NBER Proposal for a PIE Innovation Policy Grant **Martin Watzinger**

Abstract: *With the PIE Innovation Policy Grant, I want to buy a unique administrative plant-level data set for Germany. The data set contains information on the type, quantity and price of all products that were produced in every German manufacturing plant from 1995 to 2010. In addition, the data contains information on innovation inputs, such as R&D spending, number of R&D workers, and assigned patents. With the help of this data, I want to advance our understanding on the relation of innovative inputs, competition and product innovation.*

Stimulating product innovation is a key objective for managers and politicians. For managers, product innovation means gaining a competitive advantage while for politicians, it is the key to sustainable economic growth. Yet, the creation of new products is notoriously hard to observe and quantify. This explains the predominance of indirect and imperfect innovation measures, such as total factor productivity (TFP), patent counts, or patent citations. There are notable exceptions, such as Petra Moser's World Fair Innovations list or the US Manufacturing census, both of which provide direct measures of new products (Bernard et al. 2010, Moser 2005). However, they are of little use for making policy recommendations for today's fast moving economy as the former pertains to historical innovations from the 19th century and the latter is quinquennial. There are some datasets from developing countries that directly measure new products. Yet, they are unlikely to shed light on the progress at the technological frontier of advanced economies.

The lack of direct and frequent measures of product innovation makes it difficult for policymakers and managers to assess the success of their policy measures or innovation strategies. A policymaker has no choice but to rely on indirect measures of innovation when assessing, for example, whether their policy measures lead to the development of new goods and services, or improve efficiency. A manager has the advantage that she can directly observe product innovation within her industry but this might not be enough information to see general patterns and to formulate to a general long-term innovation strategy. For example, the manager's industry might have never been confronted by competition from small start-ups and it might be valuable to know how other industries reacted and evolved.

To advance on these questions, I want to purchase and analyze administrative data that provides plant level information on the type, quantity and price of every product produced by every company with more than 20 workers in Germany for every year from 1995-2013. This data gives me information on the quantities and prices of over 6,000 products at the establishment level. In addition, the data contains information on R&D employees, patents, industry affiliation, investment expenditures, and other covariates on the plant- or firm-level for at least 13 years. The data is compiled jointly by the Statistical Offices of the German states and by the Federal Statistical Office, using two main surveys: For the data on production, the sample consists of the totality of plants with more than 20 employees; for the cost data, the sample is a rolling panel of 18,000 firms. Since compliance is mandatory, the data is comprehensive, representative, and extremely reliable.

Exploiting this unique data, I can offer a novel view of unprecedented detail on the innovation activities in a large advanced economy. This data would enable me to add to our knowledge on innovation in three distinct ways:

First, it allows me to assess the reliability of the commonly used indirect indicators such as patents or R&D spending, by comparing these indirect indicators to directly observed product innovations. For example, I can measure whether companies with more highly cited patents have more profitable new products (Moser 2016) using the universe of companies and their products in a large knowledge-based economy. Thus, I can add external validity to existing studies measuring the effect of a policy on patent production. Furthermore, I can add to the discussion on whether there is product innovation without patents, that is, whether companies use mainly secrecy to protect their technical advances and therefore assess how well patents

actually measure corporate innovation. This discussion is also important because it directly speaks to the merits of patents relative to potential alternative appropriation mechanisms (Hall et al. 2014). Taking a more macroeconomic perspective, I can add to our understanding on questions such as how the introduction of new products varies with the business cycle, whether the recent worldwide slowdown in total factor productivity has coincided with a slowdown in product creation, and how many new products are developed by small- and medium-sized firms. Thus, I can add micro data facts to the current high-level debate on secular stagnation (Gordon 2012, Mokyr 2014).

Second, I can measure whether and how the price and quantity paths over the life-cycle of innovative products differ from less innovative "me-too" products. Thus, I can inform the debate on the optimal timing of product innovation and under which circumstances new products are most successful. For example - except in intensely studied industries such as pharmaceuticals - it is currently unknown how many new products in an industry fail, how profitable new products are on average, and if this is different for innovative companies (DiMasi et al. 2003). We can measure these statistics descriptively and correlate it with policy variables on the firm and industry level. With the help of my data, I can for example measure how common disruptive innovation is and how this varies with the availability of complementary assets (Gans et al 2002).

Third, I plan to study the response of competitors to the introduction of new products. Companies can react to a new product of a competitor by reducing prices or by introducing new products themselves. From a management perspective, it is of obvious interest to understand how companies can profitably react to the introduction of innovative products. From an economics perspective, it is crucial to know how the benefits of innovation spread through the economy, that is, how much accrues to the original inventor versus competitors and consumers. Here, consumer surplus might not merely benefit directly from the introduction of new products but also through a competition effect: New products create competition, which tends to lower prices of existing products and thus increase consumer surplus. With our data I can quantify the benefit of innovation-induced competition on the product level, thus giving a more complete picture of innovation spillovers.

The research grant would be used to buy the administrative plant level data for USD 17'000. I plan to use the remainder for travel expenses.

Literature:

Bernard, Andrew B., Stephen J. Redding, and Peter K. Schott. "Multiple-Product Firms and Product Switching." *American Economic Review* 100.1 (2010): 70-97.

DiMasi, Joseph A., Ronald W. Hansen, and Henry G. Grabowski. "The price of innovation: new estimates of drug development costs." *Journal of health economics* 22.2 (2003): 151-185.

Gans, Joshua S., David H. Hsu, and Scott Stern. "When Does Start-Up Innovation Spur the Gale of Creative Destruction?." *RAND Journal of Economics* (2002): 571-586.

Gordon, Robert J. *Is US economic growth over? Faltering innovation confronts the six headwinds*. No. w18315. National Bureau of Economic Research, 2012.

Hall, Bronwyn, et al. "The choice between formal and informal intellectual property: a review." *Journal of Economic Literature* 52.2 (2014): 375-423.

Mokyr, Joel. "Secular stagnation? Not in your life." *Secular Stagnation: Facts, Causes and Cures* 83 (2014).

Moser, Petra. "How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World's Fairs." *The American Economic Review* 95.4 (2005): 1214-1236.

Moser, Petra. "Patent Citations-An Analysis of Quality Differences and Citing Practices in Hybrid Corn." *Available at SSRN* (2016).

MARTIN WATZINGER
CURRICULUM VITAE

CONTACT INFORMATION

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RESEARCH FOCUS

Innovation Economics and Applied Econometrics

CURRENT & PAST POSITIONS

2012- present	**Assistant Professor** in Economics (Akademischer Rat), Department of Economics, **LMU Munich**, Germany
Winter 2014	**Interim Professor** (Lehrstuhlvertretung) in Economics, Department of Economics, **LMU Munich**, Germany

EDUCATION

2007-2012	**PhD in Economics**, LMU Munich (summa cum laude) Supervisor: Monika Schnitzer
2002- 2007	**Diploma in Business Administration** (excellent) at the University of Tübingen

RESEARCH VISITS

Boston University School of Management
(Host: Jeffrey Furman), May 2015
Harvard Business School and **NBER**
(Host: Josh Lerner), Spring 2014
Stanford University, Economics Department
(Host: Martin Schneider), Fall 2011

REFERENCES

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Prof. Dietmar Harhoff, Ph.D.
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Antitrust, Patents, and Cumulative Innovation: Evidence from Bell Labs (joint with Thomas Fackler, Markus Nagler and Monika Schnitzer, LMU)
How large is the impact of intellectual property on cumulative innovation in electronics, computers and communications? Following an antitrust lawsuit against Western Electric and AT&T, Bell Labs had to license all patents published by 1956 for free. We find that this removal of patent rights increased subsequent citations to Bell's patents by 7%. Patenting in affected patent subclasses increased by 23%. The effect comes from young and small firms in fields in which Bell did not remain commercially active. Placebo regressions support the identification assumption of parallel trends in citations.
This paper was presented at: Boston University, MIT Sloan and KU Leuven

Measuring Spillovers of Venture Capital (joint with Monika Schnitzer, LMU)
We provide the first measurement of knowledge spillovers from venture capital financed companies on the patenting activities of other companies, using panel data of U.S. firms. These spillovers are eight times larger than those generated by corporate R&D of established companies. We document that spillovers arise mainly from technology-oriented start-ups that already have a patent at the time of the first investment, suggesting that start-ups act as a translator of academic knowledge. A methodological contribution of our paper is to develop a new measure for the spillover pool, combining elements of citation-based and technology-proximity-based approaches.
This paper was presented at: NBER Summer Institute and NBER Productivity Lunch.

Knowledge Spillovers from Academic Research: Evidence from Germany (joint with Lukas Treber, Markus Nagler and Monika Schnitzer, University of Hohenheim and LMU)
How important are local knowledge spillovers from university researchers to the private sector and to colleagues in academia? We use the movements of scientists to one university in Germany and information on their runners-up to provide novel evidence on this question. Our results show that knowledge spillovers are large: Citations from local industry patents to pre-move articles of movers double three years after the move and citations from academic articles increase by around 50%. Spillovers to the private sector are driven by the hard sciences and academic superstars. Within academia, the effects are homogeneous across fields and quality of researchers. Placebo regressions support the validity of the control group.

Employment Effects of Stimulus Investments (joint with Lukas Buchheim, LMU)
We estimate the causal impact of countercyclical infrastructure investments on employment and unemployment from local level data. To this end, we exploit a particular feature of the sizable German infrastructure investment program enacted during the Great Recession. By law, 65 % of all stimulus funds were earmarked for investment in educational infrastructure with a special focus on the renovations of existing school buildings. The scope for stimulus investment within counties was thus to a large part predetermined by the number of schools, opening up the possibility to use schools as an instrument for local investments. Our 2SLS estimates suggest costs for one job-year between €18'500 Euro and €35'500. The first jobs were created one year after the stimulus program was enacted.
This paper was presented at: MIT Economics and SED.

Contract Enforcement and R&D Investment (joint with Michael Seitz, Boston Consulting Group and LMU) – revise and resubmit in *Research Policy*
Motivated by the differences in innovation intensity across countries, this paper evaluates the role of contract enforcement for R&D investments. We find empirical evidence that weak contract enforcement is associated with lower R&D investments: R&D intensity in an industry increases with the quality of the judicial system and this effect is particularly strong in industries that cannot buy inputs on competitive markets and thus depend more on contracts to acquire inputs.

The Capital Gains Tax: A Curse but Also a Blessing for Venture Capital Investment (joint with Carolin Bock, TU Darmstadt)
Our study shows a negative association between the number and success of venture capital investments and the capital gains tax rate. This analysis uses the investment and tax data of 32 countries from 2000 to 2012. Our results support the theoretical predictions that higher capital gains tax rates are associated with fewer start-ups financed and a lower probability of receiving follow-up funding. However, if a company receives its initial funding despite a higher tax burden, its probability of success increases. Therefore, our findings are in line with a selection effect of taxes.

WORK IN PROGRESS

Patents and Cumulative Innovation: Evidence from the Patent Depository Library Program (joint with Jeff Furman and Markus Nagler, BU and LMU)

Consent Decrees (joint with Petra Moser, Ryan Lampe and Thomas Fackler, NYU, CSU and LMU)

Outsourcing and its impact on wage inequality (joint with Antoinette Schoar, Matthias Wilhelm and Monika Schnitzer, MIT Sloan and LMU)

Investment in Photovoltaics and Job Creation: Evidence from a Billion Dollar Program (joint with Lukas Buchheim and Matthias Wilhelm, LMU)
We study the labor market effects of a €60 billion investment program in photovoltaics in Germany between 2003 and 2012. According to our estimates, the program created one job lasting one year for every €120'000 in investment. Gains were concentrated in the construction sector, with spillovers to local services. The effects are stronger in weaker economic times. To address endogeneity concerns, we exploit the fact that local investment was pre-determined by the amount of available rooftops and solar radiation in a region to construct an instrumental variable estimator.

PUBLICATIONS

The Allocation of Talent over the Business Cycle and its Long-term Effect on Sectoral Productivity (with Michael Böhm), *Economica*, 2015, Vol 82, pp. 892-911.

The Effect of a Credit Crunch on Equilibrium Market Structure. *Computational Economics*, 2016, forthcoming.

CONFERENCE PRESENTATIONS

2016	CEPR Applied IO (London, scheduled), CEPR Entrepreneurship (Stockholm, scheduled), Munich Summer Institute (Munich, Scheduled), Delphi Conference (Munich)
2015	Boston University Questrom School of Business, Druid (Rome), NBER Summer Institute, Massachusetts Institute of Technology Sloan School of Management, DFG-SFB Conference
2014	Verein für Socialpolitik (Hamburg), GEABA (Regensburg), University of Bayreuth, MPI for Innovation and Competition
2013	ZEW Economics of Innovation and Patenting (Mannheim), DFG-SFB Conference (Bonn), European Economic Association (Gothenburg), Verein für Socialpolitik (Düsseldorf
2012	European Economic Association (Malaga), DFG-SFB Conference (Mannheim) Ifo Institute, University of Regenburg
2010	CEPR Conference in Industrial Organization (Toulouse), TUM Munich

PROFESSIONAL RESPONSIBILITIES

2015	Organizer Innovation Reading Group
2014	Post-Doctoral Mentor in the International Doctoral Program „Evidence-Based Economics“ (Elite Network of Bavaria)
2012-2015	Organizer of the Young Researcher Workshop of the SFB TR 15 jointly with Assistant Professors of the Universities of Bonn, Mannheim and Berlin
2012	Member of SFB TR 15 of the German Science Foundation
2010, 2012	Coordinator Microeconomics I (Course with 1100 students, 11 Tutorials and 7 Student Tutorials),

REFEREE EXPERIENCE

Journal of Labor Economics, Economics of Education Review

TEACHING EXPERIENCE

Term	Title	Type	Level	Evaluation[1]
Summer 15	Economics of Science and Innovation	Seminar	Master in Economics	n/a
Winter 14/15	Managerial Economics	Lecture	Master in Business	1.80
Winter 14/15	Managerial Economics	Tutorial	Master in Business	1.70
Summer 14	Reading Course in the Economics of Science and Innovation	Lecture	PhD in Economics	1.00
Winter 13/14	Managerial Economics	Lecture	Master in Business	1.55
Winter 13/14	Managerial Economics	Tutorial	Master in Business	1.41
Winter 13/14	Managerial Economics	Tutorial	Master in Business	1.80
Winter 13/14	Analyse von Regulierungs- und Wettbewerbspolitik	Seminar	Bachelor in Economics	1.88
Summer 2012	Mikroökonomie I	Tutorial	Bachelor in Business and Economics	1.50
Summer 2011	Mikroökonomie I	Tutorial	Bachelor in Business and Economics	1.56
Summer 2011	Mikroökonomie I	Tutorial	Bachelor in Business and Economics	1.56
Winter 10/11	Mikroökonomie I	Tutorial	Bachelor in Business and Economics	1.75
Winter 09/10	Mikroökonomie I	Tutorial	Bachelor in Business and Economics	1.10
Summer 2008	Mikroökonomie I	Tutorial	Bachelor in Business and Economics	1.40

Courses I contributed to and organized

Winter 09/10	Fallstudien im Wettbewerbsrecht	Seminar	Bachelor in Economics	1.50
Winter 08/09	Die Ökonomie von Energiemärkten	Seminar	Bachelor in Economics	1.90
Summer 2008	Aktuelle Fragen der Organisationssokonomik	Seminar	Bachelor in Economics	n/a

In 2010, I received the Best Teacher Award of the Alumni Association of the University of Munich.

[1] The grade is for lectures and tutorials for the teacher and for seminars for the course.