Quantitative Decryption of the Market Environment

Part 1 – The Macroeconomic Cycle

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Introduction

The global market environment can be defined by multiple vectors which, through their interactions, influence the behavior of financial markets. They can be fundamental (economic cycle, inflation), behavioral (risk aversion, herding...), or technical (asset flows, liquidity). In this paper – the first of a series dedicated to the quantitative analysis of the market environment – we focus on the assessment of the macroeconomic cycle, which is central to any asset allocation process. As summarized by Ilmanen (2011), the impact of macroeconomic fundamentals on asset prices is significant in the long-term, especially for standard asset classes. However, though the relationship between macroeconomic fundamentals and asset prices has been extensively investigated since Chen, Roll and Ross (1986), asset allocators face a major issue regarding its operational implementation: the assessment of the economic cycle relies on the publication of a set of key macroeconomic statistics, that are usually available with a significant delay, and at low frequency. To address this problematic within a tactical allocation framework, now-casting models aim at providing a “live” forecasting of GDP growth from the ongoing macroeconomic news-flow. However, their implementation is not straightforward. Practitioners rather use synthetic indices, like the CFNAI index, that have been developed to assess the economic cycle, without the explicit objective of GDP growth forecasting. This second type of approach is easier to implement, especially within a “live” monitoring context.

In this paper, we present a set of quantitative indicators dedicated to the “live” assessment of the economic cycle.

✓ The Macroeconomic Cycle Indices (MCI) are designed to assess the level of the cycle of an economy.
✓ The Macroeconomic Dynamics Indices (MDI) are designed to evaluate the dynamics of the cycle (acceleration, deceleration), independently from its state (positive or negative, growth or recession).

As we illustrate with simple examples, the joint reading of these indicators provides a powerful toolbox for the “live” assessment of the economic cycle in the framework of tactical asset allocation.

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1 Economic growth, economic surprises, economic revisions...
2 The impact of economic outlook on risk premia is less significant that on equities, bonds, or alternative investments like hedge funds and REITs.
3 For example, the US GDP is available on a quarterly basis, and within a delay of Q+1 month (advanced publication) and Q+3 months (third estimation).
4 See for example Banbura et al (2013) for a review of the now-casting literature.
5 The Chicago Fed National Activity Index is designed to gauge overall economic activity and related inflationary pressure. It is constructed as a moving average of 85 economic indicators.
6 These indicators are often build from easy to implement statistical techniques (PCA), whereas now-casting models are generally more complex and less tractable (VAR).
Construction of Macroeconomic Cycle Indices (MCI) and Macroeconomic Dynamics Indices (MDI)

The construction process of our indicators differs somewhat from the traditional now-casting literature – which consists in forecasting GDP growth from a VAR model, namely the “now-cast” – and from that of CFNAI-like indices. Like the latter, our approach consists in extracting the common cyclical component from a given set of macroeconomic data. However, our methodology diverges in several points, from data normalization to the aggregation of cycle components, as detailed thereafter.

The data

Collection. For each country, we collect a set of macroeconomic series that are published monthly (or more frequently), and for which the publication date is available. We consider both hard statistics and advanced indicators related to production, consumption, income, employment, inventories, orders, trade balance and housing. As opposed to Beber, Brandt, and Luisi (2015), we do not consider inflation data. In line with Ilmanen (2011), we consider inflation as one of the main top/down factors that should be considered specifically. For the United-States, our dataset contains 32 time-series, listed in Appendix A.

Treatment. We may apply various treatment to the raw data, depending on their nature.

✓ Advanced indicators or sentiment indices are usually diffusion indices, i.e. they are evaluated around an \( ad\ hoc\) threshold level (50 for the ISM PMI indices for example). We therefore apply no transformation to the data.
✓ For economic data that are only available in level and that usually exhibit long term trend, we apply a percent change transformation.
✓ For relative level data that are expressed in percentage (like unemployment rate), we apply a first difference transformation.
✓ When available, we consider volume rather than value data. If not, we compute inflation adjusted series to obtain a homogenous set of volume series.
✓ When available, we consider seasonally adjusted (SA) series. If not, we apply a seasonal adjustment procedure based on the X-13 ARIMA procedure from the US Census Bureau.

Extraction of the cycle components from the economic series

Data normalization. We center all the economic series around a “rational threshold”, which is typically 0 for first difference or percent change series. For advanced indicators or survey-based data, it may take specific values (50 for the ISM PMI for example). Centering the data allows opens the door for homogenous and intuitive reading of the cycle components: a positive (negative) value is positive (negative) for the economic cycle. It differs from the construction of the CFNAI or other indices, in which the economic series are normalized on a given window. Their interpretation is therefore less intuitive, as

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7 For some series, we have backfilled the historical publication dates when made available by the provider.
8 With growth, liquidity, and tail risks.
9 As mentioned by Banbura et al. (2013), we only consider headline statistics – which are the most followed – instead of all their constituents.
10 See https://www.census.gov/srd/www/x13as/ for a detailed description of the procedure.
11 Usually from 2 to 5 years.
their sign only provides information relative to the long-term average of the underlying series. They deliver an information that lies between the cycle and its dynamics.

Data clustering. To avoid the overrepresentation of a given dimension of the economic cycle in the index, the dimension of the dataset is usually reduced in a few clusters. In the case of our US dataset (Appendix A), we consider 7 survey-based data related to production, but only 2 hard data series (industrial production and capacity utilization). In the absence of dimension reduction, survey-based production data would represent 22% of the final indicator, against 6% for the hard data. To mitigate this potential bias, we regroup our data in clusters. Unlike Beber, Brandt, and Luisi (2015) who consider ad hoc clusters, based on economic knowledge, we have applied a hierarchical cluster analysis to the datasets of the following countries: USA, Germany, France, Japan, UK. For each of these datasets, we identified 8 common and economically significant clusters, that are namely:

- Production
- Consumption and income
- Employment
- Consumer sentiment
- Business climate
- Inventories and orders
- Trade balance
- Real Estate

As the hierarchy of these clusters may differ significantly for the various countries, we do not reduce further the dimension of the datasets, for homogeneity purpose.

Cycle extraction. There is no unique methodology for extracting the economic cycle from the underlying economic series. In the “now-casting” literature, VAR models are generally used to forecast GDP growth, as exposed in Banbura et al. (2013). However, this approach is not appropriated in our context. Another type of approach relies on principal component analysis (PCA). It is widely used in the construction of synthetic indicators – like the CFNAI or the growth indicator of Beber, Brandt and Luisi (2014) – mainly for its simplicity of implementation.

In our approach, we aim at extracting the cyclical component and its dynamics from the economic series. PCA is therefore limited in that context because it does not allow the endogenization of the dynamics, that is generally defined as the monthly changes in the cyclical component (Beber, Brandt and Luisi, 2015). Instead, we opt for a state-space modeling of the economic series, that allows us to extract simultaneously the cyclical component and its endogenous dynamics. More precisely, we consider the following local linear trend model:

\[
F_t = C_t + \varepsilon_t \quad \varepsilon_t \sim N(0, \sigma_\varepsilon)
\]

\[
C_{t+1} = C_t + S_t + \eta_t \quad \eta_t \sim N(0, \sigma_\eta)
\]

\[
S_{t+1} = S_t + \xi_t \quad \xi_t \sim N(0, \sigma_\xi)
\]

---

12 We applied the maximization of the inter-group squared Euclidian distance.
13 Extracted from PCA.
where $C_t$ is the cyclical component of the economic series $F_t$, and $S_t$ its underlying dynamic component. We estimate this linear state-space model with the Kalman Filter algorithm. Chart 1 and chart 2 illustrate the cycle component and its dynamics, extracted from the monthly percent change in the US industrial production.

Chart 1. Cycle component extracted from the monthly % change in US industrial production ($C_{US\,ind\,production}$)

![Chart 1](image1)

Source: Orion Financial Partners

Chart 2. Underlying dynamic component of the % change in US industrial production cycle ($S_{US\,ind\,production}$)

![Chart 2](image2)

Source: Orion Financial Partners

The cyclical component $C_t$ can be viewed as a smoother\textsuperscript{14} version of the underlying economic series, cleaned from conjunctural jumps. $S_t$ stands for its dynamic component. Therefore, in a configuration where $C_{US\,ind\,production} > 0$, and $S_{US\,ind\,production} > 0$, one will mention a strengthening in the growth of US industrial production, whereas a configuration in which $C_{US\,ind\,production} < 0$, and $S_{US\,ind\,production} > 0$ defines a slowdown in its deterioration.

\textsuperscript{14} Note that we consider the filtered state estimates, not their smoothed version.
Construction of Macroeconomic Cycle Indices (MCI) and Macroeconomic Dynamics Indices (MDI)

As previously mentioned, we decompose the economic cycle of a given country into 8 clusters: production, consumption (and income), employment, consumer sentiment, business climate, stocks and orders, trade balance. Each of these clusters encompasses several economic series, as illustrated on chart 3.

Chart 3. Decomposition of the economic cycle

<table>
<thead>
<tr>
<th>Cluster 1 - Production</th>
<th>Cluster 2 - Consumption</th>
<th>Cluster 3 - Employment</th>
<th>Cluster 4 - Consumer sentiment</th>
<th>Cluster 5 - Business climate</th>
<th>Cluster 6 - Inventories and orders</th>
<th>Cluster 7 - Trade balance</th>
<th>Cluster 8 - Real estate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production series 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production series 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production series N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Macroeconomic Cycle Indices (MCI). The MCIs are designed to assess the economic cycle, independently from GDP growth. For a given country, it is defined as the weighted-average of the cyclical components associated to the 8 clusters. For each cluster $i$, a cyclical component $CC_i$ is computed as the equal-weighted average of the standardized cycle components of the $J$ economic series ($\tilde{C}_{i,j}$) that form this cluster.

- Cyclical component of cluster $i$: $CC_i = \frac{1}{J} \Sigma_{j=1}^{J} \tilde{C}_{i,j}$
- Macroeconomic cycle index: $MCI = \frac{1}{8} \Sigma_{i=1}^{8} CC_i$

Chart 4 below represents the US macroeconomic cycle index and the evolution of its 8 cyclical components. This dynamic decomposition provides an intuitive picture of the strengths and weaknesses of the cycle through time. For example, similar MCI levels at different dates can hide significant differences in the underlying structure of the cycle. For example, at the end of 2005 and 2014, the level of the $MCI_{USA}$ was respectively 0.77 and 0.74. However, Chart 5 highlights significant differences in the structure of the US economic cycle at these two dates.
Macroeconomic Dynamics Indices (MDI). The MDI are designed to assess the dynamics of the macroeconomic cycle (accelerating, decelerating, steady), independently from its level. Its construction is similar to the construction of the MCI. We then define the dynamic component of cluster $i$ $DC_i$ as the equal-weighted average of the standardized cycle components of the $j$ economic series ($\tilde{S}_{i,j}$) that form this cluster, and the MDI as the equal-weighted average of the dynamic components.

- Dynamic component of cluster $i$: $DC_i = \frac{1}{J} \sum_{j=1}^{J} \tilde{S}_{i,j}$
- Macroeconomic cycle index: $MDI = \frac{1}{8} \sum_{i=1}^{8} DC_i$

with $\tilde{S}_{i,j}$ the standardized underlying dynamic component of the $j^{th}$ economic series that is part of the $i^{th}$ cluster, and $DC_i$ the dynamic component of cluster $i$.

Chart 6 illustrates the dynamics of the US economic cycle since 1989. It can be interpreted as follows:

- around 0, the economic cycle is stable, which mainly coincides with growth periods;
- significantly negative values coincide with slowdown, or recession periods;
- significantly positive values indicate recovery or acceleration periods.
Chart 6. Dynamic of the US macroeconomic cycle ($MDI_{USA}$) and its components

"Real-time" monitoring of the economic cycle

Our quantitative indicators have been designed to assess the macroeconomic environment in real time. As shown above, they deliver clear information about the level of the economic cycle (MCIs), about the evolution of its structure (underlying components of the MCI), and about its dynamics (MDI). While this toolbox opens the door to many applications, it is essential to check the relevance of the information they provide.

MCIs, CFNAI, and GDP growth. As shown on chart 7, the behavior of our $MCI_{USA}$ is in line with both the evolution of the CFNAI-MA3 index\(^{15}\) and the yearly variations in GDP growth, with respective correlation coefficients of 0.89 and 0.80. This robustness check is comforted by additional comparison between our MCIs and the yearly GDP growth of several other countries (see appendix D).

Chart 7. USA – Macroeconomic Cycle Index, CFNAI index (3M), and GDP (YoY)

"Real time" detection of the phases of the macroeconomic cycle. The economic cycle can be divided in distinct phases, that lie in between the peak of growth periods and the trough of recession periods. There is no consensus about the exact number of phases to consider, nor on their precise definition. For

\(^{15}\) 3 months moving average version of the CFNAI index.
example, the National Bureau of Economic Research (NBER) consider 2 phases: recession\textsuperscript{16} and expansion, whereas Stovall (1996) divides each cycle in 5 phases: 3 growth phases of equal length\textsuperscript{17}, and 2 recession phases of equal length\textsuperscript{18}. In these approaches, the phases are determined ex-post (as they are conditioned by the observation of a peak and a trough). For example, Stovall (1996) drawn the foundation of the well-known sector rotation strategy, but let the question of the “live” determination of the phases of the cycle wide open, which is a real issue for asset allocators. Globally, monitoring a single aggregated indicator instead of a wide number of economic series can be particularly efficient, especially to discern a prolonged slowdown from an entry into recession, or to identify recovery phases.

As an example, we propose to decompose the economic cycle in 6 phases, according to our MCI and MDI indicators. We first distinguish 3 “growth” phases\textsuperscript{19}, jointly defined by positive MCI and various dynamic ranges:

- Strong growth: positive cycle and strong dynamics, that is $MCI_t \geq 0$ and $MDI_t \geq 0.5\sigma_{MDI,1\rightarrow t}$
- Steady growth: positive cycle and average dynamics, that is $MCI_t \geq 0$ and $|MDI_t| < 0.5\sigma_{MDI,1\rightarrow t}$
- Deceleration: positive cycle and negative dynamics, that is $MCI_t \geq 0$ and $MDI_t \leq -0.5\sigma_{MDI,1\rightarrow t}$

We define two “recession” phases, jointly defined by a negative MCI and negative MDI:

- Slowdown: negative cycle and average dynamics, that is $MCI_t < 0$ and $|MDI_t| < 0.5\sigma_{MDI,1\rightarrow t}$
- Recession: negative cycle and negative dynamics, that is $MCI_t < 0$ and $MDI_t < -0.5\sigma_{MDI,1\rightarrow t}$

Finally, the recovery phase is jointly defined by negative cycle and positive dynamics, that is:

- Recovery: negative cycle and positive dynamics, that is $MCI_t < 0$ and $MDI_t \geq 0.5\sigma_{MDI,1\rightarrow t}$

with $\sigma_{MDI,1\rightarrow t}$ the standard deviation of the MDI index from the beginning of the period up to time $t$.

Chart 8. Estimated phases of the US economic cycle

\textsuperscript{16} The NBER recession phases are defined as follows: “(...) a recession is a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales”.
\textsuperscript{17} Referred as Stages I to III, i.e. early expansion, middle expansion, and late expansion.
\textsuperscript{18} Referred as stages IV and V, i.e. early recession and late recession.
\textsuperscript{19} Growth phases correspond to positive MCI, not necessary to positive change in GDP growth.
The sequence of the phases of the cycle is represented on chart 8. On chart 9, we have combined the NBER recession periods – estimated ex-post – and the recession periods estimated ex-ante by with our indices. With few exceptions, our approach delivers significant results.

Chart 9. “Live” detection of US recession periods vs. NBER recession periods

Overall, our ICMs deliver similar information than competing synthetic indices. Their combination with IDM allow to detect transitions in the phases of the cycle, as illustrated above with the “real-time” detection of NBER recession periods. However, they incorporate several significant advantages.

✓ First, the construction process across countries is homogenous, that allow for cross-comparison and aggregation to construct regional indices.
✓ Second, the MCI provide a dynamic decomposition of the economic cycle into 8 cyclical components, which allows advanced analysis of its structure.
✓ Third, by construction, the sign of our indicators is of importance, as all the underlying variables used in their construction are normalized around “rational thresholds” (see above). Therefore, a positive (negative) sign in any underlying series or indicator implies a positive (negative) contribution to the cycle or to its dynamics. Despite a significant correlation with our MCI, this is not the case of the CFNAI index, for which a positive (negative) sign means that the current cycle is above (below) its long-term average. This nuance is far from being anecdotal, as our indicators are designed to provide clear and intuitive information to asset allocators. Therefore, their “binary nature” is particularly important.
✓ The fourth feature is the endogenous estimation of the dynamics of the cycle through the MDIs, where other approaches usually consider differences in the cycle level as the dynamic measure.

\[ \text{Defined by } MCI_t < 0 \text{ and } MDI_t < -0.5 \sigma_{MDI,t-1}, \text{ in dark red on chart 8.} \]
Applications in asset allocation

The assessment of the economic cycle is a key point for asset allocators. Indeed, economic growth is one of the most important factors in determining the long term returns\(^{21}\) of various traditional and alternative asset classes, as well as alternative risk premia (Ilmanen, 2011). Following this idea, Beber, Brandt, and Luisi (2015) investigate the impact of US growth on the US stock market volatility, within a short-term/tactical framework. They show that their US growth factor is a significant explanatory variable of the VIX index. In a subsequent study\(^{22}\), they conclude that (anticipated) US growth is a significant determinant of US stock returns, as well as those of international stock markets (Europe, UK, Japan). Other fields of investigation such as sector rotation\(^{23}\) could be mentioned, but an extensive review of this literature is beyond the goal of our paper. We will therefore focus on some simple practical use of our indicators within a tactical asset allocation framework.

Illustration 1: US macroeconomic environment and the risk-return profile of various asset classes

We investigate the behavior of US asset classes\(^{24}\) and strategies in various regimes of the US economy\(^{25}\), derived from the set indicators defined in the first section. As detailed in appendix E, we consider the following ad hoc binary regimes:

- Positive vs. negative economic cycle, that can be interpreted as growth vs. recession
- Positive vs. negative dynamics, i.e. acceleration vs. deceleration

Our results, displayed in table 1, confirm the findings of other studies. In details, the US economic cycle emerges as a key driver of volatility and expected returns for of the main asset classes.

- When our MCI is negative, volatility levels are up to 2.3 times higher (in the case of high yield debt\(^{26}\)) compared to the levels recorded in a positive cycle configuration. When \(MCI < 0\), the average conditional returns are also significantly lower for equities, alternative investments\(^{27}\), and the value equity premia. Conversely, corporate and sovereign debt offer better returns in a negative cycle environment.

- Globally, the impact of the dynamics of the cycle (MDI) appears to be globally less significant for traditional assets, with the exception of high yield debt\(^{28}\), at least in this univariate context.

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21 Ilmanen (2011) focus on strategic asset allocation.
24 Equities, sovereign bonds, corporate bonds, high yield bonds, hedge funds, several US equity risk premia.
25 Of course, one may consider economic regimes of other countries and regions. However, the US economy is a good indicator of overall growth, and has been identified to be a more significant driver than domestic indicators for non-US markets (see for instance the conclusions of Beber, Brandt, and Luisi, 2015).
26 And on average 1.5, 1.6, 1.1, 1.5, and 1.7 times higher for equities, corporate debt, sovereign debt, alternative investments, and equity risk premia respectively.
27 The average return of equities is 15% higher on average when our MCI is positive, 10% for alternative investments.
28 See appendix F for the results with orthogonalized variables.
Table 1. Return distribution characteristics of many asset classes in various economic regimes

<table>
<thead>
<tr>
<th>Country</th>
<th>Equity Risk Premia</th>
<th>US Macroeconomic Cycle Index (MCI)</th>
<th>US Macroeconomic Dynamics Index (MDI) ††</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>return</td>
<td>volatility</td>
<td>low</td>
</tr>
<tr>
<td>USA</td>
<td>-7.3%</td>
<td>14.0%</td>
<td>**</td>
</tr>
<tr>
<td>Eurozone</td>
<td>-8.1%</td>
<td>12.4%</td>
<td>*</td>
</tr>
<tr>
<td>UK</td>
<td>-5.4%</td>
<td>11.5%</td>
<td>*</td>
</tr>
<tr>
<td>Japan</td>
<td>-19.2%</td>
<td>8.6%</td>
<td>**</td>
</tr>
<tr>
<td>Emerging</td>
<td>1.0%</td>
<td>10.6%</td>
<td>*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>High Yield Debt</th>
<th>Corporate Debt</th>
<th>Sovereign Bonds</th>
<th>Alternative Investments</th>
<th>Equity Risk Premia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>return</td>
<td>volatility</td>
<td>low</td>
<td>high</td>
<td>signif ††</td>
</tr>
<tr>
<td>USA</td>
<td>10.1%</td>
<td>7.4%</td>
<td>5.7%</td>
<td>10.1%</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>15.6%</td>
<td>6.1%</td>
<td>10.9%</td>
<td>5.8%</td>
<td>***</td>
</tr>
<tr>
<td>USA</td>
<td>3.3%</td>
<td>6.9%</td>
<td>0.7%</td>
<td>12.0%</td>
<td>**</td>
</tr>
<tr>
<td>Germany</td>
<td>7.6%</td>
<td>6.2%</td>
<td>7.0%</td>
<td>5.9%</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>7.8%</td>
<td>6.8%</td>
<td>7.8%</td>
<td>6.2%</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>4.2%</td>
<td>3.7%</td>
<td>3.7%</td>
<td>5.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3.3%</td>
<td>7.9%</td>
<td>-5.1%</td>
<td>16.5%</td>
<td>**</td>
</tr>
<tr>
<td>Commodities</td>
<td>1.8%</td>
<td>9.7%</td>
<td>*</td>
<td>4.1%</td>
<td>12.2%</td>
</tr>
<tr>
<td>Hedge Funds</td>
<td>-1.9%</td>
<td>13.3%</td>
<td>4.1%</td>
<td>16.6%</td>
<td>*</td>
</tr>
<tr>
<td>REITS</td>
<td>3.7%</td>
<td>-1.1%</td>
<td>3.2%</td>
<td>3.0%</td>
<td>**</td>
</tr>
<tr>
<td>Size</td>
<td>11.5%</td>
<td>1.7%</td>
<td>3.0%</td>
<td>4.2%</td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>24.3%</td>
<td>11.1%</td>
<td>17.0%</td>
<td>12.0%</td>
<td>***</td>
</tr>
<tr>
<td>Momentum</td>
<td>-1.4%</td>
<td>10.7%</td>
<td>6.1%</td>
<td>10.5%</td>
<td></td>
</tr>
<tr>
<td>Low beta</td>
<td>8.0%</td>
<td>11.5%</td>
<td>4.8%</td>
<td>16.8%</td>
<td>***</td>
</tr>
</tbody>
</table>

†: MDI, CHI, and DHI indices have been orthogonalized with respect to the macroeconomic cycle. ††: significance level of the differences in means and volatilities, respectively: *: 10%, **: 5%, ***: 1%.

Source: Orion Financial Partners
Illustration 2: Sensitivity of US equities to the US economic cycle

Chart 10 illustrates the impact of the US MCI on the conditioning of the return distribution of US equities. The wider shape of the distribution when $MCI_{USA} < 0$ highlights the significant impact of the economic cycle on their volatility. Beyond this basic example, further investigations show more complex interactions between the economic cycle and other economic or non-economic environment factors\(^{29}\). For example, chart 11 shows the impact of the interactions between the level of the economic cycle and its dynamics. When $MCI_{USA} > 0$, the impact of the MDI is limited. But when $MCI_{USA} < 0$, the MDI is a key element in the identification of the deceleration, recession, and recovery phases. This is particularly the case for the recovery phase, for which the risk/return profile of US equities is similar to that of growth phases, as opposed to slowdown and recession phases that are characterized by negative expected returns and higher volatility.

Chart 10. Weekly conditional return distribution of the US equities for positive and negative US MCI

![Chart 10](source: Orion Financial Partners)

Chart 11. Weekly conditional return distribution of the US equities in the 6 phases of the economic cycle

![Chart 11](source: Orion Financial Partners)

Chart 12 illustrates the “rotation” of the risk-return profile of US equities across the different phases of the economic cycle. During the “steady growth” and “strong growth” phases, low uncertainty coupled with significant growth delivers significant expected return with relatively low risk. During the deceleration

\(^{29}\) Its dynamics or exogenous components, like risk aversion.
phase, the expected return decreases substantially, while volatility remains contained. When the cycle turns negative, the risk-return profile of US equities deteriorates significantly (negative expected return), especially during the “recession” phase where the volatility literally jumps. Finally, the shift from the “recession” phase to the “recovery” phase is reflected by the sharp decline in volatility, coupled with significant positive expected return.

Chart 12. Risk return pattern of the US equities in the 6 phases of the economic cycle

Illustration 3: Tactical management of equity exposure with a systematic overlay

As highlighted previously, the US macroeconomic cycle appears to be a key driver of equity returns. To illustrate that point in a practical way, we propose a simple application: a systematic overlay strategy applied on the S&P500, that is triggered by a signal based on our MCI. We consider the 2 simple long/flat strategies driven by the following signals:

✓ Binary strategy: hedge S&P500 exposure at time \( t \) when our cycle indicator is negative, that is \( MCI_{USA,t-1} \leq 0 \).
✓ OLS strategy: hedge S&P500 exposure at time \( t \) when the OLS estimate of the future S&P500 excess-return is negative, given by \( E[R]_{S&P500,t-1+1\text{ week}} = c + b MCI_{USA,t-1} \).

Chart 13. S&P 500 vs. MCI-based on/off strategy
Chart 13 and table 2 show the behavior of our two systematic overlay strategies vs. the S&P500 index. Over the period 2000-2017, they outperform significantly the index, both in terms of performances (annualized returns and Sharpe ratios) and risks and extreme risks (decrease in the volatility, CVaR, and drawdown).

Table 2. Performances of two simple tactical strategies

<table>
<thead>
<tr>
<th></th>
<th>SP500</th>
<th>OLS strategy</th>
<th>Binary strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annualized log return</td>
<td>4.7%</td>
<td>5.8%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Volatility</td>
<td>16.3%</td>
<td>11.3%</td>
<td>11.2%</td>
</tr>
<tr>
<td>Sharpe Ratio*</td>
<td>0.19</td>
<td>0.38</td>
<td>0.42</td>
</tr>
<tr>
<td>CVaR 95%, 21 days</td>
<td>-7.7%</td>
<td>-5.3%</td>
<td>-5.2%</td>
</tr>
<tr>
<td>Maximum drawdown</td>
<td>-55.3%</td>
<td>-34.7%</td>
<td>-30.8%</td>
</tr>
<tr>
<td>Average drawdown</td>
<td>-2.4%</td>
<td>-1.9%</td>
<td>-1.9%</td>
</tr>
<tr>
<td>Calmar ratio*</td>
<td>0.06</td>
<td>0.12</td>
<td>0.15</td>
</tr>
</tbody>
</table>

*3 month US treasury bill rate for the risk-free rate  
Source: Orion Financial Partners

Conclusions

In this short paper, we have presented a set of quantitative indicators dedicated to the “live” assessment of the economic cycle, of its dynamics, and of the dispersion of its components. In line with the now-casting literature, our MCIs show a significant ability for the “live” forecasting of GDP growth, even if they are not explicitly dedicated to this objective. To sum up, our indicators deliver several advantages compared to similar existing indicators:

✓ their interpretation is straightforward, as their sign deliver an explicit information (positive vs. negative cycle, acceleration vs. deceleration), which is not the case of the CFNAI for example;
✓ the MDIs are jointly estimated with the MCIs, they are determined endogenously;
✓ the combination of our indicators allows to identify the various phases of the economic cycle, and their transitions, especially the switch into “recession” phases (roughly in line with NBER recessions) or into “recovery” phases;
✓ our indicators are based on 8 clusters identified as being common to the main developed countries, allowing (i) to observe the evolution of the DNA of economic cycles, (ii) a homogenous reading of the worldwide cycles, and (iii) simple aggregation (to build regional indicators for example).

We have shown the relevance of their application in the field of asset allocation, through the following examples:

✓ the prominent impact of the economic cycle on the risk-return profile of various asset classes;
✓ the conditioning of the return distribution of US equities according to the interactions between the economic cycle (MCI) and its dynamics (MDI);
✓ a simple overlay strategy, based on binary signals extracted from the MCIs.
References


## Appendix

### Appendix A. US economic series used in the MCI computation

| Employment | US Employees on Nonfarm Payrolls Total MoM Net Change SA  
US Initial Jobless Claims SA  
U-3 US Unemployment Rate Total in Labor Force Seasonally Adjusted  
ADP National Employment Report SA Private Nonfarm Level Change  
US Continuing Jobless Claims SA |
| Business climate | ISM Manufacturing PMI SA  
US Empire State Manufacturing Survey General Business Conditions SA  
Market News International Chicago Business Barometer SA  
Philadelphia Fed Business Outlook Survey Diffusion Index General Conditions  
ISM Non-Manufacturing NMI  
Richmond Federal Reserve Manufacturing Survey Monthly % Change Overall Index  
ISM Milwaukee Purchasers Manufacturing Index  
Dallas Fed Manufacturing Outlook Level Of General Business Activity |
| Consumer sentiment | Conference Board Consumer Confidence SA 1985=100  
University of Michigan Consumer Sentiment Index |
| Consumption | Adjusted Retail & Food Services Sales Total SA  
US Personal Income SAAR  
US Personal Consumption Expenditures Nominal Dollars MoM SA |
| Inventories and orders | US Durable Goods New Orders Total ex Transportation MoM SA  
US Manufacturers New Orders Total SA  
US Manufacturing & Trade Inventories Total MoM SA  
Merchant Wholesalers Inventories Total Monthly % Change |
| Production | US Industrial Production MOM SA  
US Capacity Utilization % of Total Capacity SA |
| Real estate | US New One Family Houses Sold Annual Total SAAR  
US Existing Homes Sales SAAR  
US New Privately Owned Housing Units Started by Structure Total SAAR  
MBA US US Mortgage Market Index Weekly % Change SA Old Meth  
US Pending Home Sales Index SA  
Private Housing Authorized by Bldg Permits by Type Total SAAR |
| Trade balance | US Real Exports Total Goods SA  
US Real Import of Total Goods SA |

*Source: Orion Financial Partners*
Appendix B. ICMs of 16 countries

Source: Orion Financial Partners
Appendix C. IDMs of 16 countries

Source: Orion Financial Partners
Appendix D. MCIs and GDP growth compared

Chart B.1. UK – Macroeconomic Cycle Index and GDP (YoY)

* normalized data, for comparison purpose

Source: Orion Financial Partners

Chart B.2. Germany – Macroeconomic Cycle Index and GDP (YoY)

* normalized data, for comparison purpose

Source: Orion Financial Partners

Appendix E. Definition of *ad hoc* binary regimes

<table>
<thead>
<tr>
<th>Regime</th>
<th>positive / high</th>
<th>negative / low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic cycle</td>
<td>$MCI_t \geq 0$</td>
<td>$MCI_t &lt; 0$</td>
</tr>
<tr>
<td>Dynamic of the economic cycle</td>
<td>$MDI_t \geq 0$</td>
<td>$MDI_t &lt; 0$</td>
</tr>
</tbody>
</table>

Source: Orion Financial Partners
Appendix F. Return distribution characteristics of many asset classes in various economic regimes (with MDI orthogonalized from the MCI)

<table>
<thead>
<tr>
<th>Equities</th>
<th>US Macroeconomic Cycle Index (MCI)</th>
<th>US Macroeconomic Dynamics Index (MDI) †</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>return -7.3% 14.0% ** 9.4% 10.5%</td>
<td>volatility 20.2% 13.1% *** 15.4% 14.1%</td>
</tr>
<tr>
<td>Eurozone</td>
<td>return -8.1% 12.4% * 7.2% 10.1%</td>
<td>volatility 24.6% 15.3% *** 17.8% 17.5%</td>
</tr>
<tr>
<td>UK</td>
<td>return -5.4% 11.5% * 7.4% 9.5%</td>
<td>volatility 17.7% 12.0% *** 12.8% 14.4% *</td>
</tr>
<tr>
<td>Japan</td>
<td>return -19.2% 8.6% ** 1.5% 5.7%</td>
<td>volatility 21.0% 17.1% ** 18.3% 17.9%</td>
</tr>
<tr>
<td>Emerging</td>
<td>return 1.0% 10.6% 2.8% 18.0%</td>
<td>volatility 30.5% 20.7% *** 24.2% 20.5% **</td>
</tr>
</tbody>
</table>

| High yield debt | USA | return 10.1% 7.4% 5.2% 12.1% * | volatility 15.6% 6.1% *** 9.4% 7.4% *** |
|                | Europe | return 3.3% 6.9% 0.9% 14.7% ** | volatility 20.2% 8.8% *** 13.1% 10.5% *** |

| Corporate debt | USA | return 8.9% 5.8% 6.3% 6.7% | volatility 7.8% 4.4% *** 5.0% 5.7% * |
|                | Europe | return 6.4% 4.5% 4.3% 5.9% | volatility 4.4% 3.1% *** 3.2% 3.6% |

| Sovereign bonds | USA | return 8.3% 5.9% 7.7% 4.2% | volatility 8.1% 6.1% *** 6.4% 6.7% |
| Japan          | return 7.8% 6.8% 7.7% 5.9% | volatility 6.4% 5.1% ** 5.6% 5.1% |
| Germany        | return 7.6% 6.2% 6.9% 5.7% | volatility 5.3% 4.7% 4.9% 4.7% |

| Alternative investments | Commodities | return -3.3% 7.9% -3.4% 19.9% *** | volatility 26.5% 18.2% 21.5% 16.8% *** |
|                        | Hedge Funds | return 1.8% 9.7% * 4.8% 13.3% *** | volatility 7.9% 6.4% * 7.0% 6.1% * |
|                        | REITs       | return -1.9% 13.3% 5.6% 17.8% * | volatility 27.4% 14.5% 19.1% 15.3% *** |

| Equity risk premia | Size | return 3.7% -1.1% -4.6% 6.8% *** | volatility 7.1% 6.6% 6.4% 6.7% |
|                   | Value | return 11.5% 1.7% * 2.1% 6.0% | volatility 9.9% 6.9% *** 8.1% 6.8% ** |
|                   | Momentum | return -1.4% 10.7% 9.4% 6.7% | volatility 24.3% 11.1% *** 15.4% 13.6% * |
|                   | Low beta | return 8.0% 11.5% 6.7% 17.2% ** | volatility 16.2% 8.0% *** 9.6% 10.6% |

†: MDI, CHI, and DHI indices have been orthogonalized with respect to the macroeconomic cycle. ††: significance level of the differences in means and volatilities, respectively; *: 10%, **: 5%, ***: 1%.

Source: Orion Financial Partners
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