

ECONOMICS II

MACROECONOMICS

BMEGT30A101, BMEGT30A103

Monday: 8.15–9.45 (QA240)

INTRODUCTION

– THE SCIENCE OF MACROECONOMICS –

CH 1

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Consulting hours: Monday 10–11, QA215



2019. 02. 04.

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2. INTRODUCTION
3. THE SCIENCE OF MACROECONOMICS
4. OUTLINE OF THE CLASS
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1. REQUIREMENTS



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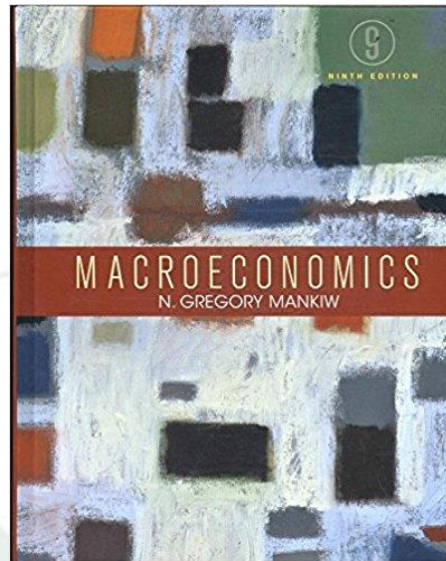
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TEXTBOOK

Mankiw, G. N. (2016): Macroeconomics (9th ed.)

Chapters: 1–5, 7–12, 14, 18, Epilogue



<https://www.studocu.com/en/document/universite-toulouse-i-capitole/economie/other/macroeconomics-9th-edition-2016-by-n-gregory-mankiw/2186126/view>



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Requirements, assessment

- Two midterm exams or
- Final exam

Percentage	Hungarian grade	ECTS equivalent	Explanation
86-100	5	A	Excellent
74-85	4	B	Good
62-73	3	C	Satisfactory
50-61	2	D	Pass
0-49	1	F	Fail

2. INTRUDUCTION



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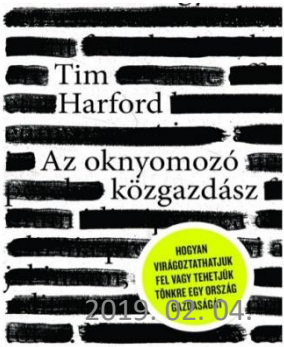
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John Maynard **Keynes** once argued that...

“**the master-economist** must possess a rare combination of gifts. ... He must be a mathematician, historian, statesman, philosopher—in some degree. He must understand symbols and speak in words. He must contemplate the particular in terms of the general, and touch abstract and concrete in the same flight of thought. He must study the present in the light of the past for the purposes of the future. No part of man’s nature or his institutions must lie entirely outside his regard.”



Undercover Economist Strikes Back: How to Run or Ruin an Economy

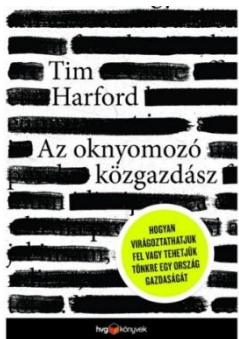


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- „We need to know more about how the economy works before we appeal to common sense!”
- „If economic policy was something we understood as well as we understand, say, building a bridge, there wouldn't be such arguments about it.”

Tim HARFORD (2012): The Undercover Economist Strikes Back: How to Run or Ruin an Economy



3. THE SCIENCE OF MACROECONOMICS



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MACROECONOMICS

Social (*imperfect*) science – Studies the forces that influence the economy as a whole

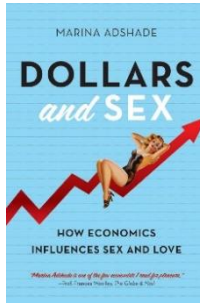
Why study? – The state of the economy affects everyone.

The GOAL:

- To show that people's everyday thinking in most cases is misleading.
- Attempt to formulate general theories to explain data → formulate economic policy

QUESTION: How can nations raise their standard of living?

Adam Smith (1776): An Inquiry into the Nature and Causes of the Wealth of Nations



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Positive and Normative science/statement

POSITIVE

What is...

„if...then”

What do we know?

(no values, descriptive)

NORMATIVE

What should be...

What do we want?

(subjective, prescriptive)



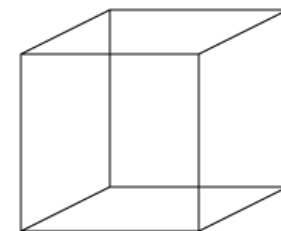
Economic rationality

https://www.youtube.com/watch?v=ODYE_KaLjA0

„The normative analysis is concerned with the nature of rationality and the logic of decision making.” (Kahneman–Tversky, 1983)

What you should study in MACRO?

- A way of thinking
- Terminology
- Theories
- Data analysis



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DATA OF MACROECONOMICS

Real GDP (RGDP, Y), inflation rate (CPI, π),
unemployment (U), ...

Stylized facts:

- How these variables are changing overtime

Theories:

- How these variables are determined
- How they interact with one another

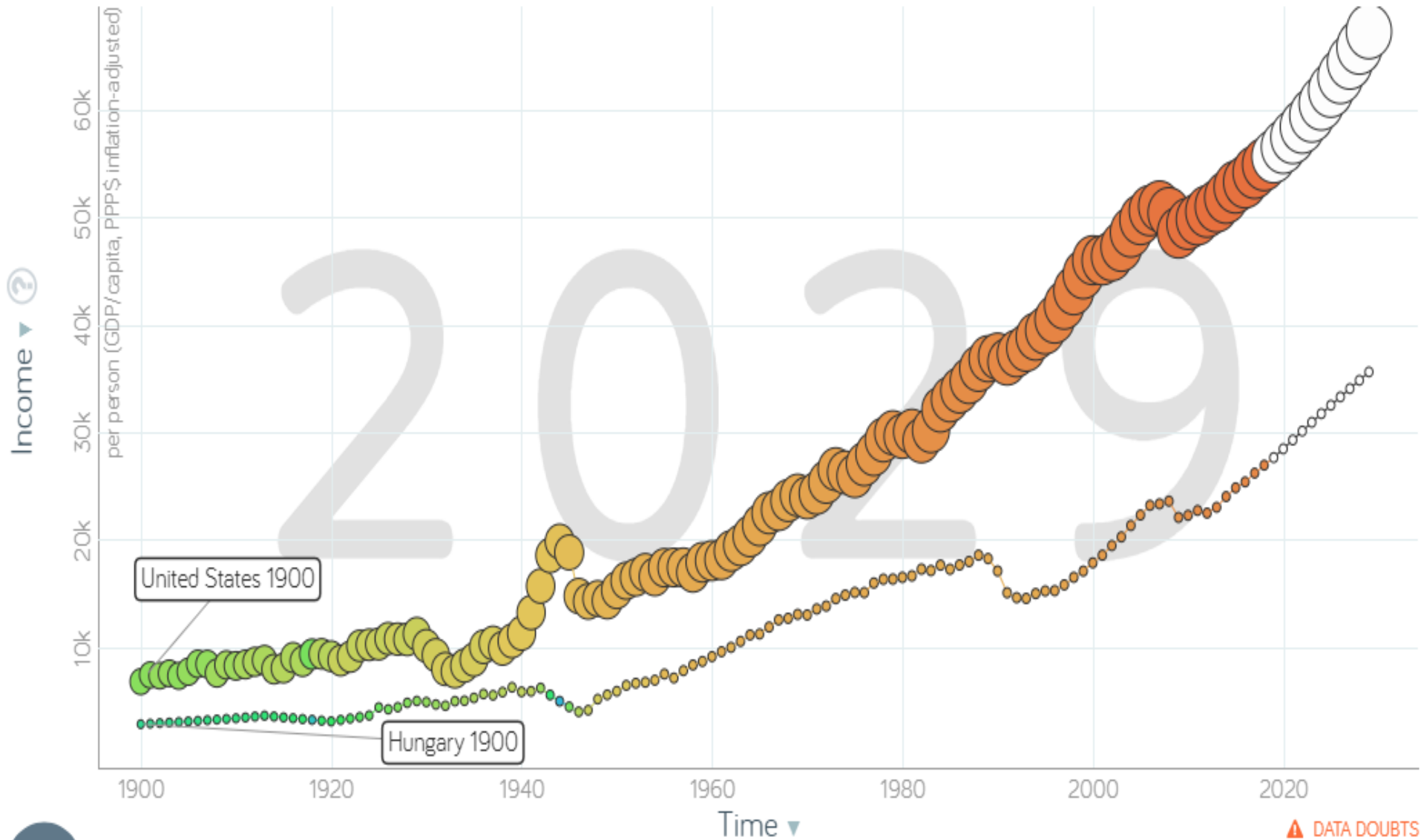


PWT, Gapminder



- The Gapminder (<https://www.gapminder.org/>)
- PWT 9.0 (Penn World Table)
(<https://www.rug.nl/ggdc/productivity/pwt/>)

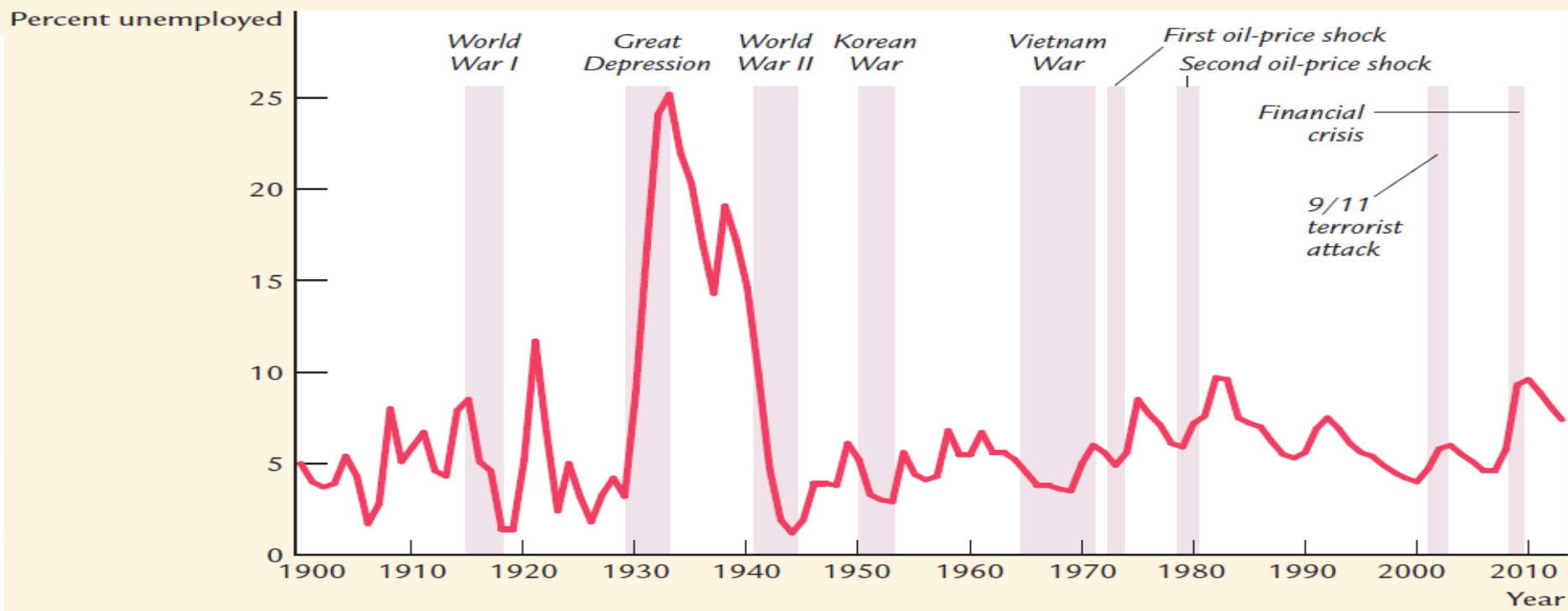
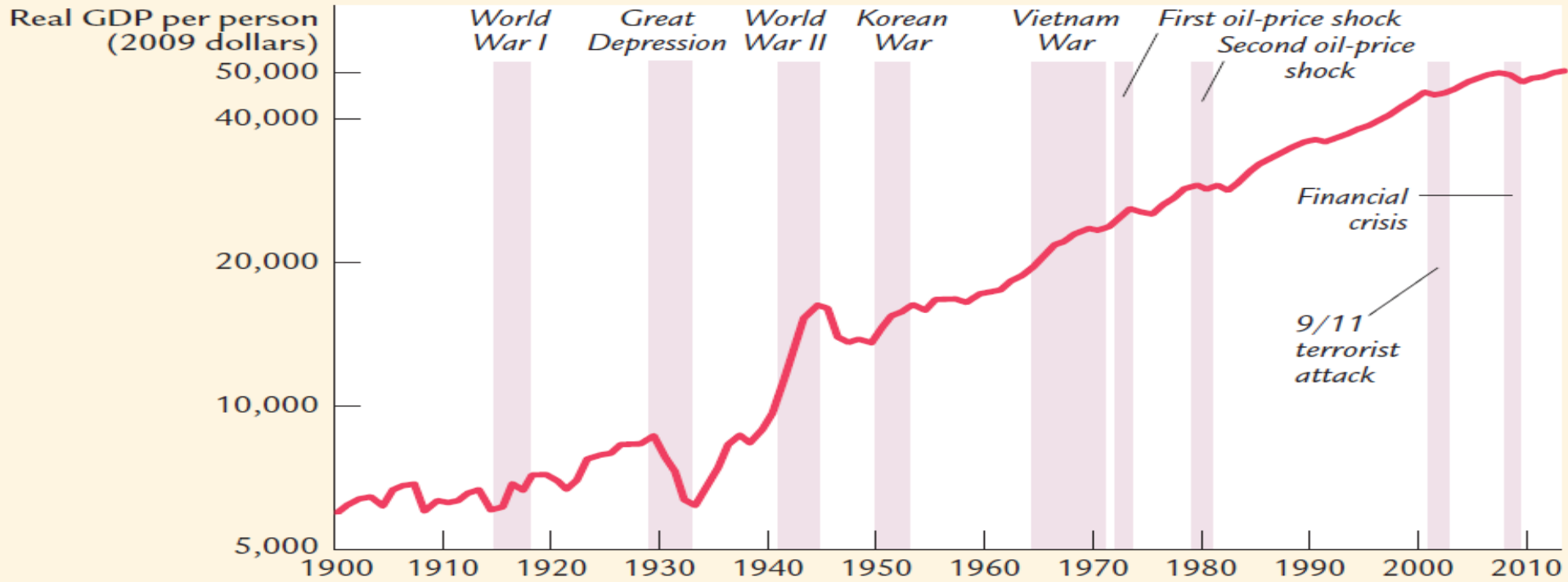
Hungary – USA (Gapminder)



STYLIZED FACTS

- General question: How to make a country rich?
- Data collecting
- Observations
- Theories
- Hypotheses testing

- Generalization, robustness



Observations 1

- **Real GDP; income ($Y/L=y$)** has a long term trend
- It has recessions and depressions
- **Unemployment (U)** always positive
- U has no long term trend



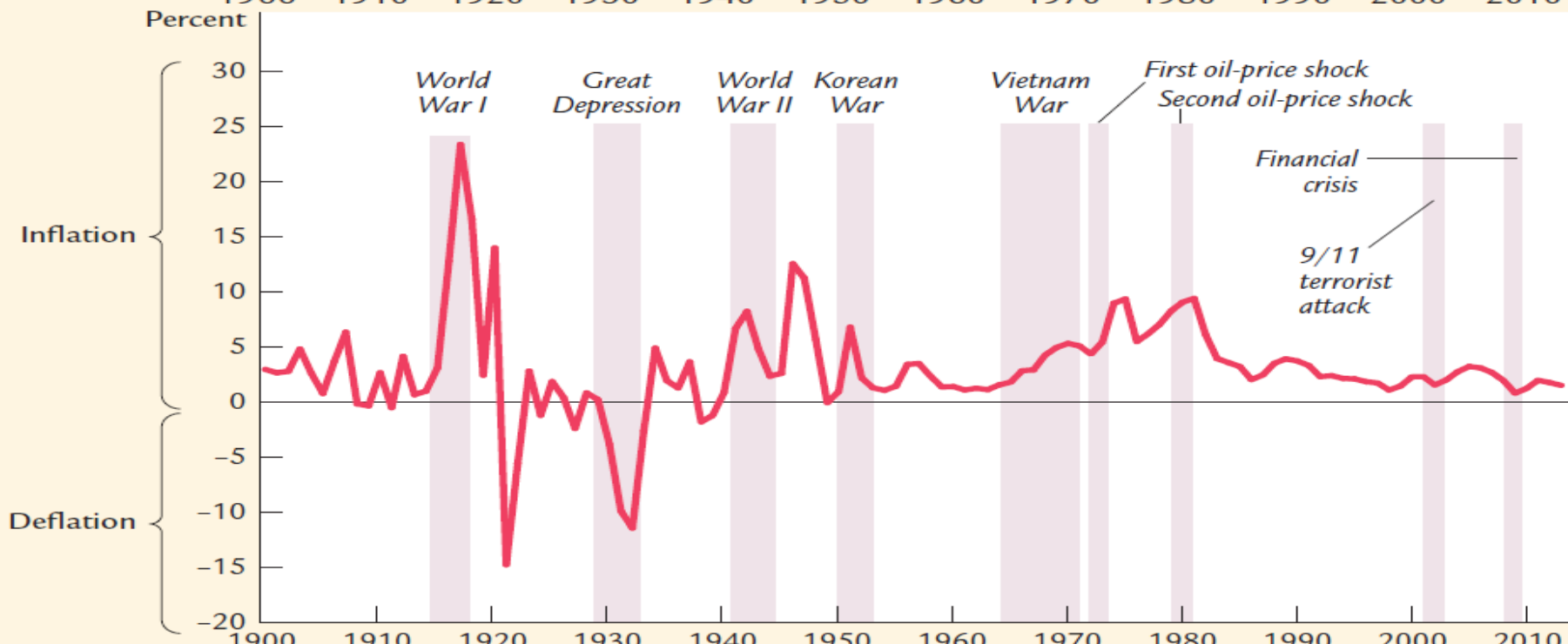
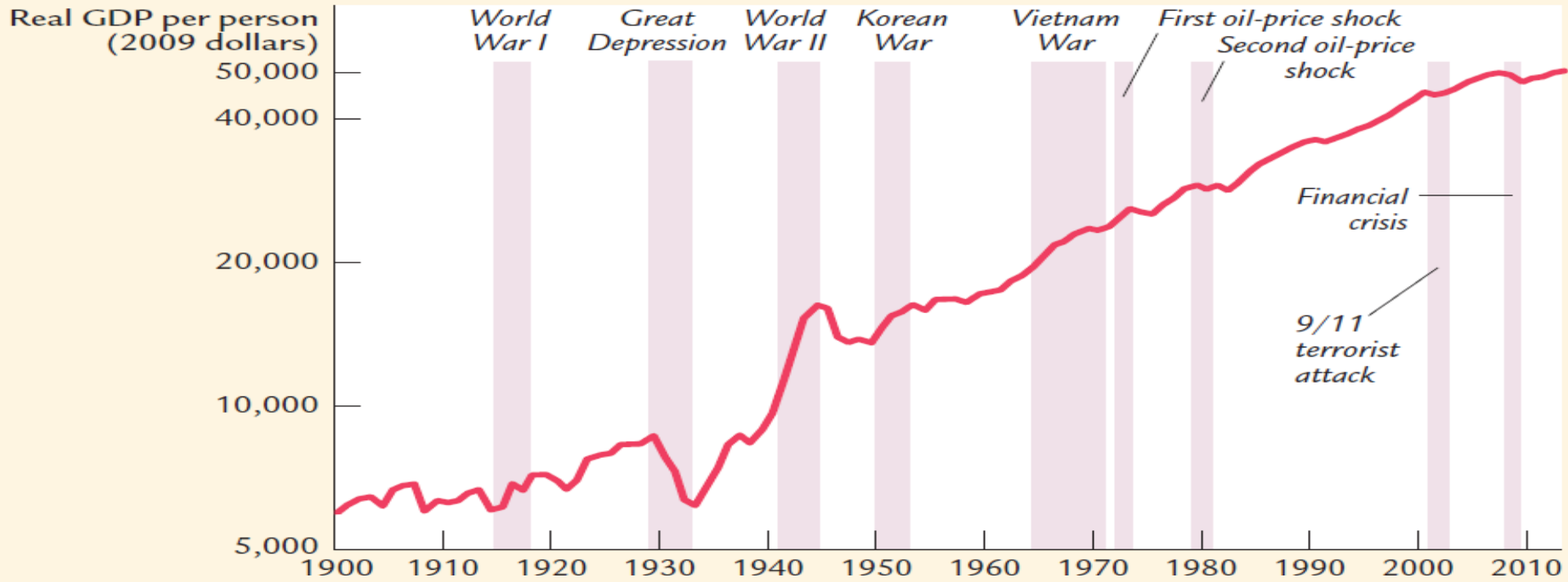
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Observations 2

- **Inflation (π)** varies substantially over time
- Deflations: periods of falling prices



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Theory as Model Building 1

A Multitude of Models:

- Models are simplified versions of a more complex reality, *irrelevant* details are stripped away
- *No one model* can address all the issues we care about.
- So we will learn different models for studying different issues (unemployment, inflation, income growth).
- For each new model, you should keep track of
 - its assumptions,
 - which variables are endogenous and exogenous,
 - which questions it can help us understand.



Theory as Model Building 2

Making assumptions: In general, making unrealistic assumptions is okay, even desirable, if they simplify the analysis without affecting its validity

The **ART** of economics lies in judging when a simplifying assumption clarifies our thinking and when it misleads us.



Endogenous vs Exogenous variables

- The values of endogenous variables are determined in the model.
- The values of exogenous variables are determined outside the model: the model takes their values & behavior as given.



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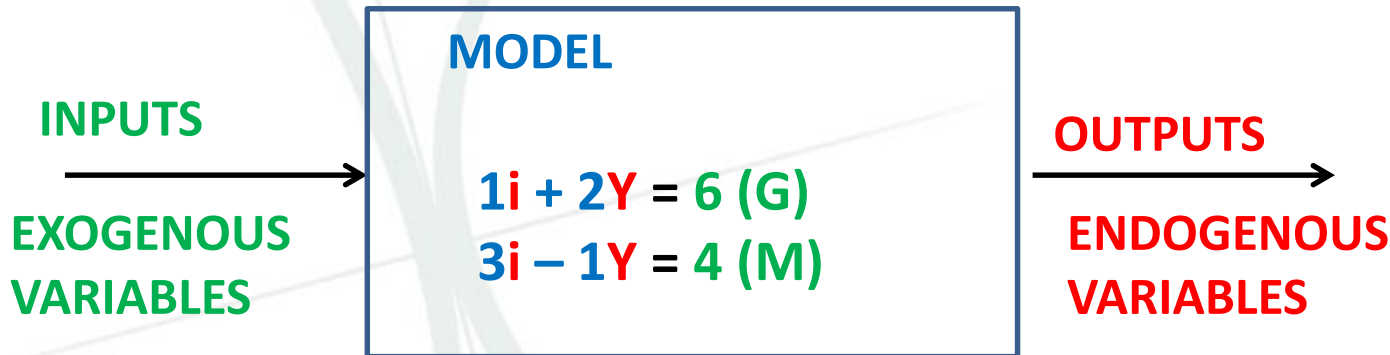
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STATIC MODEL

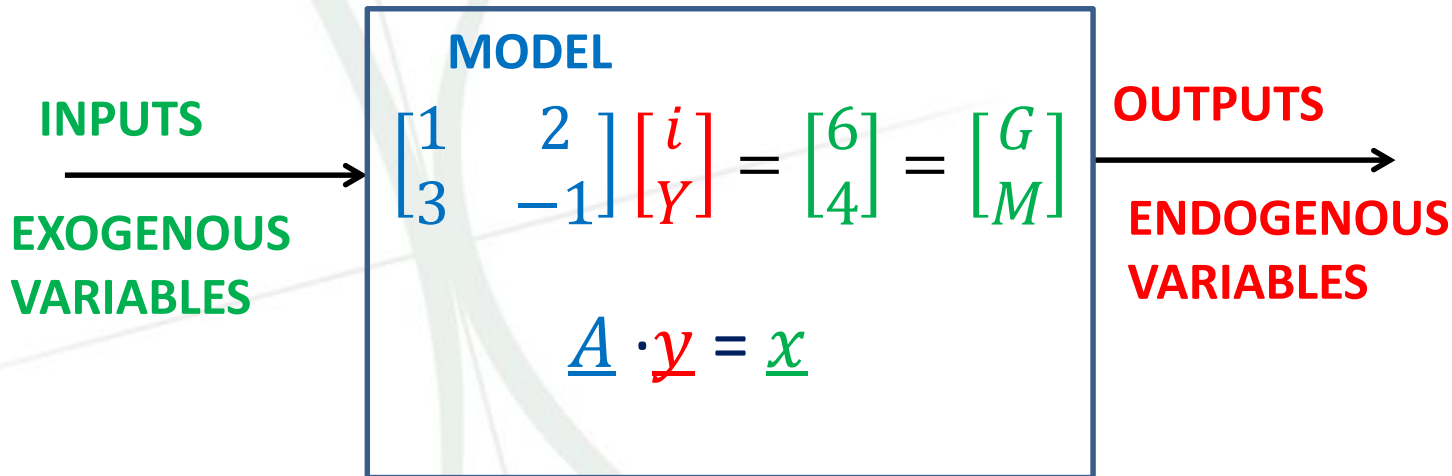
- Assumptions — Milton Friedman's theory of prediction „as if” + („if...then”)



- Efficient Market Hypothesis, EMH

COMPARATIVE STATICS

- Linearization

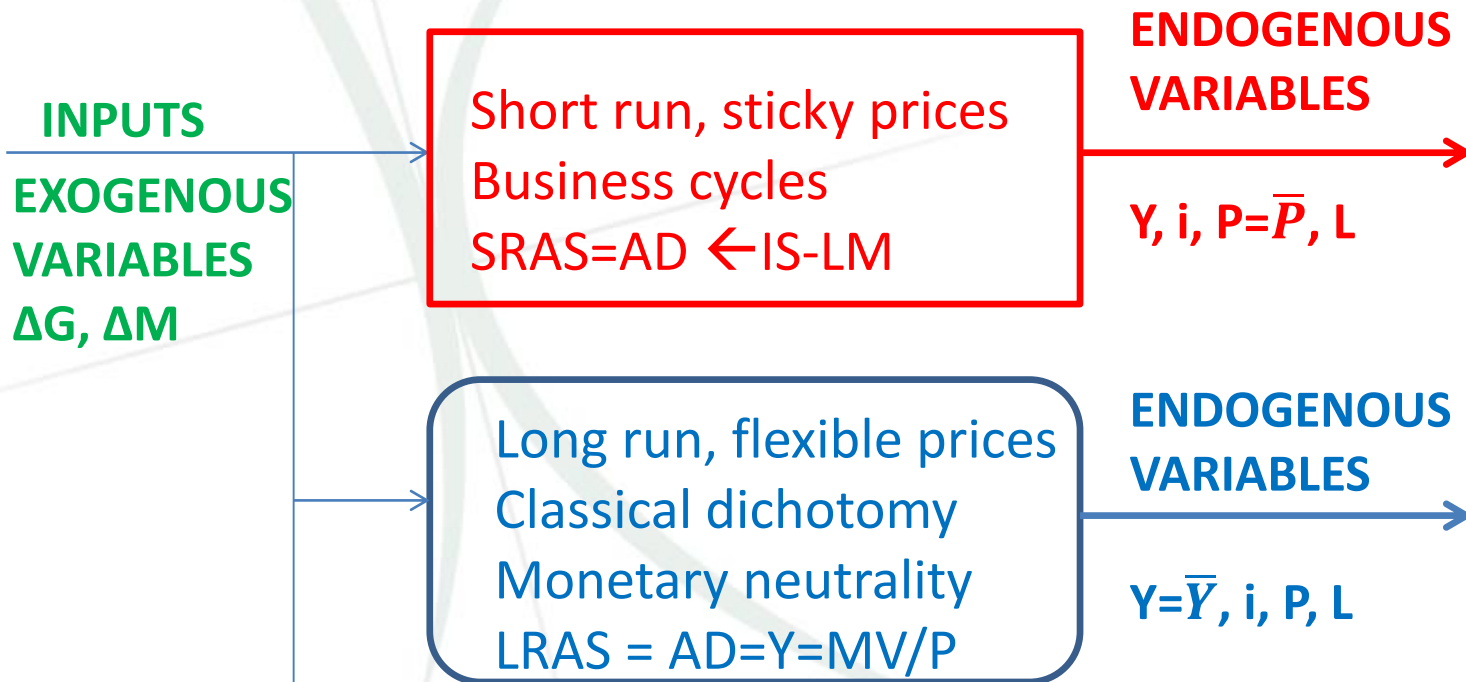


- Multiplier – partial analysis: $\frac{\Delta y_j}{\Delta x_k} = \frac{dy_j}{dx_k}; \frac{dY}{dG} = ? \frac{dY}{dM} = ?$

Flexible vs. Sticky Prices

– Schools of economic thoughts –

- In the long run prices adjust to changing economic conditions → makret-clearing models. (EQUILIBRIUM)
- Inability of firms to coordinate price changes plays a key role in explaining price stickiness



4. OUTLINE OF THE CLASS



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Outline of the class

- ***Classical and Growth Theory*** (Ch. 2-9)
How the economy works in the long run, when prices are flexible and markets work well
- ***Business Cycle Theory*** (Ch. 10-15)
How the economy works in the short run, when prices are sticky. What can policy makers do when things go wrong
- ***Microeconomic Foundations*** (Ch. 16-18)
Incorporate features from microeconomics on the behavior of consumers



5. METHODOLOGY

This course features an enhanced **critical thinking** emphasis.



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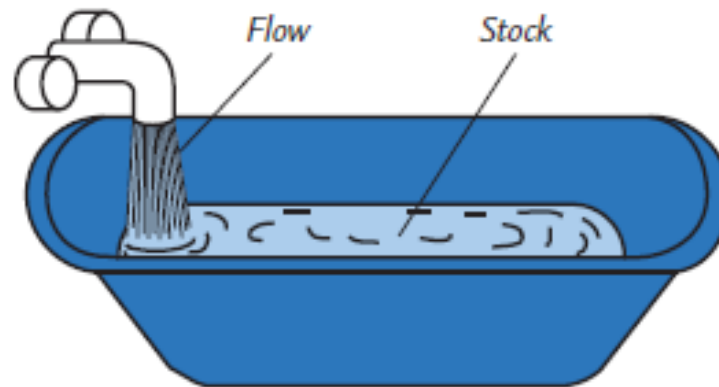
METHODOLOGY

- A. Stock or Flow variable
- B. Percentage vs percentage point
- C. Correlations
- D. Granger causality
- E. Econometrics – Regression (causality) „as if...”
 - A. Average, variance
- F. Identification
- G. „FUQed” questions

A. **STOCK** or **FLOW** VARIABLE

STOCK: is a quantity measured at a point in time

FLOW: is a quantity measured per unit of time



B. TECHNICAL NOTES

Percent \leftrightarrow Percentage point

- Change in real units: 100 kg = 100%; 1%(point) change is 1kg
- Change in interest/inflation/GDP growth rate: if $i=\pi=g=10\%$
 - 1% point change: $g^*=i^* = 11\%$
 - 1% change: $g^{**}=i^{**} = 10,1\%$

Working with changes in percentages:

– Interest/Growth/Inflation rate: $G_y \doteq \frac{\Delta y}{y} \approx \frac{dy/dt}{y} = \frac{\dot{y}}{y} =$

$\frac{d \ln[y(t)]}{dt} \rightarrow$ slope of the trend line

– $G_{Y/L} \approx G_Y - G_L$

– $G_{PY} \approx G_P + G_Y$

– $G_{K^\alpha} \approx \alpha G_K$



C. CORRELATION AND CAUSALITY

– "...**warning**: correlation does not imply causation, so empirical results...should be interpreted with caution." (Mankiw, 2016, p205) –

If X correlates with Y, then:

1. either $X \rightarrow Y$,
2. or $Y \rightarrow X$,
3. OR $Z \rightarrow X$ and $Z \rightarrow Y$ Thus X and Y correlate,
4. OR there is a Spurious correlation

<http://tylervigen.com/>

D. GRANGER CAUSALITY



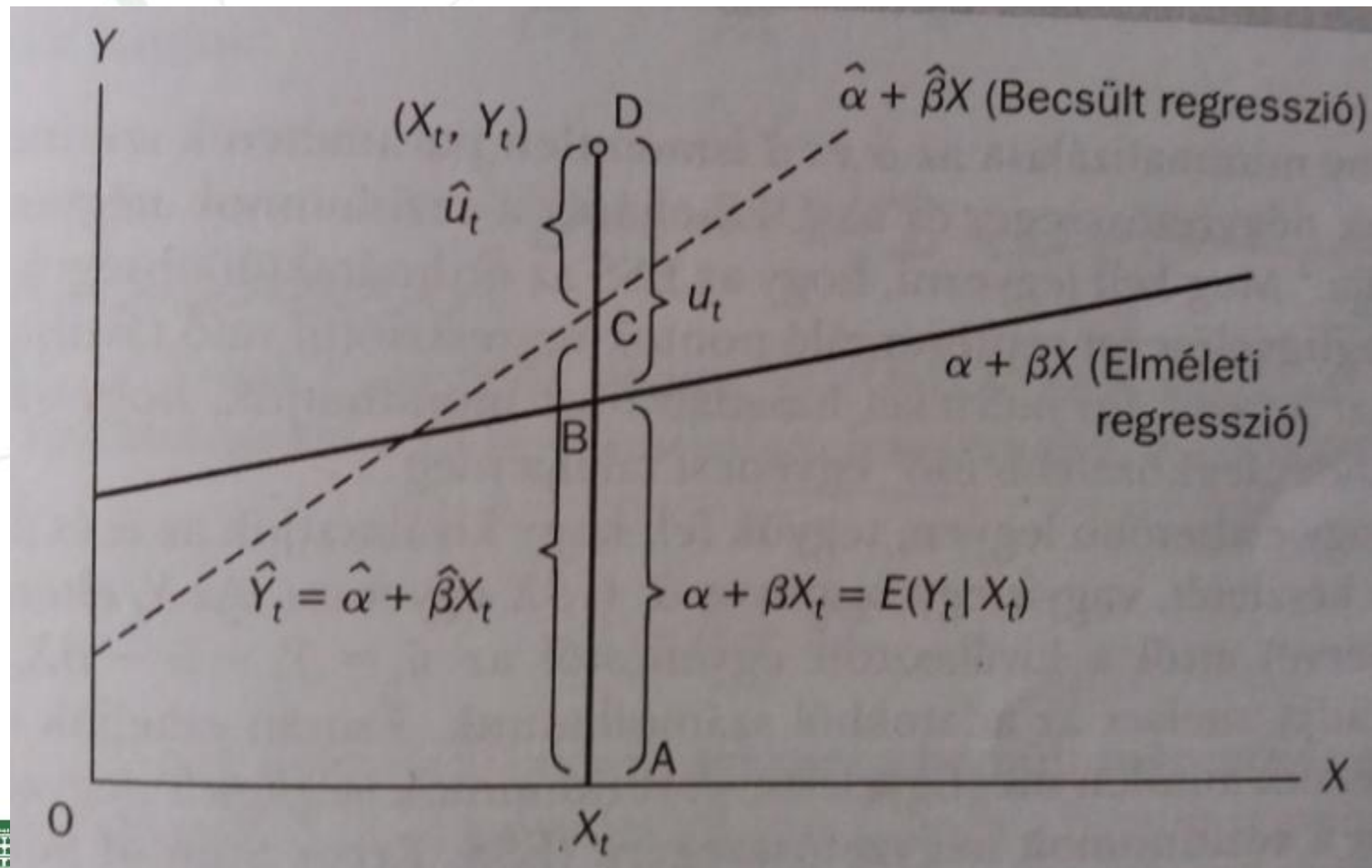
- **Sir Clive William John GRANGER (1934-2009)**
- 2003 Nobel Memorial Prize in Economic Sciences
- The **Granger causality test** is a statistical hypothesis test for determining whether one time series is useful in forecasting another

E. ECONOMETRICS – Regression

- **Econometrics** is the application of statistical methods to economic data in order to give empirical content to economic relationships
- Procrustean bed

„Where simplifications fail, causing the most damage, is when something nonlinear is simplified with the linear as a substitute. That is the most common Procrustean bed.” (Taleb 2012)

Population and sample regression functions



Ordinary Least Squares estimation (OLS)

- Population regression: $Y_t = \alpha + \beta X_t + e_t$
- Sample regression: $Y_t = \hat{\alpha} + \hat{\beta} X_t + \hat{e}_t$ $\hat{e}_t \sim N(0, \sigma^2)$!
 - Error, residual: $\hat{e}_t = Y_t - (\hat{\alpha} + \hat{\beta} X_t)$
- The best estimates of population regression's parameters:
- The method: **OLS**

$$\min_{\hat{\alpha}, \hat{\beta}} ESS = \min_{\hat{\alpha}, \hat{\beta}} \sum_{t=1}^{t=n} (\hat{e}_t)^2 = \min_{\hat{\alpha}, \hat{\beta}} \sum_{t=1}^{t=n} (Y_t - [\hat{\alpha} + \hat{\beta} X_t])^2$$

ESS: Error sum of squares, sum of squared residuals

Normal equations

$$\min_{\hat{\alpha}, \hat{\beta}} ESS = \min_{\hat{\alpha}, \hat{\beta}} \sum_{t=1}^{t=n} (\hat{e}_t)^2 = \min_{\hat{\alpha}, \hat{\beta}} \sum_{t=1}^{t=n} (Y_t - [\hat{\alpha} + \hat{\beta} X_t])^2$$

FOC:

$$1. \frac{dESS}{d\hat{\alpha}} = \sum 2\hat{e}_t \frac{d\hat{e}_t}{d\hat{\alpha}} = -2 \sum (Y_t - [\hat{\alpha} + \hat{\beta} X_t]) = \sum \hat{e}_t = 0$$

$$2. \frac{dESS}{d\hat{\beta}} = \sum 2\hat{e}_t \frac{d\hat{e}_t}{d\hat{\beta}} = -2 \sum (Y_t - [\hat{\alpha} + \hat{\beta} X_t]) X_t = \sum \hat{e}_t X_t = 0$$

OLS estimation

$$\underline{y} = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix}; \quad X = \begin{bmatrix} 118 \\ 117 \\ 147 \\ 144 \\ 191 \end{bmatrix}$$

$$\underline{y} = X\underline{\hat{b}} + \underline{\hat{e}}$$
$$\min_{\underline{\hat{b}}} S(\underline{\hat{e}}^T \cdot \underline{\hat{e}})$$

$$\underline{\hat{\beta}} = (X^T X)^{-1} X^T \underline{y} = \begin{bmatrix} 3,9705 \\ 0,1903 \\ -0,3136 \end{bmatrix}$$

$$y = 3,9705 + 0,1903 \cdot x_1 - 0,3136 \cdot x_2$$

OLS estimation

BLUE: best linear unbiased estimator – the most efficient

Assumptions:

1. Some of the observed X s are different
2. Errors average to zero
3. X s are given and nonrandom
4. Homoscedasticity
5. Serial independence

Decomposition of Y_t

$$\begin{aligned} ESS &= \sum (Y_t - \hat{Y}_t)^2 = \sum \left[(Y_t - \bar{Y})^2 + (\bar{Y} - \hat{Y}_t)^2 \right] \\ &= \sum \left[(Y_t - \bar{Y})^2 - (\hat{Y}_t - \bar{Y})^2 \right] \\ &= \sum (Y_t - \bar{Y})^2 + \sum (\bar{Y} - \hat{Y}_t)^2 - 2 \sum (Y_t - \bar{Y})(\bar{Y} - \hat{Y}_t) \\ &= \mathbf{ESS = TSS - RSS} \end{aligned}$$

$$\bar{Y} = \frac{\sum Y_t}{n} \rightarrow \sum Y_t - n\bar{Y} = \sum (Y_t - \bar{Y}) = 0$$

TSS: Total Sum of Squares

RSS: Regression of Sum of Squares

Coefficient of multiple determination

Unadjusted R-squared:

$$R^2 = \frac{RSS}{TSS} = 1 - \frac{ESS}{TSS}$$

RSS: explained variation

ESS: unexplained variation

TSS: total sum of squares

Adjusted R-squared: $\bar{R}^2 = 1 - \frac{ESS/(n-k)}{TSS/(n-1)}$

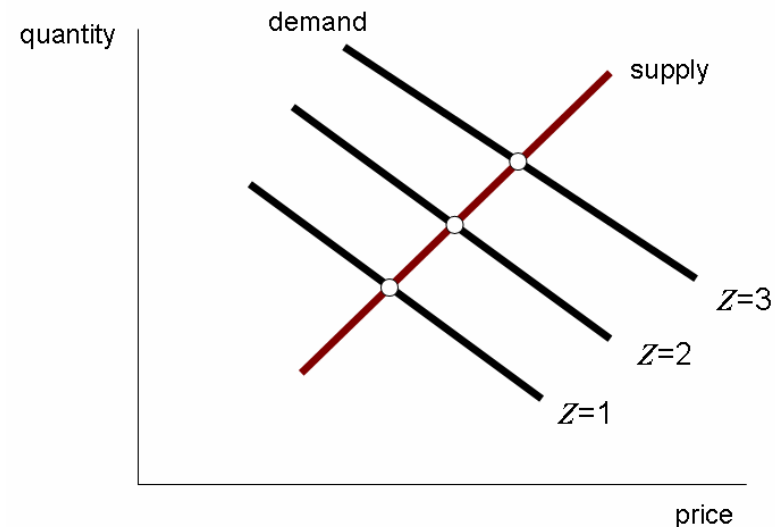
Model selection criteria: R^2 , \bar{R}^2 , AIC, BIC, HQ, ...

F. IDENTIFICATION

The inability in principle to identify a best estimate of the value(s) of one or more parameters in a regression. This problem can occur in the estimation of multiple-equation econometric models where the equations have variables in common.

supply: $Q = a_S + b_S P + cX$

demand: $Q = a_D + b_D P + dZ$



G. FUNDAMENTALLY UNIDENTIFIED QUESTIONS

„FUQed questions”

- A FUQed question is one that cannot *be answered by an experiment* – for instance, the effect of carbon dioxide emissions on the world's climate.

We can measure and calculate, extrapolate from our existing knowledge, but one thing we can't do is run a controlled experiment. We won't know exactly what our carbon dioxide emissions will do to the climate until they've already done it; even then we won't know for sure whether a different course of action would have had a different effect.

„FUQed question”

- Suppose we are interested in whether children do better in school by virtue of having started school [at age 7 instead of 6]. ... To be concrete, let's look at test scores in first grade.
- The problem with this question ... is that the group that started school at age 7 is older. And older kids tend to do better on tests, a pure maturation effect. ... The problem here is that for students, start age equals current age minus time in school. ... [T]he effect of start age on elementary school test scores is impossible to interpret even in a randomized trial, and therefore, in a word, FUQed.

„FUQed question”

- „...does GDP growth cause inflation, or does inflation cause GDP growth?”

The answer is that neither is true; GDP and inflation are jointly determined by aggregate demand and aggregate supply. Or you wouldn't ask, "does price cause quantity or quantity cause price;" instead, both price and quantity are jointly determined by supply and demand.