

# PRODUCTIVITY THEORY AND MACROECONOMIC MEASUREMENT

Instructor: Professor Harry X. Wu

Teaching Time: Wednesday 1510-1800

Office Hours: Thursday 1400-1800 by appointment

## Course Description

Fundamental economic problems, from observations of economic phenomena in time and space, tests of theories, to policy making, implementing, and assessing, cannot be solved in the absence of appropriate measurement. However, economists and policy makers can be misled by measurement without theory or lack of consistency between theory, methodology, measurement, and data. This is also an overwhelming problem encountered by a graduate student in economics.

In the conceptual framework of the neoclassical growth economics, extended to account for the industry origins of the aggregate economy via input-output networks, this course provides graduate students in economics with systematic training on solving the key measurement problems that are required by the productivity theory, specifically inputs and their services, and outputs and their costs in coherence with the system of national accounts.

In teaching, I emphasize the principle of theory-methodology-measurement consistency in handling data problems. I guide students to deal with typical data problems in Chinese official statistics following this principle and explore how China's real growth and productivity performance may be gauged.

The contents of this course are based on those used for graduate studies on growth-related measurement problems in some of the world's leading institutions. They are nonetheless often instructed individually by supervisors. After carefully selecting and organizing the contents, I am developing them into a systematic subject aiming at facilitating graduate students in economics at Peking University and filling an important gap in the curriculum of the graduate school of economics in general.

## Pre-course Knowledge

This course is designed for graduate students who are strongly interested in measuring economic growth in general and in emerging economies such as the case of China that often encounters difficult data and measurement problems. To succeed in studying this challenging subject, students are required to have had a good grasp of advanced macroeconomics, microeconomics, and econometrics, and a strong ability to independently read and understand literature in English and to solve and interpret theoretical, empirical, and computational models in the required readings. Besides, students should be strongly motivated to deal with real data problems in the case of China with proper theoretical or methodological considerations.

## Teaching and Learning Approach

This course is taught through lectures, delivered in Chinese or English, and learning activities by self-studies for each topic. Topical lectures are guidance only by motivating students with major theoretical and methodological issues and challenging questions. Learning activities are consist of two parts.

The first part is literature focused, including one critical review of a theoretical or methodological paper with a 5-page PPT presentation in class and 2-page referee report and another critical review of a data or measurement paper with a 5-page PPT presentation in class and 2-page referee report, focusing on the significance of the topic, major contributions, and remaining problems.

The second part is a short (not more than 5 pages) term paper focusing on one of the student's own data problems, focusing on the importance of the data problem in the concerned research, the current data situation, or the nature of data deficiencies, and how to follow the theory-methodology-measurement consistency principle to deal with the problem.

## Assessment and Grade

There is no exam in this course. Students are assessed based on their reports of the assigned readings and term papers. The distribution of the marks between the two parts is 50 percent each. Grading criteria for the reports and term paper will be provided in detail in the lectures.

## Lecture Topics and Required Readings

Based on the current design, there will be ten lectures and four presentation weeks. In addition, I will use one week before the course to warm up or prepare the students for the subject and use one week to arrange term papers.

### 1. Introduction: Why Theorizing and Measuring Productivity?

Zvi Griliches 1996. The discovery of the residual: A historical note. *Journal of Economic Literature*, vol. 34 (September): 1324–1330

Charles R. Hulten. 2007. "Theory and Measurement: An Essay in Honor of Zvi Griliches". In Ernst R. Berndt and Charles R. Hulten (eds), *Hard-to-Measure Goods and Services: Essays in Honor of Zvi Griliches*, 15-27. Chicago: University of Chicago Press.

\*Harry X. Wu. 2019. "In Quest of Institutional Interpretation of TFP Change – The Case of China", *Man and the Economy*, 6 (2), 2019 ([\\*China related](#))

### 2. Productivity Change as the Source of Growth

Angus Maddison. 1987. "Growth and Slowdown in Advanced Capitalist Economies: Techniques of Quantitative Assessment". *Journal of Economic Literature*, XXV, (June): 649-698

Dale W. Jorgenson. 2001. "Information Technology and the US Economy". *American Economic Review*. 91(1): 1-32

\*Yanrui Wu. 2011. "Total Factor Productivity Growth in China: A Review." *Journal of Chinese Economic and Business Studies*. 9(2): 111-26

### **3. Conceptualized and Measured Total Factor Productivity Growth**

Charles R. Hulten. 2001. "Total Factor Productivity: A Short Biography". In *New Directions in Productivity Analysis*, ed. Charles R. Hulten, Edwin R. Dean, and Michael J. Harper, 1–47. Studies in Income and Wealth, vol. 63. Chicago: University of Chicago Press.

Jorgenson, Dale W., and Zvi Griliches. 1967. The explanation of productivity change. *Review of Economic Studies* 34 (July): 349–83.

#### *4. Presentation & Discussion (1): Basic Theory*

### **5. The Measurement of Output, Intermediate Inputs and Value Added**

Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. 2005. "The Changing Structure of Output and Intermediate Inputs". Chapter 4 in Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. *Information Technology and the American Growth Resurgence*, Productivity Volume 3, The MIT Press, Cambridge, Massachusetts, London.

Sato, Kazuo. 1976. "The Meaning and Measurement of the Real Value Added Index", *The Review of Economics and Statistics*, Vol. 58 (4): 434-442

### **6. Reconstruction of China's National Accounts and Price Indices**

\*Harry X. Wu and Zhan Li. 2021. "Reassessing China's GDP Growth Performance: An Exploration of the Underestimated Price Effect", *RIETI Discussion Papers*, forthcoming

\*Harry X. Wu and Keiko Ito. 2015. "Reconstructing China's Supply-Use and Input-Output Tables in Time Series", *RIETI Discussion Papers* 15-E-004, 2015

#Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. 2005. "The Changing Structure of Output and Intermediate Inputs". Chapter 4 in Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. *Information Technology and the American Growth Resurgence*, Productivity Volume 3, The MIT Press, Cambridge, Massachusetts, London. (#Repeated)

#### *7. Presentation & Discussion (2): Output*

### **8. The Measurement of Capital Input: Capital Stock and Capital Services**

Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. 2005. "Capital Services and Information Technology". Chapter 5 in Dale W. Jorgenson, Mun S. Ho, and Kevin J.

Stiroh. *Information Technology and the American Growth Resurgence*, Productivity Volume 3, The MIT Press, Cambridge, Massachusetts, London

Charles R. Hulten. 1990. "The Measurement of Capital". In Ernst R. Berndt and Jack E. Triplett (eds.), *Fifty Years of Economic Measurement*, 119–52. Studies in Income and Wealth, vol. 54. Chicago: University of Chicago Press.

## **9. Construction of China's Capital Stock and Estimation of Capital Services**

\*Harry X. Wu. 2015. "Constructing China's Net Capital Stock and Measuring Capital Services in China, 1980-2010", *RIETI Discussion Papers* 15-E-006, 2015

#Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. 2005. "Capital Services and Information Technology". Chapter 5 in Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. *Information Technology and the American Growth Resurgence*, Productivity Volume 3, The MIT Press, Cambridge, Massachusetts, London

## *10. Presentation & Discussion (3): Capital*

## **11. The Measurement of Labor Input: Labor Quantity and Compensation Matrices**

Peter T. Chinloy. 1980. "Sources of Quality Change in Labor Input", *American Economic Review* 70 (1), 108-19

Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. 2005. "Labor Input and the Returns to Education". Chapter 6 in Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. *Information Technology and the American Growth Resurgence*, Productivity Volume 3, The MIT Press, Cambridge, Massachusetts, London

## **12. Construction of China's Labor Quantity and Compensation Matrices**

\*Harry X. Wu, Ximing Yue and George G. Zhang. 2015. "Constructing Annual Employment and Compensation Matrices and Measuring Labor Input in China", *RIETI Discussion Papers* 15-E-005, 2015

#Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. 2005. "Labor Input and the Returns to Education". Chapter 6 in Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. *Information Technology and the American Growth Resurgence*, Productivity Volume 3, The MIT Press, Cambridge, Massachusetts, London

## *13. Presentation & Discussion (4): Labor*

## **14. The Jorgensonian APPF Model with Domar Aggregation, and the Case of China**

Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. 2005. "Productivity Growth for U.S. Industries". Chapter 7 in Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh.

*Information Technology and the American Growth Resurgence*, Productivity Volume 3, The MIT Press, Cambridge, Massachusetts, London

Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. 2005. "The Industry Origins of the American Growth Resurgence". Chapter 8 in Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. *Information Technology and the American Growth Resurgence*, Productivity Volume 3, The MIT Press, Cambridge, Massachusetts, London

\*Harry X. Wu. 2019. "Losing Steam? —An Industry Origin Analysis of China's Productivity Slowdown", Chapter 8 in Barbara Fraumeni (ed.) *Measuring Economic Growth and Productivity: Foundations, KLEMS Production Models, and Extensions*, Academic Press, 2019

\*#Harry X. Wu. 2019. "In Quest of Institutional Interpretation of TFP Change – The Case of China", *Man and the Economy*, 6 (2), 2019

\*Harry X. Wu. 2016. "On China's Strategic Move for the New Stage of Development – A Productivity Perspective", in Dale Jorgenson, Marcel Timmer and Kyoji Fukao (eds.), *The World Economy: Growth or Stagnation*, Cambridge University Press, 2016: 199-233

### **Basic and Extended Reference Books**

There is no standard textbook for this course. As introduced below, a book by Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh (2005) on the measurement of the contribution of information and communication technologies in productivity growth is used as the basic reference book because of its nearly full coverage of the major issues in productivity measurement that well serve the objectives of the course. Besides, three NBER volumes of Studies in Income and Wealth are used as extended reference books to expose students to more topics in economic measurement.

#### *Basic Reference*

Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh. 2005. *Information Technology and the American Growth Resurgence*, Productivity Volume 3, The MIT Press, Cambridge, Massachusetts, London.

#### *Extended References*

Dale W. Jorgenson, Frank Gollop, and Barbara Fraumeni. 1987. *Productivity and U.S. Economic Growth*, Harvard University Press, Cambridge, MA

Ernst R. Berndt and Jack E. Triplett. 1990. *Fifty Years of Economic Measurement: The Jubilee of the Conference on Research in Income and Wealth*. National Bureau of Economic Research, Studies in Income and Wealth Vol. 54. Chicago and London, The University of Chicago Press.

Charles R. Hulten, Edwin R. Dean, and Michael J. Harper. 2001. *New Development in Productivity Analysis*. National Bureau of Economic Research, Studies in Income and Wealth Vol. 63. Chicago and London, The University of Chicago Press.

Dale W. Jorgenson, J. Steven Laudefeld, and William D. Nordhaus. 2006. *A New Architecture for the U.S. National Accounts*. National Bureau of Economic Research, Studies in Income and Wealth Vol. 66. Chicago and London, The University of Chicago Press.

### **Requirement of Assignment**

1. All graduate students enrolled in this subject must be prepared for the required readings before each lecture topic.
2. Written notes on the readings should follow the “standards” of literature review in social sciences in general.
3. Term papers should follow the norm of journal papers in economics with a simple but by no means superficial abstract of 100-150 words and the relevant JEL codes at the beginning.

### **Timetable**

The lecture will be conducted on every Wednesday afternoon.

### **Office Hours**

Fixed office hours are tentatively set on every Thursday afternoon or by appointment.