Structural Equivalence and Ontological Reembedding*

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***Abstract*—This paper proposes a general method for embedding classical economic models into topologically extended spaces without altering their functional forms. By introducing a transformation operator, we reinterpret standard formulations within curvature-informed manifolds that capture conditional activation and structural responsiveness. This reembedding preserves core assumptions like rational agents and objective functions while enhancing descriptive power under uncertainty. Apparent anomalies such as multiplicity of equilibria and policy ineffectiveness are reframed as features of the agent's curvature environment, not as failures of the original framework. The approach integrates with empirical tools, suggesting phase-dependent econometric corrections and offering insight into structural bottlenecks.**

***Index Terms*—Economic Modeling, Topology, Structural Equivalence, Nonlinear Dynamics, Game Theory, Policy Ineffectiveness**

I. Introduction

Contemporary economic models often presuppose linear responsiveness and continuous optimization [15]. However, empirical observations frequently reveal conditional activation, nonlinear adjustment, and phase-contingent behaviors that are difficult to express in traditional real-valued formulations [8], [2]. These limitations stem not from flaws in economic logic, but from the topological constraints of the model space itself [14].

This paper introduces a method to reembed existing models into topologically enriched decision spaces, preserving their analytical rigor while extending their expressive scope [5]. Our objective is not to replace classical economic theory, but to reinterpret it through a geometric lens, thereby achieving structural equivalence, not functional rejection [5].

II. Methodological Architecture

We define a reembedding function $\mathcal{T}$ that maps a traditional decision space $\mathbb{R}^n$ into a topologically enriched, curvature-sensitive manifold $\mathcal{M}_\kappa$.

$$\mathcal{T} : \mathbb{R}^n \longrightarrow \mathcal{M}_\kappa \tag{1}$$

This transformation is structure-preserving: objective functions, constraints, and agent assumptions remain unchanged in their form [14]. By reembedding the same optimization problem into a richer geometric space, the model can naturally yield outcomes like the conditional existence of solutions, nonlinear response sensitivity due to local curvature, and multipath equilibria from topological bifurcation [11].

III. Core Applications

The reembedding framework is applied to three core classes of economic models to demonstrate its utility.

A. Utility and Demand Models

Standard utility maximization is reframed over a curved manifold $\mathcal{M}_\kappa$, where the local geometry affects marginal rates of substitution. This approach can explain behavioral anomalies such as Giffen goods, cyclical preferences, and choice inertia not as violations of rationality, but as consequences of a warped utility surface [8], [9], [13].

B. Strategic Game Theory

The best-response correspondence is transformed into a conditional existence function, allowing for zones of non-strategic behavior and discontinuous engagement. In this warped strategic topology, phenomena like multiple equilibria and non-convergent play emerge as natural consequences of the underlying geometry rather than as analytical anomalies [11].

C. Policy Reaction Functions

Linear policy rules, such as the Taylor Rule, are modified to include state-contingent activation thresholds [15]. This reembedding explains observed policy behaviors like "policy stalls" or asymmetric responses as results of the policy environment's curvature, providing a structural reinterpretation of concepts like the monetary trilemma [10], [4], [16].

IV. Conclusion

This paper develops a framework for reembedding classical economic models into topologically enriched spaces, preserving their functional structure while extending interpretive scope. By introducing curvature and activation thresholds, we show that many behavioral and strategic anomalies can be understood as structural expressions of an expanded geometry. This approach maintains compatibility with existing empirical tools and offers a structurally conservative yet interpretively radical rethinking of economic reasoning. Future work may explore dynamic reembedding where the curvature of decision spaces evolves endogenously with time and learning.

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