

MACRO-FINANCIAL SIMULATION AND STRATEGIC ALLOCATION

Revisiting Black–Litterman

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Abstract

We develop an integrated and theoretically grounded framework for constructing, evaluating and interpreting macro-financial scenarios in a multi-country environment. The methodology combines a Global Vector Autoregression (GVAR) baseline with analyst-specified views using a Black–Litterman updating scheme, enabling coherent **scenario construction** that respects both data-driven dynamics and expert judgment. Scenario **plausibility** is assessed through the Hellinger distance, which provides an objective, quantitative measure of scenario extremeness relative to the prior distribution. To understand the origins of tail outcomes, the framework introduces a **scenario contribution** decomposition based on global divergence and a Shapley-value analogy, capturing both marginal and interaction effects across countries and variables.

A central innovation of the approach lies in linking macro scenarios to **fiscal implications** through stochastic debt dynamics, allowing policymakers to trace how shocks propagate into sovereign risk metrics. The framework further advances transparency by offering an objective confidence score for subjective views, seamless integration with the cross-country structure of GVARs, and a clear mapping from macroeconomic uncertainty to debt sustainability outcomes.

The practical relevance of the methodology is demonstrated through an application to Euro Area sovereign debt dynamics during the sovereign debt crisis, illustrating how scenario confidence, spillovers and debt paths interact in real time. Beyond retrospective validation, the framework provides a forward-looking toolkit for policy institutions: enabling stress testing, prioritizing risks based on scenario probability, communicating uncertainty clearly, and serving as an early-warning system via continuous monitoring of the Hellinger distance. Overall, the method offers a robust foundation for macroeconomic scenario analysis in an increasingly uncertain global environment.

Key words: Black–Litterman, GVAR, Debt-to-GDP, Hellinger Distance, Shapley Contribution, Mahalanobis Distance, Bhattacharyya Coefficient, Interaction Index

5 Conclusion

This article has presented an integrated and theoretically grounded framework for the construction, evaluation and interpretation of macro-financial scenarios in a multi-country environment. By combining a Global Vector Autoregression (GVAR) baseline with analyst-specified views through a Black–Litterman updating scheme, the methodology enables coherent **scenario construction** that preserves both empirical time-series dynamics and expert judgment. Scenario **plausibility** is assessed using the Hellinger distance, providing an objective, quantitative measure of the extremeness of each scenario relative to the baseline. To attribute the sources of tail outcomes, the framework introduces a **scenario contribution** based on global divergence and a Shapley value analogy, allowing for a systematic analysis of both marginal and interaction effects across economies and variables.

A key innovation of the approach lies in its explicit connection between macroeconomic scenarios and **fiscal implications** via stochastic debt dynamics. This linkage enables policymakers to evaluate how macro-financial shocks propagate into sovereign risk metrics, offering a transparent and rigorous mapping from macro uncertainty to debt sustainability outcomes. The framework enhances analytical transparency by providing confidence scores for subjective views, maintaining cross-country consistency through the GVAR structure, and delivering clear policy-relevant outputs.

The practical usefulness of the proposed methodology is demonstrated through its application to the Euro Area sovereign debt crisis. The case study shows how scenario confidence, cross-country spillovers and debt trajectories interact in real time, validating the framework’s ability to replicate the dynamics observed during periods of financial stress. Looking forward, the methodology offers a versatile toolkit for policy institutions. It supports stress testing, risk prioritization based on scenario plausibility, clear communication of uncertainty and continuous early-warning monitoring through the evolution of the Hellinger distance.

Overall, the framework provides a robust and operational foundation for macroeconomic scenario analysis in an increasingly volatile global environment. Its main advantages can be summarized as follows: “Consistency” by preserving the global linkages embedded in the GVAR; “Transparency” through explicit and quantitatively weighted views; “Plausibility” via the objective measurement of scenario credibility; and “Policy relevance” by linking macro scenarios directly to fiscal sustainability metrics. Together, these features make the approach well suited for modern macro-financial surveillance, risk assessment and policy formulation.