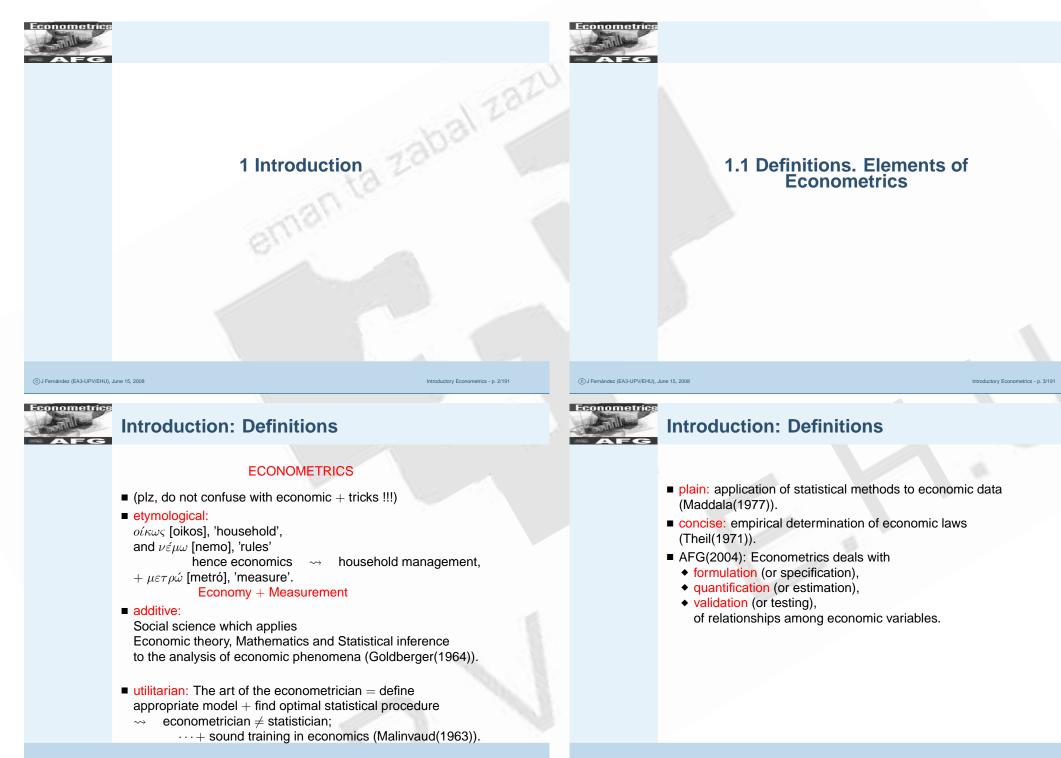
INTRODUCTORY ECONOMETRICS 3rd year LE & LADE LESSON 1

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AFG

Introduction: 3 Elements:

ECONOMIC TH:

in charge of

- ◆ (general:) analysis of the economy
- (specific:) relationships among economic variables

DATA:

to quantify is NOT one of the objectives of Economic Th

STATISTICS:

provides basic structure of data processing methods for:

(estimation:)

quantify relationships among variables in an appropriate way.

(testing:)

validate results in agreement with certain established standards.

1.2 Concept and example of model: From the economic model to the econometric model.

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Element 1: Economic Th: basic model

- Case: company manager or sales director,
 - Interest: to know relationship between their sales and their price.
- basic economic logic: sales as a function of price ~> basic economic model:

$$\underset{(-)}{\overset{V}{\underset{sales}{}}} = f(\underset{(-)}{\overset{p}{\underset{(-)}{}}})$$

 $f(\bullet)$ is a generic function (Ec Th : $f(\bullet) = \text{inverse fn} \quad \rightsquigarrow \quad \text{sales} \uparrow \text{ if price } \downarrow.$)



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Zazl

Element 1: Economic Th: additional vars

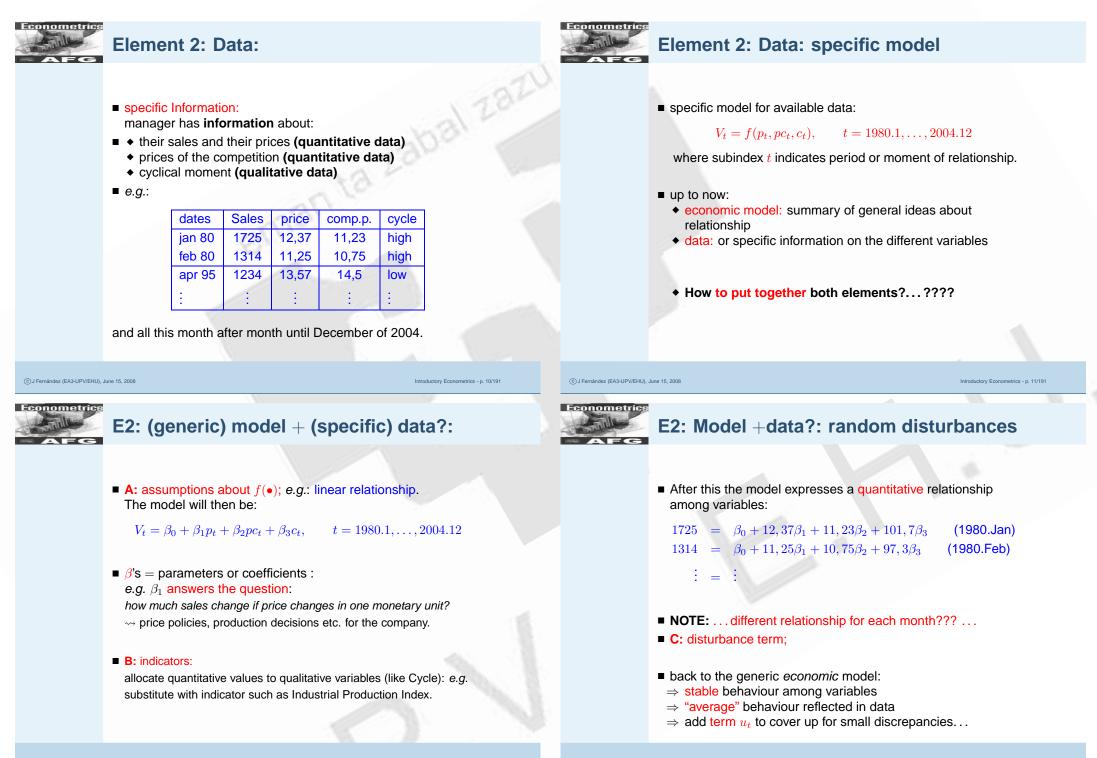
- additional economic logic: sales depend on
 - conditions of rival firms (e.g. competition price)
 - market conditions (e.g. economic cycle)
- complete Model:

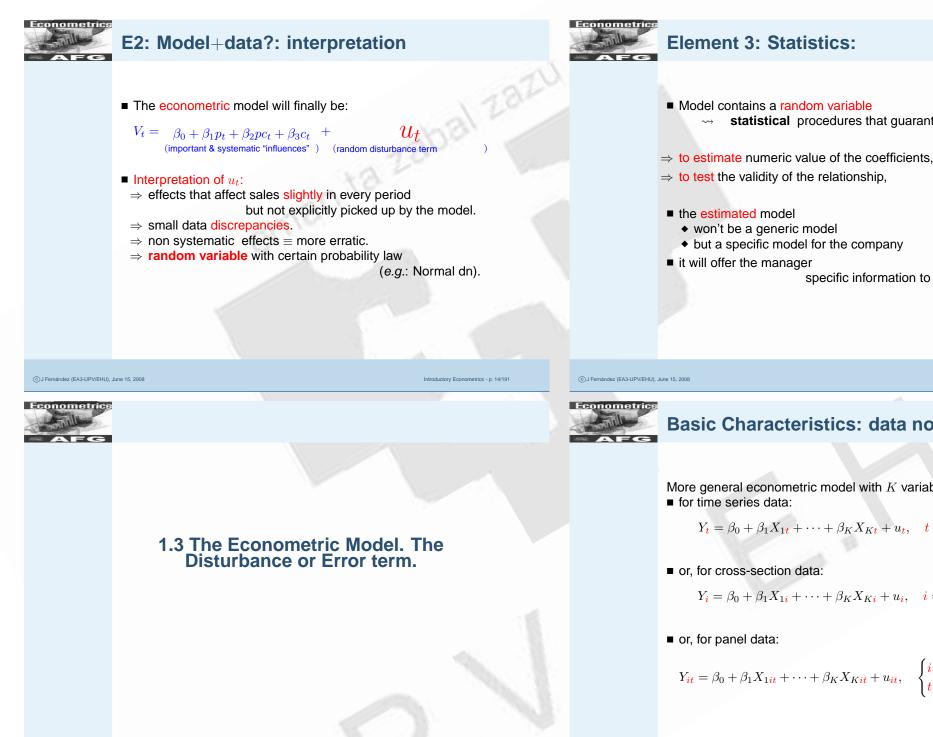


■ NOTE:

proposed economic model \equiv summary of ideas, but nothing new for manager; they need specific model for their company \rightarrow how their sales **respond** to **their** price.

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Basic Characteristics: data notation

statistical procedures that guarantee good results:

specific information to make decisions.

More general econometric model with K variables:

for time series data:

 $Y_t = \beta_0 + \beta_1 X_{1t} + \dots + \beta_K X_{Kt} + u_t, \quad t = 1, 2, \dots, T.$

or, for cross-section data:

$$Y_{\boldsymbol{i}} = \beta_0 + \beta_1 X_{1\boldsymbol{i}} + \dots + \beta_K X_{K\boldsymbol{i}} + u_{\boldsymbol{i}}, \quad \boldsymbol{i} = 1, 2, \dots, N.$$

■ or, for panel data:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \dots + \beta_K X_{Kit} + u_{it}, \quad \begin{cases} i = 1, 2, \dots, N \\ t = 1, 2, \dots, T \end{cases}$$

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Basic Characteristics: vars notation

- Y: the variable we want to explain: dependent v, explained v, endogenous v or regressand.
- X₁, X₂...X_K: variables that <u>explain</u> the variable Y: explanatory v, independent v, exogenous v or regressors.
- $\beta_k, (k = 1...K)$: <u>unknown constants</u> that determine relationship among variables: parameters or intercept & coefficients.
 - β_k is the <u>estimated</u> coefficient.
- u: variable that picks up other non-important effects present in data: random disturbance or error term.



Basic Differences with economic model

presence of a random disturbance that

picks up erratic behaviour:

$$Y_t = \underbrace{\beta_0 + \beta_1 X_{1t} + \dots + \beta_K X_{Kt}}_{\text{systematic part}} + \underbrace{u_t}_{\text{non-systematic or ran-dom part}} t = 1, 2 \dots T.$$

■ has zero mean:

$$E(Y_t) = E(\beta_0 + \beta_1 X_{1t} + \dots + \beta_K X_{Kt}) + \underbrace{E(u_t)}_{=0} \quad t = 1, 2 \dots T.$$

- hence systematic part \equiv average behaviour of Y.
- other assumptions on u (basic hypothesis, etc.)
- → probabilistic behaviour in different cases
- → statistical tools → Econometric Methods.

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Classification of econometric models



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Different approaches:

- Iooking at type of data:
 - Time series model.
 - Cross-section model.
- Iooking at period of observation:
 - static M.: Vars measured in same moment.
 - dynamic M.: Vars referred to different periods: e.g. $Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{1,t-1} + \beta_3 X_{2,t-1} + u_t$
- Iooking at number of relationships:
 - Single-equation models:
 - a single relationship or equation.
 - Simultaneous or Multiple-equation models:

more than one equation.

etc.

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1.4 Stages in the elaboration of the model. Uses of the model.



Stages in the elaboration of the model

- 0. Selection. Outline the theory of interest: ■ select the variable to explain: *Y*.
 - select the overall relationship: Y = f(X).
- 1. **Specification.** Outline econometric model coherent with theory:
 - choose the explanatory variables: $X_1 \dots X_K$.
 - choose the functional form: e.g. $f(\cdot) \equiv$ lineal.
 - choose the probabilistic behaviour (distribution) of the random disturbance: u, e.g. $u_t \sim \text{iid } \mathcal{N}(0, \sigma^2)$.

 $Y = \beta_0 + \beta_1 X_1 + \dots + \beta_K X_K + u.$



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Stages in the elaboration of the model

- 2. Estimation. Quantify unknown parameters according to the available information:
 - find data for variables:

 $Y_t, X_{1t}, ..., X_{Kt}$ for t = 1, ..., T.

• choose the appropriate statistical method, *e.g.* OLS:

 $Y_t = \widehat{\beta}_0 + \widehat{\beta}_1 X_{1t} + \dots + \widehat{\beta}_K X_{Kt} + \widehat{u}_t, \quad t = 1, 2 \dots T.$

- 3. **Validation.** Evaluate whether the model represents the initial problem correctly:
 - statistical inference on hypotheses.
 - model not adequate ~→ back to specification phase.

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Using the econometric model

The model that has gone thru all the previous stages can then be used for:

- economic analysis:
 - interpretation of coefficients,
 - hypothesis testing,
 - etc.
- prediction:
 - time series forecasting:
 - to forecast (predict) future values of Y.
 - in general:
 - to respond to questions of the type,

what would happen if ...?

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