

QUANTITATIVES TOOLS - level 1

*Students who already master the following program, given they have covered similar content during higher education previously, should register for **Quantitative Tools Level 2** (see program).*

OBJECTIVES AND CONTENTS

The teaching **QUANTITATIVE TOOLS – level 1 of political, economic and social sciences**, focuses on instruments of quantitative analysis in the context of the problems these tools allow to analyze and solve.

The objective of this module is to provide the essential basics of applied arithmetic, financial calculus, descriptive statistics, and basics for inductive statistics.

This teaching focuses on facilitating the understanding of the technical tools of reading, analyzing and decision-making and, to some extent, their mastery in a concrete setting. **The idea is to accompany the student in his understanding of the main quantified problems**, encountered in political science, economics, demography, international trade, finance and more generally to support the major axes of the master's degree, , in particular all the aspects concerning quantitative analysis of international relations.

The teaching is highly progressive starting from a minimum set of basis corresponding to the technical content of secondary school literary programs or more generally the end of high school.

Teaching « Quantitative Tools - level 1 » is followed by « Quantitative Tools - level 2 ». This is not a deeper level 1, but a wider scope of knowledge. « Quantitative Tools - level 2 » requires knowledge of « Quantitative Tools - level 1 » and approaches the instruments in other settings.

Incidentally, this module allows to specify some technical tools of Excel.

Teaching Languages : French or English

TEACHING

Courses-seminars « Quantitative Tools - level 1 » and « Quantitative Tools - level 2 » are taught in English or French and are coordinated by Didier Schlachter, engineer and economist, Professor at Sciences - Po and Maître de Conférence at ENA. - (d.schlachter@wanadoo.fr)

TEACHING METHODS

The form adopted for this teaching is « course – seminar » featuring one part with lectures on the basic principles and theories and some practical tutorials. The limited number of students should guarantee a high level of student-teacher interactivity. We strongly insist on the practical aspects of the discipline.

SELECTED BIBLIOGRAPHY**Basic books:****In english :**

- Timothy C. URBAN, Statistics in plain english, 3^e ed, Routledge edition, 2010 (book noted **C**)
- G. KELLER, B. WARRACK, Statistics for management and economics, Thomson, Brooks/Cole, Pacific Grove, 2003.
- F. K. REILLY, K.C. BROWN, Investment analysis and Portfolio Management, Thomson South Western, 2006

In French

- D. SCHLACTHER, Comprendre les mathématiques financières, Hachette, coll. Les Fondamentaux, 4^e ed. 2012 (book noted **A** in the programme)
- D. SCHLACTHER, De l'analyse à la prévision, Hachette, coll. Les Fondamentaux, 5^e ed. 2009 (book noted **B** in the programme) - 3 volumes
 - Tome I : Comprendre la Statistique descriptive statique (book noted **B1**)
 - Tome II : Comprendre la Statistique descriptive temporelle (book noted **B2**)
 - Tome III : Comprendre la Statistique inductive, ajustements, lois (book noted **B3**)

Complementary readings

- G. FERREOL, D. SCHLACTHER, Dictionnaire des Techniques Quantitatives appliquées aux sciences économiques et sociales, A. Colin, coll. U, 1995
- P. BONNEAU, Mathématiques Financières, Dunod, 1986
- D. SCHLACTHER, Calcul financier, Hachette, coll. PES, 1989
- D. SCHLACTHER, Comprendre la formulation mathématique en économie, Hachette, Coll. Les Fondamentaux, 4° ed. 2004

TOOLS

Using a financial and statistical calculator with one and two variables is essential. The Casio FC100 model is relatively easy to use.

The use of a computer and an Excel spreadsheet will be developed in the tutorials.

ASSESSMENT

The module is validated by continuous assessment -2 in-conference assessments of one hour each - and a final 3 hour assessment, common to all groups in French and English, including several different exercises. The final assessment may include the use of a simple Excel spreadsheet.

Continuous assessment accounts for 2/3 and the *final exam* for 1/3 of the final mark..

For final exam all calculators allowed ; computers with autonomous power supply allowed.

DETAILED PROGRAMME

I – ONE CHARACTER DESCRIPTIVE STATISTICS

The emphasis will be put on the understanding, the analysis and the interpretation of statistical data.

1 / Measurement of relative variations (bibl: B2, ch. 2 and 4)

- Growth
- Degrowth
- Percentages
- Variations in percentage points
- Average growth rate
- Comparison of growth

Applications: elasticity, penetration rates, degree of openness, inflation, exchange rates, VAT within and outside, scale of income tax with progressive marginal rate, tax at a fixed rate with fixed allowance

2 / Charts and Graphs (bibl: B1, ch. 1, 2, 3, 4) – (bibl : C chap 1)

- Histogram
- Cumulative frequency polygon
- The graphics and the classical "traps"
- The spinning tops

Applications: statistical distributions, age structure, ...

3 / Core Values (bibl: B1, ch. 5)) – (bibl : C chap 2)

- Mode
- Median
- Arithmetical, geometrical and harmonical means
- structural effects
- The common pitfalls of means

Applications: analysis of statistical series

4 / Values of dispersion and concentration (bibl: B1, ch. 6)) – (bibl : C chap 3)

- Inter-quantiles
- Standard deviation
- Middle-medial deviation
- Lorenz curve - Gini index

Applications: Measuring inequality, dualism analysis, analysis of wage distributions, income distribution, exchange rate volatility, ...

5 / Synthetic Index (**bibl: B2, ch. 1 and 3**)

- Properties index
- Paasche index
- Laspeyres Index
- "Soft" indicators: HDI

Applications: value / volume, terms of trade, purchasing power of exports, common currency / constant currency, nominal / real...

II - TWO CHARACTERS DESCRIPTIVE STATISTICS

The analysis of possible links between economic variables and in particular the explanatory scope of these links. The analysis will be limited to linear problems, without change of variable.

1 / Linear adjustment (**bibl: B3, ch. 1**) – (**bibl : C chap 13**)

- Method of least squares (OLS)

2 / Correlation. (**bibl: B3, ch. 2**) – (**bibl : C chap 8**)

- Sensitive approach and interpretation of results
- Total variance
- Explained variance
- Residual variance
- The difficulties of analyzing a correlation coefficient.

III - FINANCIAL CALCULUS

This part of the program concerns financial or deterministic mathematics and considers time as being discrete and not continuous.

Financial techniques include a basic approach to investment choices.

The emphasis in this section will be on applications.

1 / Simple interest (**bibl: A, ch. 2**)

- Principles
- Interest checked off - effective rates of investment
- Discount, discount shopping, rational discount.
- Equivalent effects of simple interests.
- Search of a equivalence date.
- Replacement of several effects by a single effect
- Average maturity

2 / Compound Interest rates (**bibl: A, ch. 3**)

- Principles
- Equivalent Rates
- Proportional rates
- Search for effective rates
- Schedule discounting, loan repayments

Applications: Search of the duration, the deposit rate, the amount invested or the amount obtained knowing the other data of the problem.