Tactical asset allocation: Introducing NBAAM
(National Bank Asset Allocation Model)

Highlights

› While an investor's risk profile determines most of the returns realized over the long run, marginal and timely adjustments to an asset allocation strategy can ultimately make a material difference to a portfolio's performance. This is the role of tactical asset allocation, i.e., over(under)weighting different market segments over a shorter-term horizon.

› When it comes to weights allocated to assets classified as risky (equities) and defensive (bonds, cash), the team has been using the A^3 model as a reference point since 2018, the objective of which was to translate a series of macroeconomic and financial indicators into a risk-taking recommendation over a tactical horizon. This report introduces its successor, NBAAM (National Bank Asset Allocation Model, which offers broader coverage of global macroeconomic conditions through a distinctive methodology.

› Three guiding principles have shaped NBAAM's development: (1) "economic rationale prevails" ensuring easy-to-interpret recommendations, (2) "strength in numbers" with the emphasis on the depth of signals rather than on any particular indicator, and (3) "everything is relative" referring to the fact that markets tend to react to changes in direction much more than to the level of economic activity.

› NBAAM's recommendation is derived from signals divided into five fundamental pillars: (1) cyclical conditions, (2) monetary conditions, (3) momentum, (4) valuations, and (5) market sentiment.

› Since 1995, NBAAM has outperformed its benchmark by a multiple of 2.3 x, corresponding to an annualized added value of 309 bps. In return, the portfolio's volatility increases by only 165 bps, so that the historical risk/return ratio is improved by 0.16 x.

› NBAAM is no crystal ball. Rather, it's more like a radar or even a survey on the macro-financial backdrop. As such, just because a "threat" is detected doesn't necessarily mean it's vital, and the model can always have blind spots. Similarly, the "most likely" outcome is by no means a certainty, any more than the "least likely" is impossible.

› In the end, the main advantages of such a model are to provide continuous visibility over the global macroeconomic backdrop and, above all, to ensure a maximum degree of rationality in making asset allocation decisions over a tactical horizon. It's a matter of principle.

Introducing NBAAM

Every day, markets debate over the future, faced with a steady stream of financial news, economic data, monetary policy decisions, geopolitical surprises, and much more.

For investors whose time horizon is measured in years, the good news is that it's generally in their interest not to worry too much about this, as the inevitable ups and downs of equities and bonds tend to fade over time – especially for a balanced portfolio (**Chart 1**).

1 | **Investing for the long run...**

CIO Office (data via Refinitiv). * 35% S&P/TSX, 35% S&P 500, 20% MSCI EAFE, 10% MSCI EM (total return, in CAD). ** 50% Stocks, 50% Bonds. *** FTSE Canada Universe. As of April 19, 2024.
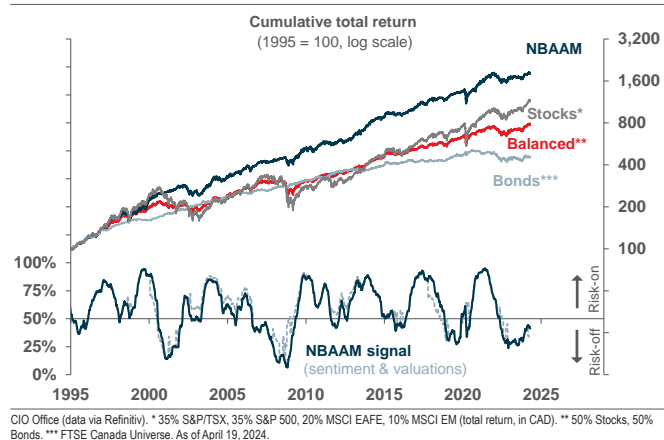
Yet, while the investor's risk profile determines most of the returns achieved over the long term, it is possible to aim for better returns by marginally adjusting the asset allocation opportunistically, and always in accordance with one's own risk tolerance. This is the role of tactical asset allocation, i.e., over(under)weighting different market segments over a shorter-term horizon (3-12 months), according to economic and financial conditions.

Now, while this may sound simple in theory, in practice it's an extremely challenging mandate. To do so, some stick to qualitative methods grounded in experience, others to more quantitative and sometimes even purely algorithmic methods. At National Bank's Office of the Chief Investment Officer (CIO Office), we have for several years advocated a hybrid approach in which investment decisions are undertaken by managers, but supported by a suite of quantitative models

developed in-house. The goal is simple: filter out the noise to ensure maximum rationality, without blindly following models that are, by definition, imperfect.

When it comes to weights allocated to assets classified as risky (equities) and defensive (bonds, cash) – the most important decision in asset allocation – the team has been using the A^3 (Asset Allocation Algorithm) Model as a reference point since 2018, the objective of which was precisely to translate a series of macroeconomic and financial indicators into a risk-taking recommendation over a tactical horizon. This report introduces its successor, NBAAM (National Bank Asset Allocation Model), which offers broader coverage of global macroeconomic conditions through a disctinctive methodology (**Chart 2**).

2 | **… with a flexible asset allocation strategy**

CIO Office (data via Refinitiv). * 35% S&P/TSX, 35% S&P 500, 20% MSCI EAFE, 10% MSCI EM (total return, in CAD). ** 50% Stocks, 50% Bonds. *** FTSE Canada Universe. As of April 19, 2024.

To this end, we begin by outlining the three guiding principles behind NBAAM's development. This is followed by a more extensive description of the model's five pillars, an overview of the methodology, and a review of its historical performance. In conclusion, a broader reflection on the model and ideas for future improvements are briefly discussed.

Guiding principles

NBAAM's first guiding principle is that **economic rationale prevails** (**Chart 3**). In practical terms, this means each factor has its own *raison d'être*, thereby ensuring the model's recommendation is not the fruit of a black box, but rather a logical sequence of complementary, simple-to-interpret macro-financial signals.
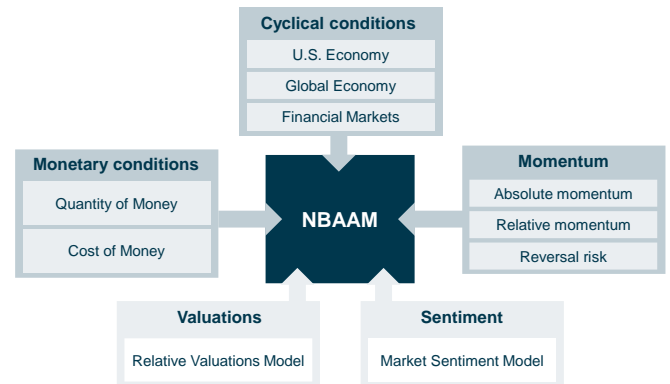
3 | **NBAAM's three guiding principles**

#1	**Economic rationale first** *Not a blackbox; each input has its purpose and logic*
#2	**Many hands make light work** *Breadth of signals is stronger than any single indicator*
#3	**Everything is relative** *Markets have a recency bias; changes in direction are key*

CIO Office

The second guiding principle is **strength in numbers**. All too often, a single, specific piece of economic data draws all the media attention. In reality, this is usually a distraction, as it can lead to losing sight of the big picture which is ultimately what counts. Accordingly, the Model is built to emphasize the depth of the signals rather than any particular indicator, much like a poll gains credibility as the sample size increases.

Finally, the third guiding principle: **everything is relative**. Here, we're referring to the fact that markets tend to react to changes in direction far more than to the level of economic activity and, especially, when they differ markedly from recent history. Once again, NBAAM's parameterization takes these fact-based observations into account.
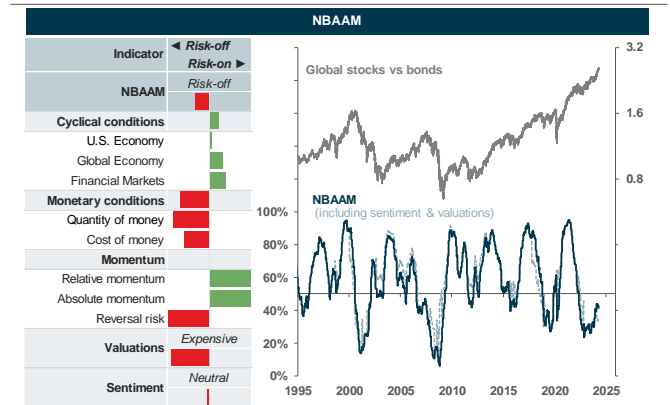
A global macro radar

NBAAM's recommendation is derived from signals divided into five fundamental pillars: (1) cyclical conditions, (2) monetary conditions, (3) momentum, (4) valuations, and (5) market sentiment (**Chart 4**). In addition to providing a detailed picture of macroeconomic conditions at all times – akin to radar – this methodology adds up the strengths and diversifies the weaknesses of each indicator in order to conclude on a well-advised asset allocation strategy (**Chart 5**).

4 | **Monitoring the five pillars of tactical asset allocation**

Cyclical conditions
- U.S. Economy
- Global Economy
- Financial Markets

Monetary conditions
- Quantity of Money
- Cost of Money

NBAAM

Momentum
- Absolute momentum
- Relative momentum
- Reversal risk

Valuations
- Relative Valuations Model

Sentiment
- Market Sentiment Model

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**5** | **NBAAM: a radar for the macroeconomic backdrop**

CIO Office (data via Refinitiv). As of April 19, 2024.

Specifically, cyclical conditions refer to more traditional leading economic indicators such as manufacturing activity, housing, employment, consumer behaviour, and their status versus consensus. In addition, we also monitor indirect measures of the cyclical context via certain relative trends within the four main asset classes, such as

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the gold/copper ratio in commodities or the cyclical/defensive ratio in equities. In short, the main advantage of the cyclical conditions signal is its ability to capture the waves of the economic cycle. In turn, this pillar tends to be more coincident with stock market cycles (which are themselves leading indicators of the economy), meaning it serves more to confirm the validity of a recent trend than to indicate the next move (**Chart 6**).

6 | **Cyclical conditions: an ever-present factor**

CIO Office (data via Refinitiv). As of April 19, 2024.
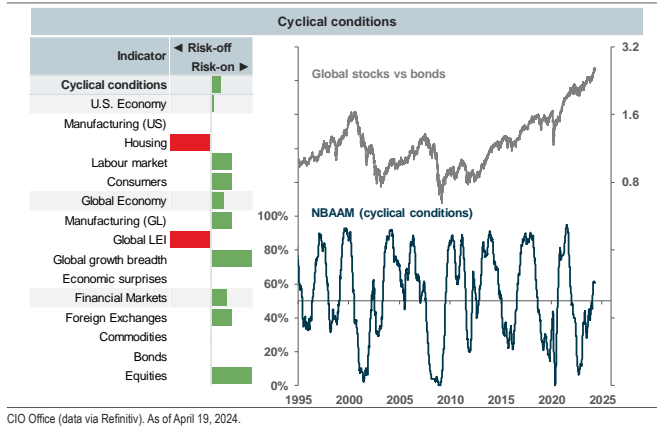
For monetary conditions, data are divided into two sub-categories: the quantity of money (largely dependent on central bank balance sheet policy) and the cost of money (mostly a function of central banks' interest rate policies). In this instance, we find a particularly advanced signal on the economic (and stock market) cycle, making it a very effective indicator during the post-crisis period characterized by significant monetary intervention, but was detrimental during the previous 10 years, when it was often far too early (**Chart 7**).

As for momentum, the logic behind its use is not rooted in an economics textbook, but in the abundant financial literature demonstrating the tendency of rising assets to rise further (and vice versa). For us, this pillar mainly acts as an insurance policy against the risk of markets moving against macroeconomic signals for an extended period. We, therefore, track the absolute momentum of the main stock market regions as well as their relative performance to bond markets, which are not always automatically an attractive

7 | **Monetary conditions: growing influence**

CIO Office (data via Refinitiv). As of April 19, 2024.
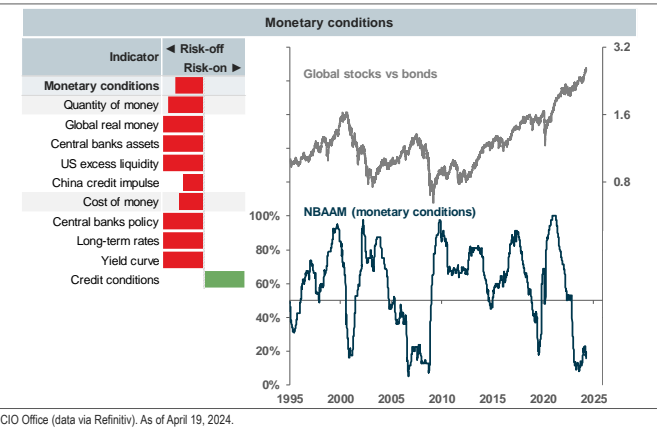
alternative. However, our research shows that an extreme divergence between momentum and the more fundamental pillars (cyclical and monetary conditions) often ends up in an abrupt return to reality for markets, hence the inclusion of a reversal risk indicator. Ultimately, this results in a signal that has the advantage of being simple and effective, although naturally more volatile and lagging than its peers (**Chart 8**).

8 | **Momentum: an insurance policy**

CIO Office (data via Refinitiv). As of April 19, 2024.
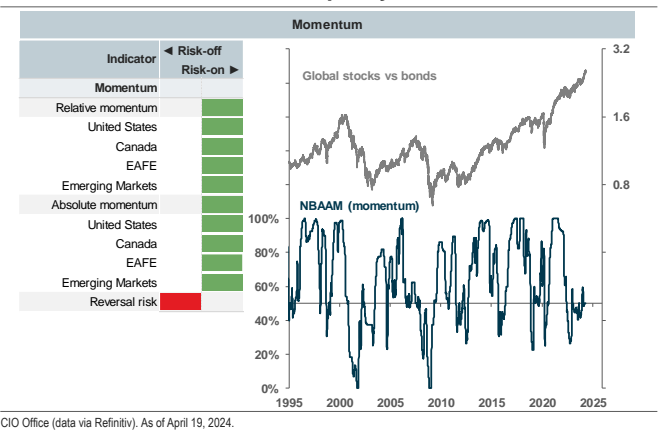
On the valuation side, the approach is different for one simple reason. Valuations say nothing about the future, at least on a tactical horizon. Rather, they serve to signal the potential for a major reversal when they reach extreme levels, conditional on a triggering event occurring. Consequently, NBAAM ignores them, except when our valuation measure – based on the spread between equity price-earnings ratios and

government bond yields – reaches extreme levels (**Chart 9**).

9 | **Valuations: measuring the risk of reversal**
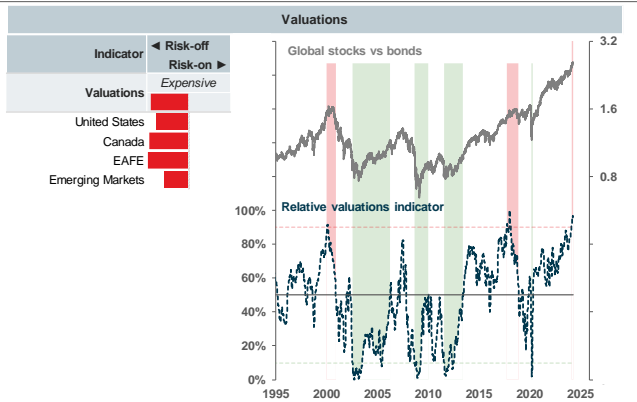
CIO Office (data via Refinitiv). As of April 19, 2024.

Lastly, as with valuations, market sentiment is also ignored by the Model, except when the indicator – which the team has been publishing since 2018 – crosses extreme thresholds. By construction, this measure is by far the most volatile. However, it complements the other four pillars by adding an even shorter-term dimension to the Model (**Chart 10**).

10 | **Sentiment: a volatile source of opportunity**
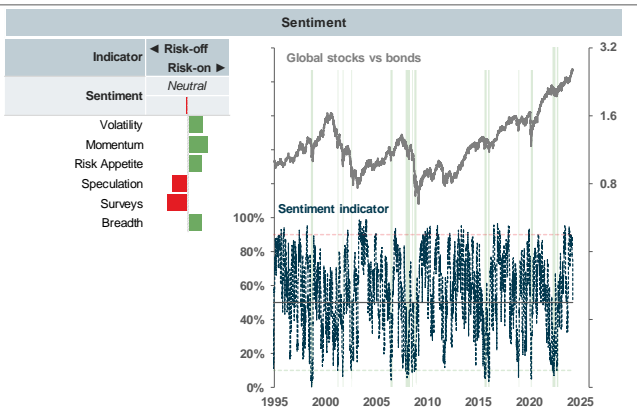
CIO Office (data via Refinitiv). As of April 19, 2024.

How does it work?

In terms of methodology, NBAAM essentially translates a series of macro-financial data into signals ranging from 0% (risk-off) to 100% (risk-on) through four distinct steps (**Chart 11**).

11 | **The methodology in four distinct steps**
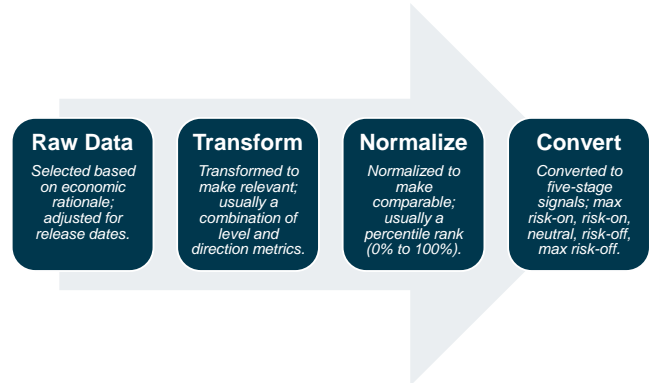
CIO Office (data via Refinitiv).

Firstly, the Model ensures that the data selected are adjusted according to their historical release dates (an essential feature to avoid inducing a look-ahead bias). In the few cases where data were subject to revisions after publication, a diligent sensitivity analysis enabled us to conclude that this represented a mitigated risk to model validity.

Secondly, each input to the model is transformed into measures that make it more relevant to markets. Typically, this involves looking not only at their level, but also at their direction as well as smoothing the data to reduce volatility.

Thirdly, the model normalizes these different measures into percentile ranks over a time span representative of the average length of a business cycle. Among the main advantages of this method are the ease with which the figures can be interpreted, the fact that they are not affected by extreme data and, above all, the uniform parameterization of all signals thereby limiting the risk of overfitting.

Finally, each indicator is converted into a signal that can take on five states: 100% (maximum risk-on), 75% (risk-on), 50% (neutral), 25% (risk-off), 0% (maximum risk-off), all with the aim of sending an

unambiguous signal. Once again, the principle behind this methodology is essentially the same as for a survey. Respondents are rarely asked to express the full nuance of their opinions. Instead, it's the aggregation of often binary responses (yes/no or pro/con, etc.) that contains information. The same logic seems to apply to macroeconomic analysis.

As an example, let's take the U.S. ISM PMI Manufacturing Index, an indicator included in the "U.S. economy" category within the "cyclical

12 | **Example: translating the PMI into a *risk-on/risk-off* signal**

NBAAM Signal: U.S. ISM Manufacturing PMI

CIO Office (data via Refinitiv).

conditions" pillar. In this case, the percentile rank incorporates both the average over the last three months (level) and the deviation from the 12-month average (direction), a figure that is then converted into five potential states, the majority of which are 0% or 100% (**Chart 12**).
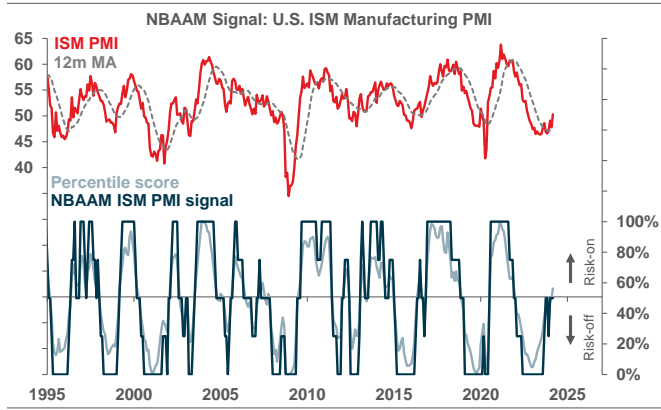
All in all, NBAAM performs a similar operation for 28 indicators, which are then weighted to form the different categories specific to each pillar and ultimately providing an asset allocation recommendation (**Chart 13**).

With regard to weightings, three points should be emphasized. First, in keeping with the Model's first guiding principle, the weights are not purely the result of optimization of the past but, rather, are primarily the reflection of an economic rationale.

In concrete terms, this means giving slightly more weight to cyclical and monetary conditions than to momentum, which we see mainly as insurance.
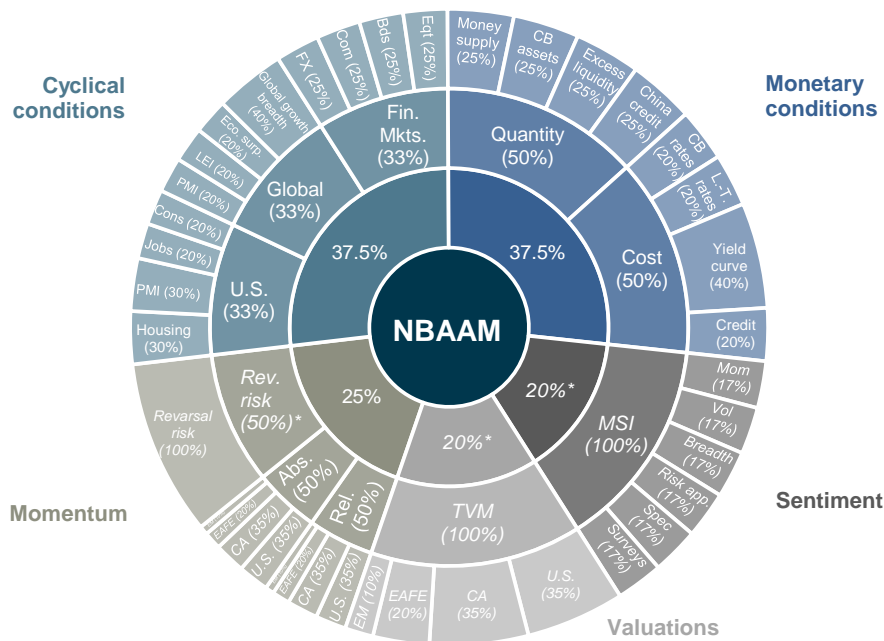
Then, unlike the other pillars, valuation and market sentiment signals are activated only when they reach extreme levels. In such circumstances, the

**13** | **On NBAAM's radar: detailed view of indicators monitored**

CIO Office (data via Refinitiv). *Weight given to the signal only when an extreme threshold is reached, in which case the other weights are reduced proportionally. Under normal circumstances, the weight is zero.

weight of momentum, cyclical conditions and monetary conditions, taken together, are proportionally reduced to make room for valuations and/or sentiment. The same methodology applies to the reversal risk indicator within the momentum pillar.

Lastly, some key indicators, such as the yield curve, are given higher weighting, but in almost all cases, equal weighting[1] is applied.

In the end, the weighted sum of all of these signals provides a continuous reading of macroeconomic conditions from a single figure, which in turn can be converted – or simplified – into five states (maximum risk-on, risk-on, neutral, risk-off, maximum risk-off, **Chart 14**).

14 | **Discretizing NBAAM's signal into five states**

National Bank Asset Allocation Model
(including sentiment & valuations)
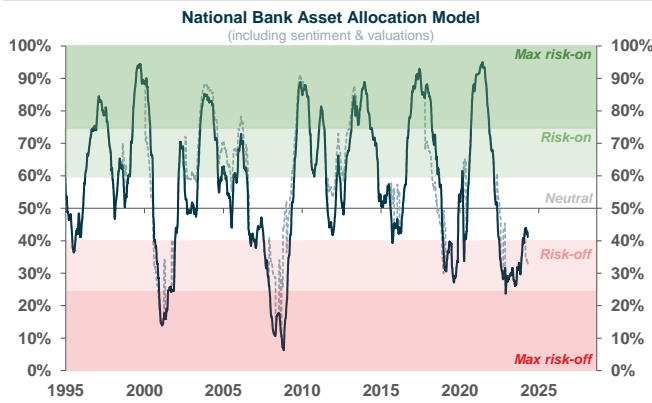
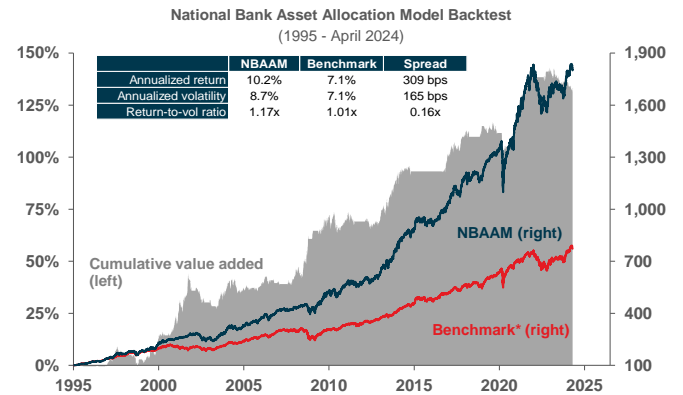CIO Office (data via Refinitiv). As of April 19, 2024.

Does it work?

To assess NBAAM's historical performance, we compare a strategy using its signal as an equity weight (the balance being in bonds) to a benchmark[2] composed of 50% equities and 50% bonds.

Since 1995, the "five-state" version of NBAAM has outperformed its benchmark by a multiple of 2.3 x, corresponding to an annualized added value of 309

bps. Conversely, the portfolio's volatility only increases by 165 bps, so that the historical risk/return ratio is improved by 0.16 x (**Chart 15**).

15 | **Historical performance: a persistent trend...**

National Bank Asset Allocation Model Backtest
(1995 - April 2024)

	NBAAM	Benchmark	Spread
Annualized return	10.2%	7.1%	309 bps
Annualized volatility	8.7%	7.1%	165 bps
Return-to-vol ratio	1.17x	1.01x	0.16x

CIO Office (data via Refinitiv). *50% stocks (35% S&P/TSX, 35% S&P 500, 20% MSCI EAFE, 10% MSCI EM total return, in CAD), 50% bonds (FTSE Canada Universe). As of April 19, 2024.

More importantly, the results show a good degree of consistency in performance across different cycles and signals, with value added for each pillar trending upward over the entire period (**Chart 16**).

16 | **... through signal diversity**

National Bank Asset Allocation Model Backtest
(cumulative value added per pillar)
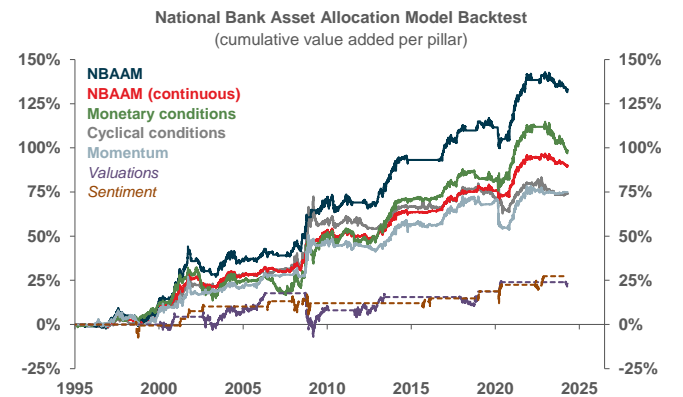
CIO Office (data via Refinitiv). As of April 19, 2024.

Naturally, the Model is by no means infallible. In fact, the past year (March 2023 - March 2024) proved rather difficult for NBAAM, which maintained a defensive bias in the face of rising stock prices, similar to what happened in 2007. Conversely, an offensive bias in 1998 and 2002 was also costly for the model.

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[1] The other exception is within momentum and valuations where weightings are simply functions of the weights of each stock market index within the benchmark (35% Canada, 35% USA, 20% EAFE, 10% Emerging Markets).
[2] The benchmark is composed of 50% FTSE Canada Universe; 17.5% S&P 500 in $C; 17.5% S&P/TSX; 10% MSCI EAFE in $C; 5% MSCI ME in $C: the benchmark for the tactical asset allocation fund managed by the CIO Office. Backtest assumes weekly rebalancing.

Overall, on a three-month horizon, NBAAM was right "only" 65% of the time, while it was not uncommon to see an underperformance of almost -100 bps over a quarter. Fortunately, as the horizon over which the Model is evaluated increases, the results become more interesting with, for example, an historical success rate of 71% over 1 year, 95% over 3 years, and 99% over 5 years (**see page 9**).
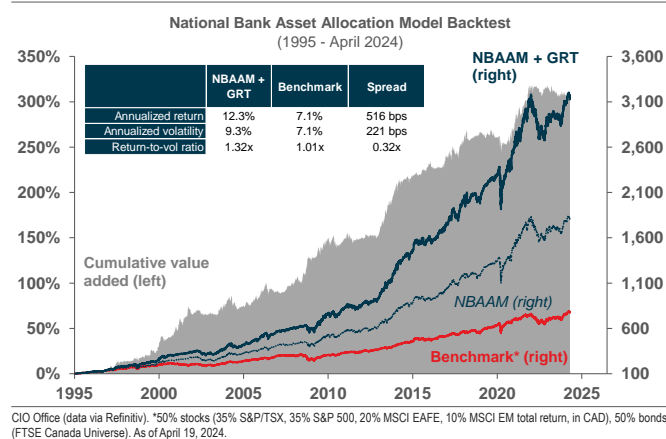
The bottom line

NBAAM is no crystal ball. Rather, it's more like a radar or even a survey on the macro-financial backdrop. As such, just because a "threat" is detected doesn't necessarily mean it's vital, and the model can always have blind spots. Similarly, the "most likely" outcome is by no means a certainty, any more than the "least likely" is impossible.

The main advantages of such a Model are to provide continuous visibility over the global macroeconomic backdrop (**see page 10**) and, above all, to ensure a maximum degree of rationality in making asset allocation decisions over a tactical horizon.

In the future, there are numerous possibilities for improving the Model. For example, adding historical data prior to 1995 would increase the diversity of market environments confronted by the Model, although this would require a simplified version given the lack of available data. Furthermore, while NBAAM currently provides a recommendation on a horizon of 3-12 months, very short-term (1-3 months) and more cyclical (12 months) versions could provide more colour on the expected sequence of markets. Finally, the use of advanced analytics is not ruled out, whether to give a little more flexibility in the weights assigned to each pillar or in the event of the addition of new, higher-frequency data.

First and foremost, however, we'll be looking to extend the coverage of our suite of quantitative tools within other asset classes. After all, the allocation between equities and bonds, while important, remains just one opportunity for value added. By way of example, by simply combining NBAAM with the geographic allocation within equities recommended by our GRT[3] relative momentum model, historical value added rises from 309 bps to 516 bps (+207 bps) annualized but, importantly, turns far more consistent over time (**Chart 17**).

17 | Combining models, compounding opportunities

National Bank Asset Allocation Model Backtest
(1995 - April 2024)

	NBAAM + GRT	Benchmark	Spread
Annualized return	12.3%	7.1%	516 bps
Annualized volatility	9.3%	7.1%	221 bps
Return-to-vol ratio	1.32x	1.01x	0.32x

CIO Office (data via Refinitiv). *50% stocks (35% S&P/TSX, 35% S&P 500, 20% MSCI EAFE, 10% MSCI EM total return, in CAD), 50% bonds (FTSE Canada Universe). As of April 19, 2024.
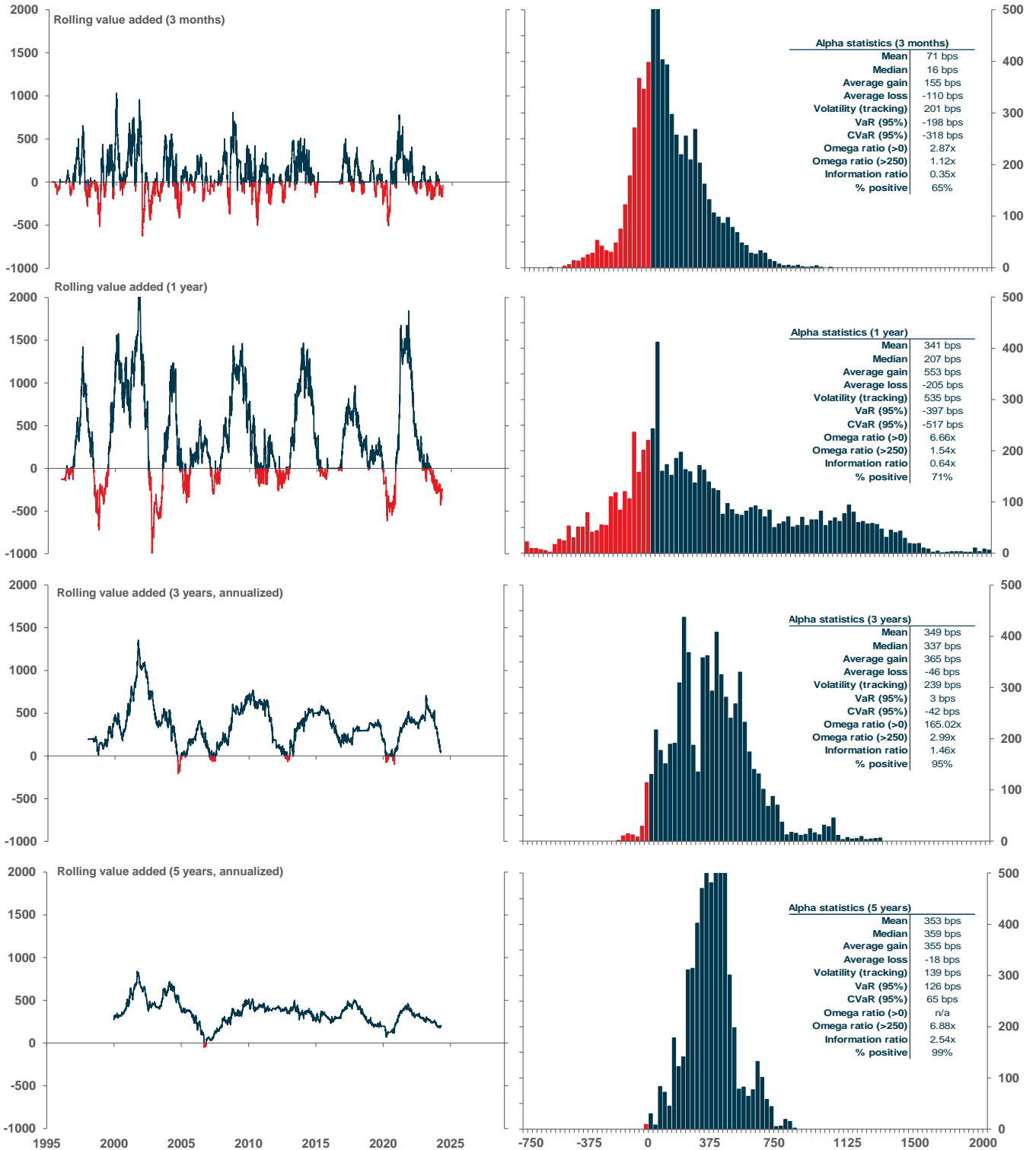
Clearly, the potential for outperformance is there and, for us, quantitative models are indispensable tools for realizing it. It's a matter of principle.

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[3] Developed in 2019, the GRT (Geographical Relative Trend) model recommends positioning between Canadian equities (S&P/TSX), U.S. equities (S&P 500), EAFE equities (MSCI EAFE) and emerging market equities (MSCI EM) according to the relative momentum between them. The simulation combining NBAAM and GRT assumes that the equity allocation (which fluctuates between 0% and 100%) is made within the portfolio recommended by the GRT.
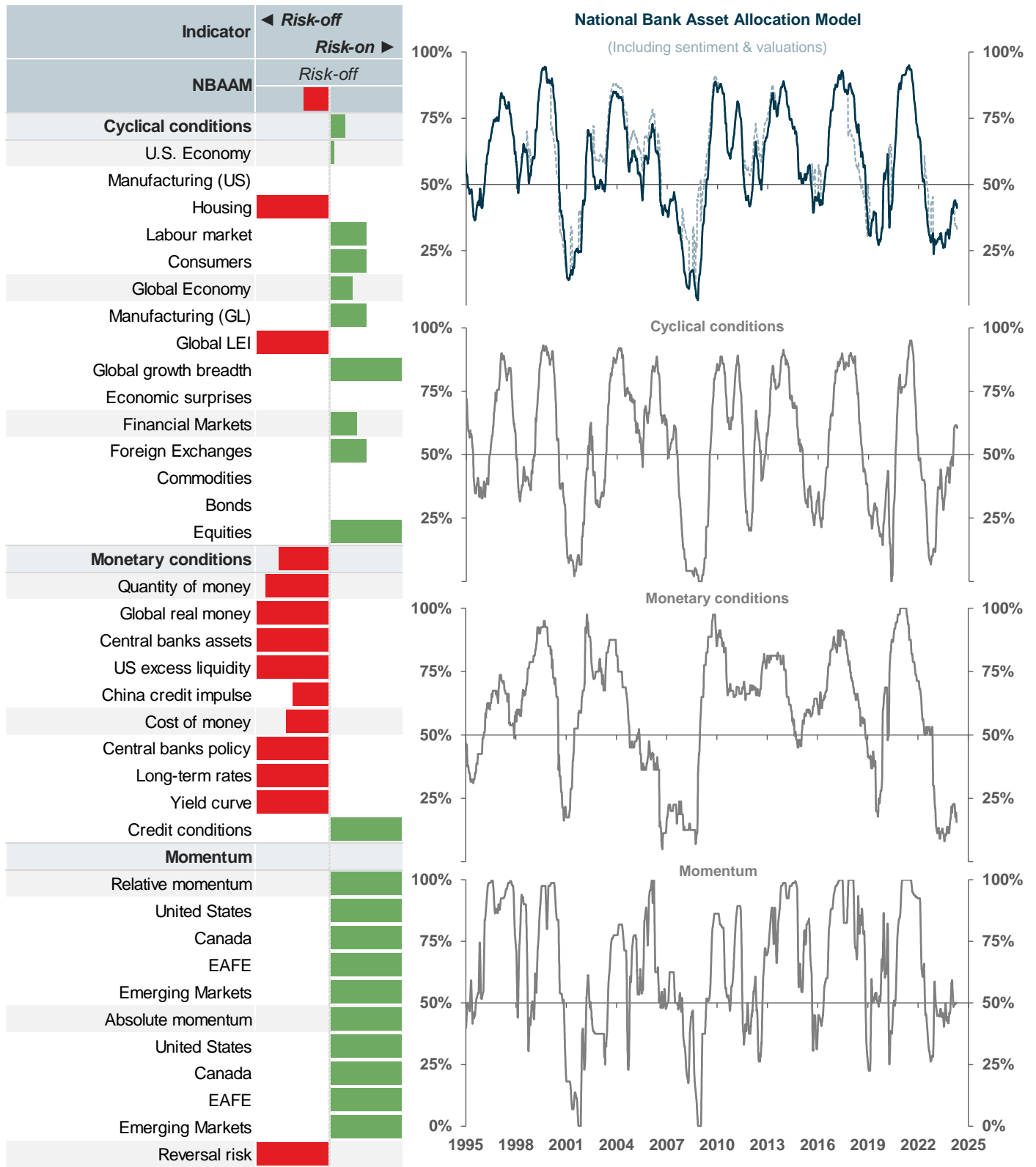
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National Bank Asset Allocation Model (NBAAM) detailed backtest

National Bank Asset Allocation Detailed Backtest

Rolling value added (3 months)

Alpha statistics (3 months)	
Mean	71 bps
Median	16 bps
Average gain	155 bps
Average loss	-110 bps
Volatility (tracking)	201 bps
VaR (95%)	-198 bps
CVaR (95%)	-318 bps
Omega ratio (>0)	2.87x
Omega ratio (>250)	1.12x
Information ratio	0.35x
% positive	65%

Rolling value added (1 year)

Alpha statistics (1 year)	
Mean	341 bps
Median	207 bps
Average gain	553 bps
Average loss	-205 bps
Volatility (tracking)	535 bps
VaR (95%)	-397 bps
CVaR (95%)	-517 bps
Omega ratio (>0)	6.66x
Omega ratio (>250)	1.54x
Information ratio	0.64x
% positive	71%

Rolling value added (3 years, annualized)

Alpha statistics (3 years)	
Mean	349 bps
Median	337 bps
Average gain	365 bps
Average loss	-46 bps
Volatility (tracking)	239 bps
VaR (95%)	3 bps
CVaR (95%)	-42 bps
Omega ratio (>0)	165.02x
Omega ratio (>250)	2.99x
Information ratio	1.46x
% positive	95%

Rolling value added (5 years, annualized)

Alpha statistics (5 years)	
Mean	353 bps
Median	359 bps
Average gain	355 bps
Average loss	-18 bps
Volatility (tracking)	139 bps
VaR (95%)	126 bps
CVaR (95%)	65 bps
Omega ratio (>0)	n/a
Omega ratio (>250)	6.88x
Information ratio	2.54x
% positive	99%

CIO Office (data via Refinitiv). As of April 19, 2024.

National Bank Asset Allocation Model (NBAAM) detailed dashboard

Indicator	◄ *Risk-off* *Risk-on* ►
NBAAM	*Risk-off*
Cyclical conditions	
U.S. Economy	
Manufacturing (US)	
Housing	
Labour market	
Consumers	
Global Economy	
Manufacturing (GL)	
Global LEI	
Global growth breadth	
Economic surprises	
Financial Markets	
Foreign Exchanges	
Commodities	
Bonds	
Equities	
Monetary conditions	
Quantity of money	
Global real money	
Central banks assets	
US excess liquidity	
China credit impulse	
Cost of money	
Central banks policy	
Long-term rates	
Yield curve	
Credit conditions	
Momentum	
Relative momentum	
United States	
Canada	
EAFE	
Emerging Markets	
Absolute momentum	
United States	
Canada	
EAFE	
Emerging Markets	
Reversal risk	

National Bank Asset Allocation Model
(Including sentiment & valuations)

Cyclical conditions

Monetary conditions

Momentum

CIO Office (data via Refinitiv). As of April 19, 2024.

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