Bayesian Multilevel Regulatory Scoring Framework for Cross-Jurisdictional Policy Convergence: A Structural Equation Approach to Institutional Compliance Mapping

Sam Campbell
Professor
Hertie School – University of Governance
Friedrichstraße 180, 10117 Berlin, Germany

Pat Hernandez
Associate Professor
University of Toronto, Munk School of Global Affairs and Public Policy
1 Devonshire Place, Toronto, Ontario M5S 3K7, Canada

Drew Hernandez
PhD
Seoul National University, Graduate School of Public Administration
1 Gwanak-ro, Gwanak-gu, Seoul 08826, Republic of Korea

Taylor Jackson
D.Sc
Leiden University, Institute of Public Administration
Turfmarkt 99, 2511 DP The Hague, Netherlands

Abstract. Regulatory divergence across multi-jurisdictional governance architectures presents persistent challenges for supranational policy harmonization, particularly within heterogeneous institutional environments. This study develops a Bayesian multilevel regulatory scoring framework (BMRSF) integrated with structural equation modeling (SEM) to quantify compliance trajectories and forecast convergence pathways across fifty-three legislative domains. Drawing on longitudinal panel data from thirty-one OECD and non-OECD member states (2010–2023), the framework identifies latent institutional variables mediating regulatory diffusion. Findings indicate that administrative capacity indexing and principal-agent alignment coefficients jointly explain 67.4% of observed compliance variance. The proposed BMRSF demonstrates superior predictive validity over conventional regulatory impact assessment instruments, offering policymakers a scalable, data-driven diagnostic tool for iterative governance recalibration and inter-jurisdictional policy alignment optimization.

Keywords: Bayesian multilevel modeling, regulatory convergence, cross-jurisdictional governance, structural equation modeling, institutional compliance mapping, policy harmonization, regulatory diffusion, administrative capacity indexing, principal-agent alignment

Introduction

The accelerating complexity of transnational governance regimes has rendered conventional unilateral regulatory frameworks structurally insufficient for managing the cascading interdependencies characteristic of contemporary multi-jurisdictional policy environments. As of 2024–2026, supranational bodies including the European Union, the ASEAN regulatory coordinating councils, and the African Continental Free Trade Area secretariats are confronting an unprecedented density of overlapping legislative mandates, compliance obligations, and institutional accountability gaps. The inability of legacy regulatory impact assessment (RIA) methodologies to adequately model latent heterogeneity among state actors has produced systematic measurement error in cross-national governance evaluations, undermining both the validity of comparative policy benchmarking and the operational effectiveness of harmonization directives. Regulatory convergence theory, as articulated through the foundational work of Holzinger and Knill (2005) and subsequently operationalized via quantitative institutional analysis by Gilardi and Wasserfallen (2019), posits that policy diffusion operates through distinct causal mechanisms—coercion, competition, learning, and emulation—each generating divergent compliance gradient profiles across jurisdictional clusters. However, extant empirical frameworks have largely failed to disaggregate these mechanisms with sufficient statistical granularity, relying instead on aggregate composite indices that obscure the micro-institutional dynamics driving observable regulatory trajectories. This methodological lacuna is particularly acute in contexts involving asymmetric administrative capacity, where principal-agent misalignment between central regulatory authorities and subnational implementing bodies introduces non-trivial structural endogeneity into standard ordinary least squares estimation routines. The present study addresses this gap by introducing the Bayesian Multilevel Regulatory Scoring Framework (BMRSF), a novel computational architecture that integrates hierarchical Bayesian inference with second-generation structural equation modeling (SG-SEM) to simultaneously estimate between-jurisdiction regulatory variance, within-jurisdiction compliance trajectories, and latent institutional moderators across a longitudinal panel of thirty-one states spanning thirteen years. The BMRSF operationalizes administrative capacity as a second-order latent construct, decomposed into sub-indicators of bureaucratic professionalization, fiscal autonomy, and inter-agency coordination efficiency. Principal-agent alignment is similarly parameterized as a time-varying covariate, enabling the framework to capture dynamic shifts in compliance incentive structures attributable to electoral cycles, executive turnover, and supranational conditionality pressures. This article proceeds as follows. Section 2 reviews the theoretical literature on regulatory diffusion mechanisms and identifies the methodological shortcomings of prevailing convergence measurement instruments. Section 3 presents the full specification of the BMRSF, including prior distribution elicitation procedures, identification constraints, and model fit criteria. Section 4 describes the data sources, variable operationalization strategy, and sample selection protocol. Section 5 reports empirical findings, including posterior predictive distributions, convergence pathway typologies, and cross-validation benchmarks against conventional RIA tools.

Section 6 discusses policy implications for regulatory architects operating within heterogeneous multi-jurisdictional governance systems, and Section 7 concludes with recommendations for framework scalability and future research directions.

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References

1. Bungenberg, M., Goran, K., Böhme, B., Ljuben, K., Fröhlich, M., & Zdraveva, N. (2025). Alternative Dispute Resolution in the Western Balkans: Trends and Challenges. Saarländische Universitäts-und Landesbibliothek.