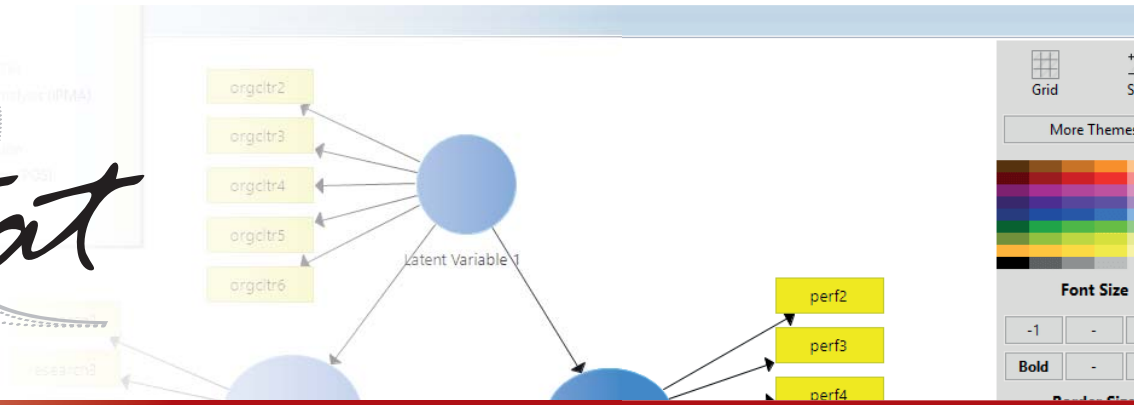


# TStat



WORKSHOP

## STRUCTURAL CAUSAL MODELLING IN STATA WITH CROSS-SECTION AND TIMES-SERIES DATA

Berlin, 19-21 September 2018

Causal modelling is increasingly being used in both the social and biomedical sciences to model the presence, sign, and direction of influence for the relations of all pairs of variables in a dataset. Typically, causal models are based on structural equations, which are analyzed using regression analysis techniques. The estimated relationships are then, as will be illustrated during the course of the workshop, often mapped in diagrams or flow graphs.

The objective of this workshop is to provide participants with the essential toolset, both applied and theoretical, for the correct implementation of structural equation models (SEM) for statistical causal modelling in Stata. Structural equation models are estimated on both cross-section and time series datasets. The former enabling researchers to undertake both confirmatory factor analysis and causal path analysis. The latter allowing researchers to construct scenario-building and policy simulation and evaluations over time. Although these two methodologies are often treated separately in standard courses, as will become evident, they are in fact intricately linked. During the course of the workshop, participants will also be exposed to the visual intuitive graphical representations of causal links.

At the end of the workshop, participants will be able to autonomously undertake articulated causal designs studies to identify, estimate and test for both direct and indirect causal effects in the presence of unobservable endogeneity, selection bias, measurement error and simultaneity, by implementing either a single-equation causal link (as in an instrumental-variables (IV) setting), or the multi-equation system (SEM) approach. Moreover, participants will take advantage of the availability of time-series data to perform scenario-building and policy evaluation via simulation analysis.

In common with TStat's workshop philosophy, participants will obtain extensive hands-on experience of the issues under consideration, working on example datasets from both social and biomedical sciences under the careful guidance of the course tutor. Although the course is to be considered primary of an applied nature, technical treatment of the analysis in hand, will however, be provided into order to allow participants to properly address real world applications.

### WORKSHOP CODE

D-EF22

### DATE AND LOCATION

Berlin, 19-21 September 2018

### COURSE REQUISITES

Basic knowledge of the statistical software Stata.

Knowledge of the following basic statistical concepts: regression model and related properties; point and interval estimation; maximum likelihood estimation.

### TARGET AUDIENCE

This workshop is of particular interest to biostatisticians, epidemiologists, applied statisticians and researchers or professionals working in the economics, the social sciences or public health.

# STRUCTURAL CAUSAL MODELLING IN STATA WITH CROSS-SECTION AND TIMES-SERIES DATA

## PROGRAM

### SESSION I: AN INTRODUCTION TO STATISTICAL CAUSAL MODELLING

1. Causality in the social and bio-medical sciences: an overview
2. Marginal, joint and conditional probability
3. The central role of the conditional expectation
4. Data generating process (DGP): exogeneity vs endogeneity
5. Structural, quasi-structural, and reduced-form models
6. Structural system analysis and its main objects
7. Structural modelling with cross-section data time-series: Stata *sem* and forecast packages

### SESSION II: AN INTRODUCTION TO THE STRUCTURAL EQUATION MODELLING (SEM) LANGUAGE IN STATA

1. What is SEM?
2. Variable definition within SEM
3. Statistical models using SEM
4. The *sem* and *gsem* Stata commands
5. The *sem* syntax
6. Path syntax using *sem*
7. The *model\_description\_options*
8. The option *method()* and *vce()*
9. The option *covstructure* for defining the structure of the variance/covariance matrix
10. The mathematical notation of SEM
11. Assumptions under SEM estimation
12. The Stata SEM *Builder*

### SESSION III: USING SEM FOR CONFIRMATORY FACTOR ANALYSIS (CFA)

1. What is CFA?
2. CFA protocol - an illustrative example
3. Model specification
4. Graphical representation of a CFA model
5. Model identification
6. Model estimation
7. Model assessment
8. Model modification
9. Practical examples using *sem* for CFA in Stata

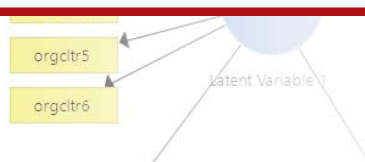
### SESSION IV: USING SEM FOR CAUSAL PATH-ANALYSIS

1. Structural equation modelling for path models
2. Path-model terminology and notation
3. Exogenous predictor, endogenous outcome, and endogenous mediator variables
4. Mediation and moderation
5. Identification and estimation of direct, indirect, and total effects
6. Recursive and non-recursive models
7. Estimation of a full structural equation model
8. Tests for SEM reliability and goodness-of-fit
9. Revisiting Instrumental-variables (IV) estimation within causal path-analysis
10. IV identification conditions
11. Instrument validity and relevance
12. IV estimation via two-stage least squares (2SLS) using *ivregress*

### SESSION V: SEM PATH-ANALYSIS APPLICATIONS USING STATA

1. A further look at the implementation of Stata's SEM packages *sem* and *gsem*
2. The Stata SEM Builder
3. Using the SEM Builder: a series of illustrative examples
4. Fitting, modifying and constraining a SEM with *sem* and *gsem*
5. Interpreting the results
6. Practical examples using

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# STRUCTURAL CAUSAL MODELLING IN STATA WITH CROSS-SECTION AND TIMES-SERIES DATA

## SESSION VI: SEM PATH-ANALYSIS APPLICATIONS USING STATA

1. Structural modelling with times-series and panel data: an overview
2. Building time-series structural models in Stata using the forecast package
3. Model specification and identification
4. Model estimation: three-stage least squares (3SLS) with the reg3 command
5. Model validation: static and dynamic forecasts
6. Practical examples in Stata using real datasets

## SESSION VII: STRUCTURAL POLICY EVALUATION

1. Policy simulation and evaluation via scenario-building using forecast adjust
2. Dynamic response to exogenous and endogenous shocks
3. Simulation-based confidence intervals for scenario-building
4. Practical examples in Stata using real datasets

## USEFUL TEXTS

Discovering Structural Equation Modeling Using Stata, Revised Edition, Acock A.C., (2013) Stata Press

Microeconometrics: Methods and Applications. Chapter 25. Cameron, A.C., & Trivedi P.K., (2005) Cambridge University Press.

Econometric Evaluation of Socio-Economic Programs: Theory and Applications, Cerulli, G. (2015) Springer.

Econometric Analysis of cross section and panel data. Chapter 21. Wooldridge, J.M., (2010) Cambridge: MIT Press.

## CONTACTS

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[www.tstat.eu](http://www.tstat.eu)

## REGISTRATION FEES

Students\*: € 735.00

Academic: € 1225.00

Non-Profit/Public Research Centres: € 1513.00

Commercial: € 1800.00

\*To be eligible for student prices, participants must provide proof of their full-time student status for the current academic year.

Fees are subject to VAT (applied at the current Italian rate of 22%). Under current EU fiscal regulations, VAT will not however applied to companies, Institutions or Universities providing a valid tax registration number.

Please note that a *non-refundable deposit* of €100.00 for students and €200.00 for Academic, Non-Profit/Public Research Centres and Commercial participants, is required to secure a place and is payable upon registration. The number of participants is limited to 15. Places will be allocated on a first come, first serve basis.

Course fees cover: teaching materials (handouts, Stata *do files* and datasets to used during the course), a temporary licence of Stata valid for 30 days from the beginning of the workshop, light lunch and coffee breaks.

To maximize the usefulness of this workshop, we strongly recommend that participants bring their own laptops with them, to enable them to actively participate in the empirical sessions.

## REGISTRATION DEADLINE

Individuals interested in attending this workshop must return their completed registration forms either by email ([training@tstat.eu](mailto:training@tstat.eu)) or by fax (+39 0864 206014) to TStat by the 30th of August 2018.

Further details regarding our registration procedures, including our commercial terms and conditions, can be found at [https://www.tstattraining.eu/training/structural\\_causal-modelling-stata\\_cross\\_section\\_times\\_series\\_data/](https://www.tstattraining.eu/training/structural_causal-modelling-stata_cross_section_times_series_data/)

