

The University of New South Wales
School of Economics

ECON4309/ECON6309 Economic Measurement

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Lecture: Fri. 12-2pm
Tutorial: Fri. 2-3pm
Location: ASB 105

Consultation: Fridays 9-12pm
Course website: Login at
www.vista.elearning.unsw.edu.au

Units of Credit: 6

Semester 2, 2009

Course Objectives

The aim of this course is to give you a solid foundation in the field of economic measurement. This is not only valuable in itself, but also aids in the understanding of data sources, uses and reliability, which can enhance empirical modelling and understanding. A side objective is to practice rigorous economic and mathematical reasoning to enhance your analytical skills. In addition, the course provides opportunities for developing applied research, technical writing, collaboration and communication skills, which are of great value in the workplace and in studying other courses.

Course Contents

This course covers the theory and practice of economic measurement, including the measurement of key economic indicators such as the Consumer Price Index, Gross Domestic Product and productivity growth. Approaches employed by statistical agencies will be highlighted, along with the possibility that policy implications are often reliant on the choice of measurement techniques. The course will be technically rigorous, particularly in the use of microeconomic theory and econometric analysis, and will draw on the latest international research developments. A substantial research project will form part of the overall assessment.

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1 Textbook

There is no required textbook for this course. Readings will be assigned for each topic, as appropriate. In particular, we will make use of three sources of notes that have been prepared by Professor W. Erwin Diewert of the University of British Columbia, with titles (and abbreviations) as follows:

- Index Number Theory and Measurement Economics (“INTME”):
www.econ.ubc.ca/diewert/580chmpg.htm
- The Measurement of Business Capital, Income and Performance (“Barcelona Lectures”)
www.econ.ubc.ca/diewert/barcelona.htm
- Applied Economics (“AE”)
www.econ.ubc.ca/diewert/594chmpg.htm

We will also make reference to the following publications by international agencies:

- OECD Productivity Manual:
www.oecd.org/dataoecd/59/29/2352458.pdf
- CPI Manual (International Labour Office):
www.ilo.org/public/english/bureau/stat/guides/cpi/index.htm

2 Some Other Resources

1. The Centre for the Study of Living Standards (CSLS) publishes the *International Productivity Monitor*, which publishes articles which are “largely nontechnical in nature and understandable to a wide audience of productivity researchers and analysts as well as the general public”. CSLS also publishes various interesting reports: www.csls.ca
2. The International Association for Research in Income and Wealth publishes the academic journal *Review of Income and Wealth*, and organises conferences with economic measurement themes: www.iariw.org

3 Consultation

Students are encouraged to ask questions related to this subject during lectures when time permits, and especially during tutorials. The lecturer is available **Fridays 9am-12noon, ASB424** for further consultations; for access, dial extension 53320 on the intercom in the fourth floor West Lobby of the ASB Building. Other consultation hours are possible by appointment.

4 Parallel Teaching

Honours, M.Ec. and PhD students may be taught in the same class. There will be appropriately different expectations for students at different stages of study, in particular in relation to the research assignment.

5 Student Learning Outcomes

This course is designed to assist students in developing their ability to:

- acquire and use up-to-date bodies of knowledge, through research-led teaching;
- contribute to the well-being of society, through skilled, responsible, imaginative, ethical and flexible professional practice;
- confidently continue to learn, through an openness to ideas and an understanding of their own potential;
- use a global outlook, through awareness of similarities and differences across borders, and seeing the world as the context for their future career development.

Table 1: Graduate Attributes

Course Learning Outcomes	ASB Graduate Attributes
1, 2	1. Critical thinking and problem solving
2, 3	2. Communication
2, 3, 4	3. Teamwork and leadership
2, 4	4. Social, ethical and global perspectives
1	5. In-depth engagement with relevant disciplinary knowledge
1, 2, 3	6. Professional skills

6 Approach to Learning and Teaching

This is not a course where you can become proficient just by observing. You will need to get involved in class — evaluating information, asking and answering questions. You must also learn to organise your independent study and practise enough problems to gain a thorough understanding of concepts and how to apply them.

Students are expected to

- put a consistent effort into learning activities throughout the semester,
- take a responsible role in preparing for tutorials and participating in them,
- develop communication skills through engaging in classroom discussions,
- concentrate on understanding how and why to use formulae and less on memorising them,
- learn to work effectively with other students in order to complete tutorial and research assignments, and
- make continuous improvements by using the feedback from assessments.

The philosophy underpinning this course and its Teaching and Learning Strategies are based on "Guidelines on Learning that Inform Teaching at UNSW. These guidelines may be viewed at: www.guidelinesonlearning.unsw.edu.au. The lectures, tutorials and assessment have been designed to appropriately challenge students and support the achievement of the desired learning outcomes. A climate of inquiry and dialogue is encouraged between students and the lecturer, and among students (in and out of class). The lecturer aims to provide meaningful and timely feedback to students to improve learning outcomes.

7 Classes and Other Teaching Strategies

7.1 Lectures

Lectures will introduce and emphasise the course content. They will include explanation of relevant topics and theory together with the use of worked examples to demonstrate the theory in practice. Where possible, lectures will show the relevance and application of the quantitative techniques covered in this course to real-world applications.

To get the most out of the lectures, students are strongly encouraged to familiarise themselves with the prescribed readings as given in the course outline prior to attending each lecture, and to be prepared to take notes during the lecture itself.

There is only a very limited time for questions to be answered during the lectures themselves. However, the tutorial class (see below) is an ideal forum for students to test their understanding and seek further instruction. Additionally, consultation times with lecturer can be used by students to clarify the lecture material.

You should attend one two-hour lecture per week.

7.2 Tutorials

Tutorials commence in week 1. The purpose of tutorials is to enable students to raise questions about difficult topics or problems encountered in their studies, and to develop communication skills. Students must not expect another lecture, but must come prepared with questions of their own.

Students are reminded of the University rule that if they attend less than 80 percent of possible classes, including tutorials, they may be refused final assessment.

7.3 Workload Expectations

It is expected that you will spend at least ten hours per week studying this course. This time should be made up of reading, research, working on exercises and attending classes. In periods where you need to complete assignments or prepare for examinations the workload may be greater. Over commitment has been a cause of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

8 Assessment

Assessment will be on the basis of tutorial assignments, a research assignment, a mid-semester examination, and an end-of-session examination:

Table 2: Assessments, Outcomes and Attributes

Assessment	Weight	Learning Outcomes assessed	ASB Graduate Attributes assessed	Length	Due Date
Tutorial Assignments	10%	1, 2, 3	1, 2, 3, 4, 5, 6	See section 8.1	
Mid-Semester Examination	20%	1, 2	1, 2, 5, 6	1 hour	4 September
Research Assignment	20%	1, 2, 3, 4	1, 2, 3, 4, 5, 6	See section 8.3	Last lecture
End-of-Semester Examination	50%	1, 2	1, 2, 5, 6	3 hours	Exam period

8.1 Tutorial Assignments

To facilitate the goals of the tutorials (see section 7.2), a set of exercises is assigned each week. **Students should attempt all of them.** Students will not gain a proper understanding of the topics unless they master these assignments. (The tutorial exercises will give a good indication of the kind of questions that can be expected in examinations.)

Answers to tutorial assignments will be collected from students without warning. Four tutorial assignments (2.5% weight on each) will count towards 10% of your overall mark for the subject. Hence, you should come to each tutorial with your attempted answers neatly prepared in case the assignment is collected during that tutorial. More than four assignments may be collected during the semester but only four assignments will count towards your overall mark.

Students are encouraged to collaborate on these assignments. However, the presentation of the answers should be done individually. Identically presented answers will be given a mark equal to (raw mark)/(total number of identical assignment answers).

8.2 Mid-Semester Examination

There will be a one-hour mid-semester examination on Friday 4 September 2009. This examination will be held during the regular lecture time, specifically 12:30-1:30pm. You should arrive at the venue by 12:15pm. Subject material from lectures for weeks 1–6, inclusive, will be examined.

The main purpose of the mid-semester exam is to test knowledge of the topics covered so far, the ability to use formulae appropriately and to perform calculations with speed and accuracy. Feedback from the exam can be used to improve performance in these areas.

There is no supplementary or replacement exam for the mid-semester exam. If you miss the mid-semester exam because of illness or other valid reason, you must contact the Lecturer and provide documentary evidence. Adjustments will then be made to the final exam mark on a pro-rata basis. Failure to do so will result in a mark of 0 being recorded for the mid-semester.

8.3 Research Assignment

The assignment will be distributed in Week 3, and will be due on 16 October (Week 12). It should be submitted at the start of the lecture on this day.

The research assignment is intended to help students develop applied research and technical writing skills. *The best assignment will be considered for presentation at the Economic Measurement Group Workshop '08, 10-12 December.*

The penalty for late submission will be FIVE MARKS (out of twenty) per day.

8.4 Final Examination

The final will be a three hour examination held during the period 30 October to 17 November 2009. The format of the exam will be announced in the last week of lectures.

9 Academic Honesty and Plagiarism

Students are reminded that the University regards academic misconduct as a very serious matter. Students found guilty of academic misconduct are usually excluded from the University for two years. Because of the circumstances in individual cases the period of exclusion can range from one semester to permanent exclusion from the University.

The following are some of the actions which have resulted in students being found guilty of academic misconduct in recent years:

1. Taking unauthorised materials into an examination.
2. Submitting work for assessment knowing it to be the work of another person.
3. Improperly obtaining prior knowledge of an examination paper and using that knowledge in the examination.
4. Failing to acknowledge the source of material in an assignment.

The University regards plagiarism as a form of academic misconduct, and has very strict rules regarding plagiarism. For UNSW's policies, penalties, and information to help you avoid plagiarism see: <http://www.lc.unsw.edu.au/plagiarism/index.html> as well as the guidelines in the online ELISE tutorial for all new UNSW students: <http://info.library.unsw.edu.au/skills/tutorials/InfoSkills/index.htm>.

10 Student Conduct and Behaviour

Students are expected to be familiar with and adhere to university policies in relation to class attendance and general conduct and behaviour, including maintaining a safe, respectful environment; and to understand their obligations in relation to workload, assessment and keeping informed.

Information and policies on these topics can be found in the 'A-Z Student Guide': <https://my.unsw.edu.au/student>. See, especially, information on 'Attendance and Absence', 'Academic Misconduct', 'Assessment Information', 'Examinations', 'Special Consideration', 'Student Responsibilities', 'Workload' and policies such as 'Occupational Health and Safety'.

11 Keeping Informed

You should take note of all announcements made in lectures, tutorials or on the course web site. From time to time, the University will send important announcements to your university e-mail address without providing you with a paper copy. You will be deemed to have received this information. It is also your responsibility to keep the University informed of all changes to your contact details.

12 Special Consideration — Illness and Misadventure

If you believe that your performance in an assessment, either during semester or in an examination, has been adversely affected by sickness or other adverse circumstances, you should formally apply for special consideration following the process below.

The UNSW policy and process for Special Consideration applies (see my.unsw.edu.au/student/atoz/SpecialConsideration.html). Specifically:

- Applications for special consideration (including supplementary examinations) must be submitted to UNSW Student Central, lower ground floor of the Chancellery building (within 3 working days of the assessment to which it refers);
- Applying for special consideration does not automatically mean that you will be granted additional assessment or that you will be awarded an amended result;
- If you are making an application for special consideration (through UNSW Student Central) please notify the Lecturer. You should also give him a copy of your application as only a very brief summary is forwarded by Central Administration.

- Please note: a register of applications for Special Consideration is maintained. History of previous applications for Special Consideration is taken into account when considering each case.
- Students should be aware that lodgement of a request for special consideration does not guarantee the granting of a supplementary examination. This will only be recommended by the School of Economics for students whose final examination performance has been affected by serious illness or other extraordinary circumstances which can be documented AND if there is evidence on the basis of performance during the semester that the student has made satisfactory progress.

13 Student Support Services

- Education Development Unit: www.business.unsw.edu.au/edu Room G07 Ground Floor, West Wing, ASB Building, 9385 5584, Edu@unsw.edu.au.
- Learning Centre: www.lc.unsw.edu.au, Level 2 of the Library, 9385 3890.
- UNSW IT Service Desk: Technical support for problems logging in to websites, downloading documents etc. Library, Level 2; Ph: 9385 1333. Website: www.its.unsw.edu.au
- Counselling Service: www.counselling.unsw.edu.au, Level 2, Quadrangle East Wing, 9385 5418.
- Student Equity and Disabilities Unit: www.studentequity.unsw.edu.au, 9385 4734.

In addition, it is important that all students are familiar with University policies and procedures in relation to such issues as:

- Examination procedures and advice concerning illness or misadventure:
<https://my.unsw.edu.au/student/academiclife/assessment/examinations/examinationrules.html>
- Occupational Health and Safety policies and expectations:
<https://my.unsw.edu.au/student/atoz/OccupationalHealth.html>

14 Continual Course Improvement

Each year feedback is sought from students and other stakeholders about the courses offered in the School of Economics and continual improvements are made based on this feedback. UNSW's Course and Teaching Evaluation and Improvement (CATEI) Process (s) is one of the ways in which student evaluative feedback is gathered. Significant changes to courses and programs within the School are communicated to subsequent cohorts of students.

Additional customised surveys may also be used to provide information to course staff.

Students are welcome to provide the lecturer with feedback at any time during the semester.

15 Lecture Outline

Table 3: Economic Measurement: APPROXIMATE LECTURE OUTLINE

Week	Date	Topics
1	24 July	Introduction to Economic Measurement and Early Approaches to Index Numbers
2	31 July	Axiomatic Approach to Bilateral Index Number Theory
3	7 August	The Cost of Living Index I
4	14 August	The Cost of Living Index II
5	21 August	Elementary Indexes
6	28 August	Adjusting for Quality Change
7	4 September	MID-SEMESTER EXAMINATION IN CLASS, 12:30-1:30pm Arrive by 12:15pm
	11 September	Mid-Semester Break
8	18 September	Measurement of Capital
9	25 September	Measurement of Labour
10	2 October	Measurement of Income
11	9 October	Measurement of Productivity I
12	16 October	Measurement of Productivity II Special Topics/Review/Research Directions

16 Topics in More Detail

Introduction to Economic Measurement and Early Approaches to Index Numbers

1. The Purpose and History of Economic Measurement
2. Index Number Purpose and Overview
3. The Fixed Basket Approach
4. The Unweighted Statistical or Stochastic Approach
5. The Weighted Stochastic Approach of Theil
6. The Divisia Approach
7. The Approaches of Bennet and Montgomery
8. The Aggregation Theorems of Hicks and Leontief

Primary References:

- Griliches, Z. (1985), “Data and Econometricians—The Uneasy Alliance,” *American Economic Review* 75(2), 196–200.
- Griliches, Z. (1994), “Productivity, R&D, and the Data Constraint,” *American Economic Review* 84, 1–23
- Diewert (INTME): Chapter 1

Axiomatic Approach to Bilateral Index Number Theory

1. Bilateral Indexes and Some Early Tests
2. Homogeneity Tests
3. Invariance and Symmetry Tests
4. Mean value tests
5. Monotonicity Tests
6. The Fisher ideal index and the test approach
7. The Test Performance of Other Indexes
8. The Additivity Test
9. The Circularity Test

Primary Reference:

Diewert (INTME): Chapter 3

The Cost of Living Index I: Theory

1. The Könus Cost of Living Index for a Single Consumer
2. The True Cost of Living Index when Preferences are Homothetic
3. Wold's Identity and Shephard's Lemma
4. Superlative Indexes: The Fisher Ideal Index
5. Quadratic Mean of Order r Superlative Indexes
6. Superlative Indexes: The Törnqvist Index

Primary References:

Diewert (INTME): Chapter 4

Diewert (1976), "Exact and Superlative Index Numbers," *Journal of Econometrics* 4, 114–145.

The Cost of Living Index II: Multiple Consumers and Problems with the Theory

1. Plutocratic Cost of Living Indexes and Observable Bounds
2. The Fisher Plutocratic Price Index
3. Democratic versus Plutocratic Cost of Living Indexes
4. Do Households Face Prices that are Independent of the Quantity Purchased?
5. Household Composition is not Constant over Time
6. Household Preferences and Environmental Variables are not Constant over Time
7. Is it Realistic to Assume that Households have Preferences over all Possible Commodities?
8. Traditional Consumer Theory Ignores the Problems Posed by Household Production
9. The Problem of Integer Purchases rather than Continuous Unit Purchases
10. Economic Approaches to the CPI do not Deal Adequately with the Problem of Seasonal Commodities

Primary References:

Diewert (INTME): Chapters 5 and 6

Prais, S.J. (1959), "Whose Cost of Living?" *Review of Economic Studies* 26, 126–134.

Elementary Indexes

1. Ideal Elementary Indexes
2. Elementary Indexes used in Practice
3. Relationships between the Frequently Used Elementary Indexes
4. Axiomatic Approach to Elementary Indexes

5. Economic Approach to Elementary Indexes
6. Sampling Approach to Elementary Indexes
7. Stochastic Approach to Elementary Indexes

Primary References:

Diewert (INTME): Chapter 10

CPI Manual, Chapter 9

Adjusting for Quality Change: Hedonic Regressions

1. Matched Models Method
2. Some Quality Adjustment Methods
3. Comparison of Implicit Methods of Quality Adjustment
4. Explicit Methods of Quality Adjustment
5. Hedonic Regression Approach
6. Hedonic Price Indexes

Primary Reference:

CPI Manual: Chapter 7

Diewert, W.E. (2003), "Hedonic Regressions: A review of some unresolved issues," manuscript.
<http://www.econ.ubc.ca/diewert/hedonic.pdf>

Some Supplementary Reading

Fox, K.J. and D. Melser (2008), "Nonlinear Pricing: Evidence and Implications from Scanner Data," manuscript.

Measurement of Capital

1. Capital Stock Construction
2. User Cost of Capital
3. Implementation of the User Cost Approach
4. Some Difficult Topics: capital stocks for R&D, inventories and land.

Primary References:

Diewert: Barcelona Lectures, chapters I to VI.

Diewert, W.E. and K.J. Fox (2005), "The New Economy and an Old Problem: Net versus Gross Output," manuscript.

Fox, K.J. (1997), "Open Economy Data Sets for 18 OECD Countries, 1960–1992," UNSW School of Economics Discussion Paper 97/26.

Measurement of Labour

1. Measurement of hours worked
2. Measurement of Human Capital
3. Quality Adjustment of Labour Inputs

Primary References:

- Australian Bureau of Statistics Information Paper (6106.0.55.001): *ABS Labour Market Statistics*, 2003.
- ABS Research Paper (1352.0.55.077): *Estimating Average Annual Hours Worked* (Methodology Advisory Committee), 2006
- ABS Research Paper (1351.0.55.010): *Quality-adjusted Labour Inputs*, 2005
- ABS Working Paper: *Measuring the Stock of Human Capital for Australia — Experimental Estimates*, Working Paper No. 2004/1.

Some Supplementary Reading:

- Griliches, Z. (1996), "Education, Human Capital, and Growth: A personal perspective," NBER Working Paper 5426.
- Fox, K.J. (2007), "Progress and Challenges in the Measurement of Productivity," manuscript.
- Fox, K.J. and C.M. Schwartz (2007), "Alternative Measures of Labour Underutilisation: Gender, education and unemployment," Centre for Applied Economic Research Working Paper No. 2007/04, University of New South Wales, Sydney, Australia.

Measurement of Income

1. Real GDP versus Real Domestic Income
2. Gross, Net and Alternative Definitions of Income

Primary References:

- Diewert: Barcelona lectures, chapter VII.
- Diewert, W.E. and K.J. Fox (2007), "The New Economy and an Old Problem: Net versus Gross Output and the Measurement of Productivity," manuscript.
- Kohli, U. (2004), "Real GDP, Real Domestic Income, and Terms-of-trade Changes," *Journal of International Economics* 62, 83–106.

Supplementary Reading

- Hill, R.J. and T.P. Hill (2003), "Expectations, Capital Gains and Income," *Economic Inquiry* 41, 607–619.

Measurement of Productivity I

1. One Input and One Output Case
2. Determinants of Productivity growth
3. Increasing Returns to Scale
4. Index Number Approach to the Measurement of Productivity

Primary References:

Diewert: Barcelona lectures, chapter VIII.

Diewert, W.E. and K.J. Fox (2001), “The Productivity Paradox and Mismeasurement of Economic Activity,” in K. Okina and T. Inoue (eds.), *Monetary Policy in a World of Knowledge-based Growth, Quality Change, and Uncertain Measurement*, Palgrave.

Some Supplementary Reading:

Caves, D.W., L.R. Christensen and W.E. Diewert (1982), “The Economic Theory of Index Numbers and the Measurement of Input, Output, and Productivity,” *Econometrica* 50, 1393–1414.

Connolly, E. and K.J. Fox (2006), “The Impact of High-Tech Capital on Productivity: Evidence from Australia,” *Economic Inquiry* 44(1), 50–68.

Diewert, W.E. and K.J. Fox (2007), “Returns to Scale, Technical Progress and Monopolistic Markups,” manuscript.

Diewert, W.E. and C.J. Morrison, Adjusting Output and Productivity Indexes for Changes in the Terms of Trade, *Economic Journal* **96**, 659–679 (1986).

Fox, K.J. and U. Kohli (1998), “GDP Growth, Terms-of-Trade Effects, and Total Factor Productivity,” *Journal of International Trade and Economic Development* Vol. 7, No. 1, 87-110.

OECD Productivity Manual

Measurement of Productivity II

1. Translog GDP Function
2. Accounting for Growth: An index number approach
3. Accounting for Growth: Parametric estimates
4. The Decomposition of Technical Change: An alternative approach
5. Specification of Functional Form and the Estimation of Technical Progress
6. Efficiency Analysis
7. Malmquist Index

Primary References:

Fox, K.J. and U. Kohli (1998), “GDP Growth, Terms-of-Trade Effects, and Total Factor Productivity,” *Journal of International Trade and Economic Development* Vol. 7, No. 1, 87-110.

Coelli, Battese and Rao (1998), *An Introduction to Efficiency and Productivity Analysis*, Kluwer Academic Publishers, chapters 6 and 8.

Diewert: AE, Chapter 8.

Diewert: Barcelona lectures, chapter IX.

Some Supplementary Reading:

- Färe, R., S. Grosskopf, M. Norris and Z. Zhang (1994), "Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries," *American Economic Review* 84, 66–83.
- Fox, K.J. (1996) "Specification of Functional Form and the Estimation of Technical Progress," *Applied Economics* 28, 1996, 947–956.
- Fox, K.J. and W.E. Diewert (1999), "Is the Asia-Pacific Region Different? Technical Progress Bias and Price Elasticity Estimates for 18 OECD Countries, 1960–1992," in T-T. Fu, C.J. Huang and C.A.K. Lovell (eds.) *Economic Efficiency and Productivity Growth in the Asia-Pacific Region*, Edward Elgar Publishing, 1999.
- Diewert, W.E. and K.J. Fox (2008), "Returns to Scale, Technical Progress and Monopolistic Markups," *Journal of Econometrics*, forthcoming.
- Diewert, W.E. and K.J. Fox (2007), "Malmquist and Törnqvist Productivity Indexes: Returns to scale and technical progress with imperfect competition," manuscript.
- Fox, K.J., R.Q. Grafton, J. Kirkley and D. Squires (2003), "Property Rights in a Fishery: Regulatory Change and Firm Performance," *Journal of Environmental Economics and Management* 46, 156–177.
- Fox, K.J., D.P. Dupont, D.V. Gordon and R.Q. Grafton (2005), "Profit and Price Effects of Multi-species Individual Transferable Quotas," *Journal of Agricultural Economics* 56, 31–57.
- Fox, K.J., R.Q. Grafton, T. Kompas, and T.N. Che (2006), "Capacity Reduction, Quota Trading and Productivity: The Case of a Fishery," *Australian Journal of Agricultural and Resource Economics* 50, 189–206.
- Lawrence, D. W.E. Diewert and K.J. Fox (2006), "The Contribution of Productivity, Price Changes and Firm Size to Profitability" *Journal of Productivity Analysis*, 26, 1–13.

Special Topics/Review/Research Directions

1. Topics by demand
2. Review
3. Research Directions: Problems that students should solve in the future

Primary References:

- Diewert, W.E. (2001), "Research in Price Measurement for the Next Twenty Years," University of British Columbia, Department of Economics Discussion Paper No. 01-11. www.econ.ubc.ca/discpapers/dp0111.pdf
- Diewert, W.E. (2006), "The Berne OECD Workshop on Productivity Analysis and Measurement: Conclusions and Future Directions," www.econ.ubc.ca/diewert/conclusions.pdf