

Kernel-based Nonparametric Tests for Shape Constraints

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Motivation: shape restrictions in finance

- ▶ **Pricing kernel:** monotonically decreasing and convex in returns.
- ▶ **Option-implied state price densities:** positivity and convexity.
- ▶ **Equity risk premia and characteristic monotonicity.**
- ▶ **Implied volatility smile:** convexity.
- ▶ **Credit spreads:** positivity and monotonicity in maturity.

These are economic hypotheses, not modeling choices.

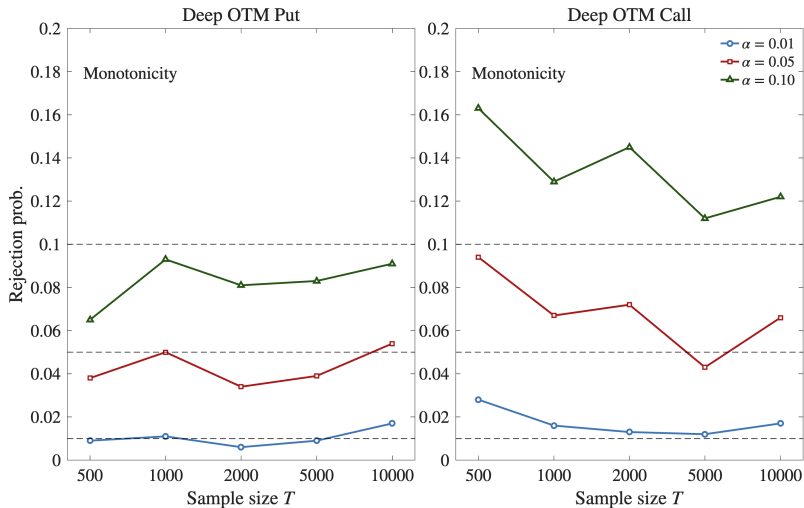
Main idea: separate learning from testing

But estimation can hide failures

- ▶ **Standard approach:** impose restriction, estimate, report the shape – violations invisible by construction.
- ▶ **This paper:** Learn a decision rule flexibly, but keep economic structure testable – violations become detectable.

Nonparametric learning $\implies$ Shape inference

Example: SDF shape test under U-shaped economy



Effective size control under true nulls; detects violations under false nulls.