Practical Applications of

Regime Shifts in Excess Stock Return Predictability: *An Out-of-Sample Portfolio Analysis*

Practical Applications
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Overview

In Regime Shifts in Excess Stock Return Predictability: An Out-of-Sample Portfolio Analysis, published in the Winter 2018 issue of ***The Journal of Portfolio Management***, **Giulia Dal Pra**, **Massimo Guidolin**, **Manuela Pedio**, and **Fabiola Vasile** analyze whether one can outperform the stock market using asset allocation strategies based on certain financial ratios as signals. They construct linear regressions relating excess returns to selected ratios. They explore both ordinary linear regressions and ones that embody a Markov-switching (regime-switching) feature. They assess performance of the strategies over several investment time horizons and include the effect of transaction costs. The authors also consider the efficacy of their strategies in an economic framework that accounts for an investor's degree of risk aversion.

Practical Applications

- **Regression-based asset allocation strategies can outperform a buy-and-hold strategy.** Over the long term, the buy-and-hold strategy beats allocation strategies based on two of the three financial ratios. However, allocation strategies based on an earnings-to-price ratio outperform buy-and-hold, even over a five-year horizon.
- **A regime-switching approach can reduce performance volatility.** In a few of their empirical backtesting experiments, the authors found that the regime-switching approach produced lower realized portfolio volatility and, correspondingly, better Sharpe ratios.

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Born in 1990, Giulia got her bachelor's degree at Luiss University in Rome. She then moved to Milan for an MA in finance at Bocconi University, which she completed in 2014. Since then, she has worked in investment banking in London, focusing primarily on structured products and covering mainly Italian clients. In her free time, she likes to travel and discover new places. She also pursues various sports, including tennis, running, skiing, and sailing. She likes reading and solving puzzles, especially late at night, when she finds time away from her research on portfolio management.

Key Definitions

Economic value

Economic value refers to measures of value based on an investor's (or a consumer's) individual preferences. In the context of investing, the ex post economic value of an investment or an investment strategy may be a function of the variability and range of potential realized portfolio returns, in addition to merely the expected value of returns.

Markov-switching model

A Markov-switching model is a type of regime-switching model used to analyze time-series data. Each regime is characterized by a different equation defining the behavior of the time series. A separate, unobservable state variable determines which regime applies. The state variable changes over time according to a Markov process, which means that its likelihood of changing to any particular state in the next period depends on its current state. Although the state variable cannot be directly observed, it can be estimated based on past data.

Optimal portfolio choice

Optimal portfolio choice refers to the process of constructing a portfolio that produces the highest ex ante economic value for an investor. In the context of a mean–variance framework, this means selecting the point on the mean–variance efficient frontier that reflects the investor's preferred trade-off of risk versus return (i.e., as a result of the investor's degree of risk aversion).

- **Assessing investor utility (partly as a function of risk aversion) potentially leads to very low equity weighting.** For even a modest theoretical level of risk aversion, reducing performance volatility can become the dominant factor and can lead to low equity allocations.

Discussion

The authors grapple with the challenge of predicting episodes of above-average performance of the overall market using three basic ratios as signals. They devise asset allocation strategies based on the predictive power of those signals over three time horizons: one month, six months, and five years.

The three signaling ratios are the following:

- the trailing dividend-to-price (DP) ratio for the S&P 500 Index
- the trailing earnings-to-price (EP) ratio of the S&P 500 Index
- the book value-to-market value (BM) ratio for the Dow Jones Industrial Average

The authors test each ratio individually in both a single-state framework and a two-state Markov-switching framework. They do not test the ratios together in any combination, which may lead to an underestimation of the economic value that their approach generates.

For the single-state framework, the authors perform regressions where excess returns are a linear function of a particular ratio and there is a single set of regression estimates: one intercept, one slope, and one error term. In the two-state Markov-switching framework, the regression still relates excess returns to a particular ratio, but there are two sets of estimates—one for each of the two unobservable states. The authors

> “Our results show that simple switching strategies based on the forecasts obtained from linear and regime-switching predictive regressions tend to outperform a B&H strategy (at least when zero or low transaction costs are considered) for two out of three predictors (namely the EP and the BM ratios).”
>
> **—Regime Shifts in Excess Stock Return Predictability: An Out-of-Sample Portfolio Analysis**

found that "the statistical evidence of predictive ability of the three ratios is mostly weak and never persistent over time."

FROM EXCESS RETURNS TO RISK ON/OFF ASSET ALLOCATION

The authors then use the results of the regression analyses to construct asset allocation strategies based on the signaling ratios. For each ratio, the asset allocation strategy calls for 100% allocation to the S&P 500 Index when the regression indicates positive excess equity returns and 100% allocation to Treasury bills when the regression indicates negative excess equity returns. They compare each strategy to buying and holding the S&P 500 Index over each of the three time horizons (one month, six months, and five years). They analyze each time horizon for each month from 1956 through 2012. They consider three levels of transaction costs: zero, 25 basis points, and 50 basis points per one-way transaction.

The authors find that the buy-and-hold strategy consistently beats the signal-based allocation strategies based on the DP ratio. By contrast,

Out-of-Sample Annualized Returns of Asset Allocation Strategies at Different Time Horizons

Signal	Trans. Costs ↓	Horizon →	One Month			Six Months			Five Years		
		Strategy →	MS	Linear	B&H	MS	Linear	B&H	MS	Linear	B&H
Dividend-to-Price (DP) Ratio	Zero	Mean return	0.0835	0.0873	0.0916	0.0831	0.0874	0.0916	0.0834	0.0798	0.0919
		Sharpe ratio	0.2862	0.3049	0.2899	0.2962	0.3090	0.2899	0.2848	0.2838	0.2908
	25 bps	Mean return	0.0807	0.0844	0.0916	0.0816	0.0875	0.0916	0.0834	0.0797	0.0919
		Sharpe ratio	0.2643	0.2871	0.2899	0.2841	0.3100	0.2899	0.2854	0.2829	0.2908
	50 bps	Mean return	0.0784	0.0845	0.0916	0.0775	0.0886	0.0916	0.0825	0.0796	0.0919
		Sharpe ratio	0.2461	0.2974	0.2899	0.2506	0.3208	0.2899	0.2785	0.2820	0.2908
Earnings-to-Price (EP) Ratio	Zero	Mean return	0.1005	0.0923	0.0916	0.0950	0.0923	0.0916	0.0948	0.0999	0.0919
		Sharpe ratio	0.3814	0.3771	0.2899	0.3467	0.3729	0.2899	0.3207	0.3984	0.2908
	25 bps	Mean return	0.0982	0.0899	0.0916	0.0948	0.0920	0.0916	0.0964	0.0998	0.0919
		Sharpe ratio	0.3643	0.3583	0.2899	0.3453	0.3701	0.2899	0.3331	0.3977	0.2908
	50 bps	Mean return	0.0946	0.0883	0.0916	0.0956	0.0935	0.0916	0.0990	0.0997	0.0919
		Sharpe ratio	0.3389	0.3504	0.2899	0.3519	0.3847	0.2899	0.3535	0.3971	0.2908
Book Value-to-Market Value (BM) Ratio	Zero	Mean return	0.0956	0.0824	0.0916	0.0941	0.0835	0.0916	0.0918	0.0907	0.0919
		Sharpe ratio	0.3377	0.3042	0.2899	0.3263	0.3017	0.2899	0.3059	0.3274	0.2908
	25 bps	Mean return	0.0933	0.0804	0.0916	0.0937	0.0830	0.0916	0.0917	0.0906	0.0919
		Sharpe ratio	0.3208	0.2885	0.2899	0.3232	0.2977	0.2899	0.3055	0.3269	0.2908
	50 bps	Mean return	0.0909	0.0749	0.0916	0.0937	0.0820	0.0916	0.0906	0.0905	0.0919
		Sharpe ratio	0.3038	0.2449	0.2899	0.3237	0.2898	0.2899	0.2979	0.3263	0.2908

Notes: MS refers to the allocation strategy based on the two-state Markov-switching regression. Linear refers to the allocation strategy based on the regular linear regression. B&H refers to the buy-and-hold strategy.

certain strategies based on the EP ratio and on the BM ratio beat the buy-and-hold strategy.

In particular, at the zero and low transaction cost levels, the allocation strategies based on the EP ratio and on the BM ratio, slightly outperform the buy-and-hold strategy. However, at the 50-bp level of transaction costs, the buy-and-hold strategy wins. At the five-year horizon, buy-and-hold slightly outperforms the BM ratio but lags the EP strategy. The accompanying table summarizes the reported results.

TIME HORIZONS MATTER

“Over the short run, Markov-switching strategies based on all the ratios produce higher returns and faster wealth accumulation. However, the opposite holds at longer horizons.”

MEAN–VARIANCE STRATEGIES

The authors next consider whether the allocation strategies can outperform the benchmarks for an investor whose preference is defined by a mean–variance utility function related to his or her level of wealth. The investor’s utility increases with the level of wealth (and investment performance) and decreases with variability of wealth (and investment performance). The utility function includes a parameter (γ) that specifies the investor’s degree of risk aversion. The analysis permits partial allocations to equities and T-bills, rather than the all-or-none approach in the earlier analysis.

In the context of the mean–variance analysis, the authors conclude that over the short run Markov-switching strategies based on all the ratios produce higher returns and faster wealth accumulation. However, the opposite holds at longer horizons. Based on those results, they assert that the opportunities for Markov-switching predictions to create higher investor utility in the long run can come only from the ability to reduce performance variability.

Finally, the authors also discuss their analysis of investor utility functions having more parameters than just the mean and variance of future wealth. They observe that the effect of increasing the complexity of the utility function is generally to increase the optimal allocation to stocks. They further observe that using the regression based on the BM ratio produces the highest equity allocation.

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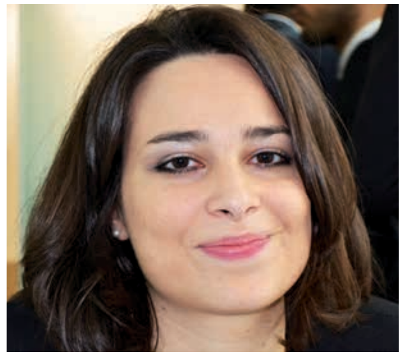
Born in 1968, Massimo Guidolin is a professor in the department of finance at Bocconi University in Milan, Italy. Since 2012 Massimo has directed Bocconi's MA program in finance, which is ranked in the top 10 by the *Financial Times*. He was previously an assistant vice president at the Federal Reserve Bank of St. Louis, and a chaired full professor at Manchester Business School in the United Kingdom. He holds a PhD from the University of California, San Diego. He has published in top economics, econometrics, and finance outlets such as *The American Economic Review*, the *Journal of Financial Economics*, the *Journal of Econometrics*, and *The Review of Financial Studies*. He has published books on asset management and financial econometrics with international publishers such as Elsevier/Academic Press and Palgrave-MacMillan. He serves on the editorial board of a number of journals, among them the *Journal of Economic Dynamics and Control*, and the *International Journal of Forecasting*.



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Born in 1989, Manuela earned her MA in finance at Bocconi University in 2013. She has worked for four years in the private sector dealing with structured products. She is also a teaching fellow at Bocconi University. Her research concerns time series applied to risk management, portfolio management, asset pricing, and derivatives. She has published books on asset management and financial econometrics with international publishers such Elsevier/Academic Press and Palgrave-MacMillan.

In her free time, she likes playing tennis and running, and she recently introduced yoga to her routine. She is an Internazionale Milan supporter, but in general she prefers to watch basketball, supporting her hometown team.

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