

University of Groningen

## Controlling omitted variables and measurement errors by means of constrained autoregression and structural equation modeling

Suparman, Yusep

**IMPORTANT NOTE:** You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*

2015

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Suparman, Y. (2015). *Controlling omitted variables and measurement errors by means of constrained autoregression and structural equation modeling: Theory, simulations and application to measuring household preference for in-house piped water in Indonesia*. [Thesis fully internal (DIV), University of Groningen]. University of Groningen.

### Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

### Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

*Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.*

# **CONTROLLING OMITTED VARIABLES AND MEASUREMENT ERRORS BY MEANS OF CONSTRAINED AUTOREGRESSION AND STRUCTURAL EQUATION MODELING**

**Theory, Simulations and Application to  
Measuring Household Preferences for  
In-House Piped Water in Indonesia**

**YUSEP SUPARMAN**

© Y. Suparman 2015  
All right reserved.

ISBN: 978-90-367-7994-4



university of  
 groningen

# **Controlling omitted variables and measurement errors by means of constrained autoregression and structural equation modeling**

Theory, simulations and application to measuring household preferences for in-house piped water in Indonesia

## **PhD Thesis**

to obtain the degree of PhD at the  
 University of Groningen  
 on the authority of the  
 Rector Magnificus Prof. E. Sterken  
 and in accordance with  
 the decision by the College of Deans.

This thesis will be defended in public on  
 Thursday 24 September 2015 at 12.45 hours

by

**Yusep Suparman**

born on 21 May 1974  
 in Soreang, Indonesia

**Supervisors**

Prof. J. van Dijk

Prof. H. Folmer

**Assessment committee**

Prof. A. J. van der Vlist

Prof. E. Figueroa

Prof. B. Nurani Ruchjana

## **Dedication**

*To my parents: I'ah Karyati and Ato Sutisna*



# Contents

LIST OF TABLE	IV
ACKNOWLEDGEMENT	V
ABSTRACT	VII
BEKNOPTE SAMENVATTING	IX
CHAPTER 1 PROBLEM STATEMENT	1
1. Introduction	1
2. Measuring preference for in-house piped water	5
3. Objectives	9
4. Outline of the thesis	11
References	13
CHAPTER 2 HEDONIC PRICE MODELS WITH OMITTED VARIABLES AND MEASUREMENT ERRORS: A CONSTRAINED AUTOREGRESSION - STRUCTURAL EQUATION MODELING APPROACH WITH APPLICATION TO URBAN INDONESIA	17
Abstract	17
1. Introduction	18
2. The Constrained Autoregression-Structural Equation Model (ASEM)	21
2.1. Constrained autoregression	21
2.2. SEM	24
3. An ASEM Housing HP for Urban Indonesia	29
3.1. Conceptual Model	29
3.2. Data	31
3.3. ASEM specification	33
3.4. Empirical results	37
4. Conclusions	43
References	44
Appendix 2.1 Model Specifications	49
Appendix 2.2 Time-invariant coefficients models	52
CHAPTER 3 CONTROLLING FOR TIME-VARYING OMITTED VARIABLES IN PANEL DATA MODELS: EVIDENCE FROM A MONTE-CARLO SIMULATION	53
Abstract	53
1. Introduction	53



2. A synopsis of methods to control for time-varying omitted variables in panel data models	56
3. Simulation design	61
4. Results	66
5. Conclusion	70
References	72
Appendix 3.1 Simulation Syntax (Bias Evaluation)	74
CHAPTER 4 CONTROLLING FOR OMITTED VARIABLES BY MEANS OF CONSTRAINED AUTOREGRESSION: TESTING THE CONSTRAINTS	91
Abstract	91
1. Introduction	91
2. Constrained Autoregression (CAR)	92
3. Simulation design	93
3. Results	96
4. Conclusion	98
References	98
Appendix 4.1 Simulation Syntax Testing the Constraint	99
CHAPTER 5 THE WILLINGNESS TO PAY FOR IN-HOUSE PIPED WATER IN URBAN AND RURAL INDONESIA	109
Abstract	109
1. Introduction	109
2. The conceptual hedonic price model	112
3. ASEM	116
4. Data and Empirical Results	127
4.1. Data	127
4.2. Empirical Results	130
5. Conclusion	138
References	140
CHAPTER 6 CONCLUSIONS, POLICY RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH	145
1. Summary and conclusions	145
2. Recommendations	147
3. Suggestions for further research	150
References	150
SAMENVATTING	153
STELINGEN BEHORENDE BIJ HET PROEFSCRIPT	159

