

STAT 6108 Official Statistics and Structural Equation Modeling
Second Term, 2019-2020
Department of Statistics
The Chinese University of Hong Kong

Instructors:

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Lecture:

Time: Wednesday 6:30pm – 9:30pm
Venue: Wu Ho Man Yuen Bldg. 408

Course Objectives and Learning Goals:

To understand the basic principles, concepts and methodologies of official statistics and structural equation modeling. The course is divided into two parts:

Part 1: “Official Statistics”. In this part an introduction will be given to the major series of Hong Kong data such as population statistics, Gross Domestic Product (GDP), Consumer Price Index (CPI), labour statistics (including the labour force, employment and unemployment), trade statistics and production statistics (goods and services). Apart from basic concepts and methods of compilation of the data series, also covered will be how the data can be obtained by users and how they may be analysed and applied in business and administration.

Part 2: “Structural Equation Modeling”. Structural equation modeling (SEM) is a multivariate statistical method and it has become increasingly popular in the past few decades across different disciplines such as business, education, and social science. In this part, the basic ideas and methods of SEM will be covered. Different models will be considered to illustrate how the method can be applied to analyze data in business and social research. The package lavaan (Rosseel, 2012) in [R system for statistical computing](#) (R Development Core Team, 2017) will be introduced for analyzing the data.

Learning Outcomes:

Upon completion of the course, students should be able to:

1. in respect of Part 1: “Official Statistics”,

a. understand the basic concepts and methods of compilation of the major series of Hong Kong data such as population statistics, Gross Domestic Product (GDP), Consumer Price Index (CPI), labour statistics (including the unemployment rate), trade statistics and production statistics (goods and services);

b. understand how the data can be obtained by users and how they may be analyzed and applied in business and administration.

2. in respect of Part 2: “Structural Equation Modeling”,

a. understand the basic ideas and methods of structural equation modeling (SEM);

b. learn how to set up different types of SEM models and how they can be applied to analyze data in business and social research;

c. acquire practical knowledge of using common computer software programmes for conducting SEM analysis, such as lavaan in R.

Suggested Readings:

Part 1:

[C&SD(1)] CENSUS & STATISTICS DEPARTMENT (2018). Hong Kong Annual Digest of Statistics, 2018.

[C&SD(2)] CENSUS & STATISTICS DEPARTMENT (11/2018). Hong Kong Monthly Digest of Statistics, November, 2018.

[C&SD(3)] CENSUS & STATISTICS DEPARTMENT (04/2017). 2015 Household Expenditure Survey and the Rebasing of the Consumer Price indices.

[C&SD(4)] CENSUS & STATISTICS DEPARTMENT (02/2018). Gross Domestic Product, 2017.

Note- These publications can be downloaded from the Website of the Census and Statistics Department free of charge [<http://www.censtatd.gov.hk>]. In fact, the whole website contains a wealth of information on both methodology and current and historical data.

Part 2:

[AB] Beaujean, A. A. (2014). *Latent variable modeling using R: A step-by-step guide*. New York, NY: Routledge.

- [DDS] Duncan, T. E., Duncan, S. C., & Strycker, L. A. (2006). *An introduction to latent variable growth curve modeling: Concepts, issues, and applications (2nd ed.)*. Mahwah, NJ: LEA.
- [JH] Healey, J. F. (2013). *The essentials of statistics: A tool for social research (3rd ed.)*. Belmont, CA: Wadsworth Cengage Learning.
- [GH] Heiman, G. W. (2014). *Basic statistics for the behavioral sciences (7th ed.)*. Belmont, CA: Wadsworth Cengage Learning.
- [GM] Maruyama, G. M. (1997). *Basics of structural equation modeling*. Thousand Oaks, CA: Sage.
- [R] R Core Team (2017). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
- [TF] Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics (6th ed.)*. Boston: Pearson Education.
- [YR1] Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, 48(2), 1-36. doi: [10.18637/jss.v048.i02](https://doi.org/10.18637/jss.v048.i02)
- [YR2] Rosseel, Y. (2017). The lavaan tutorial. <http://lavaan.ugent.be/tutorial/>

Course Homepage:

Course material including lecture notes, tutorial handouts, and homework assignments can be downloaded from our course website at [CUHK Blackboard System](#).

Assessment and Grading:

1. Assignments 50%

Part 1 - 20% for Assignments 1 and 2

Part 2 - 30% for Assignments 3, 4, and 5

Approximate Schedule:

- Assignment 1 (Week 2)
- Assignment 2 (Week 4)
- Assignment 3 (Week 9)
- Assignment 4 (Week 11)
- Assignment 5 (Week 13)

Late submission - Students should hand in their homework on or before the deadline specified for each assignment. Scripts submitted after the deadline may be subject to a scores deduction.

2. Examination 50%

Option 1. If face-to-face teaching is resumed before the examination:

We will have an open-book exam and you can bring along your lecture notes, textbooks, homework assignments and references. The exam consists of two parts: Part 1: Official Statistics (20%) and Part 2: SEM (30%). You need a scientific calculator to answer some of the questions. All students are required to attend the exam. Arrangements for makeup will only be considered under special circumstances, e.g., absence due to medical reasons with an official medical certificate.

Option 2. If face-to-face teaching cannot be resumed by April 29:

We will have a take-home examination instead, which will also consist of two parts: Part 1: Official Statistics (20%) and Part 2: SEM (30%). Details will be announced in due course.

3. Grade Descriptors

Grade A: Have a thorough understanding of the basic concepts and methods of compilation of the major series of Hong Kong data. Have a thorough understanding of how the data can be obtained by users and how they may be analyzed and applied in business and administration. Have a thorough understanding of the basic ideas and methods of structural equation modeling. Demonstrate the excellent ability to set up different types of SEM models for applications. Have a thorough understanding of practical knowledge of using common computer software programmes for conducting SEM analysis.

Grade B: Have a satisfactory understanding of the basic concepts and methods of compilation of the major series of Hong Kong data. Have a satisfactory understanding of how the data can be obtained by users and how they may be analyzed and applied in business and administration. Have a satisfactory understanding of the basic ideas and methods of structural equation modeling. Demonstrate the elaborate ability to set up different types of SEM models for applications. Have a satisfactory understanding of practical knowledge of using common computer software programmes for conducting SEM analysis.

Grade C: Have a fair understanding of the basic concepts and methods of compilation of the major series of Hong Kong data. Have a fair understanding of how the data can be obtained by users and how they may be analyzed and applied in business and administration. Have a fair understanding of the basic ideas and methods of structural equation modeling. Demonstrate the acceptable ability to set up different types of SEM models for applications. Have a fair understanding of practical knowledge of using common computer software programmes for conducting SEM analysis.

Grade D: Have a brief understanding of the basic concepts and methods of compilation of the major series of Hong Kong data. Have a brief understanding of how the data can be obtained by users and how they may be analyzed and applied in business and administration. Have a brief understanding of the basic ideas and methods of structural equation modeling. Barely show the ability to set up different types of SEM models for applications. Have a brief understanding of practical knowledge of using common computer software programmes for conducting SEM analysis.

Grade F: Fail to understand the basic concepts and methods of compilation of the major series of Hong Kong data. Fail to understand how the data can be obtained by users and how

they may be analyzed and applied in business and administration. Fail to understand the basic ideas and methods of structural equation modeling. Fail to set up different types of SEM models for applications. Fail to understand practical knowledge of using common computer software programmes for conducting SEM analysis.

Class Schedule:

Date (Week)	Lecture	Readings
Part 1		
Jan 8 (1)	General Introduction to Official Statistics	[C&SD (1)] and [C&SD(2)]
Jan 15 (2)	Social Statistics (population, employment and unemployment, health, welfare etc.)	[C&SD (1)] and [C&SD(2)]
Jan 22 (3)	Economic Statistics I (GDP and CPI)	[C&SD (3)] and [C&SD(4)]
Jan 29	<i>Lunar New Year Vacation</i>	
Feb 19 (4)	Economic Statistics II (trade, industry, services etc.)	[C&SD (1)] and [C&SD(2)]
Feb 26 (5)	Analysis and application of official statistics	[C&SD (1)] and [C&SD(2)]
Part 2		
Mar 4 (6)	Correlations and Measures of Association (Review)	[GH] Ch. 2, 7 [JH] Ch. 11, 12
Mar 11 (7)	Exploratory Factor Analysis	[TF] Ch. 13
Mar 18 (8)	Confirmatory Factor Analysis 1	[AB] Ch. 1 [YR1]
Mar 25 (9)	Confirmatory Factor Analysis 2	[AB] Appendix A [GM] Ch. 10
Apr 1 (10)	Structural Equation Modeling 1: Path Analysis	[AB] Ch. 2
Apr 8 (11)	Structural Equation Modeling 2: General Structural Models	[AB] Ch. 3
Apr 15 (12)	Structural Equation Modeling 3: Multisample Analysis	[AB] Ch. 4
Apr 22 (13)	Structural Equation Modeling 4: Mean and Covariance Structure Analysis	[YR2]
Apr 29 (14)	Structural Equation Modeling 5: Latent Growth Curve Models	[AB] Ch. 5 [DDS] Ch. 2
May 6 (15)	<i>Course Examination (Option 1 or Option 2)</i>	

Academic Honesty and Plagiarism:

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at <http://www.cuhk.edu.hk/policy/academichonesty/>.

With each assignment, students will be required to submit a signed [declaration](#) that they are aware of these policies, regulations, guidelines and procedures.

- In the case of group projects, all students of the same group should be asked to sign the declaration, each of whom is responsible and liable to disciplinary actions should there be any plagiarized contents in the group project, irrespective of whether he/she has signed the declaration and whether he/she has contributed directly or indirectly to the plagiarized contents.
- For assignments in the form of a computer-generated document that is principally text-based and submitted via VeriGuide, the statement, in the form of a receipt, will be issued by the system upon students' uploading of the soft copy of the assignment.

Assignments without the properly signed declaration will not be graded by teachers.

Only the final version of the assignment should be submitted via VeriGuide.

The submission of a piece of work, or a part of a piece of work, for more than one purpose (e.g. to satisfy the requirements in two different courses) without declaration to this effect shall be regarded as having committed undeclared multiple submission. It is common and acceptable to reuse a turn of phrase or a sentence or two from one's own work; but wholesale reuse is problematic. In any case, agreement from the course teacher(s) concerned should be obtained prior to the submission of the piece of work.

PLEASE SIGN AND RETURN:

I am submitting the assignment for:

- ☐ an individual project or
- ☐ a group project on behalf of all members of the group. It is hereby confirmed that the submission is authorized by all members of the group, and all members of the group are required to sign this declaration.

I/We declare that: (i) the assignment here submitted is original except for source material explicitly acknowledged; (ii) the piece of work, or a part of the piece of work has not been submitted for more than one purpose (e.g. to satisfy the requirements in two different courses) without declaration; and (iii) the submitted soft copy with details listed in the <Submission Details> is identical to the hard copy(ies), if any, which has(have) been / is(are) going to be submitted.

I/We also acknowledge that I am/we are aware of University policy and regulations on honesty in academic work, and of the disciplinary guidelines and procedures applicable to breaches of such policy and regulations, as contained in the University website <http://www.cuhk.edu.hk/policy/academichonesty/>.

In the case of a group project, we are aware that each student is responsible and liable to disciplinary actions should there be any plagiarized contents/undeclared multiple submission in the group project, irrespective of whether he/she has signed the declaration and whether he/she has contributed directly or indirectly to the problematic contents.

It is also understood that assignments without a properly signed declaration by the student concerned and in the case of a group project, by all members of the group concerned, will not be graded by the teacher(s).

Signature(s)

Date

Name(s)

Student ID(s)

STAT 6108
Course code

Official Statistics and Structural
Equation Modeling
Course title