Practical Applications of

Regime-Based versus Static Asset Allocation: *Letting the Data Speak*

Practical Applications
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Overview

The authors of this research advocate for data-driven, regime-based asset allocation. This approach provides flexibility within the discipline of benchmark-based investing and offers a middle ground between strategic and tactical allocation. In an interview with **Institutional Investor Journals**, co-authors **Peter Nystrup** and **Bo William Hansen** advise investors to focus on different economic regimes that govern market and portfolio performance over time.

Practical Applications

- **Focus on the facts.** The data identify regime changes in broad financial markets. Investors may make timely use of this information to improve returns.
- **Test new tools.** Newer tools and quantitative methodologies, such as Hidden Markov Models with time-varying parameters, reveal useful opportunities, particularly during periods of flux.
- **Respond to change effectively.** Dynamic approaches to asset allocation help mitigate tail risk in changing economic environments.

Practical Applications Report

Throughout history, the financial markets have demonstrated that they can change quickly. While the changes may be fleeting sometimes, at other times they can mark the beginning of a new financial regime. Regimes may take a cyclical or semi-cyclical form, from recession through expansion and back again. Or they may take the form of structural breaks that become "permanent"—at least, until the next major rupture occurs.

In ***Regime-Based versus Static Asset Allocation: Letting the Data Speak***, published in ***The Journal of Portfolio Management***, Nystrup, Hansen, **Henrik Madsen** and **Erik Lindström** study the regime phenomena and assess the various approaches to asset allocation under ever-changing market conditions. Traditional strategic asset allocation (SAA) approaches tend to construct static, "all-weather" portfolios that optimize efficiency across a range of economic scenarios. However, the team finds

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Peter is an industrial PhD student at **Sampension**, a Danish life-insurance company, and in the department of applied mathematics and computer science at the **Technical University of Denmark**, where he is part of the section for dynamical systems. His research focuses on detection of regime shifts in financial time series, methods for estimating statistical models with time-varying parameters and development and implementation of dynamic asset allocation strategies. He is part of the investment analysis team at Sampension, where he develops the company's models for both dynamic and strategic asset allocation.

Prior to joining Sampension, Peter worked in the equity sales department in Nordea Markets. He is a financial engineer and holds a BA in mathematics and technology and an MA in mathematical modeling and computation with honors from the Technical University of Denmark.

Key Definitions

Hidden Markov Model (HMM)

A black box model in which the probability distribution that generates an observation depends on the state of an unobserved Markov chain. The use of HMMs to infer the state of financial markets has gained popularity over the last decade.
—Peter Nystrup, Bo William Hansen, Henrik Madsen and Erik Lindström

Regime-Based Asset Allocation (RBAA)

In contrast to tactical asset allocation, regime-based investing targets a longer time horizon—one year or longer—and is driven by changing economic fundamentals.
—Peter Nystrup, Bo William Hansen, Henrik Madsen and Erik Lindström.

Strategic Asset Allocation (SAA)

In strategic asset allocation, investment managers seek to construct durable, but static, "all-weather" portfolios that optimize efficiently across a range of economic scenarios. However, if economic conditions are persistent and strongly linked to asset class performance, then a dynamic strategy should add value over static weights.
—Peter Nystrup, Bo William Hansen, Henrik Madsen and Erik Lindström

Tactical Asset Allocation (TAA)

A form of investment management that tends to be shorter-term, higher frequency (i.e., weekly or monthly) and driven primarily by valuation considerations.
—Peter Nystrup, Bo William Hansen, Henrik Madsen and Erik Lindström

that a more dynamic strategy may provide a better chance of profiting from bullish markets, protecting against bearish markets and reducing potential drawdowns during declines.

They make an important distinction between their view of regime-based investing and tactical asset allocation (TAA): TAA takes on short-term, higher-frequency trading activities and is driven by valuation. Regime-based asset allocation (RBAA) takes a long-term view and is driven by changing economic fundamentals.

WHAT DO THE DATA SAY?

Although other studies have developed the case for both static and dynamic portfolios, Nystrup and his team highlight the substantial amount of research that shows how dynamic asset allocation strategies based on regime-switching models can be quite profitable.

The authors offer two caveats to these results, however. First, some studies do not include transaction costs when comparing the relative performance of static and dynamic strategies. With the potential for frequent rebalancing, the dynamic approach may cost more over time, eroding returns, they caution. Second, studies may show a bias for in-sample performance testing, which tends to surpass out-of-sample performance, and some do not test the strategies out-of-sample at all. Nevertheless, the research cited in the article based on concrete empirical evidence from the markets underscores the authors' point about "letting the data speak."

The research on performance centers on a portfolio consisting of a global stock index (**MSCI ACWI**) and a global government bond index (**JPM GBI**) in various combinations over a 20-year period, from 1994 to 2014. As the authors explain, the goal is not to predict regime changes of future market movements, but rather to identify when a regime shift has occurred and to adjust the allocation to profit from the opportunities in the new environment.

Nystrup and his team advise that RBAA focuses on exploiting the persistence of volatility. "There might be conjecture that you will need to have some kind of forecasting skill to make RBAA work," says Hansen, "Yet here, there is no prediction involved, we are just looking at the history and watching for turning points." They then develop a model to aid them in this effort.

HIDDEN MARKOV MODELS AND EMPIRICAL RESULTS

Hidden Markov Models (HMMs) are black-box models where the inferred states may be associated with business cycle phases. Such models have become popular in recent years due to their ability to reproduce stylized facts of financial returns and enable researchers to interpret the states along actionable lines. Specifically, "HMMs can match the financial markets' tendency to change behavior abruptly, and they can highlight features of financial series such as volatility clustering and leptokurtosis," notes Nystrup.

In their empirical testing, Nystrup and his coauthors construct a series of portfolios: 1) a static portfolio consisting of a 49% fixed allocation to stocks, 2) a strategy that is fully invested in the stock index in the low-volatility state and in the bond index

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> **—Bo William Hansen**

in the high-volatility state, and 3) a strategy that is long the stock index in the low-volatility state, and short the stock index in the high-volatility state. The results are also compared to the returns of the 100% stock and 100% bond indexes independent of any strategy.

The team found that there were a total of 16 regime changes over a 17-year period, and that the length of time per regime varied from a few weeks to six years. There were also substantial differences in the level of volatility present in the six-year, high-vol period that started in 1998 and spanned the rise and crash of the dot-com bubble, indicating that market states were less persistent during this period.

In terms of the results for the indexes and the strategies:

- The **bond index** had the highest Sharpe ratio (1.90), with an annualized return of 6.0% and an adjusted annualized standard deviation of just 3%. Maximum drawdown was lowest of the group, at 5%.
- The **stock index** had the lowest Sharpe ratio, at 0.38, with an annualized return of 6.9% and a standard deviation of 18%. The maximum drawdown for the stock index was the highest of the entire group, at 58%.
- The **static strategy** had a Sharpe ratio of 0.72, and annual return of 6.4%, with a standard deviation of 9% and a maximum drawdown of 32%.
- The **stocks–bonds strategy** had the second highest Sharpe ratio of 1.23, and its realized return (at 11.4%, with a standard deviation of 9%) was higher than that of the static portfolio—which had the same average exposure to the stock index (49%)—as long as transaction costs did not exceed 239 basis points. The maximum drawdown (13%) was also much lower for the stock–bonds strategy than for the static strategy.
- The **long–short strategy** turned out to be less profitable than stocks–bonds, with an annualized return of 9.6% and 18% standard deviation, although it outperformed the stock index when transaction costs were less than 130 basis points per one-way transaction. Long–short also had lower tail risk and a better Sharpe ratio (0.52) and lower maximum drawdown (44%) than the stock index.

“While the results are compelling, these strategies are fairly simple and the next step will be to include additional asset classes and develop a more realistic portfolio,” advises Nystrup.

Nystrup and his team find that forecasting skill is not necessary for the regime-based asset allocation strategy to be more profitable than a static strategy. Their research is based on available market data, and they made no assumptions about equilibrium returns, volatilities or correlations. They speculate that a portfolio manager might improve performance by including economic variables, interest rates, investor sentiment surveys or other indicators in the analysis.

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Henrik is a Professor in Mathematical Statistics at the **Technical University of Denmark**, with a special focus on stochastic dynamical systems. His main research interest is related to analysis and modeling of stochastic dynamical systems. This includes signal processing, time series analysis, identification, estimation, grey-box modeling, prediction, optimization and control. The applications are mostly related to energy systems, informatics, environmental systems, bioinformatics, biostatistics, process modeling and finance.

Henrik has authored or co-authored approximately 500 papers and 12 books. His most recent books are ***Time Series Analysis*** (Chapman and Hall/CRC, 2008); ***Introduction to General and Generalized Linear Models*** (Chapman and Hall/CRC, 2010); ***Integrating Renewables in Electricity Markets*** (Springer, 2013), and ***Statistics for Finance*** (Chapman and Hall/CRC, 2015). Henrik received a PhD in statistics from the Technical University of Denmark in 1986.

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Erik is an Associate Professor at the **Centre for Mathematical Sciences at Lund University**. He earned his MA in engineering physics in 2000 and his MA in business and economics in 2001, followed by a PhD in mathematical statistics in 2004, all from Lund Institute of Technology (LTH)/Lund University. Erik has a great interest in teaching; he is part of the **LTH Pedagogical Academy** and was appointed an **Excellent Teaching Practitioner** (ETP) in 2013.

Erik's research ranges from statistical methodology (primarily time series analysis in discrete and continuous time) to financial mathematics and problems related to the energy markets, and he has published extensively in each of these fields. His most recent book is ***Statistics for Finance*** (Chapman and Hall/CRC, 2015).