Methodology of Econometrics

1. Statement of theory or hypothesis
2. Specification of mathematical model of the theory
3. Specification of econometric model of theory
4. Obtaining the data
5. Estimation of the parameters of the econometric model
6. Hypothesis testing
7. Forecasting or prediction
8. Using model for control or policy purposes

The Nature of Econometrics and Economic Data

What is econometrics?

- Econometrics is the use of statistical methods to analyze economic data.
- Econometricians typically analyze nonexperimental data.

Econometrics vs Data Mining

The Nature of Econometrics and Economic Data

Typical goals of econometric analysis:

- Estimating relationships between economic variables.
- Testing economic theories and hypotheses.
- Evaluating and implementing government and business policy.

The Nature of Econometrics and Economic Data

Common applications

- Forecasting macroeconomic variables (interest rates, inflation rates, GDP).
- Forecasting non-macro variables.

Statement of theory or hypothesis

Keynes:

Marginal propensity to consume (MPC), the rate of change of consumption for a unit change in income is greater than zero but less than one.

Specification of mathematical model of the theory

Keynesian consumption function:

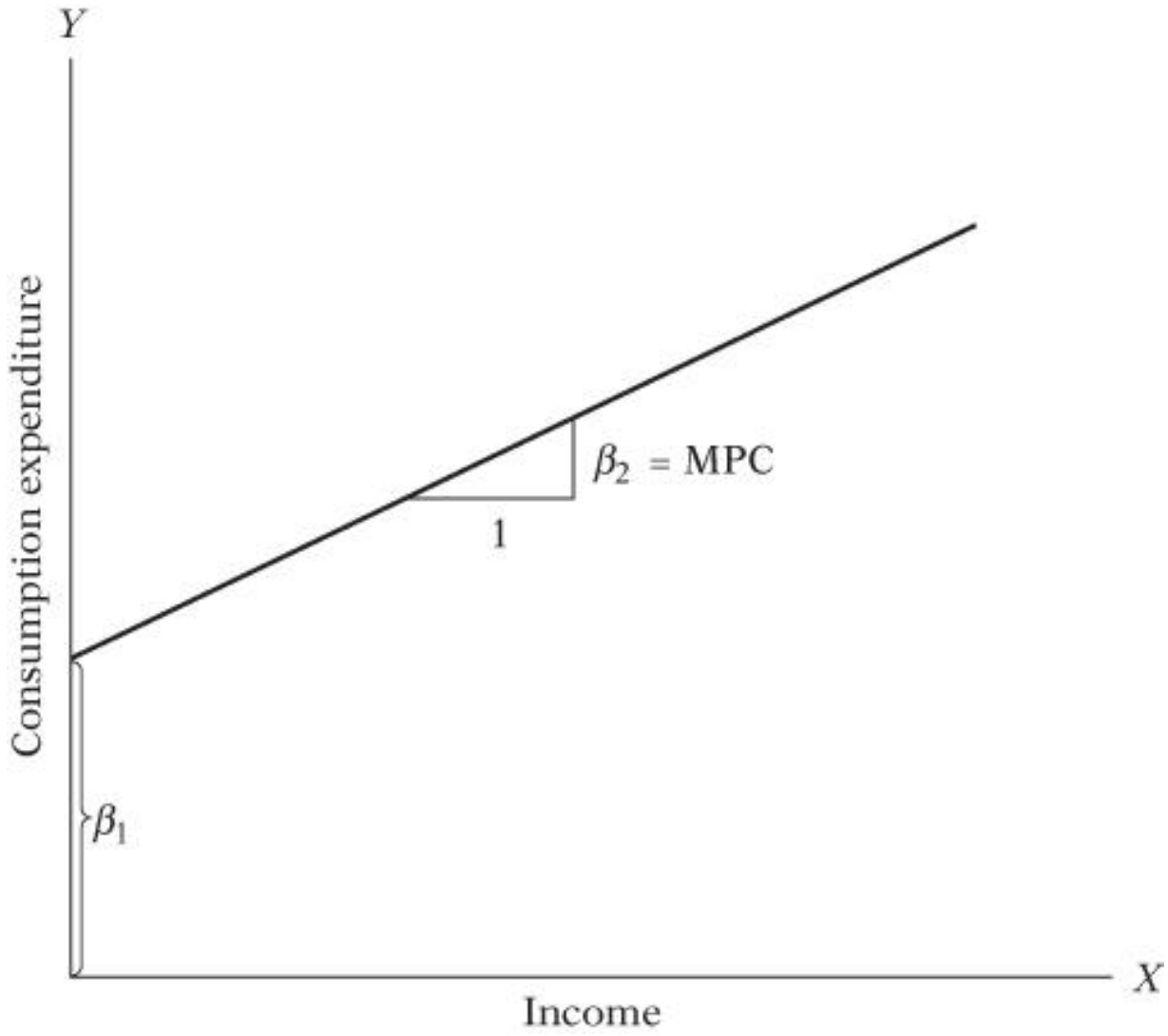
$$Y = \beta_1 + \beta_2 X \qquad 0 < \beta_2 < 1$$

where Y = consumption expenditure

X = income

β_i = parameters $\quad i = 1, 2$

Specification of mathematical model of the theory



Specification of Econometric model of the theory

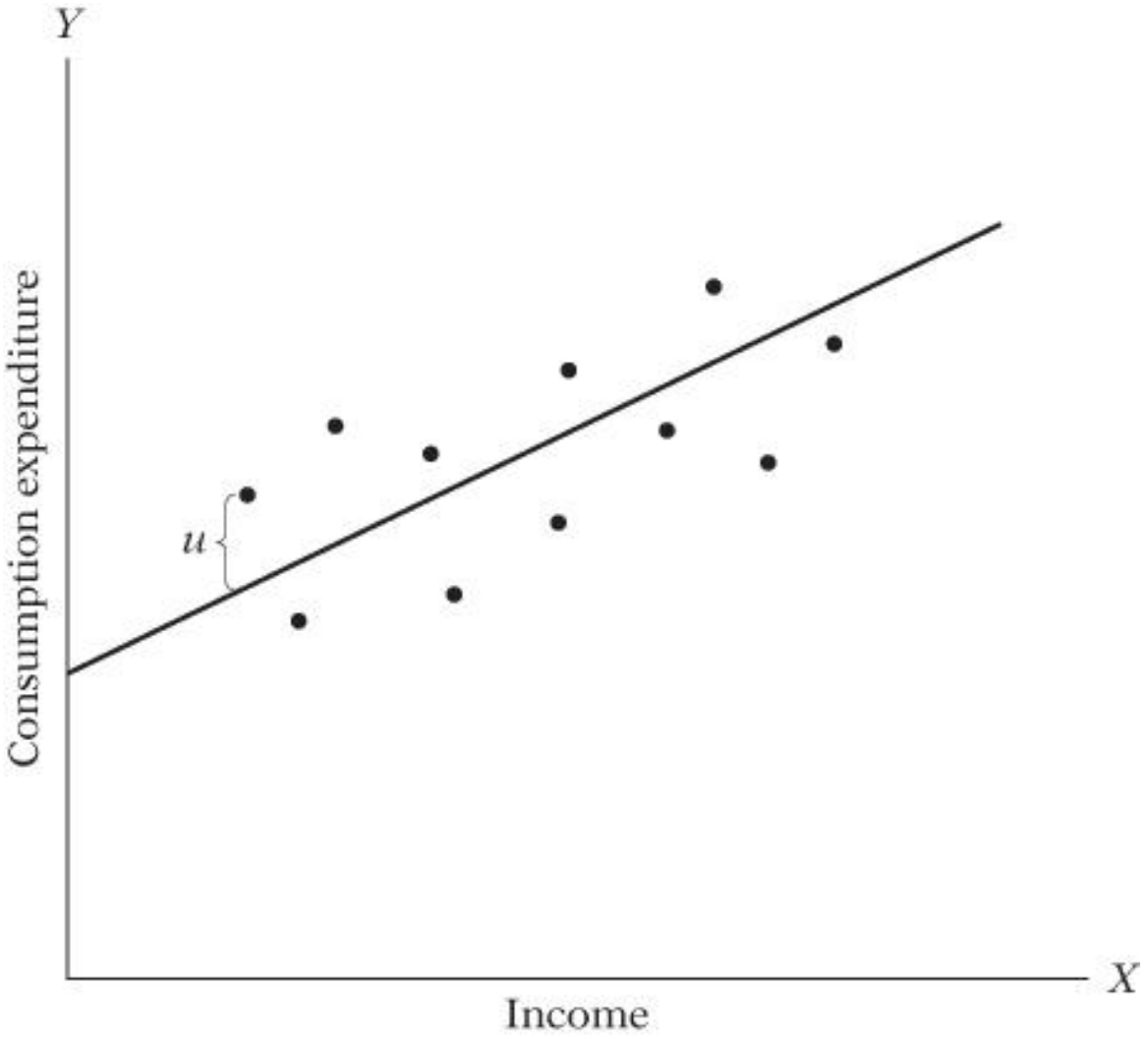
Transform consumption function to econometric regression model:

$$Y = \beta_1 + \beta_2 X + u$$

where u = disturbance or error term

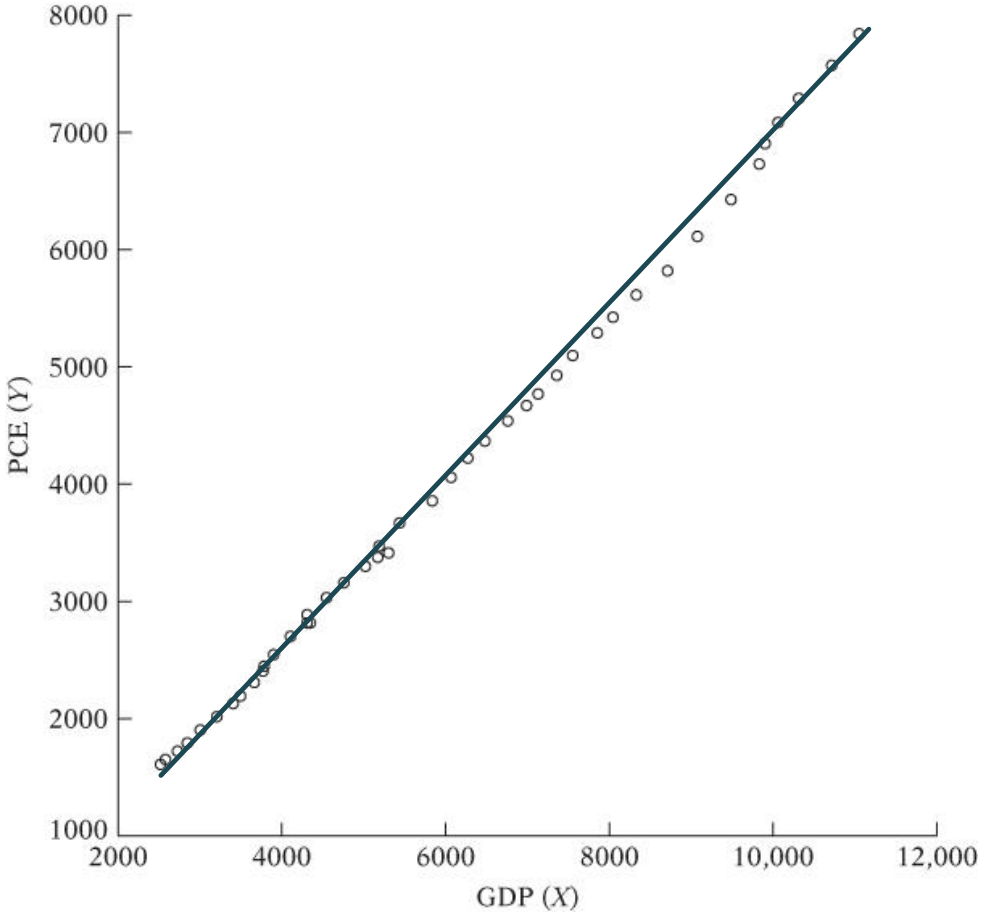
a random (stochastic) variable

Specification of Econometric model of the theory



Obtaining the data

Year	PCE(Y)	GDP(X)
1960	1597.4	2501.8
1961	1630.3	2560.0
1962	1711.1	2715.2
1963	1781.6	2834.0
1964	1888.4	2998.6
1965	2007.7	3191.1
1966	2121.8	3399.1
1967	2185.0	3484.6
1968	2310.5	3652.7
1969	2396.4	3765.4
1970	2451.9	3771.9
1971	2545.5	3898.6
1972	2701.3	4105.0
1973	2833.8	4341.5
1974	2812.3	4319.6
1975	2876.9	4311.2
1976	3035.5	4540.9
1977	3164.1	4750.5
1978	3303.1	5015.0
1979	3383.4	5173.4
1980	3374.1	5161.7
1981	3422.2	5291.7
1982	3470.3	5189.3
1983	3668.6	5423.8
1984	3863.3	5813.6
1985	4064.0	6053.7
1986	4228.9	6263.6
1987	4369.8	6475.1
1988	4546.9	6742.7
1989	4675.0	6981.4
1990	4770.3	7112.5
1991	4778.4	7100.5
1992	4934.8	7336.6
1993	5099.8	7532.7
1994	5290.7	7835.5
1995	5433.5	8031.7
1996	5619.4	8328.9
1997	5831.8	8703.5
1998	6125.8	9066.9
1999	6438.6	9470.3
2000	6739.4	9817.0
2001	6910.4	9890.7
2002	7099.3	10048.8
2003	7295.3	10301.0
2004	7577.1	10703.5
2005	7841.2	11048.6



Estimation of the parameters of the econometric model

$$\hat{Y} = -299.5913 + 0.7218X$$

$$MPC = 0.7218$$

Hypothesis testing

Choose appropriated statistical method to test hypothesis, known as statistical inference.

Forecasting or Prediction

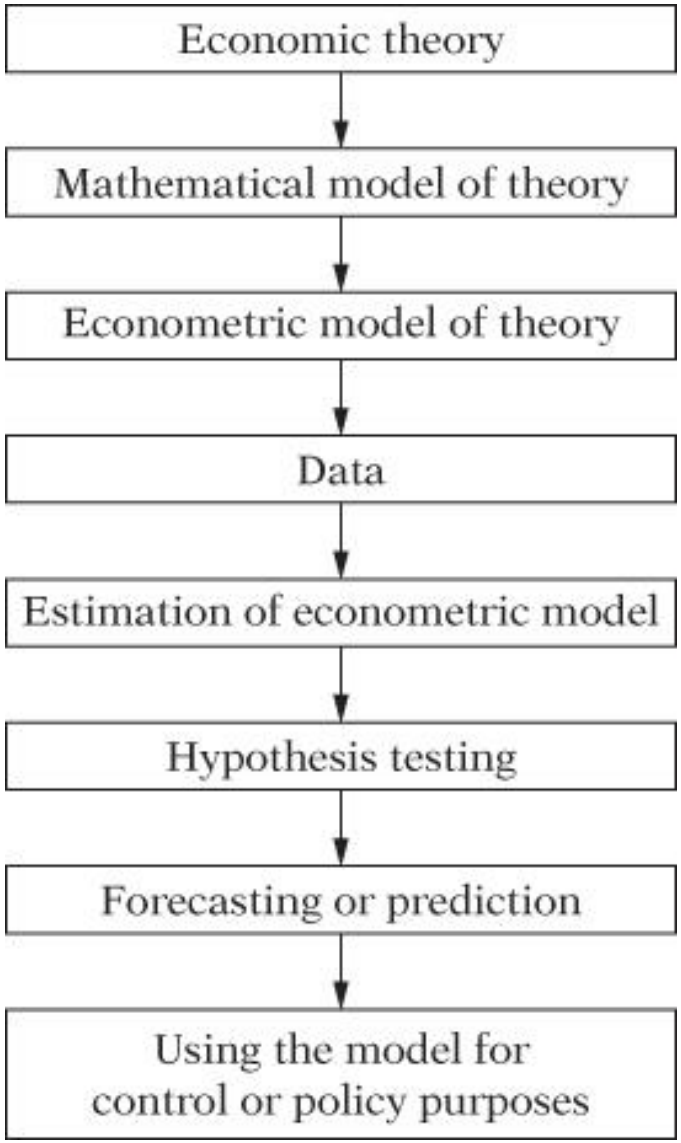
If income (or GDP) is expected to be 11,319.4 (billions)

Consumption should be

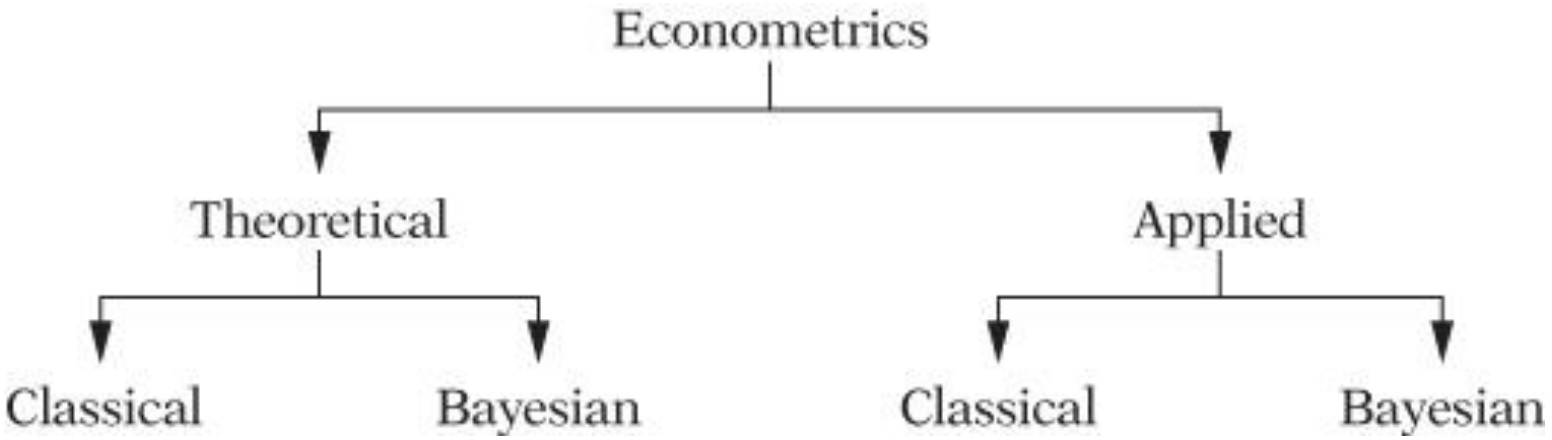
$$\hat{Y} = -299.5913 + 0.7218(11319.4)$$
$$= 7870.7516$$

Using model for policy purposes

Econometric Modeling



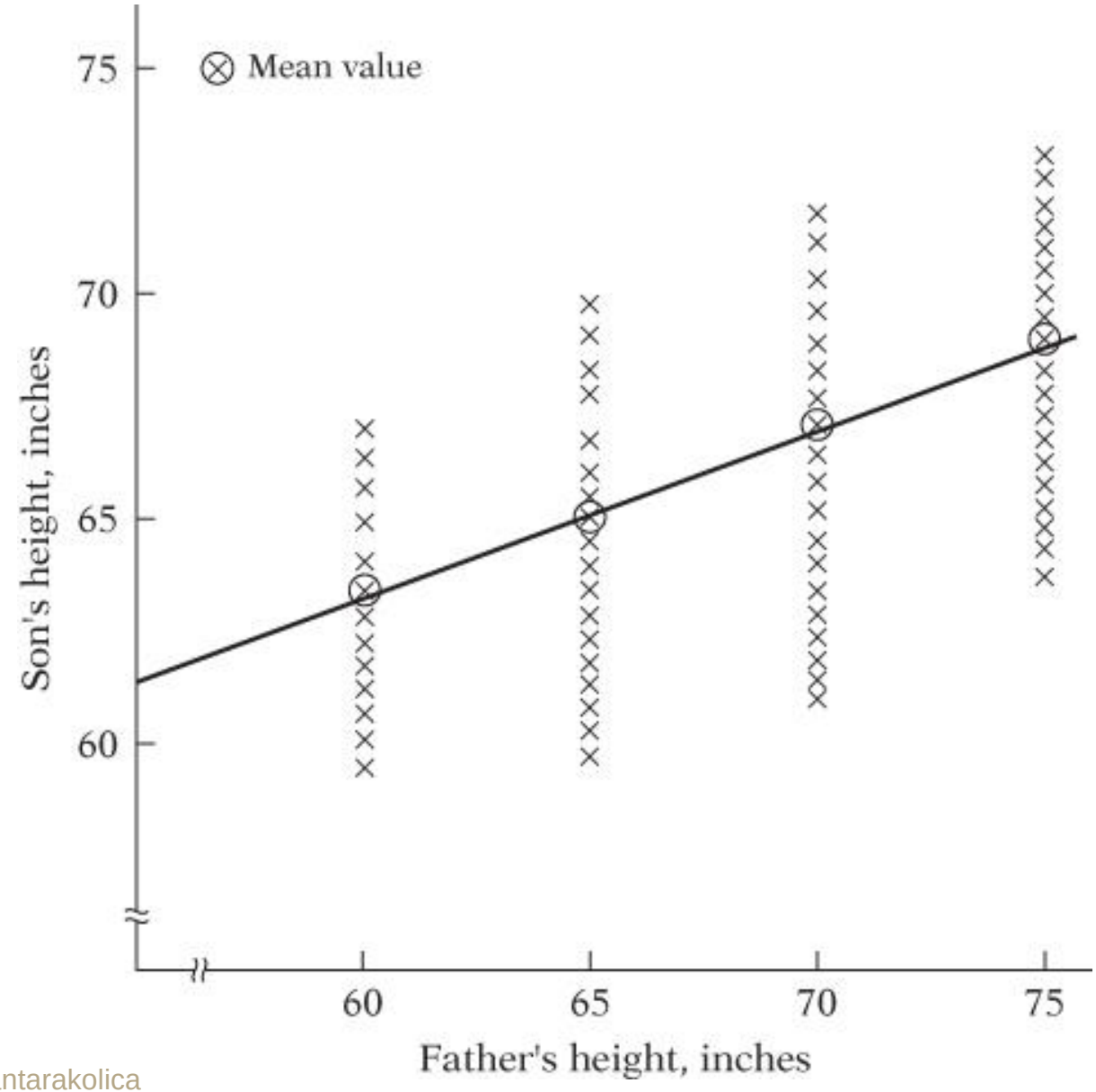
Types of Econometrics



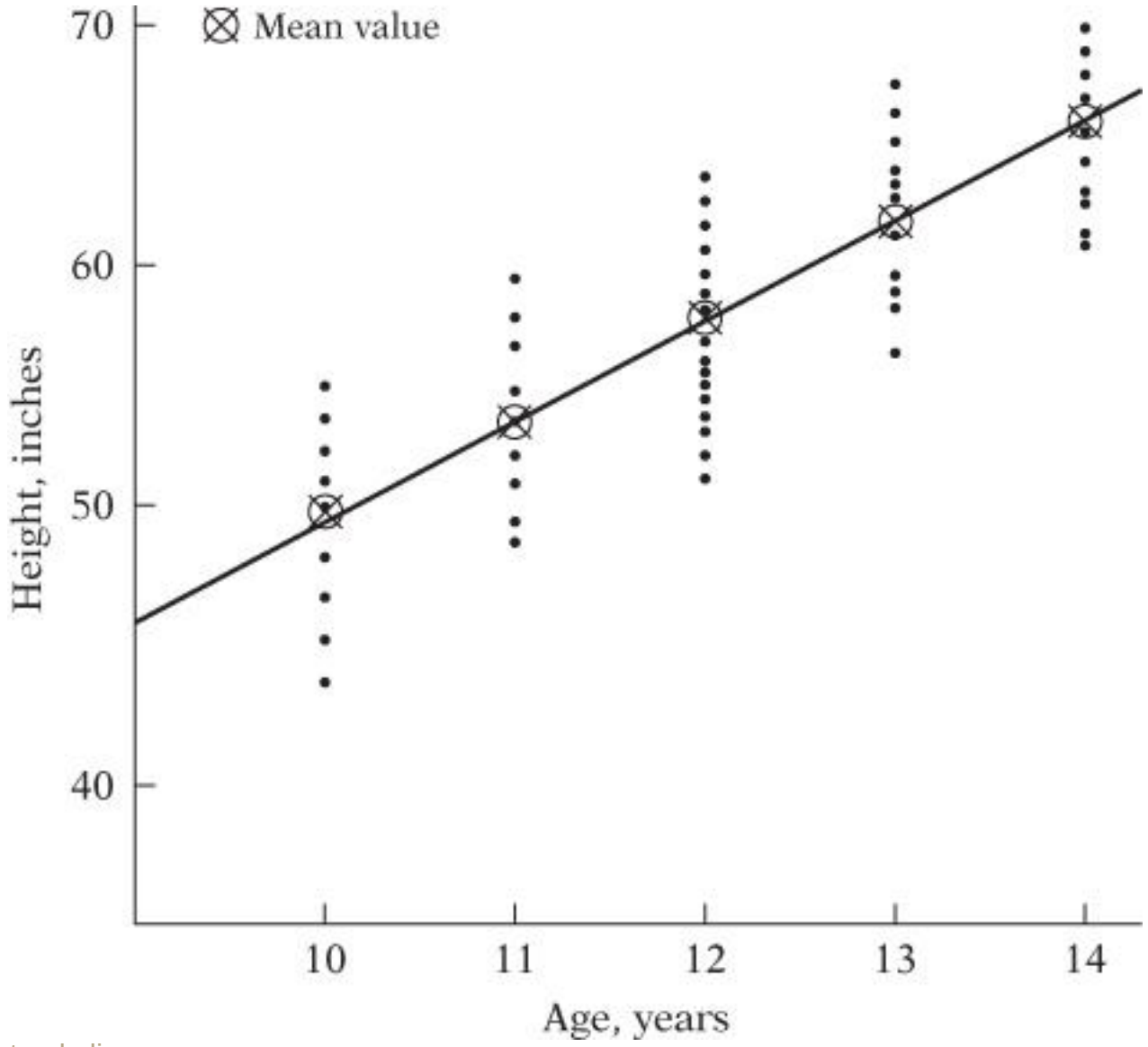
Nature of Regression Analysis

Regression analysis is concerned with the study of the dependence of one variable, the *dependent variable*, on one or more other variables, the *explanatory variables*, with a view to estimating and/or predicting the (population) mean of or average value of the former in terms of the known or fixed (in repeated sampling) values of the latter.

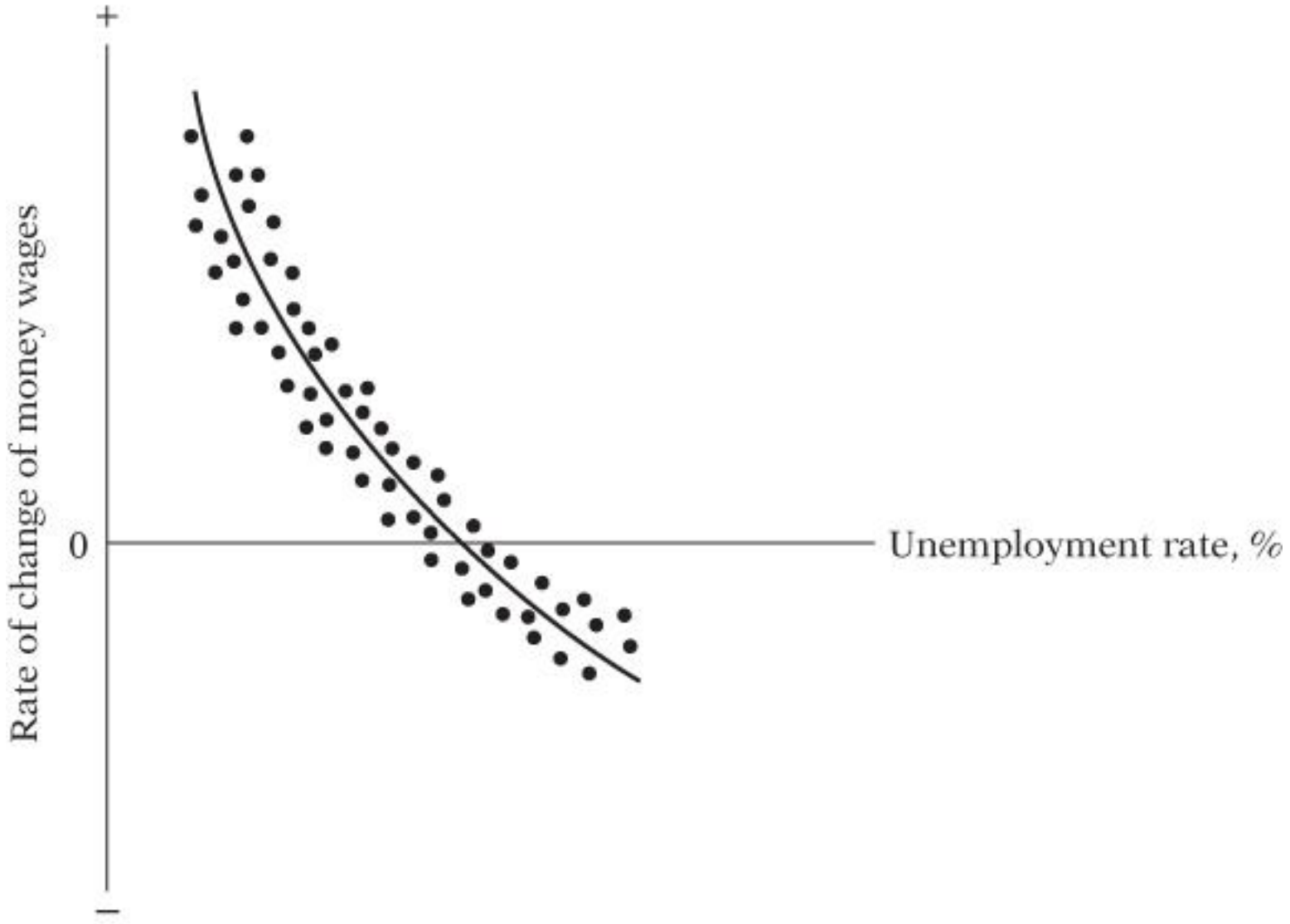
Examples


Mean value
75
70
65
60
Son's height, inches
60
65
70
75
Father's height, inches

Examples



Examples



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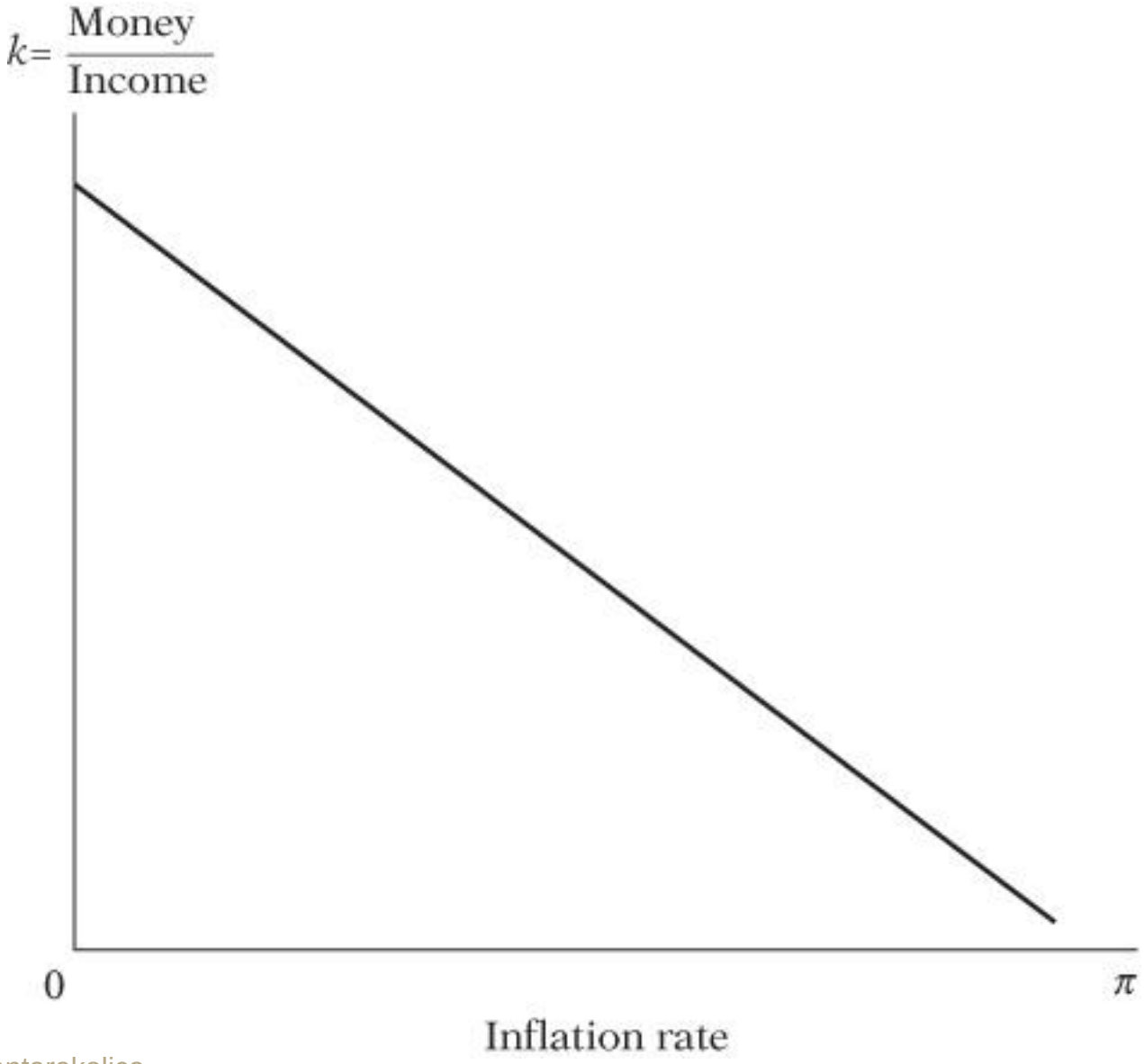

Statistical vs Deterministic Relationship
Regression vs Causation
Regression vs Correlation
Terminology and Notation

Y	X
Dependent Variable	Explanatory Variable
Explained Variable	Independent Variable
Predictand	Predictor
Regressand	Regressor
Response	Stimulus or Control Variable
Endogenous	Exogenous

Types of Data

Qualitative Data: Nonnumerical Data

Quantitative Data: Numerical Data

- Time Series Data
- Cross-sectional Data
- Pooled Data
- Panel Data
- Transaction Data
- Big Data – Organized vs Unorganized Data

Accuracy of Data

Selectivity Bias