

A WORKSHOP FOR UNDERSTANDING AND USING INSTRUMENT-FREE
METHODS: WHEN THE GAUSSIAN COPULA WORKS, CRACKS, AND A NEW
METHOD FOR TAKING UP THE PIECES

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Special Session Proposal

A WORKSHOP FOR UNDERSTANDING AND USING INSTRUMENT-FREE METHODS: WHEN THE GAUSSIAN COPULA WORKS, CRACKS, AND A NEW METHOD FOR TAKING UP THE PIECES

Chairs and Workshop Presenters

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Short Abstract

Endogeneity undermines causal inference in marketing research. Traditional fixes need valid instrumental variables, which are often difficult to find. Copula-based methods provide a promising instrument-free alternative. This hands-on workshop, designed for applied researchers, authors, and reviewers, delivers a well-rounded understanding, a code library for recent advances, and concrete guidance. We diagnose common omitted-variable cases where copulas fail and present an alternative method that handles them—also with code. Participants follow a complete workflow: assessing when which method suits their context, choosing the right method, coding and integrating it into models, and drafting manuscript sections on testable and untestable assumptions.

Proposal

This workshop supports marketing researchers where data cannot be experimentally altered. Copula-based (and other novel) methods provide instrument-free endogeneity correction that, in select cases, outperforms medium/weak instruments. Correct use, however, requires understanding all assumptions; mindless application can fail catastrophically.

Three barriers inhibit correct use: (1) limited understanding and resulting reservations, (2) limited awareness of variants for problem–method fit, and (3) a perception of a complicated literature that hides straightforward implementations in standard analysis code. The workshop addresses these barriers—encouraging adoption where warranted while warning against using copulas as a “get-out-of-endogeneity-jail” card. The primary audience are reviewers who must judge copula-corrected models; also marketing researchers and PhD students can use this workshop to build their empirical toolkits.

By combining mini-lectures, case studies, and hands-on exercises, attendees gain conceptual knowledge and practical skills. Every participant leaves with a code library to run copula-based and other instrument-free methods in their own models, plus an understanding of what to look out for (and what to demand as reviewer) in the explaining paragraphs, statements, and statistics of existing empirical studies with instrument-free methods.

Opening Mini Lecture (5 min): The Problem of Endogeneity

We introduce endogeneity as a core empirical challenge, show how it arises across business contexts, and explain why OLS fails. We review instrumental variables (IV): power and limitations, including strong/fragile assumptions and the scarcity of valid instruments. These constraints motivate instrument-free approaches, setting up copula-based methods.

Introduction and Theoretical Foundations of Copula-Based Methods (15 min)

The first technical session defines copulas and their role in handling dependence between endogenous regressors and errors without instruments. Topics:

- Sklar’s Theorem: expressing a joint distribution via marginals and a copula.
- Gaussian Copula Control Function (GCCF): the most widely used approach in marketing; structure and intuition.

- Assumptions: normal structural errors, continuity of endogenous regressors, and Gaussian dependence between regressors and errors, with examples and practical plausibility checks.
- Challenges & extensions: limits of the Gaussian copula; alternative copulas; methods that relax error-normality.

Practical Implementation (20 min, in R)

The hands-on session equips participants with the skills to implement copula-based methods using statistical software. The focus will be on the R programming language.

Participants will learn:

1. **Data preparation:** detect potential endogeneity; choose variables and transformations.
2. **Estimation:** estimate GCCF, generate correction terms, and integrate them into regressions; address boundary issues in the probability integral transform and summarize recent fixes.
3. **Interpretation:** read copula-corrected outputs for actionable implications; emphasize the often-ignored estimate of correlation between endogenous regressors and errors.
4. **Troubleshooting & tests of assumptions:** handle non-convergence and violations; provide pragmatic diagnostic guidelines for verifying identifying assumptions (often underemphasized in the literature).

[5 min break]

Revisiting the assumptions in a DAG; introducing new method (10 min)

The second technical session will map GCCF assumptions to an implied data-generating process (DGP) and corresponding causal diagrams (DAGs). Participants learn to argue whether their context matches this DGP. Participants will uncover themselves, when the copula fails in classic omitted variable settings. We then discuss what could be done to remedy that.

A New Method (10 min)

We present an instrument-free estimator targeted precisely to the omitted variable DGP. The approach recasts omitted-variable bias as a blind source separation problem and uses Independent Component Analysis (ICA) to extract the latent normal confounder shared by the endogenous regressor and the outcome. Under minimal and interpretable conditions, comparable to the three original GCCF assumption—normality of the structural error and confounder, and non-normal exogenous variation in the regressor—ICA recovers a control function that absorbs the endogeneity, yielding consistent estimates without external instruments. We provide identification proof, an algorithmic recipe, diagnostics for the assumptions, and open-source code to the participants.

Case Studies (10 min)

This part covers real-world applications of instrument-free (copula- or ICA-based) methods in a marketing model (where the method originates from). Participants will analyze case studies that demonstrate the versatility and effectiveness of these methods in addressing endogeneity. We will also pay special attention to scenarios in which the respective approach does not work to highlight limitations.

Write-up and Discussion and Outlook (10 min)

Building on the foundational and practical sessions, this segment showcases how to present and argue for an instrument-free approach in a manuscript, and conversely what to look out for and demand when reading or reviewing one. We will further provide an outlook into further topics and ongoing methodological developments. Topics may include: Recent methods that relax or address the Gaussian dependence assumption; Extensions that allow for the inclusion of binary or categorical endogenous regressors; Techniques for handling nonlinear dependencies and interaction terms, essential for complex marketing models.

This segment will encourage participants to think critically about the economic and statistical assumptions underlying their models, ensuring that their applications of instrument-free methods are both rigorous and contextually appropriate. Participants will leave with actionable plans and a network of peers to support their future work.

[5 min buffer, Q&A]