVERY	
	Trend Around or Above Potential	Deceleration	Fast Adjustment&Volatility	Trough	Fragile/Slow	Strong
Driver of Aggregate Demand Growth & Leverage						
Household Credit and Residential Investment	✓	✗	!	✓	!	✓
Business Credit and Business Fixed investment	✓	✗	!	✓	!	✓
Government Borrowing and Fiscal Spending	✓	✗	!	✓	!	✓

(✓) *ON* (!) *OFF* (X) *REVERSE*

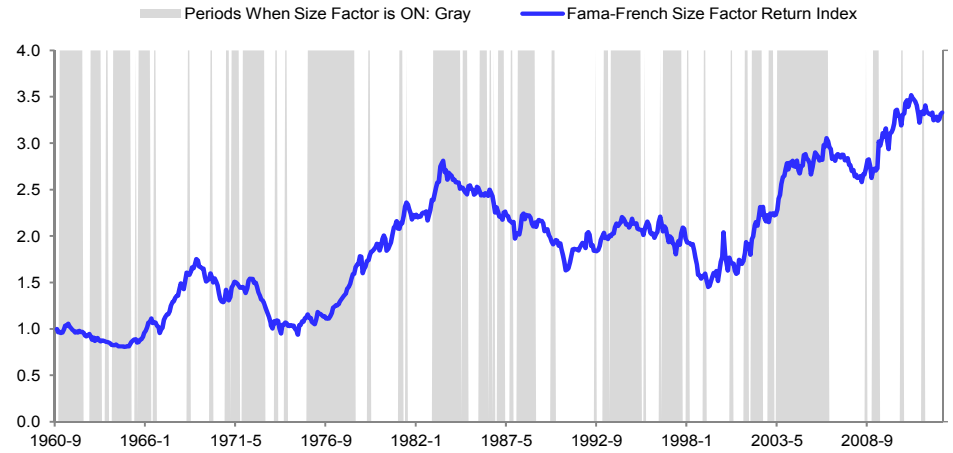
Source: Deutsche Bank

In the US sample going back to 1960s, the size factor does not show any significant relationship to the Growth or Leverage cycles

In the US sample going back to the 1960s, the Size factor does not show any significant relationship to the Growth or Leverage cycles (see Figure 47 below). Post publication of the Banz paper in 1981, the Size factor experienced a 20-year super-cycle of underperformance, followed by an upward trend since the early 2000s. A blend of capacity considerations as Size investing became quite popular in the 1980s, micro-

and macro- factors may have been responsible for the observed performance trends: As far as the macro part is observed, the macro-financial Grid avoids some significant losses within those super-cycles.

Figure 47: The size factor since 1960 and ON signals from the grid

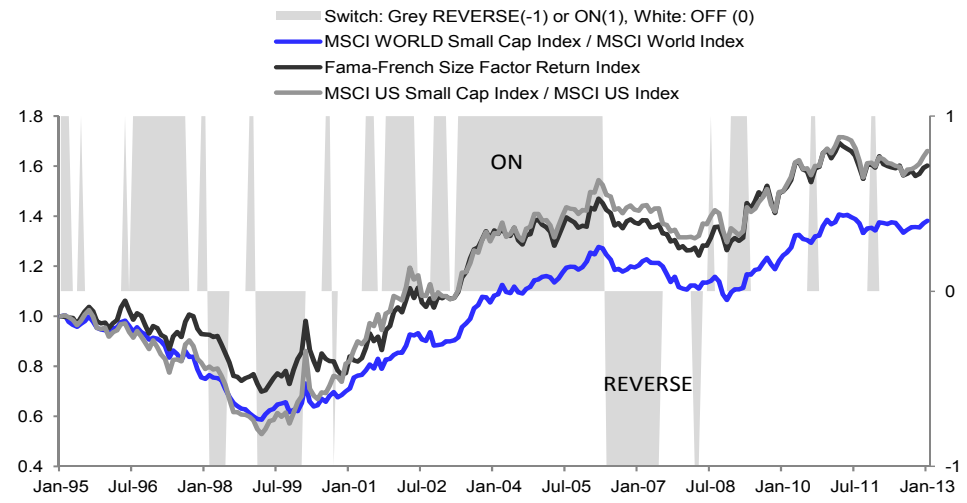


Source: Deutsche Bank, Bloomberg Finance LP

However, over the last two decades, backtest analysis with the Fama-French Size factor suggests that we are able to address the significant drawdowns experienced. This is confirmed through using the MSCI World Small Cap Index relative to the MSCI World index (or MSCI US Small Cap Index relative to the MSCI US index) as a proxy for the small-cap premium. We can see that the Grid is successful at capturing various performance phases of the Size factor. Especially in the post-2000 period, the Grid has helped to avoid protracted losses in a timely manner although it has missed on some good performing months, in return. (Figure 48)

The Grid is successful at capturing various performance phases of the Size factor in the last two decades

Figure 48: The switch has helped to reduce drawdowns of the Size factor in the past two decades



Source: Deutsche Bank, Bloomberg Finance LP

To test the performance of the factor along the Grid, we first proxy for the Size factor by using the MSCI World Small Cap relative to MSCI World Index from January 1995 onwards. Figure 49 below confirms that the Grid actually helps avoid some major

The Grid helps avoid some major losses at the expense of missing out on some of the positive returns

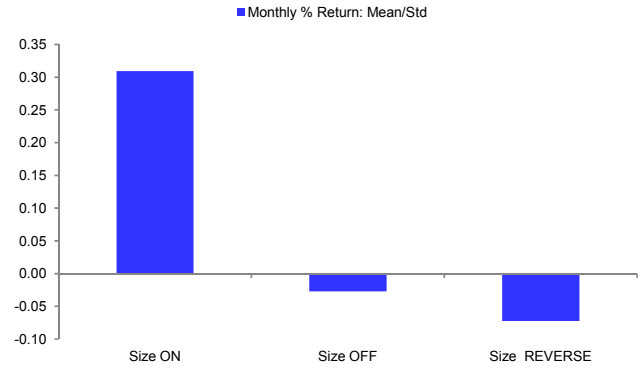
losses, and we have a better risk-adjusted return overall by using the signals from our switchboard. [6]

Figure 49: MSCI WORLD Small Cap relative to MSCI World, monthly return statistics under 3 different switch positions

	Size ON	Size OFF	Size REVERSE	Size w/o Switch
mean	0.64	-0.06	-0.25	0.20
stdev	2.07	2.23	3.40	2.44
5 %-tile	-2.42	-3.97	-4.82	-3.59
95 %-tile	4.39	3.66	3.80	3.94
min	-5.11	-6.15	-9.86	-9.86
max	5.14	6.09	11.89	11.89
T-stat of the Switch (ON/OFF/REVERSE)			t-stat:2.00	
Monthly Ret %: mean/stdev	0.31	-0.03	-0.07	0.08

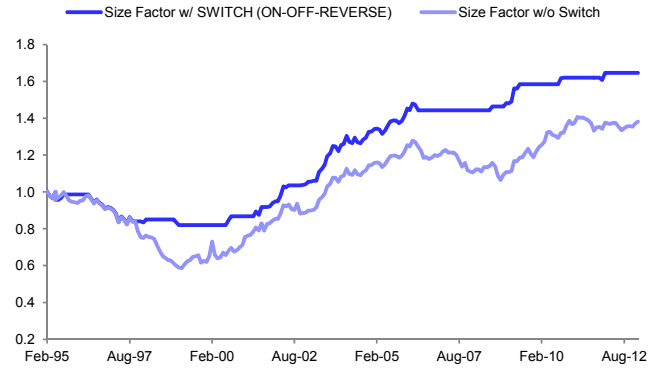
Source: Deutsche Bank

Figure 50: The switch is able to distinguish the economic states that provide better risk-adjusted return



Source: Deutsche Bank

Figure 51: Cumulative return indices of the Size factor with and without switch



Source: Deutsche Bank

Our backtests of the long-short decile portfolios show similar results (Figures 52-57) to the ones presented in Figures 49 to 51. To construct the Size factor, we simply take the market cap of the stocks and group them into deciles as of the rebalancing dates. We try to capture the size risk premium by constructing long-short decile portfolios.

By using the Grid decision framework we are able to statistically differentiate between outperforming and underperforming periods for the Size factor (and, by implication, identify episodes when large-caps tend to outperform). In particular, the improvement derives from avoiding major drawdowns and it is rather powerfully reflected in the MSCI World sample.

[6] Similar conclusions follow from the statistics of the Size Premium captured from the monthly return data of MSCI US Small Cap Index relative to the MSCI US Index

The efficacy of the size factor switch: S&P 1500 Universe

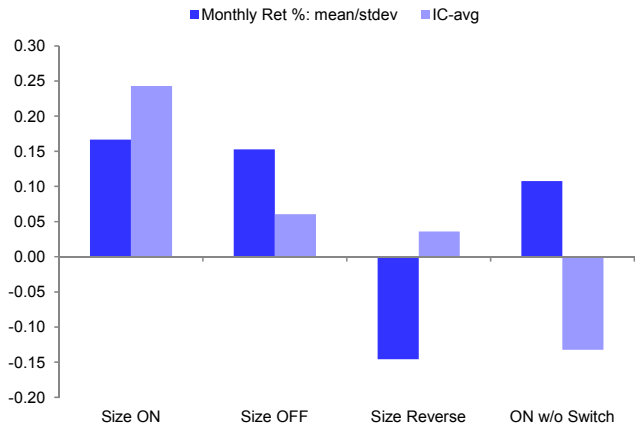
Jan-1995:Jan2013 back- test sample, Long-Short Decile Monthly Return Statistics

Figure 52: Performance of Size under 3 different switch positions; ON, OFF, REVERSE

	Size ON	Size OFF	Size Reverse	ON w/o Switch
mean	0.51	0.44	-0.41	0.31
stdev	3.04	2.85	2.78	2.93
5 %-tile	-3.63	-3.54	-5.73	-3.67
95 %-tile	5.59	6.02	4.89	5.48
min	-6.85	-7.20	-5.98	-7.20
max	12.25	8.07	5.66	12.25
Monthly Ret %: mean/stdev	0.17	0.15	-0.15	0.11
T-stat of the Switch (ON/OFF/REVERSE)			t-stat: 1.46	
IC-avg	0.24	0.06	0.04	-0.13

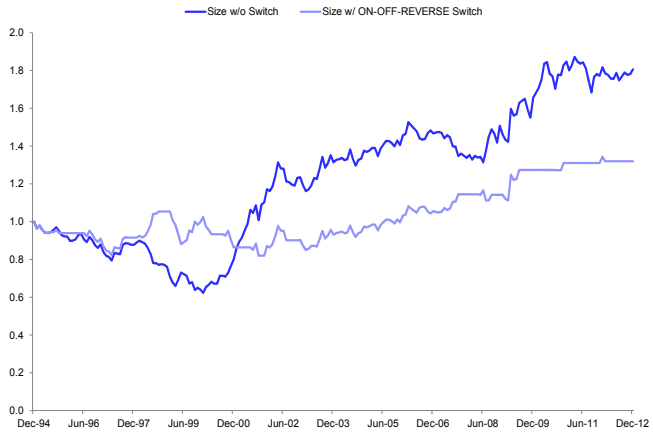
Source: Deutsche Bank

Figure 53: The switch helps to avoid big draw-downs at the expense of missed rallies



Source: Deutsche Bank

Figure 54: The switch helps to avoid big draw-downs at the expense of missed rallies



Source: Deutsche Bank

The efficacy of the size factor switch: MSCI World Universe

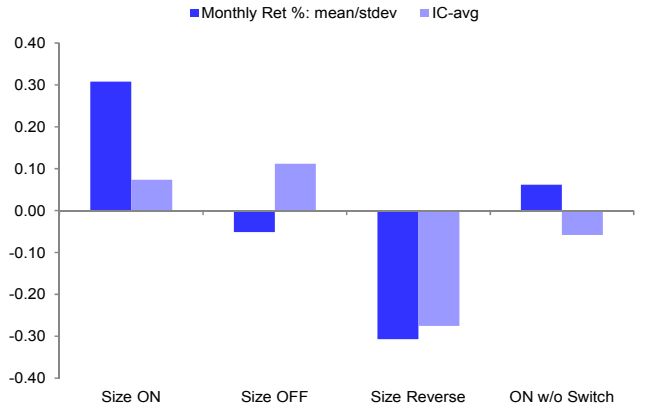
Jan-1995:Jan2013 back- test sample, Long-Short Decile Monthly Return Statistics before transaction costs

Figure 55: Performance of Size under 3 different switch positions; ON, OFF, REVERSE

	Size ON	Size OFF	Size Reverse	Size Factor w/o Switch
Mean	1.04	-0.16	-0.99	0.21
Stdev	3.37	3.19	3.23	3.35
5 %-tile	-3.54	-4.59	-6.47	-5.20
95 %-tile	5.53	4.67	3.94	5.13
Min	-6.85	-12.26	-9.27	-12.26
Max	18.72	9.84	7.18	18.72
Monthly Ret %: mean/stdev	0.31	-0.05	-0.31	0.06
T-stat of the Switch (ON/OFF/REVERSE)			t-stat=3.48	
IC-avg	0.07	0.11	-0.28	-0.06

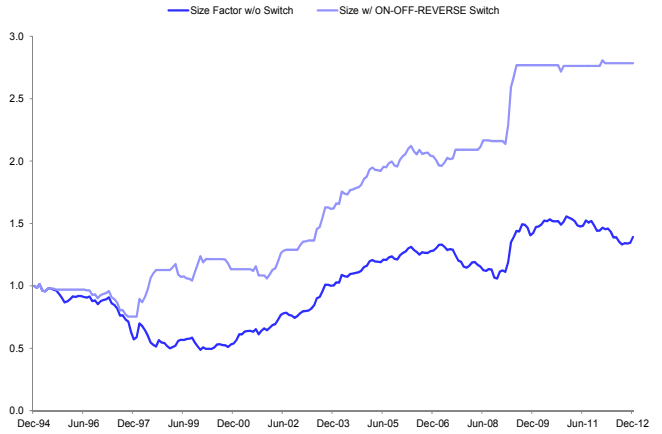
Source: Deutsche Bank

Figure 56: The switch helps to avoid big draw-downs and takes advantage of the upside



Source: Deutsche Bank

Figure 57: The switch is very successful for the MSCI World universe



Source: Deutsche Bank

The Momentum Switch

We have discussed the Momentum factor in detail in our recent publication titled 'Momentum: Riding on a bumpy road'.[7]As we presented in that report, Momentum is probably the best performing strategy over the long-term, but it is vulnerable to big crashes along the way. Momentum strategies can incur substantial losses during jumps in market volatility. Unlike the Value, Quality, or Size factors, it is less intuitive to argue that recent best and worst performers exploit some risk premium that interacts with the macro-financial cycle, although recent research (like Kolari and Wu (2012)) has argued that Momentum presents compensation for cross-sectional dispersion risk.

Momentum is probably the best performing strategy over the long-term, but it is vulnerable to big crashes along the way

Typically, Momentum has negative exposure to Value simply because the convergence of valuations partly involves a convergence of returns. A momentum strategy would expect value stocks to be "trapped" in the near future, and thus would forego the potential returns that can be generated by companies that manage a turnaround and attract flows. The turn-around horizon of Value stocks fluctuates according to cyclical and structural factors, and typical 12- or 6-month look-back periods for constructing momentum strategies allow for negative correlation in the two styles whilst supporting positive long-term performance from both factors.

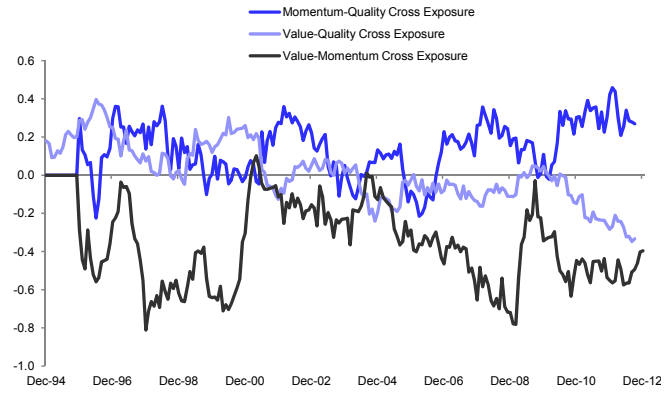
Typically, Momentum has negative exposure to Value

During secular growth trends that favor the Value style ([Row 1&3, Column 1&6]), the turnaround horizon of Value stocks tends to shorten because of the favorable leverage dynamics and risk pricing. As a result, Momentum is likely to suffer in proportion (potentially) to its exposure to the Value style. Therefore, it would appear logical to underweight momentum when the macro indicators of growth and leverage point to ([Row 1&3, Column 1&6]) of our grid. However, we cannot jump into conclusions so quickly without looking at the cross-exposure of the Momentum factor to the other factors that are more closely linked to the macro-leverage grid.

[7] Deutsche Bank Quantitative Strategy, Quantitative Musing, "Momentum: Riding a Bumpy Road", 15 February 2013

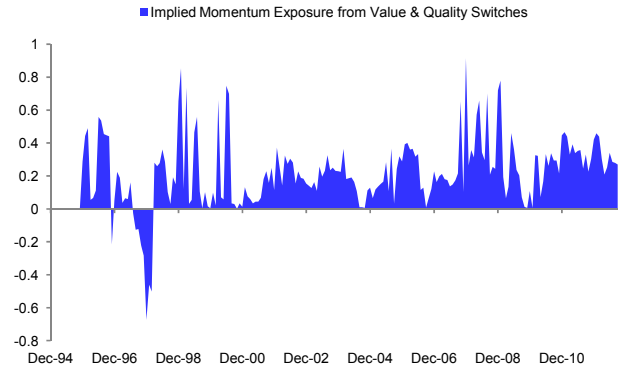
As seen in the charts below, the implied Momentum exposure of the Value and Quality portfolios are highly variable in time. Based on this observation, we mark the periods that are significantly pro- and anti- Momentum as a result of our Value and Quality allocations. We then incorporate the information from the grid location as we explained in the above paragraph. For our analysis, we employ the classic First-11M Momentum factor.

Figure 58: The implied Momentum exposure of the Value and Quality portfolios



Source: Deutsche Bank

Figure 59: The implied Momentum position from the combination of Value & Quality switches



Source: Deutsche Bank

We construct the Momentum switch-board such that it is linked to the grid and also to the Value-switch. At times when the value-switch is ON and the cross-exposure is significantly negative (we use -50% as the cut-off), we turn the momentum switch OFF, we keep it OFF in volatile periods marked as Column 3 on the grid, as well as the Trough phase (Column 4) where we are most likely to experience a turnaround in markets that can hurt the Momentum factor. Otherwise, the Momentum switch is kept ON to benefit from the likely positive performance during all other scenarios. We do not assume a direct relationship between Momentum and leverage dynamics (ie. Row location). We only work that out through the cross-exposure of the factor to Value and Quality.

We construct the Momentum switch-board such that it is linked to the grid and also to the Value-switch.

Figure 60: The switchboard for the Momentum Factor

MOMENTUM	GROWTH		RECESSION		RECOVERY	
	Trend Around or Above Potential	Deceleration	Fast Adjustment&Volatility	Trough	Fragile/Slow	Strong
Driver of Aggregate Demand Growth & Leverage						
Household Credit and Residential Investment	(!)	(√)	(!)	(!)	(√)	(!)
Business Credit and Business Fixed investment	(√)	(!)	(!)	(!)	(√)	(!)
Government Borrowing and Fiscal Spending	(!)	(√)	(!)	(!)	(√)	(!)

(√) *ON* (!) *OFF*

Source: Deutsche Bank

We are not able to test this switch setup accurately with the long history of Fama-French factor returns because we are not able to generate the cross-exposure of the Value long-short portfolios to the Momentum long-short portfolios. However, we can still verify whether the negative relationship with the Value factor shows over the long-term. The regression of the forward month's long-short momentum return on the current month's return and the Value switch shows that our value switch is a negative predictor of Momentum returns, although statistical significance is not all that strong as this relationship would be more important around turning points.

We are not able to test this switch setup accurately with the long history

Figure 61: Regression of Momentum returns on the Value switch

1960-2013 sample	Forward Monthly Momentum Return (%)			
	Coef.	Std.err	z	P-Value
Current Monthly Return	0.05	0.04	1.25	0.21
Value Switch [-1, 0, 1]	-0.42	0.25	-1.68	0.09
Constant	0.84	0.19	4.22	0.00

Source: Deutsche Bank

In fact, our back-tests using both US and Global data over the past two decades confirm that our Momentum switch setup is able to remove some of the volatility and a substantial part of the drawdowns in Momentum, resulting in significant return and risk improvements.

Our Momentum switch setup is able to remove some of the volatility and a substantial part of the drawdowns in Momentum

The efficacy of the momentum factor switch: S&P 1500 Universe

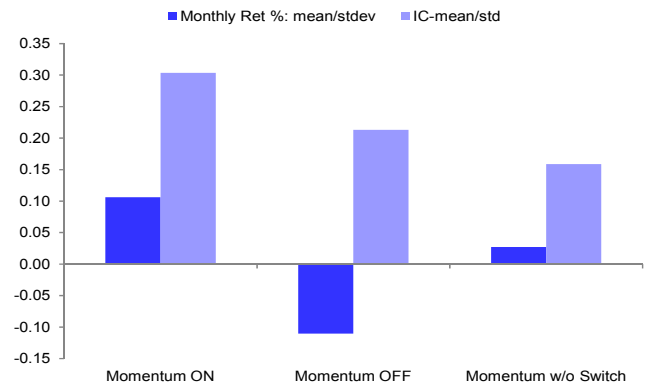
Jan-1995:Jan2013 back- test sample, Long-Short Quintile Monthly Return Statistics before transaction costs

Figure 62: Return statistics based on S&P 1500 Universe

Monthly Return (%)	Momentum ON	Momentum OFF	Momentum w/o Switch
Mean	0.66	-0.83	0.18
Stdev	6.20	7.54	6.60
5 %-tile	-9.81	-12.68	-11.21
95 %-tile	9.33	9.90	9.95
Min	-24.17	-32.05	-32.05
Max	24.18	16.18	24.18
Monthly Ret %: mean/stdev	0.11	-0.11	0.03
T-stat of the Switch (ON/OF)		t-stat:1.01	
IC-mean/std	0.30	0.21	0.16

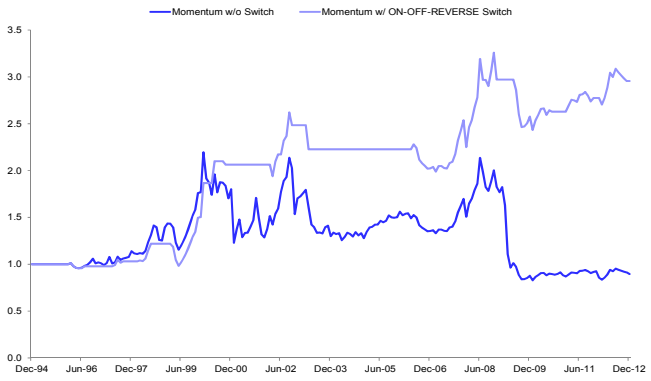
Source: Deutsche Bank

Figure 63: The switchboard is able to avoid major losses



Source: Deutsche Bank

Figure 64: The switchboard is able to avoid major losses



Source: Deutsche Bank

The Efficacy of the Momentum Factor Switch: MSCI World Universe

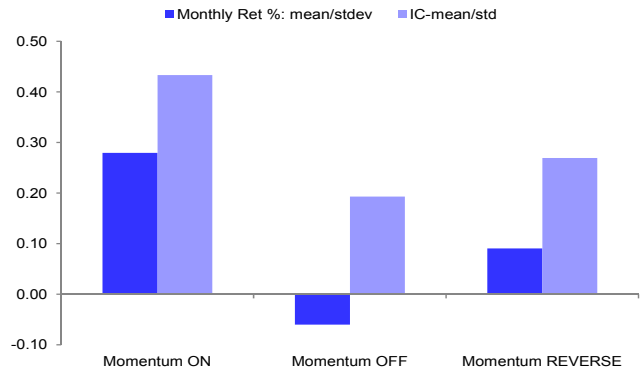
Jan-1995:Jan2013 back- test sample, Long-Short Quintile Monthly Return Statistics before transaction costs

Figure 65: Return statistics based on MSCI World Universe

	Momentum ON	Momentum OFF	Momentum w/o Switch
Mean	1.29	-0.39	0.53
Stdev	4.61	6.56	5.84
5 %-tile	-5.84	-12.53	-10.06
95 %-tile	10.83	7.57	10.52
Min	-14.82	-29.78	-29.78
Max	14.07	14.98	14.98
Monthly Ret %: mean/stdev	0.28	-0.06	0.09
T-stat of the Switch (ON/OF)		t-stat: 2.31	
IC-mean/std	0.43	0.19	0.27

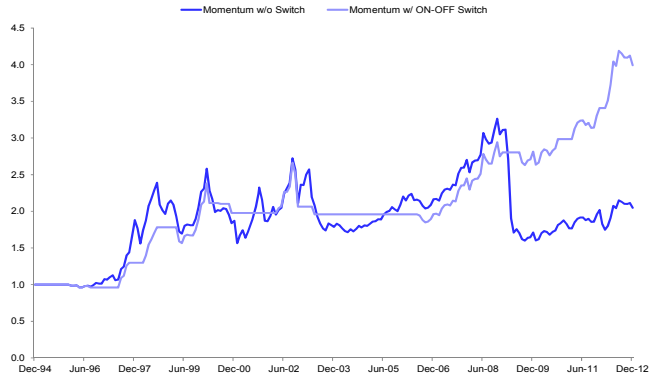
Source: Deutsche Bank

Figure 66: The switchboard is successful in picking the better-performing Momentum periods



Source: Deutsche Bank

Figure 67: The switchboard is able to avoid most of the Momentum downside in the MSCI World Universe



Source: Deutsche Bank

The Switchboard in Action

We have explained the intuition and the mechanics of the macroeconomic grid in the earlier sections. According to the data available by the end of each month, we construct the grid location signal according to our decision tree. The Grid locations detected based on the available data since 1960 are provided in Appendix B.

Once we decide on the grid location, we link it to the factor switch map based on the analysis that we presented at length earlier. We rotate or reverse factor allocations based on the factor switch diagram we show below.

Figure 68: The suggested factor allocations in different Grid positions

Combined Factor Switchboard	Broad Cyclical Position >>>	GROWTH		VOLATILITY & RECESSION		RECOVERY	
	Speed/Phase of Cyclical Position>>>	Strong	Deceleration	Volatility	Trough	Fragile/Slow	Strong
Driver of Leverage	ON OFF REVERSE	Column1	Column2	Column3	Column4	Column5	Column6
Row 1 Household Credit and Residential Investment	Value	✓	✗	!	✓	!	✓
	Momentum	!	✓	!	!	✓	!
	Quality	!	✓	✓	!	✓	!
	Size	✓	✗	!	✓	!	✓
Row 2 Business Credit and Business Fixed investment	Value	✗	!	✓	✓	!	✗
	Momentum	✓	!	!	!	✓	!
	Quality	!	✓	✓	!	✓	!
	Size	✓	✗	!	✓	!	✓
Row 3 Government Debt and Fiscal Spending	Value	✓	✗	!	✓	!	✓
	Momentum	!	✓	!	!	✓	!
	Quality	!	✓	✓	!	✓	!
	Size	✓	✗	!	✓	!	✓

Source: Deutsche Bank

Combining style portfolios based on the Switchboard

We have shown that we can improve individual style factor performance by using the switchboard based on macro-financial conditions. Our switchboard is not able to catch the occasional twist and turns in the factor returns, but it certainly helps to avoid protracted periods of losses.

We now construct a single long-short portfolio which utilizes the style switching calls. We take the long and short stock baskets coming from the quintiles of each of the four factors (for the small-cap factor we take the lowest size decile of the S&P 1500 universe), multiply them with the contemporaneous switch of each factor (ON/OFF/REVERSE, [1, 0, -1]); and then add them altogether. The resulting net portfolio is a factor-switch weighted basket of stocks. Therefore, we have an overweight on the stocks that appear in multiple long factor baskets and an underweight for the ones that show up in multiple short baskets. For example, in a month when the Value and Quality switches are ON, and the Size switch is REVERSE, a stock with good Value and Quality

We take the long and short stock baskets coming from the quintiles of each of the four factors multiply them with the contemporaneous switch, and then add them together

score and, a low Size (Larger mcap) score will be picked by our switchboard strategy as an attractive long.[8]

We back-tested the style-switch model and compared it to a strategy that keeps an equal weight on all four risk factors at all times, anticipating that we would be able to outperform an arbitrary style allocation rule. Our backtest period runs from January 1995 to January 2013, and we use the S&P 1500 and MSCI World universes.

The results show that the switchboard brings significant improvement to returns at the cost of additional volatility, with an overall improvement in Information Ratio relative to the equally-weighted model of about 18 per cent for both the S&P 1500 and the MSCI World universes. Figures 69 to 71 demonstrate that most of the improvement has been achieved in the post-2002 period. Especially, the timely switch out of Value in 2006 as the credit/leverage cycle had matured, and the focus on Quality since 2009, was well-picked up and helped to sustain the upward trend. Nevertheless, the bulk of the over-performance is down to the sharp improvement in sentiment by the end of March-2009, during which our framework correctly assigned factor exposures to benefit from the market bounce.

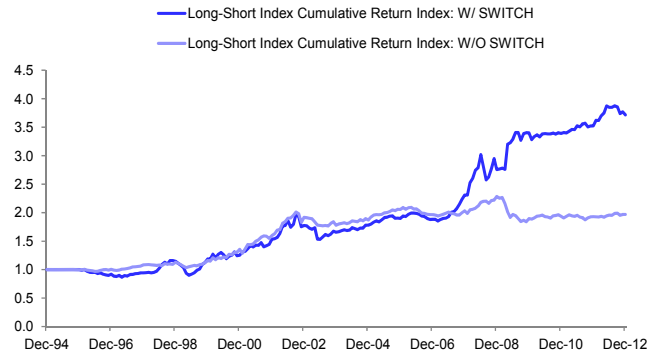
The results show that the switchboard brings significant improvement to returns at the cost of additional volatility

Figure 69: Back-test statistics of the combined factor portfolios; Long-Short

S&P 1500 Universe	IR	CAGR	Ann Vol	Skew	Kurtosis	Max Drawdown
Switching Applied	0.68	7.5%	11.6%	0.04	3.38	-22.4%
Equally-Weighted (No Switch)	0.62	4.1%	6.9%	-0.27	2.20	-19.4%
MSCI World Universe						
Switching Applied	1.35	13.9%	11.2%	0.78	2.95	-11.5%
Equally-Weighted (No Switch)	1.14	8.8%	7.7%	0.23	1.76	-13.4%

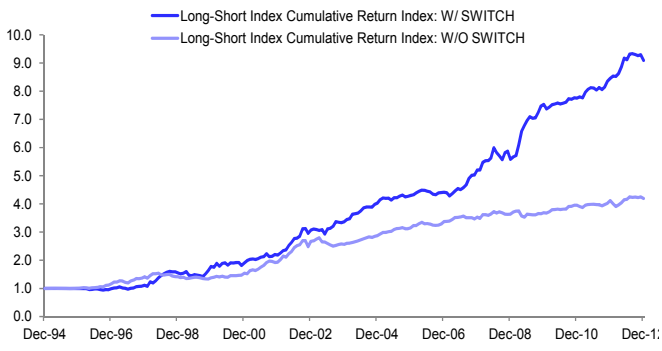
Source: Deutsche Bank

Figure 70: Long-Short cumulative return with and without switch: S&P 1500 Universe



Source: Deutsche Bank

Figure 71: Long-Short cumulative return with and without switch: MSCI World Universe



Source: Deutsche Bank

In addition, we also conduct a long-only factor backtest based on the timing signals from the grid and compare the results against an equally-weighted long-only portfolio across the factors, as well as against the relevant market index. Once more, the results with both US and global data are encouraging: Following the switchboard leads to

[8] Please see the Appendix A for the description of the factor construction from the accounting and market data.

outperformance both versus the market index (both capitalization- and equally-weighted) as well as versus the equally-weighted factor model.

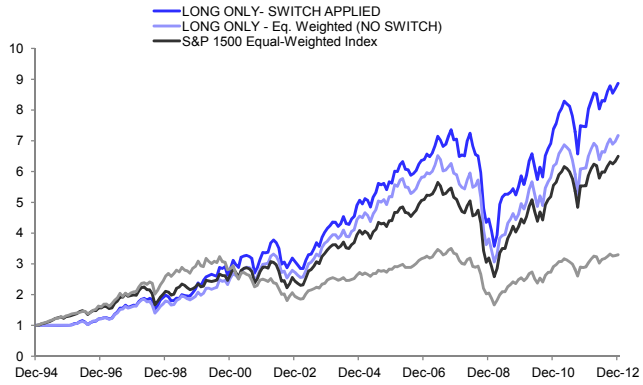
As Figure 72 shows, the long only factor portfolio which incorporates the timing signals in the MSCI World universe generates an additional 20% improvement in Sharpe ratio compared with the long-only equally weighted factor model.

Figure 72: : Back-test statistics of the combined factor portfolios; Long Only

S&P 1500 Universe	IR	CAGR	Ann Vol	Skew	Kurtosis	Max Drawdown
Switching Applied	0.76	13.7%	19.3%	-0.24	2.46	51.4%
Equally-Weighted (No Switch)	0.72	12.2%	18.4%	-0.62	1.50	53.0%
MSCI World Universe						
Switching Applied	0.91	16.4%	18.7%	0.02	3.81	53.9%
Equally-Weighted (No Switch)	0.76	12.1%	17.0%	-0.92	3.27	56.1%

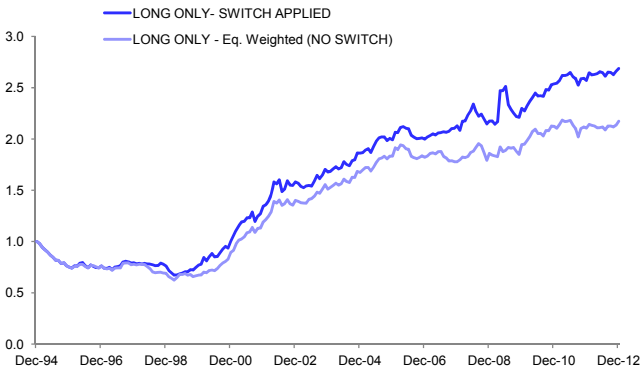
Source: Deutsche Bank

Figure 73: S&P 1500 Universe: Long only portfolios with and without switch and the S&P 1500 Index



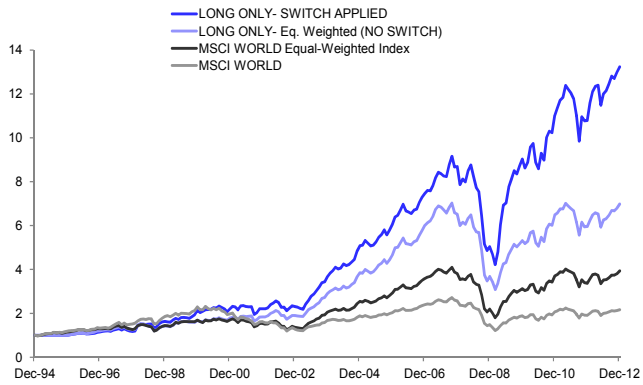
Source: Deutsche Bank, Bloomberg Finance LP

Figure 74: S&P 1500 Universe: Cumulative return index of long only portfolios relative to the S&P 1500 Index



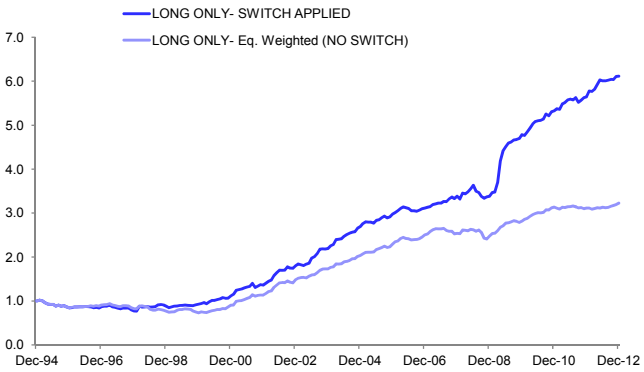
Source: Deutsche Bank, Bloomberg Finance LP

Figure 75: MSCI World Universe: Long only portfolios with and without switch and the MSCI World Index



Source: Deutsche Bank, Bloomberg Finance LP

Figure 76: : Cumulative return index of long only portfolios relative to the MSCI World Index



Source: Deutsche Bank, Bloomberg Finance LP

Combining Factor Scores based on the Switchboard

An alternative way to incorporate the switchboard is to construct portfolios based on aggregating the stock weights in each factor, and re-ranking into quintiles, to obtain the long (top quintile) and short (bottom quintile) equally-weighted positions. The switchboard dictates which factors will be considered at each point in time (the "ON" positions).

The back-test results are shown in the table below. For both the S&P1500 and MSCI World universes, return improves, but volatility increases as well. The most significant improvement comes with the global universe, where the Information Ratio boost from timing (in the region of 33%) seems to be worth the corresponding increase in turnover.

Figure 77: Quintile long-short return statistics with and without style switching; monthly rebalancing, Jan:1995-Jan:2013

	CAGR	AnnVol	IR	tstat	Skew	Kurtosis	MaxDD	VaR95	ES95	Turnover
S&P 1500 Universe										
Switching Applied	8.0%	10.0%	0.80	3.37	0.78	5.97	-0.17	-0.04	-0.06	57%
Equally-Weighted (No Switch)	5.0%	6.1%	0.78	3.82	0.10	0.71	-0.09	-0.02	-0.03	39%
MSCI WORLD Universe										
Switching Applied	14.9%	10.2%	1.54	6.14	0.61	2.18	-0.08	-0.03	-0.05	61%
Equally-Weighted (No Switch)	9.1%	9.0%	1.16	4.76	0.21	0.80	-0.15	-0.03	-0.04	50%

Source: Deutsche Bank

Although we are able to achieve significant improvements in the Information Ratio of single-factor portfolios with the help of our switchboard, we see that the combined portfolios do not reflect those improvements in an additive manner. To a large extent, this is because we have assumed we implement the factor switches "to the full", shifting around a significant part of the portfolio at each rebalance, as a result (and some factors may be inversely correlated and "cancel" each other out in some periods). This was done in order to demonstrate the "raw" added value of the switching framework, which we deem to be in the right direction. More sophisticated portfolio construction techniques can be employed to optimize the trade-off between expected return, volatility, and turnover at each rebalance.

Although we are able to achieve significant improvements in the Information Ratio of single-factor portfolios, we see that the combined portfolios do not reflect those improvements in an additive manner

Moreover, as a lot of volatility is imparted to the final portfolio by the Momentum and Size switches, we have also tested a timing scheme between Value and Quality alone based on the Grid. Arguably, they are also the factors with the strongest link to the variation in macroeconomic conditions. The improvement in Information Ratio is substantial, especially for the S&P 1500 universe that suffered the most from the volatility of Momentum and Size portfolios. These results confirm that our macroeconomic switchboard is able to guide the risk allocation decisions in the Value-Growth axis and the High Quality- Low Quality axis successfully by monitoring the growth-leverage dynamics in the US economy.

As a lot of volatility is imparted to the final portfolio by the Momentum and Size switches, we have also tested a timing scheme between Value and Quality alone

Figure 78: Long-Short factor portfolio statistics with only Value and Quality

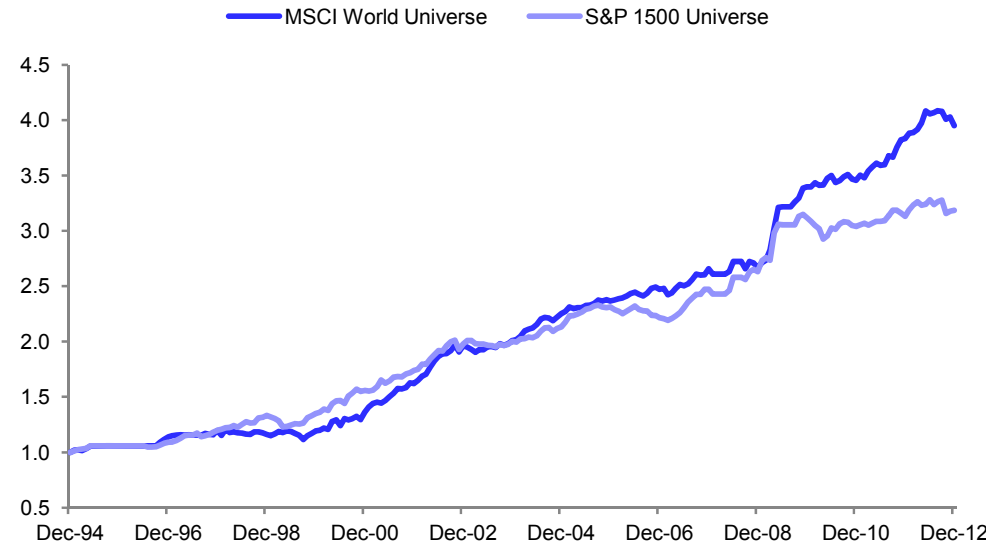
	CAGR	AnnVol	IR	tstat	Skew	Kurtosis	Hit Ratio	Max DD	VaR95	ES95	Turnover
S&P 1500 Universe											
Switching Applied	7.7%	6.3%	1.30	5.46	0.72	5.10	0.61	-0.08	-0.01	-0.03	78%
Equally-Weighted (No Switch)	4.4%	4.5%	0.77	3.30	0.22	2.50	0.60	-0.10	-0.02	-0.03	66%
MSCI WORLD Universe											
Switching Applied	8.2%	5.5%	1.49	6.05	0.65	2.15	0.62	-0.07	-0.02	-0.03	79%
Equally-Weighted (No Switch)	7.6%	6.3%	1.20	5.08	0.23	0.13	0.64	-0.12	-0.02	-0.03	71%

Source: Deutsche Bank

Figure 79 below shows the cumulative return indices of the quintile long-short baskets created by using the combined stock score generated from the Value and Quality factors only. In the past 4 years, the Quality switch has been mostly in the ON position, and performed much better for the MSCI World universe than the S&P 1500. Although the Quality switch has not generated significant returns in the US sample, it definitely provided protection against the losses in the other styles factors in the current Fragile Growth cycle.

The Quality switch has been mostly in the ON position, and performed much better for the MSCI World universe than the S&P 1500

Figure 79: Long-Short cumulative return with only Value and Quality Factors with SWITCH



Source: Deutsche Bank

Where are we now?

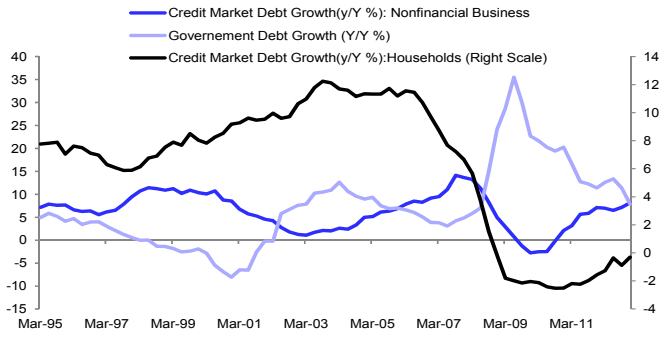
The latest data from the US still points to the Fragile Recovery phase (Column 5), but we are probably in the latter stages of this. The current Fragile Growth phase may well develop into to a Strong Recovery phase (Column 6) ahead, but further weakening and a volatile adjustment cannot be ruled out. The debt reduction rate in the household sector is showing signs of stabilization (Figure 80-81). Monetary policy and labor market dynamics appear to be supportive for growth if private leverage leads to household credit growth or business spending. On the other hand, the nonfinancial corporate sector's profit margin appears to be stretched, reaching historical peaks (Figure 82). Therefore, there is a risk that the growth cycle may slide into the deceleration phase in the absence of additional supporting factors. Lower commodity prices coupled with a stronger USD, however, may provide some more room for margin expansion.

The current Fragile Growth phase may well develop into to a Strong Recovery phase (Column 6) ahead, but further weakening and a volatile adjustment cannot be ruled out

The growth cycles we observed in the earlier decades that registered GDP growth rates well ahead of the growth rate of money supply seem to be a thing of the past (Figure 83). GDP growth has been keeping its head above water with the support from monetary policy, while corporate profitability has soared. We need more demand for leverage (and more supply in Europe) to start shifting convincingly away from the Quality theme, towards more risk-taking in the Momentum and Value styles. Our macroeconomic data monitors mapped into the grid position should be able to pick up these developments as and when they come by.

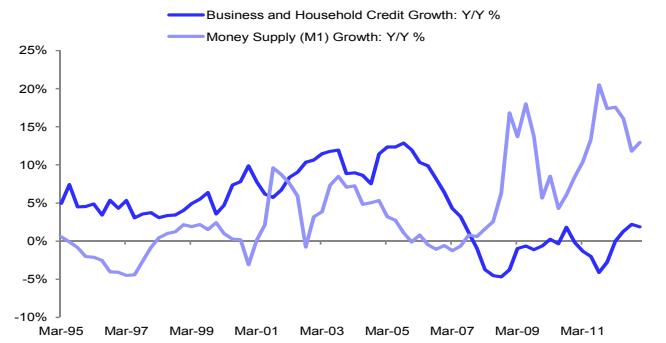
GDP growth rates well ahead of the growth rate of money supply seem to be a thing of the past

Figure 80: The household deleveraging cycle is bottoming



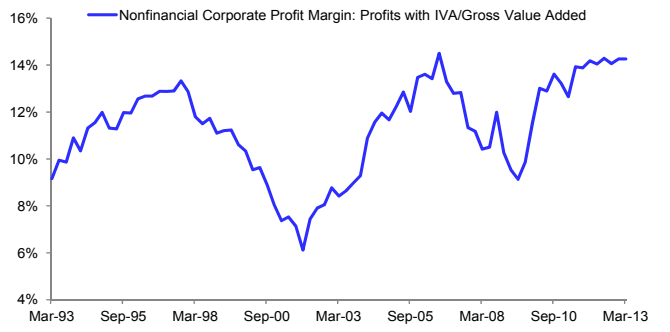
Source: Deutsche Bank, Bloomberg Finance LP

Figure 81: Private credit demand is still weak relative to money supply growth



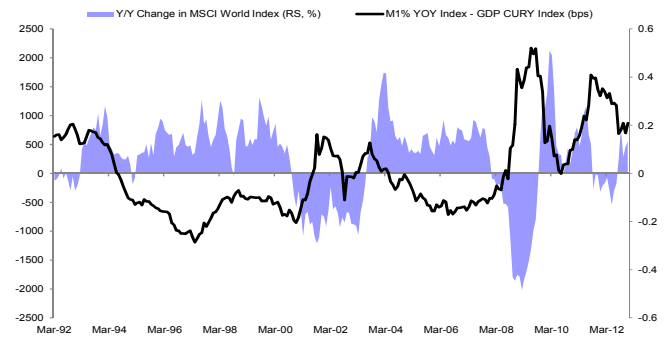
Source: Deutsche Bank, Bloomberg Finance LP

Figure 82: Corporate profit margins reached historical highs despite weak Growth dynamics



Source: Deutsche Bank, Deutsche Bank, Bloomberg Finance LP

Figure 83: The cyclical patterns of GDP, monetary policy reaction and market action have disappeared



Source: Deutsche Ban, Deutsche Bank, Bloomberg Finance LP k

Current Recommendation: Quality (adjusted for Value Exposure) + Momentum

According to our model, the latest data recommends continuing with the Quality and Momentum factor while remaining neutral on Value and Size. If the data on private credit growth shows some improvement in the coming data releases, the model may start to signal an allocation along the Value-Growth axis depending on the driver of the revived leverage demand, if any.

The sustained fragility in private credit demand and the high plateau of margins makes the Quality factor more attractive, at this time. However, when we look at the cross-exposure of the current long-short quality factor quintiles, we currently observe a significant net negative exposure to the Value style. (See Figure 59 on page 40). This implies that the Quality long-short baskets have been losing their attractiveness from a valuation perspective. Therefore, it appears that we are in a mature Fragile Recovery phase where the relative factor performance opportunities are diminishing in line with bond yields.

Some recovery in the private leverage trend in the coming quarters from the current stabilizing phase may turn out to be a strong signal in favor of Value and Size, with the latter risk factors benefiting from the robust growth-leverage combination. However, in all likelihood, we will be able to see such changes, if any, in the second half of the year when growth and leverage data will give some signals about the state of the recovery amid aggressive monetary policy actions.

Some recovery in the private leverage trend in the coming quarters from the current stabilizing phase may turn out to be a strong signal in favor of Value and Size

As long as the low-growth/low-yield/low leverage combination is sustained, the demand for 'bond-like' strategies focusing on free cash flow and dividend yield are likely to continue to dominate equity markets, although we do keep a watchful eye on valuations (We actually intend to incorporate the Valuation dimension in an upcoming report in a more systematic way than discussed in this Section) As we have seen recently in the case of Apple Inc., strong investor preference for yield should continue to drive companies with free cash flow to boost their payout ratios, in the near future.

'Bond-like' strategies focusing on free cash flow and dividend yield are likely to continue to dominate equity markets

Casting an Eye to Risk factors From Other Asset Classes

In this Section, we present some preliminary discussion on the potential use of our macro-financial Grid for risk factors in other asset classes. We choose to discuss one risk factor from each of FX, Credit, Rates, and Commodities, as well as the Implied versus Realized Volatility premium in Equities, implemented via derivative instruments. The chosen factors are thought to have some rational relevance to our decision framework.

FX Carry (Bloomberg Ticker: DBHVUSI Index)

The FX carry strategy is based on the forward-rate bias and essentially involves the outflow of capital from funding currencies to higher-yielding currencies. The FX carry risk premium delivers positive returns as long as the risk attitude on the funding side is positive. Therefore, we could conjecture that the FX carry strategy attracts risk capital in a similar fashion to the factors that benefit from cyclical optimism and monetary accommodation. It is subject to a potential unwind of risk if cyclical risks on either the funding side or the receiving side of the trade start to increase.

FX carry is one of the strategies with strongest mapping to states of risk appetite, so the categorization is comparatively easier versus other Risk Premia

FX carry is one of the strategies with strongest mapping to states of risk appetite, so the categorization is comparatively easier versus other risk premia, essentially resting on the Column location in the macro-financial grid. We could even simplify further to argue that the sensitivity of FX Carry to economic states should be similar to that of equities.[9] Like in the equity space, the state of the US economy and the demand for dollars in financial markets are key drivers of returns and volatility in the FX carry space. Strong Growth periods accompanied by accommodative monetary policy (Column 1) are typically very conducive to Carry strategies, as corrections are temporary and positioning-driven. A Strong Recovery period (Column 6) has similar implications for Carry strategies, while the depths of a recession ("Trough", Column 4) are neutral to positive for Carry, albeit with high volatility, as market participants will be uninvested in Carry at this point in time.

When demand for US dollars picks up quickly (and the USD is perceived as a "safe haven" currency), which is usually associated with heightened volatility in equities, the Carry trade tends to suffer significant losses. In the "Fast Adjustment and Volatile" Recession phase (Column 3), the FX Carry trade should be switched OFF. A Growth Deceleration stage (Column 2) would be neutral for Carry, assuming it is neutral for risk appetite, but as corrections will start becoming pronounced, we prefer to shy away from FX Carry exposure (tail-winds from the labor market, monetary policy, and profit margins, start to dissipate). A Fragile Recovery period (Column 5) is unclear for FX Carry given that this state isn't directly mapped into a state of risk appetite (although last year FX Carry strategies performed well supported by the unprecedented quantitative easing actions by Central Banks). Again, to be more conservative, we keep the switch at the "OFF" position during Fragile Recovery periods.

[9] It is important to note though, that the returns of the carry trade have mostly been attributed to spot moves, as opposed to interest rate differentials, since the late 1990s in the G-10 markets and since the mid-2000s in Emerging Markets. It could be counterintuitive, but plausible that the FX Carry trade has been influenced by the transmission of risk appetite in FX

Figure 84: Switch position on the grid [0,1] for the FX Carry Premium

FX Carry	GROWTH		RECESSION		RECOVERY	
	Trend Around or Above Potential	Deceleration	Fast Adjustment&Volatility	Trough	Fragile/Slow	Strong
Driver of Aggregate Demand Growth & Leverage						
Household Credit and Residential Investment	(√)	(!)	(!)	(√)	(!)	(√)
Business Credit and Business Fixed investment	(√)	(!)	(!)	(√)	(!)	(√)
Government Borrowing and Fiscal Spending	(√)	(!)	(!)	(√)	(!)	(√)

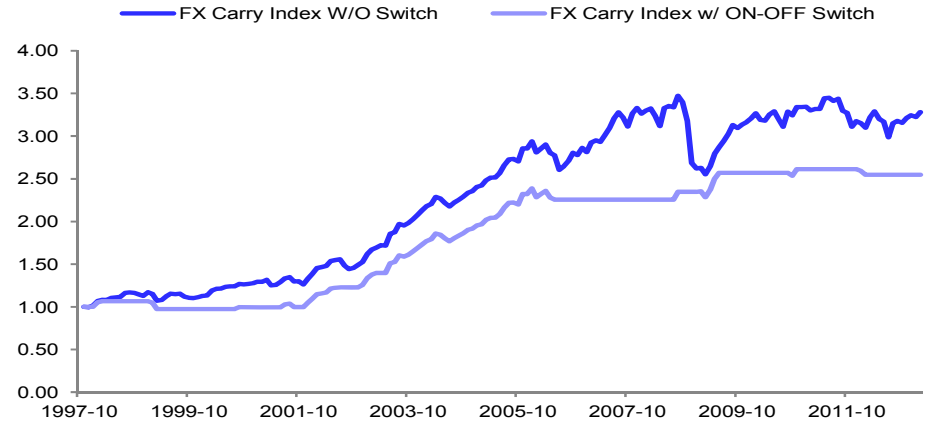
(√) *ON* (!) *OFF*

Source: Deutsche Bank

The FX carry risk premium delivers positive returns as long as the risk attitude on the funding side is positive

Based on our G10 FX Carry strategy returns between October 1997 to January:2013, we find that by fine-tuning the Carry trade based on the Grid recommendations (Figure 84), we are able to avoid some significant drawdowns before high volatility sets in and market panic emerges. The returns in the "ON" versus "OFF" states are significantly different. (Figures 85 & 86).

Figure 85: FX Carry Strategy: Cumulative return index with and without the Switch



Source: Deutsche Bank

Figure 86: FX Carry monthly return statistics at different Switch positions
Period: 1997:10-2013:1

Monthly Return When FX Carry Switch is:	ON	OFF
Mean	0.98	0.26
Stdev	2.67	2.92
Min	-6.89	-15.56
Max	6.25	6.76
95%-tile	5.08	3.94
5%-tile	-2.51	-2.84
Mean/Stdev	0.37	0.09
		t-stat:2.63

Source: Deutsche Bank

Like the Risk Factors in the equity space, the extraordinary central bank actions have distorted the FX-carry strategy in recent years, obscuring the nature of risk pricing in financial markets. As a result, we fail to see a sustained cycle of performance for the FX carry premium in a way observed in the pre-2008 period. It is rather unusual not to expect positive returns to a carry trade strategy when central banks openly commit to money-printing. But in the absence of a robust growth-leveraging cycle, the returns are

In the absence of a robust growth-leveraging cycle, the returns are likely to be subject to more policy uncertainty on the funding and receiving end of the FX carry trades

likely to be subject to more policy uncertainty on the funding and receiving end of the FX carry trades. Although the switch is currently "OFF", we are on the lookout for a move to the Strong Recovery stage to change our stance.

Credit HY vs IG

Long High Yield (HY), Short Investment Grade (IG) is a type of 'carry' strategy in the corporate debt market. The High Yield asset class, BB bonds in particular, have historically exhibited the best risk-adjusted returns in credit due to reasons relating to credit risk appetite and relative illiquidity. In Europe, we believe that the liquid iTraxx Crossover index is a good proxy for the High Yield asset class as it consists predominantly of BB rated names. Going long the **iTraxx Crossover Index** and shorting the iTraxx Main (only Investment Grade bonds included) according to the "hedge ratio" which renders the strategy ex-ante beta neutral (a levered short on **iTraxx Main**), is our preferred implementation as it reduces the correlation to traditional beta and provides a hedge against European systemic risk. Still, the performance of this strategy is down to the importance of systemic versus idiosyncratic company concerns, as well as the difference between actual HY default levels and expectations.

By distinguishing the source of leverage, we are able to identify the macro-financial conditions where credit market discipline is sacrificed for the promotion of growth and/or financial market stability.

Our grid provides an interesting angle for this risk trade. By distinguishing the source of leverage, we are able to identify the macro-financial conditions where credit market discipline is sacrificed for the benefit of growth and/or financial market stability. At times when counter-cyclical policies are being pursued (Column 4) and the government provides subsidized credit (Row 3), expanding its balance sheet in the process, systemic concerns may surface which work in favour of the HY vs IG trade, given the short levered position on IG. We are likely to experience blurry budget constraints in credit markets because the credit provision partly gains a 'public good status'. We conjecture that a subsidized credit environment where monetary expansion and fiscal spending promote credit growth as a public good is the most attractive condition for the HY vs. IG carry strategy. Instead, increasing corporate leverage increases idiosyncratic risk, which is bad for the strategy given that HY is expected to widen over IG.

Therefore, we would like to switch the HY-IG strategy ON as long as the growth-leverage indicators point to strong growth, or point to subsidized credit environment driven by monetary and fiscal expansion. When cyclical risks start to become more apparent after a strong growth period, and when fast market adjustment is observed, we turn the switch to an OFF position.

Switch the HY-IG strategy ON as long as the growth-leverage indicators point to strong growth, or point to subsidized credit environment

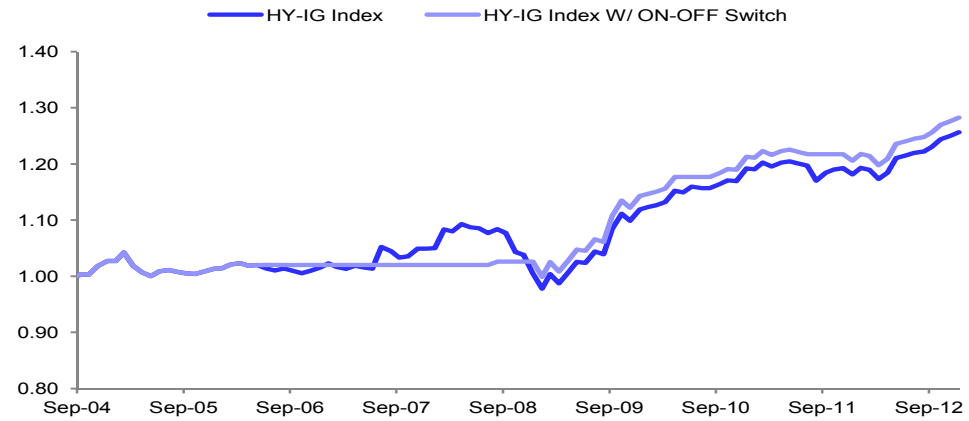
Figure 87: Switch position on the grid [0,1] for the HY-IG Premium

HY-IG	GROWTH		RECESSION		RECOVERY	
	Trend Around or Above Potential	Deceleration	Fast Adjustment&Volatility	Trough	Fragile/Slow	Strong
Driver of Aggregate Demand Growth & Leverage						
Household Credit and Residential Investment	✓	!	!	✓	!	✓
Business Credit and Business Fixed investment	✓	!	!	✓	!	✓
Government Borrowing and Fiscal Spending	✓	!	!	✓	✓	✓

(√) *ON* (!) *OFF*

Source: Deutsche Bank

Figure 88: HY- IG Strategy: Cumulative return index with and without the Switch



Source: Deutsche Bank

Figure 89: HY-IG monthly return statistics at different switch positions
Period: 2004:10-2013:1

	ON	OFF
Mean	0.31	0.11
Stdev	1.25	1.21
Min	-3.18	-3.16
Max	4.33	3.80
95%-tile	2.21	1.97
5%-tile	-1.13	-0.66
mean/stdev	0.25	0.09
t-stat of the Switch (ON/OF)	t-stat:0.81	

Source: Deutsche Bank

Equity Implied vs. Realized Volatility (Bloomberg Ticker: DBCUSUVU Index)

In an environment where high market volatility is countered by monetary and fiscal policy actions, this strategy lives its 'golden era'

Dealers demand a premium for selling options to hedgers, resulting in a systematic bias between implied and subsequent realized volatility. The existence and persistence of this risk premium for equity index options has been empirically verified in academic research, and similar strategies are now commonplace in other asset classes such as Rates and Credit. Practical implementations of this strategy involve selling implied volatility and buying realized volatility using naked options, variance swaps, delta-hedged straddles, etc.. In a stable market environment this risk premium is typically positive, i.e. implied volatility exceeds realized. Moreover, in an environment where high market volatility is countered by monetary and fiscal policy actions, such strategy is likely to thrive. On the contrary, during strong growth-leverage environments with benign volatility, or during systemic crisis episodes characterized by realized volatility shocks, the strategy incurs significant losses.

The switch on the Implied Vs Realized Volatility premium is "ON" when there are indications that monetary policy is countering the volatility and fragility of the growth cycle, as well as when it is fueling the leverage cycle. These are the times when frequent fluctuations in volatility create a fertile ground for the Implied Vs Realized strategy.

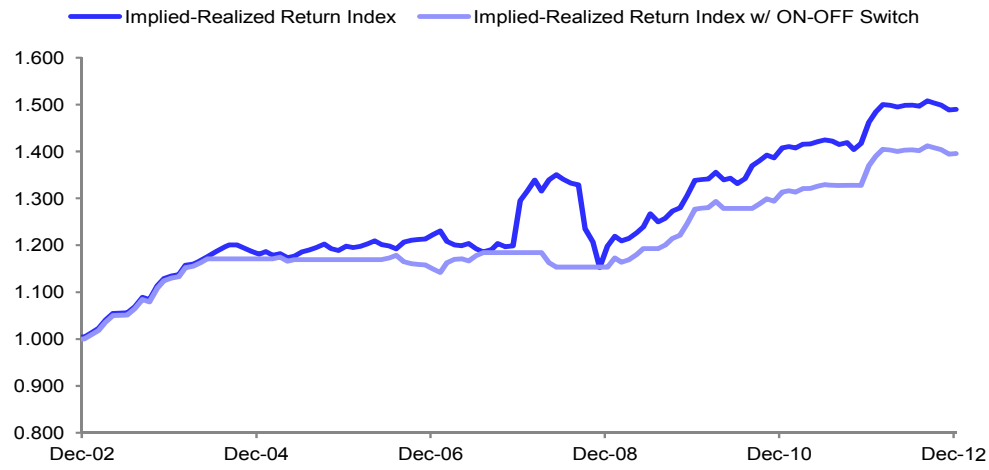
Figure 90: Implied vs. Realized Volatility Switch position on the grid [0,1]

Implied vs. Realized	GROWTH		RECESSION		RECOVERY	
	Trend Around or Above Potential	Deceleration	Fast Adjustment&Volatility	Trough	Fragile/Slow	Strong
Driver of Aggregate Demand Growth & Leverage						
Household Credit and Residential Investment	(!)	(!)	(!)	(√)	(√)	(!)
Business Credit and Business Fixed investment	(!)	(!)	(!)	(√)	(√)	(!)
Government Borrowing and Fiscal Spending	(√)	(!)	(!)	(√)	(√)	(√)

(√) *ON* (!) *OFF*

Source: Deutsche Bank

Figure 91: Implied-Realized Vol. Strategy: Cumulative return index with and without the switch



Source: Deutsche Bank

Figure 92: Implied vs. Realized monthly return statistics at different switch positions Period: 2002:12-2013:1

Monthly Return (%)	ON	OFF
Mean	0.59	0.09
Stdev	0.89	1.81
Min	-1.16	-7.06
Max	3.18	8.06
95%-tile	2.04	2.04
5%-tile	-0.33	-1.01
Mean/stdev	0.67	0.05
t-stat of the Switch (ON/OF)	t-stat:2.36	

Source: Deutsche Bank

Relative Rates Carry

The Relative Rates Carry strategy utilizes the Duration Bias across two different sovereign yield curves through going long the slope of the steep curve and short the slope of the flat curve within a selected rates universe. The strategy is implemented by using the swap curves of liquid sovereign markets. The liquid rates markets include the main traded currencies and sovereign curves in global markets (USD, EUR, JPY, GBP, CAD, SGD, AUD). The strategy collects the duration risk premium from the steepest curves in the 3M-5Y segment of the curve and pays the duration premium to the flat swap curve. Therefore, it is mostly immune to parallel shifts in the global rates environment.

The Relative Rates Carry strategy utilizes the Duration Bias across two different sovereign yield curves.

During a Strong Growth phase (Column 1), high correlation in global rates would be expected (rate rises), leading to better capture of carry; however, the carry differential is likely to decrease as yield curves flatten uniformly. During a Growth Deceleration phase (Column 2), the volatility in rates would be expected to fall, though curves tend to be flat at this point, making the strategy bear lower risk but with lesser carry.

The fast adjustment phase of a Recession (Column 3) with typically high correlations at the outset (rates falling) limits dispersion, improving the chance to extract carry. Positive carry in each yield curve gradually increases, and at the Trough phase (Column 4) the variance in rates falls (i.e. rates get more stable as the worst is over); there should be a rich range of carry (or slope) in the curves with each economy usually at a different stage of the recession, which would lead to high relative carry being extracted.

In a fragile Recovery stage (Column 5), market uncertainty implies that the risk of the premium strategy increases, but the rich flavour of carry is expected to stay intact at these early stages of the recovery. If the fragile growth phase gives way to stronger, more sustained growth (Column 6), one would expect moves in rates to lead to lower risk of dispersion; however the carry differential between curves could narrow as a result of similar views being expressed in each market.

The results show that our Grid structure can help to distinguish the periods that yield better risk-adjusted returns.

The risk to this strategy is a rapid flattening, or inversion of, the curves that reduces the term premium in the liquid rates space

Figure 93: Switch position on the grid [0,1]

Duration Bias Spread	GROWTH		RECESSION		RECOVERY	
	Trend Around or Above Potential	Deceleration	Fast Adjustment&Volatility	Trough	Fragile/Slow	Strong
Driver of Aggregate Demand Growth & Leverage						
Household Credit and Residential Investment	✓	!	!	✓	✓	✓
Business Credit and Business Fixed investment	✓	!	!	✓	✓	✓
Government Borrowing and Fiscal Spending	✓	!	!	✓	✓	✓

(✓) *ON* (!) *OFF*

Source: Deutsche Bank,

Figure 94: Relative Rates Carry monthly return statistics at different switch positions
Period: 1990:2-2013:1

Monthly Return (%)	ON	OFF
Mean	0.23	0.06
Stdev	0.97	0.76
Min	-3.50	-2.82
Max	3.31	1.93
95 %-tile	1.82	1.05
5 %-tile	-1.17	-1.07
Mean/stdev	0.24	0.08
t-stat of the Switch (ON/OF)	t-stat:1.42	

Source: Deutsche Bank

Commodity Backwardation Curve Strategy (Bloomberg Ticker: DBRCBAAE Index)

Like other asset classes, commodities also provide some structural risk premia that investors can potentially take advantage of. For example, it has been documented that trading strategies which invest in backwardated commodities have historically performed better than the commodities with curves relatively in contango. A backwardation based trading strategy tries to exploit the risk premia across commodities as well as the risk in the term structure of individual commodity curves.

Commodities also provide some structural risk premia

The strategy goes long the 6 most backwardated (or least contangoed) commodities and short the other 6 of the 12 distinct commodity curves selected among energy, industrial metals and precious metals.

This strategy collects most of the risk premia when there are secular turns in the cycle that generates higher volatility in curve slopes and levels. The supply/inventory conditions relative to current demand shows bigger variations during the cyclical phases with higher uncertainty. We apply this intuition to our grid structure and lay out a switchboard for the backwardation strategy. The rows in the grid are irrelevant for our switchboard but the phases of growth in columns define the switch points.

This strategy collects most of the risk premia when there are secular turns in the cycle that generates higher volatility in curve slopes and levels

Figure 95: Switchboard for the Bacwardation Strategy

Backwardation Strategy	GROWTH		RECESSION		RECOVERY	
	Trend Around or Above Potential	Deceleration	Fast Adjustment&Volatility	Trough	Fragile/Slow	Strong
Driver of Aggregate Demand Growth & Leverage						
Household Credit and Residential Investment	(!)	(√)	(!)	(√)	(√)	(!)
Business Credit and Business Fixed investment	(!)	(√)	(!)	(√)	(√)	(!)
Government Borrowing and Fiscal Spending	(!)	(√)	(!)	(√)	(√)	(!)

(√) *ON* (!) *OFF*

Source: Deutsche Bank

Nevertheless, we should state our reservation to stretch the grid structure based on the US data to the commodity space which was dominated by the Chinese investment super-cycle for the most part of the last decade. We believe that commodity-related strategies require some focus on the Chinese growth and policy environment. The broad depreciation trend of the USD in the past decade has been an important part of spot prices, but the curve slopes are mostly driven by Chinese demand.

We think the commodity-related strategies require some focus on the Chinese growth and policy environment

One should probably overlay the US macro conditions with the Chinese growth and policy variables to construct a more reliable switchboard. The USD weakness and Chinese stimulus measures have been very important for the commodity curves especially in recent years.

The USD weakness and Chinese stimulus measures have been very important for the commodity curves

As a preliminary exercise, however, we would like to apply the switchboard to the Backwardation Strategy. We consider the US economy and the potential link of the USD weakness/strength during risk on/risk off attitude in global financial markets as our basis for the switch positions, at this stage. The switchboard structure is able to generate.

Figure 96: Return statistics at different switch positions; 2000:1- 2012:12

Monthly Return (%)	ON	OFF
Mean	1.53	0.50
Std	2.82	2.73
Min	-3.81	-6.93
Max	10.52	9.40
5th Percentile	-1.80	-3.14
95th Percentile	6.94	5.30
Mean/Stdev	0.54	0.18
t-stat of the Switch (ON/OF)	2.29	

Source: Deutsche Bank

Challenges and Caveats

Cycle or evolutionary path?

The grid that we constructed is a simple, initial attempt to relate risk premia to economic factors. There is much more work to be done to introduce more detail and more scope to the macroeconomic grid, and to expand our digital decision tree to yield finer decision points. Therefore, we are not ruling out the addition of new rows and columns to our grid as the economy evolves into different cyclical patterns.

Moreover, some of the data series that we use in our backtests derive from national accounts, and as such, are only available on a quarterly basis. We have had to settle with using lower frequency data to be able to empirically verify our hypotheses over a long historical window, covering a number of business cycles. Going forward, we intend to utilize higher frequency proxies to render our model more adaptive to changing conditions.

Central bank policies

Central bank policies around the globe have evolved into direct market intervention. These policy developments possibly have some ramifications for the pricing of risk premia that we will only be able to learn in retrospect. Our setup considering the relative speed and fragility of the cyclical trends was able to deliver over-performance lately. However, the implications of a policy unwind along with some improvement in the strength of growth might be complicated for the style factors and for the markets as a whole since the financial markets and the major economies have become too dependent on the monetary policy actions.

The transition from an extended fragility and de-leveraging phase to either a growth or a recession trend will inevitably introduce some volatility to the equity markets. We will either face the unwinding of the extreme easing cycle due to its success; or will face the collapse of the current policy environment due its futility within the 12-to-18 months ahead. This is not an environment that we can test and analyze with historical data. However, our recommended quality-value combination, we think, is a good way to balance the equity market risks and opportunities at this time.

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Appendix A

Description of the macroeconomic data used in the construction of the Grid

The US economic data included in the construction of our Grid span different frequencies. We lag each data series according to its frequency and announcement schedule so that our monthly back-tests and our regression analysis do not have a look-ahead bias. We use point-in-time data where available.

Data Item	Frequency	Source
US Real GDP Growth Rate QoQ SAAR	Quarterly	BOE
ISM Manufacturing PMI	Monthly	Inst of Supply Managers
ISM Non-Manufacturing PMI	Monthly	Institute of Supply Managers
US Unemployment Rate (Total , SA)	Monthly	US Dept. of Labor
NAIRU	Semi-Annual	OECD
Federal Reserve Money Supply USD SA	Weekly	Federal Reserve
FOF US Debt Outstanding by Sector: Household	Quarterly	Federal Reserve
FOF US Debt Outstanding by Sector: Corporates	Quarterly	Federal Reserve
FOF US Debt Outstanding by Sector: Federal Govt	Quarterly	Federal Reserve
US Nonfinancial Corporate Profits with IVA & CCA	Quarterly	BOE
US Nonfinancial Gross Value Added of Nonfinancial Corporate Profits	Quarterly	BOE
ISM Manufacturing PMI	Monthly	Institute of Supply Managers
ISM Non-Manufacturing PMI	Monthly	Institute of Supply Managers

Appendix B

Volatility/Fast Adjustment

Growth

Trough/Stabilization

Fragility

Recovery

Numbers denote the address in the grid

Figure B.1: Grid location in time

Year/ Month	1	2	3	4	5	6	7	8	9	10	11	12
1960									7	7	7	8
1961	8	8	8	10	10	1	1	1	1	1	1	1
1962	1	1	1	1	7	7	7	10	10	1	1	1
1963	1	1	1	1	1	2	2	2	1	1	7	7
1964	7	8	8	1	1	1	1	1	1	1	1	1
1965	1	1	2	2	2	1	7	8	8	1	1	1
1966	1	1	1	1	7	7	8	8	7	7	7	7
1967	10	10	10	10	10	10	10	2	2	2	2	2
1968	2	2	7	7	7	7	8	8	4	4	4	4
1969	4	4	4	4	4	4	4	7	7	7	8	8
1970	11	11	11	11	7	7	7	7	7	8	8	8
1971	11	11	3	3	3	3	3	7	7	8	8	3
1972	3	3	3	3	3	3	3	3	3	3	3	3
1973	3	4	4	7	7	7	7	7	8	8	4	7
1974	7	7	7	8	8	4	7	7	7	7	7	7
1975	7	10	10	10	10	10	10	5	5	5	5	5
1976	5	5	5	5	5	5	5	5	5	5	5	5
1977	5	5	5	5	5	1	1	1	1	1	1	1
1978	1	1	1	1	1	2	2	2	2	2	7	7
1979	7	7	8	8	2	2	2	10	10	10	10	10
1980	10	2	7	7	7	7	10	10	2	2	2	7
1981	8	8	8	2	2	5	12	12	12	7	7	7
1982	12	12	12	12	12	12	12	7	7	7	7	7
1983	8	8	5	5	5	5	5	5	5	5	5	5
1984	5	5	5	5	5	5	5	5	12	5	5	5
1985	5	12	12	12	12	12	12	12	12	5	5	5
1986	5	5	5	12	5	5	12	5	7	7	8	8
1987	5	5	5	7	7	7	7	8	8	7	7	7
1988	8	8	5	5	5	5	5	5	5	5	5	1
1989	1	2	2	2	10	10	10	10	10	7	7	7
1990	8	8	8	10	10	10	10	7	7	7	7	10
1991	10	10	10	10	10	9	9	9	9	9	12	12
1992	12	9	9	9	9	9	9	12	12	9	9	9
1993	9	12	12	5	5	12	5	5	5	5	5	5
1994	5	5	5	5	5	5	5	5	5	5	5	1
1995	1	1	1	1	10	10	5	12	12	12	12	12
1996	12	12	12	12	12	1	10	1	1	1	1	1
1997	1	1	1	1	1	3	3	3	3	7	7	7
1998	8	8	4	4	4	4	4	7	7	7	7	7
1999	8	8	4	4	4	4	4	4	4	4	4	4
2000	4	4	7	7	7	7	7	8	8	4	7	7
2001	7	7	7	7	7	8	8	8	7	7	8	8
2002	8	10	10	1	1	1	7	7	7	7	8	8
2003	5	5	12	12	5	5	5	5	5	5	5	5
2004	5	5	5	5	5	1	1	1	1	1	1	1
2005	1	1	5	5	5	1	1	1	1	1	1	1
2006	1	1	1	1	1	2	2	2	2	2	2	2
2007	2	2	2	2	2	2	2	7	7	7	7	10
2008	10	10	10	2	2	10	10	1	7	7	7	7
2009	8	8	8	8	8	10	10	9	9	9	9	9
2010	9	9	9	9	7	7	7	7	8	8	9	9
2011	9	9	9	9	9	9	9	7	7	7	7	8
2012	8	9	9	9	9	9	9	9	9	9	9	9
2013	9	9	9	9								

Source: Deutsche Bank

Figure B.2: Factor switch duration statistics: Months with same switch position

Number of Months	Momentum Switch	Size Switch	Quality Switch	Value Switch
mean	5	6	9	7
median	3	4	5	5
min	1	1	1	1
max	33	37	41	37

Source: Deutsche Bank

Appendix 1

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