# Economics of Science in Germany

Dieter Timmermann
Bielefeld

# Economics of Science in Germany

- Idea born in the BMBF (in 2009 or earlier) to release a tender on economics of science.
  - Philosophy of science well developed.
  - Sociology of science well developed.
  - But no economics of science in Germany?
- In spring 2010 BMBF asked 6 economists with different specialisations to join an expert group to discuss the tender idea and to give advice to BMBF.

# Economics of Science in Germany

- The expert group:
  - Prof. Dr. Alexander Kemnitz (TU Dresden, economic policy and research)
  - PD Dr. Friedhelm Pfeiffer (ZEW, labour market economics and economics of education )
  - Prof. Dr. Kerstin Pull (Tübingen University, economics of human resources and organisations)
  - Prof. Dr. Robert Schwager (Göttingen University, public finance)
  - Prof. Dr. Dieter Timmermann (Bielefeld University, economics of education, chair)
  - Prof. Dr. Berthold Wigger (KIT, public finance and public management)

# Economics of Science in Germany

- The basis of the counseling: a research report done by Friedhelm Pfeiffer (ZEW).
- The **context of the task** was (and still is):
  - The rise of new competitors in the world market due to rapid investments into education and science (China, India, Brasil, Korea).
  - Endangering of the competitiveness of German products and services in the world market.
  - The perceived end of the expansion of higher education due to demografic as well as financial restrictions

# Economics of Science in Germany

- The **context of the task** was (and still is):
  - The failure to reach the Lisbon target (to spend 3% of the GDP for research and development).
  - Politicians and managers asking for more research, particularly fostering innovations.
  - Requests for mergers or at least closer collaboration between university and non-university research.
  - The uncertainty whether the Bologna reform, the excellence initiatives as well as the remuneration reform would help in the long run to keep or, better, to raise the quantity and the quality of learning and research output.

# Economics of Science in Germany

- What might be expected from economic research about science?
  - To identify science to be an investment for the individual researcher, for the research institution and for the society.
  - To make transparent and optimize the investment processes which underlie science and its steering from a macroeconomic point of view.
  - To produce information about the cost and benefits of science for the individual, the institution and the economy resp. for the society.
  - To help funding institutions to decide where to invest into science and how much.

# Economics of Science in Germany

- What might be expected from economic research about science?
  - To help to decide about the distribution of budgets between teaching and research as well as between research institutions and faculties.
  - To describe and explain the shape of the productivity curve of researchers during the life cycle.
  - To evaluate higher education reforms.
  - Information about the incentives of researchers to devote their life to research resp. to science.

# Economics of Science in Germany

- Remarkable results of the report:
  - More research about teaching and learning than about research.
  - But overall, economic higher education research lived a kind of niche existence compared with research about schooling.
  - None of the higher education research institutes or other institutes with occasional publications on higher education resp. research topics had or has a unit whose research profile is shaped by economics. (This is nearly similar as to the economics of education)
  - Research refers to students, teaching personnel and researchers (the individual level of observation) as well as to higher education institutions (the organizational level) as well as to transition processes between institutions and the labor market.
  - With respect to research objectives, competition between institutions, productivity of professors and financing were somewhat covered in the literature.

# Economics of Science in Germany

- Remarkable results of the report:
  - Studies about the quality of teaching and of student services were not discovered.
  - A non-representative view into foreign journals did not find any German contribution.
  - A non-representative sample of European and US-American publications revealed research interest focusing on location factors of research resp. higher education institutions, on resource allocation, financing, life cycle productivity, educational rates of return, human capital formation in the course of the life cycle, the matching of competencies of graduates with work requirements (f. e. overeducation) and higher education reform.
  - The US research was more empirically directed while the European research had a bias towards theoretical argumentation.

# Economics of Science in Germany

- Remarkable results of the report: no (empirical) studies on
  - The efficiency of the joint production of basic research and teaching,
  - The optimal size of faculties or of learning groups,
  - The macroeconomic cost and benefits of science for the different groups of stakeholders,
  - The effects of incentive structures in institutions of higher education and in pure (non-university) research institutions,
  - The impact of the quality of teaching and research on learning success,
  - The economic value of certain knowledge

# Economics of Science in Germany

The report identified seven main foci of need for research :

- Location factors of research and teaching.
- Resource allocation within institutions of higher education and non-university research organizations.
- Financing of research, of teaching and of the joint production of research and teaching.
- Productivity of researchers and teaching professors in the life cycle.
- Convergence or divergence of rates of return to graduates in the Bologna world.
- Study as a means for human capital formation in the life cycle
- Economic analysis of higher education reform processes

# Economics of Science in Germany

Discovering the work of Paula Stephan:

I. The Economics of Science in JEL 1996

1. Introduction
2. The Public Nature of Knowledge and the Reward Structure of Science
    1. The Reward Structure of Science: The Importance of Priority
    2. The Reward Structure of Science: Financial Remuneration and the Satisfaction Derived from Puzzle Solving
3. Inequality in Science
4. The Choice of Scientific Contests
5. Efficiency Considerations
    1. The Functional Nature of the Reward System
    2. Are There Too Many Contestants in Certain Contests?
    3. The Incentives to Share Knowledge in a Timely Fashion
6. Scientists in Industry
7. The Market for Scientists
    1. A Description of Scientific Labor Markets
    2. Studies of the Supply and Demand for New Entrants to Science
    3. Forecasting Scientific Labor Markets
8. Life-cycle Models
    1. Empirical Studies of Research Activity
    2. Empirical Studies of the Acceptance of New Ideas
    3. Empirical Studies of Earnings Functions
    4. Does the Human Capital Model Come Up Short?
9. The Production of Scientific Knowledge
    1. Time and Cognitive Inputs
    2. Research Resources
    3. An Alternative Approach to the Study of Scientists
10. Funding Regimes
11. Science, Productivity, and the New Growth Economics
12. Conclusions (p. 30!)

# Economics of Science in Germany

Discovering the work of Paula Stephan:

II. The Economics of Science in JEL 2009:


- **1. INTRODUCTION .....3**
- **2. THE PUBLIC NATURE OF KNOWLEDGE AND THE REWARD**
- **STRUCTURE OF SCIENCE .....4**
- *2.1 THE IMPORTANCE OF PRIORITY .....6*
- *2.2 FINANCIAL REMUNERATION AND THE SATISFACTION DERIVED FROM*
- SOLVING THE PUZZLE .....10
- **3. HOW KNOWLEDGE IS PRODUCED .....14**
- *3.1 TIME AND COGNITIVE INPUTS .....15*
- *3.2 RESEARCH RESOURCES .....20*
- *3.3 SERENDIPITY .....27*
- **4. CHOICE OF SCIENTIFIC CONTESTS AND CHARACTER OF**
- **RESEARCH .....28**
- *4.1 CHOICE OF CONTESTS .....28*
- *4.2 CHARACTER OF RESEARCH .....31*
- *4.3 PRODUCTION OF DUAL KNOWLEDGE .....33*
- **5. OUTCOMES .....34**
- *5.1 IS SCIENCE A YOUNG PERSON'S GAME? .....36*
- *5.2 THE PRESENCE OF COHORT EFFECTS .....42*
- *5.3 GENDER .....43*
- *5.4 INEQUALITY .....46*
- **6. EFFICIENCTY CONSIDERATIONS AND FUNDING REGIMES .....48**
- *6.1 EFFICIENT NATURE OF THE REWARD SYSTEM .....48*
- *6.2 FUNDING REGIMES .....50*
- *6.3 ARE THERE TOO MANY CONTESTANTS IN CERTAIN CONTESTS? .....56*
- *6.4 THE INCENTIVE TO SHARE KNOWLEDGE IN A TIMELY FASHION .....58*
- **7. SCIENTISTS IN INDUSTRY .....62**
- **8. SCIENTIFIC LABOR MARKETS .....66**
- *8.1 A DESCRIPTION OF SCIENTIFIC LABOR MARKETS .....67*
- *8.2 STUDIES OF SUPPLY AND DEMAND FOR NEW ENTRANTS TO SCIENCE .....70*
- *8.3 FORECASTING SCIENTIFIC LABOR MARKETS .....73*
- **9. SCIENCE, PRODUCTIVITY, AND THE NEW**
- **GROWTH ECONOMICS .....75**
- **10. CONCLUSION .....85 (!)**

# Economics of Science in Germany

- In the light of the ZEW report and Paula Stephan's work, the expert group defined 5 areas of research topics which would be named in the tender.
  - Governance structures in Science (higher education as well as non-university research)
  - Resource allocation
  - Business models for science directed services resp. services close to science
  - Rates of return to higher education and science
  - Career systems within higher education and labor markets for graduates
- Expectation that applicants would define project proposals in one of these areas.
- The tender appeared in early summer 2010, intention was a two stage application process: a short sketch of the research question and the research methods planned, these short proposals were checked and evaluated with respect to formal and quality aspects.

# Economics of Science in Germany

- More than 70 applications were submitted, a little more than 50 were asked to extend their proposal to a complete version of 15 pages.
- As the proposals covered the areas quite unevenly, the 5 groups were merged into 3:
  - Governance structures and resource allocation
  - Business models for science directed services resp. services close to science and rates of return to higher education and science
  - Career systems within higher education and labor markets for graduates
- The proposals were assigned to the areas.
- The proposals of each area were assessed and judged by two experts (professors of the fields).
- At the end, 30 proposals were accepted
- Many of them are here to exchange their experiences

| FKZ | ZE | Thema | Cluster | Beginn |
|---|---|---|---|---|
| **01PW11001** | Zentrum f. Europäische Wirtschaftsforschung GmbH (ZEW) | **BRendit** - Bildungsrenditen | **2** | 01.03.11 |
| **01PW11002** | Universität Kassel | **Re-Bild** - Regionale Bildungsrenditen | **2** | 01.04.11 |
| **01PW11003A** | Hochschule Niederrhein | **RegTrans** - Regionale Transfereffekte verschiedener Hochschultypen | **2** | 01.03.11 |
| **01PW11003B** | Ruhr-Universität Bochum | | | 01.03.11 |
| **01PW11004** | Georg-August-Universität Göttingen | **PODESt** - Persönliche und organisatorische Determinanten eines erfolgreichen Studiums | **2** | 01.04.11 |
| **01PW11005** | Universität Paderborn | **OrgEniFa** - Organisatorische Entwicklung in Fakultäten | **2** | 01.03.11 |
| **01PW11006** | Technische Universität München | **P^3** - Pay Professors for Performance?! Entwicklung eines neuen Anreizsystems für Forschende und Lehrende an Hochschulen | **3** | 01.06.11 |
| **01PW11007** | Universität Duisburg-Essen | **Helena** - Higher Education Global Efficiency Analysis | **1** | 01.07.11 |
| **01PW11008** | Eberhard Karls Universität Tübingen | **RHSKH** - Die Rolle von Human- und Sozialkapital im Karrieresystem Hochschule | **3** | 01.05.11 |
| **01PW11009A** | TSB Technologiestiftung Berlin | **HoFiTrans** - Forschungs- und Technologietransfer in den neuen Steuerungsmodellen zur Hochschulfinanzierung | **1** | 01.06.11 |
| **01PW11009B** | Institut für Hochschulforschung an der Martin-Luther-Universität Wittenberg | | | 01.06.11 |
| **01PW11010** | Zentrum f. Europäische Wirtschaftsforschung GmbH (ZEW) | **ANREIZE** - Effiziente Anreizsysteme in der Wissenschaft - Eine experimentelle Analyse | **3** | 01.07.11 |
| **01PW11011A** | Institut für Hochschulforschung Wittenberg an der Martin-Luther-Universität Halle-Wittenberg e. V. | **RegDemo -** Hochschulstrategien für Beiträge zur Regionalentwicklung unter Bedingungen demografischen Wandels: Soziologische Analyse der Potenziale für Regionalentwicklung | **1** | 01.07.11 |
| **01PW11011B** | Institut für Wirtschaftsforschung Halle (IWH) | | | 01.07.11 |
| **01PW11011C** | Friedrich-Schiller-Universität Jena | | | 01.07.11 |
| **01PW11012A** | Otto-von-Guericke-Universität Magdeburg | **Uni:prise** - Universities as Enterprises | **1** | 01.07.11 |
| **01PW11012B** | Technische Universität Dortmund | | | 01.07.11 |
| **01PW11012C** | Goethe-Universität Frankfurt/Main | | | 01.07.11 |
| **01PW11013** | Universität Siegen | **MOHSL** - Mobility of High Skilled Labor | **3** | 01.05.11 |
| **01PW11014** | RWTH Aachen | **CHE-Analyse** - Theoretische und empirische Analyse des CHE-Forschungsrankings am Beispiel der Betriebswirtschaftslehre | **1** | 01.08.11 |
| **01PW11015** | Karlsruher Institut für Technologie (KIT) | **STEUFIN** - Steuerungswirkungen der Hochschulfinanzierung | **1** | 01.08.11 |
| **01PW11016** | FernUniversität in Hagen | **StratUM** - Strategisches Universitäts-Management: Entscheiden - Steuern - Reflektieren | **1** | 01.06.11 |
| **01PW11017A** | Bauhaus-Universität Weimar | **FLHO** - Allokation und Steuerung von Flächenressourcen in Hochschulen | **1** | 01.06.11 |
| **01PW11017B** | Hochschul-Informations-Systeme (HIS) GmbH | | | 01.06.11 |
| **01PW11018A** | Universität Hamburg | **RePort** - Mehrebenen-Steuerung hochschulspezifischer Ressourcen-Portfolios | **1** | 01.07.11 |
| **01PW11018B** | Leuphana Universität Lüneburg | | | 01.07.11 |
| **01PW11019** | Zentrum f. Europäische Wirtschaftsforschung GmbH (ZEW) | **ADÄQUAT** - Wiss.ökonomische Analysen zur Beschäftigungsadäquanz v. HochschulabsolventInnen | **3** | 01.08.11 |
| **01PW11020A** | Universität Siegen | **KORFU** - Korporatismus als ökonomisches Gestaltungsprinzip für Universitäten | **1** | 01.08.11 |
| **01PW11020B** | Universität des Saarlandes | | | 01.08.11 |
| | | one more project on migration! | | |

1: Governancestrukturen, Ressourcenallokation
2: Betriebs- u. Geschäftsmodelle für wissenschaftsnahe Dienstleistungen; Bildungsrenditen und -bilanzen
3: Karrieresystem Hochschule; Arbeitsmärkte für Hochschulabsolvent(inn)en

# Economics of Science in Germany

- Before diving into the projects, we have the pleasure to welcome Paula Stephan who will give the keynote lecture to this workshop.

Some information about Paula:

**PAULA E. STEPHAN**

Professor of Economics and Senior Associate, Policy Research Center, Georgia State University, 1988-present

Department of Economics, Andrew Young School of Policy Studies

Georgia State University

B.A., economics, Grinnell College, 1967

M.A., economics, University of Michigan, 1968

Ph.D., economics, University of Michigan, 1971

# Economics of Science in Germany

Some information about Paula:

**Visiting Appointments**

- Visiting faculty, Department of Economics Cognetti de Martiis, University of Turin, Fall
- 2011, Spring 2012
- Fellow, International Centre for Economic Research, Turin, Italy, Fall 2009, Spring and
- Fall 2011.
- Visiting Fellow in Innovation Studies group, Politecnico di Torino, Spring 2008.
- Wertheim Fellow, Harvard University, February, March 2007
- Visiting Fellow, Katholieke Universiteit Leuven, Leuven, Belgium, March, April, May
- 2005 Katholieke Universiteit Leuven
- Visiting Scholar, Wissenschaftszentrum Berlin für Sozialforschung, Berlin, Germany,
- Spring 1992; Summer 1994.
- Visiting Professor of Economics, Ecole Superieur de Commerce, Paris, France, Fall 1984

# Economics of Science in Germany

Some information about Paula:

11 Honors and Awards

29 Funded Research Projects

29 Panel and Committee Memberships

Board of Reviewing Editors: *Science, 2012-2014*

Board of Editors, *Southern Economic Journal, 1977-1981.*

Referee for *American Economic Review; Economic Inquiry; Public Finance Quarterly; Journal of Political Economy; Journal of Human Resources; Science, Technology, and Human Values; Industrial and Labor Relations Review; Non-Profit and Voluntary Sector Quarterly; Small Business Economics; Journal of Econometrics; American Sociological Review; Sex Roles: A Journal of Research; Review of Economics and Statistics; Journal of Economic Literature; International Journal of Industrial Organization; Research in Labor Economics; Social Studies of Science; Research Policy; IEEE Technology and Society; Journal of Technology Transfer; Economics of Education Review; Managerial and Decision Economics; Journal of Labor Economics; Science; Economics Letters Economics of Innovation and New Technology; Annales of Economie et Statistique, Journal of Economic Behavior and Organization, Public Finance Review, Social Forces, Quarterly Journal of Economics, Management Science. Reviewer for National Science* Foundation, National Research Council, Alfred P. Sloan Foundation, TIAA-CREF Institute.

More than 100 publications