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Stochastic Volatility Models with Skewness Selection

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Abstract: This paper expands traditional stochastic volatility models by allowing for time-varying skewness without imposing it. While dynamic asymmetry may capture the likely direction of future asset returns, it comes at the risk of leading to overparameterization. Our proposed approach mitigates this concern by leveraging sparsity-inducing priors to automatically select the skewness parameter as dynamic, static or zero in a data-driven framework. We consider two empirical applications. First, in a bond yield application, dynamic skewness captures interest rate cycles of monetary easing and tightening and is partially explained by central banks' mandates. In a currency modeling framework, our model indicates no skewness in the carry factor after accounting for stochastic volatility. This supports the idea of carry crashes resulting from volatility surges instead of dynamic skewness.

Keywords: stochastic volatility; sparsity; skewness

1. Introduction

Accurate representation of asset returns is one of the key topics in finance. Based on the theoretical results from [1,2], standard approaches to asset pricing have largely focused on the first and second moments. Stochastic volatility (SV) models, discussed, for example, by [3], are among the cornerstone models in modern financial econometrics. In their simplest form, SV models represent asset returns via normal distribution with persistent volatility and a mean that is either constant or a linear function of explanatory variables. Such models capture the first two moments of asset returns in a simple and elegant manner, being supported empirically and theoretically, as discussed in [4].

While we acknowledge the importance of the first two moments in asset pricing, we also recognize the potential benefits of including skewness when modeling returns. Due to its ability to capture the likely direction of returns, models with time-varying skewness may be more suitable for forecasting periods with a higher concentration of same sign returns, leading to better detection of both overperformance and underperformance periods. Ref. [5] is one key example of the empirical benefits of adding such feature for modeling cross-sectional stock momentum. While the momentum factor is known for delivering good mean–variance compensation, it is also subject to a long period of negative performance. By capturing such prolonged periods of likely negative returns via dynamic skewness, ref. [5] improves the performance of the stock momentum factor compared to traditional approaches that neglect skewness.

However, including dynamic skewness in traditional financial econometric models can be costly. While allowing for asymmetry may lead to a better representation of some financial time series, it may not be a vital feature, and its inclusion risks overparameterization. Therefore, we wish to include dynamic skewness only when required by the data and remove such a feature if it is not necessary.

This paper expands stochastic volatility models by allowing dynamic skewness without having to impose it. We replace the traditional hypothesis of Gaussian errors with a skew-normal distribution. Such a change preserves the usual features for the first two moments of SV models but allows for dynamic skewness. Since the inclusion of time-varying

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Citation: Martins, I.; Freitas Lopes, H. Stochastic Volatility Models with Skewness Selection. *Entropy* **2024**, *26*, 142. https://doi.org/10.3390/e26020142

Academic Editor: Nikolay Kolev Vitanov

Received: 29 November 2023
Revised: 7 January 2024
Accepted: 10 January 2024
Published: 6 February 2024

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