

Economics of central banking (Zentralbanktheorie und -politik)

Matrix algebra, identification

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Introduction These slides present the main elements of the course 9,272,1.00 (contact studies); they are based on several papers and books (e.g. Walsh, 2003, Galí, 2008, Walsh, 2010) whose references are given during the term; a separate reading list for the exam will be given after the term break; solutions of the exercises and self studies (Selbststudium) will be given during the class.

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Pro memoria: matrix algebra

- 'Reduction' of a system

$$x_1 = 3a + 4b$$

$$x_2 = 5b$$

becomes

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 3 & 4 \\ 0 & 5 \end{bmatrix} \times \begin{bmatrix} a \\ b \end{bmatrix}$$

or

$$\mathbf{x} = \mathbf{A}\mathbf{v}$$

- Multiplication, 1st example

$$\begin{bmatrix} a & b \end{bmatrix} \times \begin{bmatrix} c \\ d \end{bmatrix} = ac + bd$$

- Multiplication, 2nd example

$$\begin{bmatrix} c \\ d \end{bmatrix} \times \begin{bmatrix} a & b \end{bmatrix} = \begin{bmatrix} ca & cb \\ da & db \end{bmatrix}$$

Multiplication, 3rd example

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \times \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} ae + bg & af + bh \\ ce + dg & cf + dh \end{bmatrix}$$

 Premultiplication, postmultiplication, multiplication is not commutative

$$\mathbf{AB} \neq \mathbf{BA}$$

 Size matters, conformable matrices Inverse

$$\mathbf{AA}^{-1} = \mathbf{A}^{-1}\mathbf{A} = \mathbf{I} = \begin{bmatrix} 1 & 0 & \dots \\ 0 & 1 & \\ \vdots & & \ddots \end{bmatrix}$$

 Sum

$$\begin{bmatrix} a & b \end{bmatrix} + \begin{bmatrix} c & d \end{bmatrix} = \begin{bmatrix} a + c & b + d \end{bmatrix}$$

 Literature

- books on mathematics, econometrics, or statistics
- eg. *Econometric Analysis*, William Greene, 6th edition, Prentice Hall, Appendix A

Identification

- (just)identified

$$7 = 9 - X$$

$$\rightarrow X = 2$$

- underidentified

$$7 = X + Y$$

→ assumption $Y = 1$, which implies $X = 6$

- overidentified

$$10 = 12 - X$$

$$45 = 40 + X$$

→ needs to optimize