

nake nieuws

jaargang 7, nr. 2

April 1995

Netwerk Algemene en Kwantitatieve Economie

Netherlands Network of Economics

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Woord vooraf

Nu de cursussen van het Utrecht-programma bijna ten einde lopen is het weer tijd voor de afsluitende workshop van dit jaar. Gedurende de week van 12 t/m 16 juni zal de Rijksuniversiteit Leiden gastvrijheid verlenen voor de NAKE-workshop. Wederom is het gelukt om vier toppers naar Nederland te halen: **David Card** (Princeton University) is één van de belangrijkste arbeidseconomen van dit moment. Hij is co-editor van *Econometrica*. Tijdens de workshop zal hij een cursus verzorgen over *Education and the Labor Market*. **John Moore** (LSE) is niet alleen een briljant onderzoeker, die zich moeiteloos beweegt van de macro-economie (credit markets and business cycles) naar de micro-economie (financiële intermediatie, mechanism design, theorie van organisaties) en vice-versa, maar hij is ook een begenadigd docent. Zijn cursus heeft als titel: "Credit markets and aggregate fluctuations". **Barry Eichengreen** (UCLA) heeft grote naam verworven als internationaal econoom en economisch historicus. Zijn onderzoek omvat de geschiedenis van internationale financiële stelsels, de crisis van de jaren '30, de wederopbouw na WOII en de Europese monetaire eenwording. Zijn werk laat zien dat het verleden juist bij het ontwerp van instituties ook voor het heden uiterst relevant kan zijn. De econometrie-cursus wordt verzorgd door **Thomas Stoker** (MIT, Sloan School of Management), een expert op het gebied van de semi-parametrische econometrie.

Het is weer een intensief programma; het zal moeilijk zijn om alle cursussen te volgen. Het verdient daarom aanbeveling om - ook in de voorbereiding - op drie cursussen te concentreren. Van de deelnemers wordt verwacht dat zij een *verslag* schrijven van één van de cursussen. Als voorbeeld voor een dergelijk verslag kunnen de verslagen dienen van de december-workshop die in dit "nake nieuws" zijn opgenomen. Voor AIO/OIO's die aan het *nake* programma deelnemen vormen de workshops een verplicht onderdeel van het programma.

Aanmelding voor de workshop kan door het formulier in dit NAKE-nieuws volledig in te vullen en **vóór 12 mei** a.s terug te sturen. Wij zullen dan proberen het cursusmateriaal enkele weken van te voren toe te sturen.

Naast alle informatie over de komende workshop bevat dit "nake nieuws" drie uitstekende verslagen van de december workshop over *Growth, Migration and Regional Development* door Harm Zebregs, Marcel Timmer en Hiek van der Scheer. Waarvoor mijn dank.

Tijdens de komende workshop zal ook de ledenvergadering van het Netwerk Algemene en Kwantitatieve Economie plaatsvinden. Alle 135 leden (= fellows) worden hiervoor van harte uitgenodigd. Zij zullen in de loop van mei ook het - optimistisch gestemde - Jaarverslag van het NAKE ontvangen. Het Netwerk mag zich nog steeds in een stijgende belangstelling verheugen. Het aantal deelnemers aan de Utrecht cursussen is sinds 1990 meer dan verdubbeld, van 134 deelnemers in 1990 tot 278 deelnemers in 1993, en zelfs 296 in 1994. Naast de zes economische faculteiten en LU Wageningen nemen nu ook AIO's van de Universiteit van Nijmegen (Fac. Beleidswetenschappen), TU Twente (Bestuurskunde), TU Eindhoven en de Juridische Faculteit (vakgroep economie) van de RU Groningen officieel aan het NAKE deel.

Casper van Ewijk

Ledenvergadering

15 juni 1995, Leiden

De ledenvergadering van het Netwerk Algemene en Kwantitatieve Economie vindt plaats tijdens de *nake* workshop in Leiden, op **donderdagmiddag 15 juni 1995**. Nadere informatie wordt in mei aan de leden toegestuurd.

Inventarisatie cursussen 1995/1996

Op de middenpagina's is een overzicht opgenomen van alle cursussen die in beginsel door fellows van het *nake* worden aangeboden. Hiervan kunnen er in het komende cursusjaar zestien à twintig in het "Utrecht-programma" worden opgenomen. Voor de samenstelling van het programma is het van belang om inzicht te hebben in de potentiële belangstelling voor de verschillende cursussen. Daarom wil ik graag alle (potentiële) deelnemers verzoeken om het *inventarisatie*-formulier op de middenpagina's in te vullen en te retourneren **vóór 12 mei** a.s. De outlines van alle cursussen kunnen worden opgevraagd bij het NAKE-secretariaat. Suggesties voor gewenste nieuwe cursussen zijn vanzelfsprekend ook welkom. Het nieuwe programma voor het cursusjaar 1995/1996 zal in juni bekend worden gemaakt.

nake spring workshop

Leiden June 12 - 16

The Netherlands Network of Economics organises a workshop for PhD students in general and quantitative economics from June 12 - 16 at the University of Leiden. Four courses will be given on different subjects; each course consists of five lectures from Monday to Friday.

..... Courses

Professor John Moore, *London School of Economics*

"Debt, Aggregate Fluctuations and Financial Intermediation"

Professor David Card, *Princeton University*

"Lectures on Education"

Professor Barry Eichengreen, *University of California at Berkeley*

"Topics in International Economic History"

Professor Thomas Stoker, *MIT, Sloan School of Management*

"Semi-parametric econometrics"

..... Private Consultations

During the workshop it is possible for PhD students to have a private talk with one (or more) of the lecturers. Students who wish to consult one of the lecturers on their research are invited to hand in a brief description (one page) of the research(-proposal) they would like to discuss. Each consultation will be approx. 30 minutes.

..... Judgement and Credits

The *nake*-workshops are obligatory for all first-year and second-year graduate students following the *nake*-programme. So, each student has to attend at least four workshops. For three workshops the student should write a comprehensive report on the lectures of one course based on notes taken

during the workshop and the literature. These reports are judged by the organiser(s) of the workshop. All (NAKE-) students are expected completely to follow at least 3 courses.

With regard to study intensity, participation in the workshop (including the judgement by the written report) is worth 2 "Study Points" (SP); one SP = 40 hours.

..... Registration

Participation in the workshop is free for AIO's/OIO's of the institutions participating in **nake**, including tea, coffee, lunches, reception, dinner on Thursday. The participants carry the costs of accommodation and breakfast. These costs, together with travel expenses, can however be declared at the faculties. There are hotel rooms available in a hotel near the University. It is recommendable to share a room (price single room about Dfl. 90, double room from Dfl. 125 to 170).

The number of participants in the workshop is limited. NAKE-students have precedence, and the date of receipt of the registration form is also taken into consideration. (Binding) arrangements are made for lunches, dinner, accommodation etc. and we would therefore request you to notify the NAKE secretariat of any alterations. You can register by filling in the form on the middle page as fully as possible and returning it to the NAKE secretariat **before 12 May 1995**. After registration you will receive a confirmation of registration together with readers for the courses, hotel information, a street plan of Tilburg etc.

..... Addresses and Information

Location: University of Leiden
"Academiegebouw", Rapenburg 73, room 012

Information: NAKE-secretary, José Dijkzeul, Roetersstraat 11, 1018 WB Amsterdam. Tel. +31-20-5254199, Fax +31-20 5255280, E-mail: nake@butler.fee.uva.nl

Local organiser: Arjan Heyma, Tel. +31-71-277616

Hotels: several, t.b.a., price indication: Dfl. 90 (single room), Dfl 125 to 170 (double room)

Provisional Programme NAKE - Workshop
Leiden, 12 - 16 June 1995

| | |
|--|---|
| | Tuesday June 13 |
| <p>09.30 - 10.30 <i>registration/ coffee/tea</i></p> <p>10.30 - 12.30 Card</p> <p>12.30 - 13.30 <i>Lunch</i></p> <p>13.30 - 15.30 Eichengreen</p> <p>15.30 - 15.45 <i>coffee/tea</i></p> <p>15.45 - 17.45 Stoker</p> <p>17.45 - 18.45 <i>reception</i></p> | <p>09.00 - 10.45 Card</p> <p>10.45 - 11.15 <i>coffee/tea</i></p> <p>11.15 - 13.00 Stoker</p> <p>13.00 - 14.00 <i>Lunch</i></p> <p>14.00 - 15.45 Moore</p> <p>15.45 - 16.15 <i>coffee/tea</i></p> <p>16.15 - 18.00 Eichengreen</p> |
| Wednesday June 14 | Thursday June 15 |
| <p>09.00 - 10.30 Stoker</p> <p>10.30 - 10.45 <i>coffee/tea</i></p> <p>10.45 - 12.15 Card</p> <p>12.15 - 13.15 <i>Lunch</i></p> <p>13.15 - 14.45 Eichengreen</p> <p>14.45 - 15.00 <i>coffee/tea</i></p> <p>15.00 - 18.00 Moore</p> | <p>09.00 - 10.45 Eichengreen</p> <p>10.45 - 11.15 <i>coffee/tea</i></p> <p>11.15 - 13.00 Moore</p> <p>13.00 - 14.00 <i>Lunch</i></p> <p>14.00 - 15.45 Stoker</p> <p>15.45 - 16.15 <i>coffee/tea</i></p> <p>16.15 - 18.00 Card</p> |
| Friday June 16 | |
| <p>09.00 - 10.30 Stoker</p> <p>10.30 - 10.45 <i>coffee/tea</i></p> <p>10.45 - 12.15 Eichengreen</p> <p>12.15 - 13.15 <i>Lunch</i></p> <p>13.15 - 14.45 Card</p> <p>14.45 - 15.00 <i>coffee/tea</i></p> <p>15.00 - 17.00 Moore</p> | |

..... course outlines spring workshop.....

John Moore

DEBT, AGGREGATE FLUCTUATIONS AND FINANCIAL INTERMEDIATION

Lectures 1 and 2: Entrepreneurial Debt

- O. Hart and J. Moore (1994) "A Theory of Debt based on the Inalienability of Human Capital", *Quarterly Journal of Economics*.
- O. Hart and J. Moore (1989) "Default and Renegotiation: A Dynamic Model of Debt", *University of Edinburgh Discussion Paper*, revised 1989.
- O. Hart (1995) Chapter 4 from *Firms, Contracts and Financial Structure*.
- J. Moore (1992) "The firm as a Collection of Assets", *European Economic Review*, Section 3.

Lecture 3: Debt and Aggregate Fluctuations

- N. Kiyotaki and J. Moore (1995) "Credit Cycles", *LSE Financial Discussion Paper*, no. 205.
- M. Gertler (1988) "Financial Structure and Aggregate Economic Activity: An Overview", *Journal of Money, Credit and Banking*.

Lecture 4: Financial Intermediation

- D. Diamond and P. Dybvig (1983) "Bank Runs, Deposit Insurance and Liquidity", *Journal of Political Economy*.
- M. Hellwig (1994) "Liquidity Provision, Banking, and Allocation of Interest Rate Risk", *European Economic Review*.
- N. Kiyotaki and J. Moore (1995) "Credit Chains", in progress.

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David Card

LECTURES ON EDUCATION

Lectures 1 and 2 : Modelling and Estimating the Return to Education

These lectures will introduce some of the new (U.S.) literature that tries to use instrumental variables type estimators to measure "the return to education". We will then attempt to interpret this literature in the framework of a simple structural model of education choices.

Key readings:

David Card, "Earnings, Schooling and Ability Revisited", *NBER Working Paper* 4832, August 1994.

Joshua Angrist and Alan Krueger, "Does Compulsory Schooling Affect Schooling and Earnings?" *Quarterly Journal of Economics* 106 (November 1991).

Background Material:

A. "Theory"

Becker, Gary S. *Human Capital and the Personal Distribution of Income*, Ann Arbor: University of Michigan Press, 1967.

Willis, Robert J. "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions", in Orley Ashenfelter and Richard Layard, (eds.), *The Handbook of Labour Economics*.

Lang, Kevin. "Ability Bias, Discount Rate Bias, and the Return to Education." Unpublished Discussion Paper, Boston University Department of Economics, May 1993.

B. "Empirical Issues"

Griliches, Zvi. "Estimating the Returns to Schooling: Some Econometric Problems." *Econometrica* 45 (January 1977: 1-22).

Angrist, Joshua D. and Guido W. Imbens. "Two-Stage Least Squares Estimation of Average Causal Effects in Models with Variable Treatment Intensity." Unpublished Discussion Paper, Harvard University Department of Economics, 1993.

John Bound, D. Jaeger and R. Baker. "Problems with Instrumental Variables Estimation when the Correlation between Instruments and the Endogenous Explanatory Variables is Weak." *Journal of the American Statistical Association*, forthcoming 1995.

Butcher, Kristin F. and Anne Case. "The Effect of Sibling Composition on Women's Education and Earnings." *Quarterly Journal of Economics* 109 (August 1994).

Card, David. "Using Geographic Variation in College Proximity to Estimate the Return to Schooling" *NBER Working Paper* 4483, October 1993.

Kane, Thomas J. and Cecilia E. Rouse. "Labor Market Returns to Two- and Four-Year Colleges: Is a Credit a Credit and Do Degrees Matter?" *Princeton University Industrial Relations Section Working Paper* #311, January 1993.

Lecture 3: Models of Ability and Family Effects

This lecture will provide a (brief) review of the literature that attempts to deal with issues of schooling and ability by using data on siblings/twins/father-son pairs, etc.

Key Readings:

Orley Ashenfelter and Alan Krueger. "Estimates of the Economic Return to Schooling for a New Sample of Twins." *American Economic Review* 84 (December 1994).

Orley Ashenfelter and Cecilia Rouse. Work in progress.

Background Material:

Jere Behrman, Z. Hrubec, P. Taubman, and T. Wales. *Socioeconomic Success: A Study of the Effects of Genetic Endowments Family Environments and Schooling*. North Holland, 1980.

Gary Chamberlain and Zvi Griliches. "More on Brothers." In Paul Taubman, (ed.), *Kinometrics: Determinants of Socioeconomic Success Within and Between Families*. North Holland, 1977.

Zvi Griliches. "Sibling Models and Data in Economics: Beginnings of a Survey." *Journal of Political Economy* 87 (October 1979).

Lecture 4: The Effects of School Quality

This lecture will focus on recent literature that attempts to measure the effects of school quality on students' subsequent outcomes.

Key Reading:

David Card and Alan Krueger. "Does School Quality Matter? Return to Education and the Characteristics of Public Schools in the United States." *Journal of Political Economy* 100 (February 1992).

Background Readings:

Erik Hanushek, "The Economics of Schooling: Production and Efficiency in Public Schools." *Journal of Economic Literature* 24 (September 1986).

David Card and Alan Krueger. "School Quality and Black-White Relative Earnings." *Quarterly Journal of Economics* 107 (February 1992).

James Heckman, A.S. Layne-Farrar, and P.E. Todd. "Does Measured School Quality Really Matter? Understanding the Empirical and Economic Foundations of the Evidence". Unpublished Paper, University of Chicago, 1994.

Susanna Loeb and John Bound. "The Effect of Measured School Inputs on Academic Achievement: Evidence from the 1920, 1930, and 1940 Birth Cohorts." Unpublished Paper, University of Michigan, 1995.

Lecture 5: **Variation in the Returns to Education Over Time: Explanations and Implications**

This lecture will briefly survey some of the recent literature on changes over time in the return to education, and discuss some of the explanations and implications of these changes.

Key Readings.

Chinhui Juhn, Kevin Murphy, and Brooks Pierce. "Wage Inequality and the Rise in Returns to Skill" *Journal of Political Economy* 101 (June 1993).

John Bound and George Johnson. "Changes in the Structure of Wages During the 1980s: An Evaluation of Alternative Explanations." *American Economic Review* 82 (June 1992).

Alan Krueger. "How Computers Have Changes the Structure: Evidence from Microdata, 1984-89." *Quarterly Journal of Economics* 108 (February 1993).

David Card and Thomas Lemieux. "Wage Dispersion, Returns to Skill, and Black-White Wage Differentials." *Journal of Econometrics*, forthcoming 1995.

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Barry Eichengreen

TOPICS IN INTERNATIONAL ECONOMIC HISTORY

1. **19th Century International Capital Markets**

Tamim Bayoumi (1990), "Saving-Investment Correlations: Immobile Capital, Government Policy, or Endogenous Behavior?" *IMF Staff Papers* 37.

Albert Fishlow (1986), "Lessons from the Past: Capital Markets During the 19th Century and the Interwar Period", in Miles Kahler (ed.), *The Politics of International Debt*, Ithaca: Cornell University Press.

Stefano Fenoaltea (1988), "International Resource Flows and Construction Movements in the Atlantic Economy: The Kuznets Cycle in Italy 1861 - 1913", *Journal of Economic History* 48.

2. **The Gold Standard**

Arthur Bloomfield (1959), *Monetary Policy Under the International Gold Standard*, New York: Federal Reserve Bank of New York.

3. **The Great Depression**

..... course outlines workshop

Barry Eichengreen (1993), "The Origins and Course of the Great Slump, Revisited", *Economic History Review*.

4. The Marshall Plan and Post-World War II Economic Recovery

J. Bradford DeLong and Barry Eichengreen (1993), "The Marshall Plan: History's Most Successful Structural Adjustment Program", in Rudiger Dornbusch, Willem Nolling and Richard Layard (eds), *Postwar Economic Reconstruction and its Lessons for the East Today*, Cambridge: MIT Press.

Andrea Boltho (1982), "Growth", in Andrea Boltho (ed.), *The European Economy: Growth and Crisis*, Oxford: Clarendon Press.

5. The Bretton Woods System

Maurice Obstfeld (1993), "The Adjustment Mechanism", in Michael D. Bordo and Barry Eichengreen (eds.), *A Retrospective on the Bretton Woods System*, Chicago: University of Chicago Press.

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Thomas Stoker

SEMIPARAMETRIC ECONOMETRICS WITH APPLICATIONS

1. Overview
2. Review of Some Nonparametric Methods
3. Limited Dependent Variables Models
4. Averages Derivatives, Index Models and Other Dimension Reduction Methods
5. Specification Testing with Semiparametric Methods

Reading list will be available at the NAKE secretariat in May.

REGISTRATION FORM
NAKE WORKSHOP, JUNE 12-16 1995, LEIDEN

Name

Department

Institute

Address

Postal code/Place

Phone no./Email

AIO/OIO/
Otherwise

Would like to have a private consultation with: Eichengreen/Card/Stoker/Moore*)

Will write a report on the lectures by: Eichengreen/Card/Stoker/Moore*)

Will attend the:*)

| | |
|----------------------------|----------|
| reception (Monday) | yes / no |
| workshop dinner (Thursday) | yes / no |
| vegetarian | yes / no |

Wants a hotelroom
for Mon/Tues Tues/Wednes Wednes/Thurs Thurs/Fri *)

Will share a room yes / no

with

Remarks:

*) Please circle what is applicable and return this form before 12 May 1995 to the NAKE-secretariat, attn. José Dijkzeul, Roetersstraat 11, 1018 WB Amsterdam. Tel: 020-525.4199, fax: 020-525.5280, Email: NAKE@BUTLER.FEE.UVA.NL

QUESTIONNAIRE UTRECHT-COURSES 1995/1996

Please circle the number of the course(s) you wish to follow next year and return the form before **12 May 1995** to the NAKE-Secretariat. In principle a course can only be scheduled once every two years. The courses marked with (*) have been given this year and will therefore not be available next year.

10-week courses (4 SP = 160 hours)

| | <i>Teacher(s)</i> | <i>Institute</i> | <i>Course</i> |
|----|------------------------------|------------------|---|
| 1 | Van Damme/Tijs/ Jansen* | KUB | Game theory |
| 2 | Hartog/Teulings/ Theeuwes | UvA/RUL | Advanced labor economics |
| 3 | Nijman/Pfann* | KUB/RUL | Methods for solving and estimating models with unobserved rational expectations |
| 4 | Palm/Nijman | RL/KUB | Theory and application of financial decision making in relationship with modelling volatility |
| 5 | Ridder/Wansbeek | VU/RUG | Econometrics of panel data |
| 6 | Schoonbeek/Sterken | RUG | Construction, use and dynamic analysis of macroeconomic models |
| 7 | van Soest/Melenberg | KUB | Applied non-parametric and semi-parametric econometrics |
| 8 | Talman/van der Laan* | KUB/VU | General equilibrium model |
| 9A | Folmer/de Zeeuw | LUW/KUB | A) Environmental problems and policy: A theoretical introduction |
| 9B | Withagen/Bovenberg | TUE/KUB | B) Growth and environment |

5-week courses (2 SP = 80 hours)

| | | | |
|----|----------------------|---------|---|
| 10 | de Beus | UvA | The criterium of equity (justice) in economic theory |
| 11 | Bomhoff | NU | Interaction between the financial and real sectors |
| 12 | Bomhoff | NU | Empirical financial economics |
| 13 | Bovenberg | KUB | Fiscal policy in open economies |
| 14 | Brenner | RUU | A critical view of economic theory |
| 15 | Brenner | RUU | Social economics: Heterodox approaches to economic theory |
| 16 | Burrell/Oskam | LUW | Agricultural policy analysis |
| 17 | den Butter | VU | Macroeconomic Policy Modelling |
| 18 | den Butter/van Ours* | VU | Applied labour economics |
| 19 | Cramer | UvA | Econometric applications of maximum likelihood methods |
| 20 | van Dijk/Boswijk* | EUR/UvA | Econometric inference in dynamic models with integrated processes |
| 21 | Ellman | UvA | Analytic aspects of transition to a market economy |

| | | | |
|----|---------------------------------|---------|---|
| 22 | van Ewijk | UvA | Growth, distribution and economic policy |
| 23 | de Gooijer/Franses * | UvA/EUR | Recent Developments in Non-Linear Time Series Analysis |
| 24 | de Gijssel | RL | Micro-economische onderbouwing van een monetaire economie |
| 25 | Gunning/Keyzer * VU | | Current issues in development economics |
| 26 | Huizinga * | KUB | International factor movements and international financial markets |
| 27 | Jager/de Jong | UvA | Exchange rate economics |
| 28 | de Kam | RUG | Micro-model simulatie van de gevolgen van veranderingen in belastingen en ink. overdrachten |
| 29 | Koedijk/de Vries | RL/EUR | Empirical distribution of speculative prices |
| 30 | Kool/Koedijk * | RL | Empirical financial economics II |
| 31 | Kooreman/Kapteyn * | LUW/KUB | Intertemporal Choice |
| 32 | van der Laan/Talman | VU/KUB | Economic equilibrium under price restrictions |
| 33 | Leeflang/Wedel | RUG | Applied econometric/statistics in marketing |
| 34 | Maks | RL | Competition and Market Coordination |
| 35 | Meijdam/Verbon | KUB | Theories of government debt |
| 36 | Morgan | UvA | History of Economic Ideas |
| 37 | Muysken | RL | Aggregated relationships and the distribution of individuals |
| 38 | Muysken | RL | Classification of unemployment: analytical and policy relevance |
| 39 | Nijman | KUB | Estimation of models containing unobserved rational expectations |
| 40 | Otter | RUG | Economic applications of state-space modelling and control theory |
| 41 | Peters/Storcken | RL | Social Choice Theory |
| 42 | Van der Ploeg | UvA | Intertemporal aspects of macroeconomics |
| 43 | Olson/Schram/ v. Winden | UvA | Experimental economics and the design of mechanism |
| 44 | Van Raay | EUR | Consumer information processing and choice |
| 45 | Ruys | KUB | Public Economics and Ethics |
| 46 | Ruys | KUB | 'New' welfare economics: incentives and ethics |
| 47 | Schoorl | RUG | History of Dutch Economic Thought |
| 48 | Steenge | UT | Input-output analysis and related areas |
| 49 | Thijssen/Kuiper | LUW | Dynamic Models of the Agricultural Sector |
| 50 | Verbon | KUB | Decision-making on intergenerational transfers |
| 51 | Viaene/v Marrewijk/ de Vries | EUR | The Theory of International Trade |
| 52 | Vorst | EUR | Options pricing theory |
| 53 | Vorst | EUR | Behavioral Finance |
| 54 | de Vos | VU | Bayesian views on Testing and Model Selection |
| 55 | Wansbeek | RUG | Latent variables and methods of moments estimation |
| 56 | Weddepohl | UvA | Overlapping generations models |
| 57 | van Winden | UvA | Behavioural modelling of government decision-making |
| 58 | van Wijnbergen * UvA | | Economics of Transition |
| 59 | de Zeeuw | KUB | Differential games in economics |

INTERNATIONAL TRADE: SELECTED TOPICS

Elhanan Helpman

Report by Harm Zebregs (EUR)

The course given by professor Helpman was divided into two parts. The first three lectures were concerned with trade and economic growth, in which an overview of existing theories of international trade was given and a link was laid between trade and growth through the introduction of a R&D sector. The last two lectures were devoted to a topic in the field of political economic theory. In these lectures Helpman developed a model that explains the structure of protection as the result of a political process with special-interest groups lobbying for tariffs. Section 1 of this report covers the first part of the lectures on trade and economic growth. The other part is covered in section 2.

1. Trade and Economic Growth

1.1 *A brief overview of the main theories of international trade*

Helpman started his series of lectures by discussing what causes factor prices in autarky to differ, as these differences motivate *interindustry* trade between countries. Three sources for different factor prices between countries can be distinguished. These are dissimilar production technologies between countries, as in the Ricardo model, different factor endowments as in the Heckscher Ohlin Samuelson model (HOS model) and lastly a difference in consumer preferences between countries.

The factor endowments approach, or the HOS model, and the Heckscher-Ohlin theorem that is central to it have played a dominant role in the international trade literature. The theorem was challenged by Leontief (1954)¹, who discovered that U.S. imports were more capital intensive than U.S. exports, while it was assumed that the U.S. had the highest capital labour ratio in the world in those days. This paradox was resolved by taking more than two inputs into consideration. It turned out that U.S. exports were very intensive in skilled labour, a relatively abundant input in the U.S..

According to the factor proportions theory that was subsequently elaborated, a country will be a net importer (exporter) of the services of those factors of which its

¹ Wassily Leontief (1954) 'Domestic production and foreign trade: The American capital position re-examined', *Econ. Internationale* 7, pp. 3-32.

share in the world endowment of these factors is less (larger) than the country's share in world GDP. Apart for high-tech products, Leamer (1984)² found empirical evidence in favour of the factor proportions theory.

Although there is empirical support for the factor proportions theory, some facts cannot be explained by it. These facts are that most trade takes place between countries that are very similar and that there is much *intraindustry* trade, that is two-way trade in products with a similar factor content. These shortcomings led economists to look for alternative approaches to international trade, resulting in the introduction of the theory of monopolistic competition in the trade literature.

Under monopolistic competition an industry produces a large variety of the same product with an increasing returns to scale technology. Each producer chooses a variety that is not already produced, so that profits do not have to be shared with an other producer. The monopoly power of a producer depends on the elasticity of demand for the differentiated product. On the demand side, to allow for the existence of monopolistic competition, consumers preferences have to be specified in a particular way. Two specifications are available. One from Lancaster (1979)³ who assumes that each individual has its own ideal variety of a product and an other specification from Dixit and Stiglitz (1977)⁴, who assume that consumers have a taste for variety. An example of this is, that someone will not always buy a yellow sweater, but will like to have sweaters of different colours. In his lectures Helpman adopted the latter specification by Dixit and Stiglitz.

When applied to international trade the theory of monopolistic competition can explain why there is intraindustry trade and why most trade occurs between countries that are very similar. Suppose there are two countries, two factors of production and two sectors, an agricultural sector and a manufacturing sector. Production in the agricultural sector is relatively intensive in labour, while production in the manufacturing sector is relatively intensive in capital. The agricultural sector produces a homogeneous product. The manufacturing sector in each country produces a variety of differentiated products. Each product is produced in only one country. Because of fixed setup costs there is no perfect proliferation of all brands in every economy.

²Leamer, Edward E. (1984) *Sources of international comparative advantage*, Cambridge: MIT Press.

³Lancaster, Kelvin (1979) *Variety, equity and efficiency*, New York: Columbia University Press.

⁴Dixit, Avinash and Joseph E. Stiglitz (1977) 'Monopolistic competition and optimum product diversity', *American Economic Review*, vol. 67, pp. 297-308.

If in this two country world, country A is relatively better endowed with capital and country B is relatively better endowed with labour, the Heckscher-Ohlin theorem would predict that country A is an exporter of manufactured products, while country B is an exporter of the labour intensive agricultural product. The theorem still holds, but now country A is a *net* exporter of manufactured products, while country B is a *net* importer of these goods. Both countries import and export manufactured commodities. Country A imports those brands from country B which it does not produce domestically and similarly country B imports brands that are only produced in country A. The share of output of the manufacturing sector that is exported depends on the foreign country's share in world spending. Assume both countries have the same relative factor endowments, which precludes interindustry trade. Then when, say, country B is small compared to country A, the former will produce less varieties than the latter and intraindustry trade will be low. Hence, most intraindustry trade will occur between countries of equal size. On the other hand, most interindustry trade occurs between countries that have very different relative factor endowments. Differences in relative factor endowments reduce intraindustry trade as the relatively labour intensive country will produce more of the agricultural product and trade part of it for the manufacturing output of the relatively capital abundant country. Hence, intraindustry trade is replaced by interindustry trade.

1.2 *Trade, R&D and growth*

After having discussed the static theory of monopolistic competition in the context of international trade, Helpman turned to the dynamics and introduces R&D. The fixed costs that have to be incurred before a new product can be introduced constitute of R&D expenses, which are assumed to be high enough to prevent the infinite amount of producible products from being introduced at the same time.

The first model Helpman discusses is a two-sector model with one productive factor, labour. Labour is employed in the R&D sector to produce 'blueprints' for new varieties of the differentiated product and in the manufacturing sector to produce consumption goods. Labour is allocated to the R&D sector until the cost of developing an additional blueprint equals the discounted flow of profits and capital gains that can be realized with that blueprint if it is used to produce a new variety. R&D is financed by issuing equity, of which the return should equal the return on a risk-free bond. This no-arbitrage condition ensures that consumers are willing to invest their savings in R&D. This is a rather strong assumption as in the real world R&D is subject to uncertainty and asymmetric information, but the results would probably not change dramatically if the assumptions were relaxed. Uncertainty and asymmetric information will probably only have level effects, in a sense that the R&D sector will receive less finance, which will lead to slower growth.

A requirement for sustained long-run growth in the above two-sector model is that there should be knowledge spillovers from R&D. Without these spillovers growth will cease in the long-run. If there is a second economy identical to the one described here, there are gains from sharing knowledge between the two economies and there are separate gains from trade. Trade cannot further increase the growth rate if the two economies share their knowledge. Although trade does not influence the slope of the growth path it will shift the growth path upward as trade increases the number of varieties that are available to consumers in each country.

In a second model, discussed by Helpman, there are two economies with in each three sectors and two factors of production, low skilled and high skilled labour. There is a R&D sector, a sector that produces a homogeneous product and one that produces a differentiated product. All three sectors employ both skilled and unskilled labour, with the R&D sector being most intensive in skilled labour, the homogeneous product sector most intensive in unskilled labour and the differentiated product sector taking a middle position. In the homogeneous product sector prices are set equal to the marginal costs of production, while in the differentiated product sector there is markup pricing. In this model a country's per capita growth rate increases when the stocks of skilled and unskilled labour increase to the same extent or when the stock of skilled labour increases relatively to the stock of unskilled labour. The former case implies that a larger economy will grow faster, while in the latter case, by the Rybczynski theorem, the increase in skilled labour increases output of the R&D sector, which in turn boosts growth. Helpman showed that an integrated economy can be replicated if knowledge flows freely between the two economies. If, on the other hand, knowledge does not flow freely an initial comparative advantage (i.e. the number of brands produced by country A is initially larger than the number produced by country B) can turn out to be a permanent advantage. Country A with an initially higher rate of innovation will in this case be capturing an ever increasing share of the world market for differentiated products. Without knowledge flowing freely trade enlarges country A's incentive to innovate, while this incentive is diminished for country B.

2. Political economy of trade policy

The last two lectures were dedicated to the behaviour of governments in trade policies. Helpman developed a model where special-interest groups lobby for tariffs. They make political contributions to influence an incumbent governments policy. Politicians maximize their welfare, which depends on the contributions of interest groups and national welfare. If a politician would give too much attention to interest groups (i.e. impose high tariffs) he or she would collect a large amount of

contributions for its campaign, but at the cost of national welfare. Higher tariffs imply higher prices for consumers and hence lower welfare, especially when only a small fraction of the voting population is represented by a lobby.

Every lobby offers a contribution schedule to the politician, which says how much the lobby will donate when the politician chooses a particular tariff. It is in the interest of a lobby to get a high tariff for its own industry and low tariffs or even import subsidies for other industries. Therefore, when an import competing industry is not organized or when its donations are small compared to that of other industries it will get a low tariff or worse an import subsidy. The tariffs that are set by the government in equilibrium are represented by the trade policy vector τ^o . This vector maximizes the joint welfare of the government and each lobby. If the government chooses τ' instead of τ^o , joint welfare is not maximized and it is possible for a lobby to design an alternative contribution schedule to induce the government to choose τ^o and by doing so the lobby can even share in the surplus that is generated from the switch in policy. An important property of the contribution schedules is that they are *locally truthful* around τ^o , i.e. a marginal change in the donation to establish a small policy change matches the effect the policy change has on gross welfare of the lobby. Or in other words the true preferences of the lobby around the equilibrium are revealed by the shape of the contribution schedules.

Next, Helpman discussed two situations, one in which governments act noncooperatively in international trade negotiations (trade war) and one where governments negotiate over the trade policy schedules (trade talks). In a trade war each government acts unilaterally and takes the opponent's policy as given. In the first stage the lobbies offer their contribution schedules to their government (these schedules cannot be observed by governments and lobbies abroad), while in the second stage each government chooses its trade policy vector, thereby taking the anticipated actions of the foreign government as given. Helpman demonstrated that, in case of a trade war, the Johnson (1953/54)⁵ equilibrium results when the government cares overwhelmingly about its voters and acts as a benevolent social welfare maximizer. In this case tariffs are set equal to the inverse of the elasticity of foreign import demand, which is the standard optimum tariff result. When governments are more selfinterested and care about the contributions that they can collect from lobbies, tariffs will be higher than in the Johnson equilibrium.

⁵Johnson, Harry G. (1953/54) 'Optimal tariffs and retaliation', Review of Economic Studies, vol. 21, pp. 142-153.

When there are trade talks governments negotiate about the policy trade vectors by following, for example, a Rubinstein (1982)⁶ bargaining procedure, where each government makes a proposal which the other government can either accept or reject. When a government rejects a proposal there is a chance that the trade negotiations break down. If that does not happen, the government that has rejected the previous proposal gets to make a new proposal. As long as there is no agreement, the actual state of affairs is a trade war, which is costly to both governments in terms of foregone welfare. Now whether an import competing industry gets a tariff or an import subsidy, depends on the foreign industry's lobbying power. If a particular industry is better organized than its foreign counterpart it will get a tariff, while the foreign industry will get an import subsidy. Finally, the foreign trade elasticities do not appear in the trade talks equilibrium, as they benefit one country at the expense of an other country and impose a deadweight loss on the world economy. Efficient negotiations eliminate this deadweight loss and may compensate the party that would benefit otherwise by more direct means.

⁶Rubinstein, Ariel (1982) 'Perfect equilibrium in a bargaining model', *Econometrica*, vol. 50, pp. 709-724.

Empirical Analysis of Simple I.O. Models Ariel Pakes

Report by Hiek van der Scheer (RUG)

1 Introduction

Ariel Pakes (Yale University) discussed three topics during the NAKE-workshop in Amsterdam. The first topic is based on the paper by Berry, Levinsohn and Pakes (1994): *Automobile prices in market equilibrium*. This paper develops techniques for empirically analyzing demand and supply in differentiated oligopolistic product markets. These techniques are applied to analyze the equilibrium in the U.S. automobile industry. A function of products characteristics is estimated on the cost side, and on the demand side own- and crossprice elasticities as well as elasticities of demand with respect to product attributes are estimated. I will discuss this topic in section 2.

The second topic, discussed in section 3, is a paper by Olley and Pakes (1994): *The dynamics of productivity in the telecommunications equipment industry*. This paper deals with the estimation of the parameters of a production function for the telecommunication equipment industry. These estimates are used to analyse the evolution of the plant-level productivity. This is an interesting topic since technological change and deregulation greatly influenced the restructuring the American telecommunication equipment industry over the last two decades.

The third topic is about the computation of the dynamic Markov perfect Nash equilibrium (Pakes and McGuire 1993). I will briefly discuss this topic. The important conclusion is that Markov perfect Nash equilibria for dynamic models provide a useful tool for descriptive and policy analysis of firm level data. The lectures of Pakes provided a worthwhile addition to the other three, more macro-oriented, courses. Pakes showed how these micro-econometric models can be used to research the development, e.g. growth, in specific industries.

2 Automobile prices

To derive an equilibrium for automobile prices we have to estimate parameters that describe the firms' marginal cost and the distribution of consumers tastes. The distribution of the tastes determines elasticities, and these together with marginal cost and a Nash assumption, determine equilibrium prices. An approach, that is

often used, is some form of aggregation (e.g. over domestic and foreign cars). Although this approach is useful for some research questions, there are several question that cannot be solved. For example, investigating the effect of pollution taxes, or of new goods introduction, on domestic competition.

To answer this kind of research question we need a market-level approach. A standard way to do this is to use a model that represents consumer preferences over products as a function of individual characteristics and of the attributes of those products. The consumer faces the choice of all new goods and an outside good. The producer and consumer characteristics are taken as given, so it is not modeled how producers choose the characteristics of the marketed goods.

Two problems arise in this framework. The first concerns the imposed functional form of the utility and the resulting pattern of cross-price elasticities. The second problem involves the correlation between prices, which are observed by the econometrician, and the product characteristics, some of which are observed by the consumer but not of the econometrician; this can cause a bias in the estimated elasticities. These problems (and solutions) will now be discussed in greater detail. The utility derived by consumer i from consuming product j is given by

$$U(v_i, p_j, x_j, z_j; \beta)$$

where v is a vector of individual characteristics, p the price of the product, x and z are respectively the observed and unobserved (by the econometrician) product attributes, and β is a vector of parameters to be estimated. Consumer i chooses good j if and only if

$$U(v_i, p_j, x_j, z_j; \beta) \geq U(v_i, p_r, x_r, z_r; \beta)$$

for $r=1, \dots, J$. The alternatives represent purchases of competing differentiating products. A possible functional form of utility is

$$U(v_i, p_j, x_j, z_j; \beta) = x_j \beta - \alpha p_j + f_j + e_{ij}$$

where the mean of the e vector in the population of consumers is assumed to be zero so that for each j , f_j is the unobserved component of utility. This specification is particularly tractable if the unobserved characteristics $f_j=0$ and the vector e_{ij} is distributed independently across both consumers and products. With this utility function we can find the market demand by aggregation over the consumers. The assumption that the utility function is additively separable into two terms, one determined by the product characteristics and one determined by the consumers characteristics, is problematic. This is caused by the fact that the function generates

price elasticities (as well as responses to the introduction of new products) that possess a behavior that cannot hold in practice. For example (1) the cross-price elasticities between two large (rather similar) cars would be equal to the cross-price elasticity between a small and large car, (2) it implies that two products must have the same markup over marginal cost. By allowing for interaction between individual and product characteristics, the cross-price elasticities between two large cars will be higher than between a small and large car. This specification, however, introduces computational difficulties. These can be overcome using simulation based techniques.

For the firms the following is assumed: they choose prices to maximize the profits from sales of all of their products. The price is determined as the sum of the marginal cost, that depends on the observed and unobserved characteristics of the product, and a markup, that depends on the parameters of the demand system and the equilibrium price vector. Both, the demand system and the price equation can be estimated by the generalized methods of moments, provided some appropriate instruments can be found. I will skip the discussion about estimation and present some results now.

The standard logit model gives wrong signs for some of the attributes (e.g. air conditioning has a negative sign), and about 67 percent of the models have an inelastic demand. This is inconsistent with profit maximizing choice sets. The instrumental variable logit specification, i.e. an unobserved component is included, reduces the inelastic demand problem but does not produce reasonable markups. The full model, as described above, gives intuitively, good results. The elasticities with respect to price are monotonically decreasing in price. The cross-price elasticities between a large expensive car and a small inexpensive car are about zero, while the cross-price elasticity between two small cars is up to 9.7 percent. The model also gives the right markup direction, i.e. more expensive cars have higher markups.

The drawback of this study is that there are no dynamics in the model, e.g. heterogeneous product characteristics. So, growth or shifts (for example by an oil-price shock) in this market do not exist. In the following section a model will be discussed where the dynamics are taken into account.

3 Telecommunications equipment

The restructuring of the telecommunications equipment industry, due to technological change and deregulation, involves significant entry, exit, and large changes in the sizes of incumbents. The choice on whether to exit and the quantity of inputs demanded depend on the firm's productivity. In order to obtain consistent estimates, the selection process on exit, and the input demand should be taken into account. The latter is the simultaneity problem generated by the relationship between productivity and inputs demand.

The objective of the paper is two-fold. The first objective is to provide a model and an estimation algorithm that explicitly takes these difficulties into account. The second objective is to analyze the changes in the distribution of productivity that accompanied the described changes in the industry.

Model

To analyze the simultaneity problem and the selection problem a more detailed dynamic model of firm behavior is needed. To control the selection process, the model must generate an exit rule. Olley and Pakes (1994) use the sample-selection model. Note that in the traditional way for taking into account the entry and exit in empirical analysis is to use a balanced panel. That is the part of the panel data where no entry or exit took place. The model Olley and Pakes use, allows for firm-specific efficiency differences that exhibit idiosyncratic changes over time. For the simultaneity problem, the model has to specify the available information when the decisions are made.

The model is constructed as follows. It is assumed that current profits are a function of the firm's own state variables, factor prices, and a vector of the state variables of the other (active) firms in the market. Hence the market consists of a list of these triples for all firms. Factor prices are assumed to be common across firms and to evolve according to an exogenous first order Markov process. At the beginning of each period a firm has to make three decisions: (1) whether to stay or exit, (2) level of input factor, and (3) level of investment. This determines the capital stock at the beginning of the next period. Furthermore it is assumed that the firm maximizes the expected discounted value of future net cash flows. This, together with a sample selection model describes the structure.

I will not discuss the more detailed assumption of the model, the mathematical formulation of the model, and the estimation procedure. Olley and Pakes use non- and semiparametric methods to estimate the model. Ericson and Pakes (1994) provide a formal definition and a proof of the existence of a Markov Perfect Nash equilibrium in such a structure.

Results

It is expected that the OLS estimates cause a bias in the labor coefficient. The within estimator will only account for this if the firm's productivity is constant over time (what is certainly not the case here). By going to the full sample, i.e. adding back the firms that were active during only part of the sample period, the capital coefficient almost doubles and the labor coefficients decreases by about 20 percent. Then, using the more advanced econometric estimation methods show small changes of the coefficients. It is clear, however, that both the total and within estimates from the balanced panel data produce coefficients of labor and capital with large biases in the direction predicted by the theory.

The results indicate that, by inducing a reallocation of capital from less to more productive firms, the changes that occurred in the telecommunications equipment industry in this period improved the performance of this industry. It seems that this reallocation of capital, rather than some increase in either the efficiency of the allocation of variable inputs, or in average productivity, lies behind the increase in productivity that followed the deregulation of the telecommunications equipment industry. The exit-rule that comes out of the dynamic behavioral model is a function of firm's productivity, capital stock and age. Olley and Pakes emphasize that it is too early to assess the full impact of deregulation on the productivity.

4 Computation of Markov perfect Nash equilibrium

The last topic Pakes discussed, was about the computation of dynamic Markov perfect Nash equilibrium (based on Pakes and McGuire 1993). I will only briefly discuss some implications of the dynamic models they present. The dynamic models they present allow for heterogeneity among firms and of firms specific sources of uncertainty. The models can be used to simulate market structures, and to illustrate policy implications for such a market. For example, the deregulation of the telecommunications equipment industry described in section 3. The advantage of the framework is that its flexibility to reproduce important aspects of reality.

In a numerical illustration Pakes and McGuire consider the impact of institutional changes on both the market structure and on welfare. The welfare is divided in a welfare for the firms, the total cash flow, and a welfare for the consumer, the consumer surplus. For example, an economy with a social planner generates the highest total benefits, and a monopoly the lowest benefits. The total firms' cash flow, however, is the highest in a monopolistic market. The Markov perfect Nash market structure generates a rather low firms' cash flow but a high consumer benefit, resulting in a total benefit that is close to that of the social planner. In the same way Pakes and McGuire show how deregulation affects the different form of benefits.

Lessons from the study of economic growth by Paul Romer

Report by Marcel Timmer (TU Eindhoven)

A summary of his courses during the NAKE workshop in Amsterdam, 12-16 december 1994 by Marcel Timmer, Department of Technology and Development Sciences, Eindhoven University of Technology.

1. What is at stake in the debate about growth theory?

Economic theories about growth have always attracted a lot of attention from policy makers. These theories seem to reveal the underlying causes of growth and macro-economic policy based on it should therefore be favourable for economic growth. The classical theory of growth stresses the importance of capital accumulation for creating growth, thereby advising to stimulate savings and avoidance of excessive spending, especially of the government. Keynesian theories however, argue that these fears were misplaced and that the government should take an active stand, especially during slumps in the economy.

Romer enlightens these two types of macro-economic policy advices, using the metaphor of a swimmer trying to make progress. The classical advice can be compared with 'tapering' (reduce the training intensity before the race), and Keynesian advice with 'blood doping' (infuse extra blood before the race). He argues that both advices may be helpful in the short run, but that long term progress can only be attained by refining the swimming technique.

This means for governments trying to stimulate economic growth that attention has to be turned to the creation of an environment that fosters change and progress in the techniques used in the economy.

This change in point of view arises from the recent developments in the theories of growth, mirrored in the so-called 'new' growth theories. These theories are fundamentally different from the 'old' theories in focusing on the role of technological change in economic growth and the way this change is created: technological change is endogenized.

2. The development of growth models.

Romer treated five types of models, starting with the classical Solow-model. In all models the consumption side is modelled in the standard way with discounted, constant elasticity preferences. The production side of the economy is modelled by means of a Cobb-Douglas production function which is homogeneous of degree one in its rival inputs.

A. The Solow-model.

In this model a simple Cobb-Douglas production function is used to describe the production side of the economy. The function is homogenous of degree one in the inputs labour and capital, and technical change (or the state of knowledge) is represented by a parameter which grows at an exogenously given rate. Therefore growth is not affected by changes in the rate of interest or incentives of the government (like e.g. taxes). Knowledge is considered to be a non-rival and non-excludable good, so the classical assumption of perfect competition is retained (see below).

B. Linear models.

In these models all inputs are included in one variable: capital. Capital is used here as a broad concept (including e.g. human capital), assuming that labour input does not constrain production. Knowledge is exogenously given and does not grow. Now the rate of interest is determined by this parameter, and e.g. taxes do have an influence on the growth rate of the economy.

C. External increasing returns.

This model starts from the Solow model but now the rate of growth of technology is depended on the rate of growth of the capital stock. This phenomenon of 'learning by investing' may give rise to non-diminishing returns to capital and thereby to increasing returns to scale taking labour and capital together. In that case the rate of interest is not equal to the marginal rate of return to capital. In contrast to the previous models the social marginal product of capital is higher than the interest rate because not all revenues accrue to the firms.

A firm making investments raises the productivity of other investments but these revenues cannot be appropriated by the firm. Because of this, there is (theoretically speaking) reason for the government to interfere in the economy. Taxes do affect growth in this model.

D. Monopolistic competition.

This model differs in a fundamental way from the previous models. Instead of a

homogeneous stock of capital a range of different types of inputs features as factors of production, besides labour. The number of these inputs is a representative of the state of technology in the economy. The economy is considered to consist of two sectors: the final-goods sector (which is modelled in the usual way) and an inputs-producing sector. In this sector new goods are 'designed' which can be used as input in the final-goods production.

These designs are non-rival, that is they can be used by every producer in the economy. They are however perfect excludable (by means of infinitely lived patent rights), so there are no spill overs as there were in model C. By assuming monopolistic competition in the market for differentiated inputs (which is in sharp contrast to the classical assumption of perfect competition), inventing new designs for inputs is a profitable activity since the fixed costs which have to be incurred for the development of these designs can be covered by monopoly pricing. In this way growth is driven by monopoly rents.

Because of the perfect excludability, there are no spill-overs. Still the social marginal product is higher than the interest rate. Because of the free entry assumption in the inputs-producing sector profits are zero. Hence the surplus of the producers buying designs accrue to labour. So also in this model there are gains for collective action.

E. Monopolistic competition with spill-over effects.

This model is an elaboration of the previous model by introducing an extra sector: the R&D-sector, which takes over the development process of new designs of the inputs-producing sector. In the R&D-sector knowledge (in the form of new designs) is produced with the means of human capital (which was not considered in the previous model) and the existing stock of knowledge. Developing new designs raises the stock of knowledge and thereby the productivity of the R&D-sector: there are spill-over effects. The intermediate goods sector uses these designs to produce producer durables and rents these durables in a monopolistic market. The durables are used in the final-goods production sector.

In this way knowledge enters in two distinct ways in the economy: in the research sector, and in the production of durables. The model is in a way the same as the Solow-model with labour and human capital augmenting technological change with spill-over effects, and price setting. The decision is to allocate human capital to research or final-goods production. This decision depends on the interest rate r : the higher r , the lower is the present discounted value of the design and therefore the lower the share of human capital devoted to research.

Therefore government action to reduce the cost of R&D or increase return to

savings will speed up growth. In the absence of feasible policies that can remove the divergence between the social and private rate of returns to research, a second-best policy would be to subsidize the accumulation of total human capital.

3. Implications of the new growth theory

The most important contribution of the new growth models is not the endogenizing of technological change, but stressing the importance of thinking about just what the specific characteristics of technology are. Important terms in this respect are rival vs. non-rival, excludable vs. non-excludable and idea vs. object. Is technology embodied in physical goods (= object, e.g. new capital goods) or does it also appear in ideas (e.g. the way in which a shop can be efficiently managed)? Is it a rival good, that means that using it excludes the possibility of others to use it (e.g. a patented idea or good), or is it something non-rival (e.g. a scientific discovery)? Can it be excluded, that is, can all profits that arise from it be obtained by the owner (like e.g. land), or is it non-excludable (e.g. fish in the sea)? Thinking about technology means thinking about the mix of these characteristics goods possess. As was shown in the models described above, e.g. non-excludable technological progress creates spill-over effects.

Seeing technological progress as something showing up in the development of new goods (as was done in models D and E, see above) forces one to question the classical assumption of perfect competition. Developing new goods means incurring certain fixed costs (i.e. non-convexities) and therefore under perfect competition (with zero profits) no development will take place. Hence, markets of monopolistic concurrence have to be introduced in which these fixed costs can be covered by means of monopoly rents.

4. Empirical work

Most empirical work concerning economic growth consists of regression studies in which variables like initial national income, investment, R&D-expenditures, school enrolment rates, direct foreign investment and the import of machinery & equipment are regressed on GDP-growth. It appears that for example investments seem to matter a lot. The problem is however that it is hard to interpret these results: did investment cause growth or is there an underlying force (say technological change) driving them both? These regression studies are in a way inconclusive, especially because causality is difficult to determine.

An other major branch of empirical work consists of growth-accounting: most

of the time a Cobb-Douglas production function is assumed and total factor productivity is derived from subtracting weighted growth rates of capital and labour from the growth of output. This method however gives no standard errors so the usual econometric tools

cannot be applied. Moreover, the results depend on the model used.

Therefore Romer pleads to use alternative (non-mainstream) types of empirical evidence which consist more of explanatory data analysis than rigid hypothesis testing, accompanied by historical accounts, case studies of the growth experiences of countries and also micro-level studies of the development of technology and growth in specific industries. This kind of evidence can indicate the causality relations between growth, investments and technological progress.

5. Conclusions with respect to policy and future research

The development of the new growth theory leads to policy advices which are different from those arising from earlier models. Taking into account the possibility of the introduction of new goods for example results in a dramatic change in the welfare effects of imposing an import tariff, making it much more harmful. Most important is the conviction embodied in these models that economic growth is ultimately driven by technological progress and that the production of non-rival goods makes this growth possible. However an unavoidable conflict exists between the incentives necessary to encourage the production of goods and the optimal distribution of these goods (i.e. the differences between the social and private rate of return to research). To address to this problem governments should stimulate R&D and the accumulation of human capital to the desired levels.

To achieve this Romer proposes to implement a national technology strategy with 'self organizing industry investment boards'. This idea consists of the following. Industries create investment boards which are funded with a tax on every unit of product sold in the country (this part is arranged by the government). These tax revenues have to be spent on research, but the board can support any research they like, be it universities, other existing institutes or new ones. In this way the market will efficiently allocate the tax revenues to research with the highest rates of returns.

Taking into account all the arguments mentioned above, Romer proposes with respect to the direction of future research that the mainstream growth theorists should continue to follow the direction in which this theory has evolved, focusing on non-convexities and imperfect competition. It has been shown that it is possible to do this at a macro-level and that it matters (i.e. different policy implications follow

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from it). Further, explicit attention should be given to the role of disembodied ideas in affecting production.

Empirical economists working outside the main-stream should try to aggregate all of the diverse bits of evidence gathered thusfar and push the analysis of the evidence further down to the most detailed microeconomic level.

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.....Announcements

PhD Workshops Tinbergen Institute

The Tinbergen Institute Amsterdam organises two workshops for PhD students. The programme of both Workshops consists of courses and seminars given by the guest lecturers, presentations of papers by PhD students and optional private consultations with the guest lecturers.

I. INTERNATIONAL & DEVELOPMENT ECONOMICS

16 - 18 May 1995

Credit Markets and Adjustment

Guest Lecturers: **Paul Collier** (Centre for the Study of African Economies, Oxford)

Christopher R. Udry (Northwestern University, Illinois, U.S.A.)

Courses: **Collier:** Trade Shocks and Macroeconomics of Trade Liberalization

Udry: Risk, Information and Credit Markets in Developing Countries

Information: *Ingrid Mulder: tel 020.4446142.*

II. WORKSHOP on ECONOMETRICS

22 - 24 May 1995

The Statistical Analysis of Econometric Models
for $I(1)$ and $I(2)$ Variables

Guest Lecturers: **Søren Johansen** (University of Copenhagen)

Katarina Juselius (University of Copenhagen)

Seminars **Johansen:** A Likelihood Analysis of the $I(2)$ Model

Juselius: A Structured VAR under Changing Monetary Policy

Information: *Peter Boswijk: tel 020.5254316.*

Place: Tinbergen Institute, Keizersgracht 482, 1017 EG Amsterdam

General information and registration: Gonneke de Ridder, tel: +31.20.5513500.

.....FPPE.....

The Nordic Doctoral Programme in Economics and the Finnish Postgraduate programme in Economics arrange a course on

Adaptive Learning and Economic Dynamics

June 15-22, 1995 at the University of Helsinki.

Lecturers:

George Evans (Univ. of Oregon) and
Seppo Honkapohja (Academy of Finland).

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