

Gasteiger, Emanuel; Prettnner, Klaus

**Working Paper**

## On the possibility of automation-induced stagnation

Hohenheim Discussion Papers in Business, Economics and Social Sciences, No. 07-2017

**Provided in Cooperation with:**

Faculty of Business, Economics and Social Sciences, University of  
Hohenheim

Suggested Citation: Gasteiger, Emanuel; Prettnner, Klaus (2017) : On the possibility of automation-induced stagnation, Hohenheim Discussion Papers in Business, Economics and Social Sciences, No. 07-2017, <http://nbn-resolving.de/urn:nbn:de:bsz:100-opus-13389>

This Version is available at:

<http://hdl.handle.net/10419/155784>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

UNIVERSITY OF HOHENHEIM

FACULTY OF BUSINESS, ECONOMICS AND SOCIAL SCIENCES



HOHENHEIM DISCUSSION PAPERS  
IN BUSINESS, ECONOMICS AND SOCIAL SCIENCES

Institute of Economics

DISCUSSION PAPER 07-2017

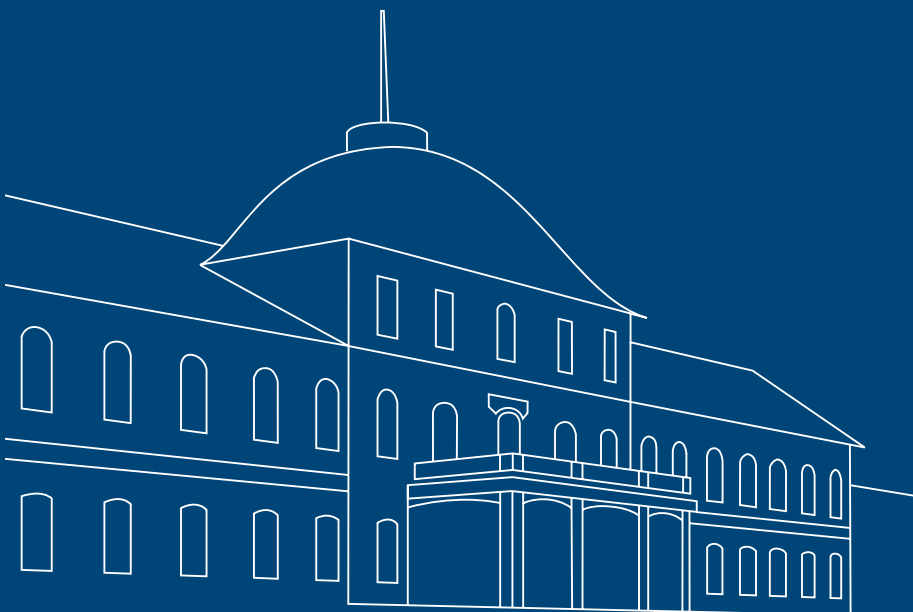
**ON THE POSSIBILITY OF  
AUTOMATION-INDUCED STAGNATION**

**Emanuel Gasteiger**

Freie Universität Berlin

**Klaus Prettner**

University of Hohenheim



[www.wiso.uni-hohenheim.de](http://www.wiso.uni-hohenheim.de)

Discussion Paper 07-2017

## **On the possibility of automation-induced stagnation**

Emanuel Gasteiger, Klaus Prettnner

Download this Discussion Paper from our homepage:

<https://wiso.uni-hohenheim.de/papers>

ISSN 2364-2076 (Printausgabe)  
ISSN 2364-2084 (Internetausgabe)

Die Hohenheim Discussion Papers in Business, Economics and Social Sciences dienen der schnellen Verbreitung von Forschungsarbeiten der Fakultät Wirtschafts- und Sozialwissenschaften. Die Beiträge liegen in alleiniger Verantwortung der Autoren und stellen nicht notwendigerweise die Meinung der Fakultät Wirtschafts- und Sozialwissenschaften dar.

---

Hohenheim Discussion Papers in Business, Economics and Social Sciences are intended to make results of the Faculty of Business, Economics and Social Sciences research available to the public in order to encourage scientific discussion and suggestions for revisions. The authors are solely responsible for the contents which do not necessarily represent the opinion of the Faculty of Business, Economics and Social Sciences.

# On the possibility of automation-induced stagnation

Emanuel Gasteiger<sup>a,b</sup> and Klaus Prettnner<sup>c\*</sup>

24 February 2017

a) Freie Universität Berlin,  
School of Business & Economics,  
Boltzmannstraße 20  
14195, Berlin, Germany  
email: emanuel.gasteiger@fu-berlin.de

b) Instituto Universitário de Lisboa (ISCTE-IUL),  
Business Research Unit (BRU-IUL),  
Av. das Forças Armadas,  
1649-026 Lisboa, Portugal

c) University of Hohenheim  
Institute of Economics  
Schloss, Osthof-West,  
70593 Stuttgart, Germany  
email: klaus.prettnner@uni-hohenheim.de

## Abstract

We analyze the long-run growth effects of automation in the standard overlapping generations framework. We show that, in contrast to other neoclassical models of capital accumulation, automation does not promote growth but induces economic stagnation. The reason is that automation suppresses wages, which are the only source of investment in the overlapping generations framework.

**JEL classification:** J10, J20, O14, O33, O41.

**Keywords:** Automation, robots, investment, stagnation, economic growth, overlapping generations model.

---

\*The authors acknowledge financial support from Fundação para a Ciência e a Tecnologia (UID/GES/00315/2013), the Berlin Economics Research Associates (BERA) program, and the Faculty of Business, Economics, and Social Sciences at the University of Hohenheim within its research focus “Inequality and Economic Policy Analysis (INEPA)”. All remaining errors are the responsibility of the authors.

# 1 Introduction

Automation and its potential economic consequences have caught the attention of economists and the general public over the last few years (see, for example, The Economist, 2014). While some economists show how automation can lead to economic prosperity (Steigum, 2011; Acemoglu and Restrepo, 2015; Graetz and Michaels, 2015; Hémous and Olsen, 2016; Abeliansky and Prettnner, 2017; Prettnner, 2017), others are afraid that automation could (partly) be responsible for economic stagnation (Sachs and Kotlikoff, 2012; Benzell et al., 2015; Sachs et al., 2015). We contribute to this debate by showing that the long-run economic growth effects of automation crucially depend on the underlying framework used to describe the process of saving and investment. While the standard neoclassical growth models lead to remarkably similar predictions regarding the growth effects of changes in household's savings behavior, we show that they lead to diametrically opposed predictions of the effect of automation. On the one hand, models of automation based on Solow (1956), Ramsey (1928), Cass (1965), and Koopmans (1965), in which households save a part of wage income *and* a part of asset income, imply that automation has the potential to lead to perpetual long-run growth even without (exogenous or endogenous) technological progress. On the other hand, models of automation based on the overlapping generations (OLG) framework of Diamond (1965), in which households save *exclusively* out of wage income, imply economic stagnation in the face of automation. The reason for stagnation is that the accumulation of automation capital suppresses wages, which is the only source of investment in the OLG framework. Consequently, automation itself prevents the takeoff that would occur in neoclassical types of growth models in which also parts of asset income are (re-)invested.

## 2 The effects of automation in an OLG framework

Consider a household who lives for three time periods, youth, adulthood, and retirement. Children do not make any economic decisions and fulfill their needs via the consumption expenditures of their parents. Adults supply their available time on the labor market for the market clearing wage  $w_t$  and save for retirement. Retirees do not work and finance their consumption expenditures at old age out of their savings carried over from adulthood. The number of children is denoted by  $n$  such that the evolution of the population size is exogenous and given by  $N_{t+1} = (1 + n)N_t$ , where  $N_t$  refers to the size of the adult cohort at time  $t$ .

Following Diamond (1965), households derive utility from consumption in adulthood,  $c_{1,t}$ , and from consumption in retirement,  $c_{2,t+1}$ . Assuming that households discount the future at rate  $\rho$ , which implies a discount factor of  $\beta = 1/(1 + \rho)$ , the household's lifetime utility is given by

$$U_t = \log(c_{1,t}) + \beta \log(c_{2,t+1}). \tag{1}$$

Denoting the real interest rate on savings between time  $t$  and time  $t+1$  by  $r_{t+1}$ , the budget constraint of households is standard and given by

$$c_{1,t} + \frac{c_{2,t+1}}{1 + r_{t+1}} = w_t, \quad (2)$$

where the left-hand side refers to discounted lifetime consumption expenditures and the right-hand side to lifetime labor income. Solving the households' intertemporal optimization problem yields the consumption Euler equation

$$\frac{c_{2,t+1}}{c_{1,t}} = \beta(1 + r_{t+1}) \quad (3)$$

describing the optimal individual consumption growth path for a given interest rate and a given discount factor. From this expression and the budget constraint, optimal consumption and savings of adults follow as

$$c_{1,t} = \frac{1}{1 + \beta} w_t, \quad s_t = \frac{\beta}{1 + \beta} w_t. \quad (4)$$

There are three production factors: labor, which is supplied by adults, traditional physical capital in the form of machines, factory buildings, etc., which is an *imperfect* substitute for labor, and automation capital in the form of industrial robots, 3D printers, etc., which is, by definition, a *perfect* substitute for labor. Both types of capital are accumulated according to the investment decisions of households and a no-arbitrage relationship holds between the two investment vehicles.

The representative firm has access to a production technology as described by Prettnner (2017)

$$Y_t = K_t^\alpha (N_t + P_t)^{1-\alpha}, \quad (5)$$

where  $Y_t$  denotes aggregate output (GDP),  $K_t$  denotes the stock of traditional physical capital,  $P_t$  denotes the stock of automation capital, and  $\alpha \in (0, 1)$  is the elasticity of output with respect to traditional physical capital. We assume that there is perfect competition in goods and factor markets such that production factors are paid their marginal value products. Assuming that aggregate output is the numéraire, we get the following factor rewards

$$w_t \stackrel{!}{=} R_t^p = (1 - \alpha) \left( \frac{K_t}{N_t + P_t} \right)^\alpha, \quad (6)$$

$$R_t^k = \alpha \left( \frac{N_t + P_t}{K_t} \right)^{1-\alpha}, \quad (7)$$

where  $R_t^k$  is the rate of return on traditional physical capital and  $R_t^p$  is the rate of return on automation capital. We observe that, while an increase in traditional physical capital raises the wage rate, as in the standard Diamond (1965) model, an increase in automation capital has the opposite effect because automation competes with workers.

### 3 Equilibrium and main results

In an interior equilibrium, both savings vehicles have to deliver the same rate of return such that rational investors invest in both types of savings vehicles. Consequently, in any interior equilibrium, we have that  $R_t^k = R_t^p$  from which the following no-arbitrage relationship derives

$$P_t = \left( \frac{1 - \alpha}{\alpha} \right) K_t - N_t. \quad (8)$$

The intuition behind this expression is related to (6) and (7): a higher stock of traditional physical capital ( $K_t$ ) raises the rate of return on investment in automation capital ( $P_t$ ) and hence, *ceteris paribus* raises the stock of automation capital. By contrast, a larger cohort size of adults ( $N_t$ ) implies that there are more workers available such that the incentives for automation are lower (see also Abeliansky and Prettnner, 2017).

Plugging the no-arbitrage relationship (8) into the production function (5) yields an *AK*-type of technology in equilibrium

$$Y_t = \frac{1 - \alpha}{\alpha} K_t, \quad (9)$$

where  $A \equiv (1 - \alpha)/\alpha$ . As is well-known, such a production structure typically leads to perpetual growth because there are no diminishing returns with respect to the accumulation of physical capital (see, for example, Romer, 1986; Rebelo, 1991). As far as neoclassical models of automation that admit a representative household (Solow, 1956; Ramsey, 1928; Cass, 1965; Koopmans, 1965) are concerned, there is indeed the possibility of perpetual long-run growth (see Steigum, 2011; Prettnner, 2017). The intuition behind this result is that the availability of automation capital as a perfect substitute for labor prevents the diminishing returns from capital accumulation from kicking in and hence impedes the standard neoclassical convergence mechanism.

Since the economy is closed and both types of capital fully depreciate over the course of one generation, the aggregate stock of assets at time  $t + 1$  is determined by investment in period  $t$ . This implies that we have the following law of motion for the aggregate stock of assets

$$S_t = s_t N_t \stackrel{!}{=} K_{t+1} + P_{t+1} = \frac{\beta(1 - \alpha)}{1 + \beta} \left( \frac{K_t}{N_t + P_t} \right)^\alpha N_t. \quad (10)$$

In this case a competitive equilibrium can be defined as follows.

**Definition 1.** *A competitive equilibrium is a sequence  $\{K_t, P_t, c_{1,t}, c_{2,t}, R_t, R_t^k, R_t^p, w_t\}_{t=0}^\infty$ , such that  $\{R_t, R_t^k, R_t^p, w_t\}_{t=0}^\infty$  satisfy (6), (7), and  $R_t = R_t^k = R_t^p$ ,  $\{c_{1,t}, c_{2,t}\}_{t=0}^\infty$  satisfy (3) and (4),  $\{K_t, P_t\}_{t=0}^\infty$  satisfy (8) and (10), and  $\{N_t\}_{t=0}^\infty$  satisfies the population growth equation  $N_{t+1} = (1 + n)N_t$ .*

Dividing (10) by the size of the adult cohort  $N_{t+1}$  and plugging in the aggregate

production function (5) and the no-arbitrage condition (8), we arrive at the steady-state capital-labor ratio of the economy as given by

$$k = \alpha + \frac{(1 - \alpha)\alpha\beta}{(1 + n)(1 + \beta)(1/\alpha - 1)^\alpha}. \quad (11)$$

It is immediately clear that there is no growth in the capital-labor ratio. Consequently, GDP per capita stagnates and there is no potential for long-run economic growth. We summarize our main finding in the following proposition

**Proposition 1.** *In the Diamond (1965) model with automation, the production structure resembles the properties of an AK type of growth model. However, in contrast to other models of automation with this production structure, the economy is trapped in a stagnation equilibrium.*

This proposition implies that, in contrast to the standard neoclassical literature with a representative agent, there is the possibility of automation-induced stagnation in an OLG model. The reason is that investment is fully financed out of wage income, which is, at the same time, reduced by automation. In a sense, automation is therefore digging its own grave in the OLG model. Our result provides an explanation for stagnation due to automation as found by Sachs and Kotlikoff (2012), Benzell et al. (2015), and Sachs et al. (2015). However, we show that this result is an artifact of the underlying OLG framework such that it cannot be stated as a general economic regularity that pertains to automation.

## 4 Conclusions

We demonstrate that the possibility of automation-induced stagnation exists in the OLG model of Diamond (1965). The reason is that, in this framework, households exclusively save out of their labor income. By definition, however, automation competes with labor and depresses the wage rate and therefore labor income. This in turn reduces the savings and investment potential of households and prevents the economy from growing. Our result explains the numerical findings of Sachs and Kotlikoff (2012), Benzell et al. (2015), and Sachs et al. (2015), but also shows that their result is not generalizable to other models of capital accumulation.

## References

- Abeliansky, A. and Prettnner, K. (2017). Automation and demographic change. Hohenheim Discussion Papers in Business, Economics, and Social Sciences. Discussion Paper 05-2017.
- Acemoglu, D. and Restrepo, P. (2015). The Race Between Man and Machine: Implications of Technology for Growth, Factor Shares and Employment. Mimeo.



- Benzell, S. G., Kotlikoff, L. J., LaGardia, G., and Sachs, J. D. (2015). Robots are us: Some economics of human replacement. NBER Working Paper 20941.
- Cass, D. (1965). Optimum growth in an aggregative model of capital accumulation. *The Review of Economic Studies*, Vol. 32(No. 3):233–240.
- Diamond, P. A. (1965). National debt in a neoclassical growth model. *American Economic Review*, Vol. 55(No. 5):1126–1150.
- Graetz, G. and Michaels, G. (2015). Robots at Work. CEPR Discussion Paper 10477.
- Hémous, D. and Olsen, M. (2016). The Rise of the Machines: Automation, Horizontal Innovation and Income Inequality. Mimeo.
- Koopmans, T. C. (1965). On the concept of optimal economic growth. In *The Econometric Approach to Development Planning*. Amsterdam: North Holland.
- Prettner, K. (2017). A note on the implications of automation for economic growth and the labor share. *Macroeconomic Dynamics*. (forthcoming).
- Ramsey, F. P. (1928). A mathematical theory of saving. *The Economic Journal*, Vol. 38(No. 152):543–559.
- Rebelo, S. (1991). Long-Run Policy Analysis and Long-Run Growth. *Journal of Political Economy*, Vol. 99(No. 3):500–521.
- Romer, P. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, Vol. 94(No. 5):1002–1037.
- Sachs, J. D., Benzell, S. G., and LaGardia, G. (2015). Robots: Curse or blessing? A basic framework. NBER Working Paper 21091.
- Sachs, J. D. and Kotlikoff, L. J. (2012). Smart machines and long-term misery. NBER Working Paper 18629.
- Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, Vol. 70(No. 1):65–94.
- Steigum, E. (2011). *Frontiers of Economics and Globalization: Economic Growth and Development*, chapter 21: Robotics and Growth, pages 543–557. Emerald Group.
- The Economist (2014). Immigrants from the future. A special report on robots. *The Economist*, March 27th 2014.

## Hohenheim Discussion Papers in Business, Economics and Social Sciences

The Faculty of Business, Economics and Social Sciences continues since 2015 the established "FZID Discussion Paper Series" of the "Centre for Research on Innovation and Services (FZID)" under the name "Hohenheim Discussion Papers in Business, Economics and Social Sciences".

### Institutes

510	Institute of Financial Management
520	Institute of Economics
530	Institute of Health Care & Public Management
540	Institute of Communication Science
550	Institute of Law and Social Sciences
560	Institute of Economic and Business Education
570	Institute of Marketing & Management
580	Institute of Interorganisational Management & Performance

### Research Areas (since 2017)

INEPA	"Inequality and Economic Policy Analysis"
TKID	"Transformation der Kommunikation – Integration und Desintegration"
NegoTrans	"Negotiation Research – Transformation, Technology, Media and Costs"
INEF	"Innovation, Entrepreneurship and Finance"

Download Hohenheim Discussion Papers in Business, Economics and Social Sciences from our homepage: <https://wiso.uni-hohenheim.de/papers>

No.	Author	Title	Inst
01-2015	Thomas Beissinger, Philipp Baudy	THE IMPACT OF TEMPORARY AGENCY WORK ON TRADE UNION WAGE SETTING: A Theoretical Analysis	520
02-2015	Fabian Wahl	PARTICIPATIVE POLITICAL INSTITUTIONS AND CITY DEVELOPMENT 800-1800	520
03-2015	Tommaso Proietti, Martyna Marczak, Gianluigi Mazzi	EUROMIND-D: A DENSITY ESTIMATE OF MONTHLY GROSS DOMESTIC PRODUCT FOR THE EURO AREA	520
04-2015	Thomas Beissinger, Nathalie Chusseau, Joël Hellier	OFFSHORING AND LABOUR MARKET REFORMS: MODELLING THE GERMAN EXPERIENCE	520
05-2015	Matthias Mueller, Kristina Bogner, Tobias Buchmann, Muhamed Kudic	SIMULATING KNOWLEDGE DIFFUSION IN FOUR STRUCTURALLY DISTINCT NETWORKS – AN AGENT-BASED SIMULATION MODEL	520
06-2015	Martyna Marczak, Thomas Beissinger	BIDIRECTIONAL RELATIONSHIP BETWEEN INVESTOR SENTIMENT AND EXCESS RETURNS: NEW EVIDENCE FROM THE WAVELET PERSPECTIVE	520
07-2015	Peng Nie, Galit Nimrod, Alfonso Sousa-Poza	INTERNET USE AND SUBJECTIVE WELL-BEING IN CHINA	530

<b>No.</b>	<b>Author</b>	<b>Title</b>	<b>Inst</b>
08-2015	Fabian Wahl	THE LONG SHADOW OF HISTORY ROMAN LEGACY AND ECONOMIC DEVELOPMENT – EVIDENCE FROM THE GERMAN LIMES	520
09-2015	Peng Nie, Alfonso Sousa-Poza	COMMUTE TIME AND SUBJECTIVE WELL-BEING IN URBAN CHINA	530
10-2015	Kristina Bogner	THE EFFECT OF PROJECT FUNDING ON INNOVATIVE PERFORMANCE AN AGENT-BASED SIMULATION MODEL	520
11-2015	Bogang Jun, Tai-Yoo Kim	A NEO-SCHUMPETERIAN PERSPECTIVE ON THE ANALYTICAL MACROECONOMIC FRAMEWORK: THE EXPANDED REPRODUCTION SYSTEM	520
12-2015	Volker Grossmann Aderonke Osikominu Marius Osterfeld	ARE SOCIOCULTURAL FACTORS IMPORTANT FOR STUDYING A SCIENCE UNIVERSITY MAJOR?	520
13-2015	Martyna Marczak Tommaso Proietti Stefano Grassi	A DATA–CLEANING AUGMENTED KALMAN FILTER FOR ROBUST ESTIMATION OF STATE SPACE MODELS	520
14-2015	Carolina Castagnetti Luisa Rosti Marina Töpfer	THE REVERSAL OF THE GENDER PAY GAP AMONG PUBLIC-CONTEST SELECTED YOUNG EMPLOYEES	520
15-2015	Alexander Opitz	DEMOCRATIC PROSPECTS IN IMPERIAL RUSSIA: THE REVOLUTION OF 1905 AND THE POLITICAL STOCK MARKET	520
01-2016	Michael Ahlheim, Jan Neidhardt	NON-TRADING BEHAVIOUR IN CHOICE EXPERIMENTS	520
02-2016	Bogang Jun, Alexander Gerybadze, Tai-Yoo Kim	THE LEGACY OF FRIEDRICH LIST: THE EXPANSIVE REPRODUCTION SYSTEM AND THE KOREAN HISTORY OF INDUSTRIALIZATION	520
03-2016	Peng Nie, Alfonso Sousa-Poza	FOOD INSECURITY AMONG OLDER EUROPEANS: EVIDENCE FROM THE SURVEY OF HEALTH, AGEING, AND RETIREMENT IN EUROPE	530
04-2016	Peter Spahn	POPULATION GROWTH, SAVING, INTEREST RATES AND STAGNATION. DISCUSSING THE EGGERTSSON- MEHROTRA-MODEL	520
05-2016	Vincent Dekker, Kristina Strohmaier, Nicole Bosch	A DATA-DRIVEN PROCEDURE TO DETERMINE THE BUNCHING WINDOW – AN APPLICATION TO THE NETHERLANDS	520
06-2016	Philipp Baudy, Dario Cords	DEREGULATION OF TEMPORARY AGENCY EMPLOYMENT IN A UNIONIZED ECONOMY: DOES THIS REALLY LEAD TO A SUBSTITUTION OF REGULAR EMPLOYMENT?	520

<b>No.</b>	<b>Author</b>	<b>Title</b>	<b>Inst</b>
07-2016	Robin Jessen, Davud Rostam-Afschar, Sebastian Schmitz	HOW IMPORTANT IS PRECAUTIONARY LABOR SUPPLY?	520
08-2016	Peng Nie, Alfonso Sousa-Poza, Jianhong Xue	FUEL FOR LIFE: DOMESTIC COOKING FUELS AND WOMEN'S HEALTH IN RURAL CHINA	530
09-2016	Bogang Jun, Seung Kyu-Yi, Tobias Buchmann, Matthias Müller	THE CO-EVOLUTION OF INNOVATION NETWORKS: COLLABORATION BETWEEN WEST AND EAST GERMANY FROM 1972 TO 2014	520
10-2016	Vladan Ivanovic, Vadim Kufenko, Boris Begovic Nenad Stanisic, Vincent Geloso	CONTINUITY UNDER A DIFFERENT NAME. THE OUTCOME OF PRIVATISATION IN SERBIA	520
11-2016	David E. Bloom Michael Kuhn Klaus Prettnner	THE CONTRIBUTION OF FEMALE HEALTH TO ECONOMIC DEVELOPMENT	520
12-2016	Franz X. Hof Klaus Prettnner	THE QUEST FOR STATUS AND R&D-BASED GROWTH	520
13-2016	Jung-In Yeon Andreas Pyka Tai-Yoo Kim	STRUCTURAL SHIFT AND INCREASING VARIETY IN KOREA, 1960–2010: EMPIRICAL EVIDENCE OF THE ECONOMIC DEVELOPMENT MODEL BY THE CREATION OF NEW SECTORS	520
14-2016	Benjamin Fuchs	THE EFFECT OF TEENAGE EMPLOYMENT ON CHARACTER SKILLS, EXPECTATIONS AND OCCUPATIONAL CHOICE STRATEGIES	520
15-2016	Seung-Kyu Yi Bogang Jun	HAS THE GERMAN REUNIFICATION STRENGTHENED GERMANY'S NATIONAL INNOVATION SYSTEM? TRIPLE HELIX DYNAMICS OF GERMANY'S INNOVATION SYSTEM	520
16-2016	Gregor Pfeifer Fabian Wahl Martyrna Marczyk	ILLUMINATING THE WORLD CUP EFFECT: NIGHT LIGHTS EVIDENCE FROM SOUTH AFRICA	520
17-2016	Malte Klein Andreas Sauer	CELEBRATING 30 YEARS OF INNOVATION SYSTEM RESEARCH: WHAT YOU NEED TO KNOW ABOUT INNOVATION SYSTEMS	570
18-2016	Klaus Prettnner	THE IMPLICATIONS OF AUTOMATION FOR ECONOMIC GROWTH AND THE LABOR SHARE	520
19-2016	Klaus Prettnner Andreas Schaefer	HIGHER EDUCATION AND THE FALL AND RISE OF INEQUALITY	520
20-2016	Vadim Kufenko Klaus Prettnner	YOU CAN'T ALWAYS GET WHAT YOU WANT? ESTIMATOR CHOICE AND THE SPEED OF CONVERGENCE	520

<b>No.</b>	<b>Author</b>	<b>Title</b>	<b>Inst</b>
01-2017	Annarita Baldanzi Alberto Bucci Klaus Prettner	CHILDRENS HEALTH, HUMAN CAPITAL ACCUMULATION, AND R&D-BASED ECONOMIC GROWTH	INEPA
02-2017	Julius Tennert Marie Lambert Hans-Peter Burghof	MORAL HAZARD IN VC-FINANCE: MORE EXPENSIVE THAN YOU THOUGHT	INEF
03-2017	Michael Ahlheim Oliver Frör Nguyen Minh Duc Antonia Rehl Ute Siepmann Pham Van Dinh	LABOUR AS A UTILITY MEASURE RECONSIDERED	520
04-2017	Bohdan Kukharskyy Sebastian Seiffert	GUN VIOLENCE IN THE U.S.: CORRELATES AND CAUSES	520
05-2017	Ana Abeliansky Klaus Prettner	AUTOMATION AND DEMOGRAPHIC CHANGE	520
06-2017	Vincent Geloso Vadim Kufenko	INEQUALITY AND GUARD LABOR, OR PROHIBITION AND GUARD LABOR?	INEPA
07-2017	Emanuel Gasteiger Klaus Prettner	ON THE POSSIBILITY OF AUTOMATION-INDUCED STAGNATION	520

## FZID Discussion Papers

(published 2009-2014)

### Competence Centers

IK	Innovation and Knowledge
ICT	Information Systems and Communication Systems
CRFM	Corporate Finance and Risk Management
HCM	Health Care Management
CM	Communication Management
MM	Marketing Management
ECO	Economics

Download FZID Discussion Papers from our homepage: [https://wiso.uni-hohenheim.de/archiv\\_fzid\\_papers](https://wiso.uni-hohenheim.de/archiv_fzid_papers)

<b>Nr.</b>	<b>Autor</b>	<b>Titel</b>	<b>CC</b>
01-2009	Julian P. Christ	NEW ECONOMIC GEOGRAPHY RELOADED: Localized Knowledge Spillovers and the Geography of Innovation	IK
02-2009	André P. Slowak	MARKET FIELD STRUCTURE & DYNAMICS IN INDUSTRIAL AUTOMATION	IK
03-2009	Pier Paolo Saviotti, Andreas Pyka	GENERALIZED BARRIERS TO ENTRY AND ECONOMIC DEVELOPMENT	IK
04-2009	Uwe Focht, Andreas Richter and Jörg Schiller	INTERMEDIATION AND MATCHING IN INSURANCE MARKETS	HCM
05-2009	Julian P. Christ, André P. Slowak	WHY BLU-RAY VS. HD-DVD IS NOT VHS VS. BETAMAX: THE CO-EVOLUTION OF STANDARD-SETTING CONSORTIA	IK
06-2009	Gabriel Felbermayr, Mario Larch and Wolfgang Lechthaler	UNEMPLOYMENT IN AN INTERDEPENDENT WORLD	ECO
07-2009	Steffen Otterbach	MISMATCHES BETWEEN ACTUAL AND PREFERRED WORK TIME: Empirical Evidence of Hours Constraints in 21 Countries	HCM
08-2009	Sven Wydra	PRODUCTION AND EMPLOYMENT IMPACTS OF NEW TECHNOLOGIES – ANALYSIS FOR BIOTECHNOLOGY	IK
09-2009	Ralf Richter, Jochen Streb	CATCHING-UP AND FALLING BEHIND KNOWLEDGE SPILLOVER FROM AMERICAN TO GERMAN MACHINE TOOL MAKERS	IK

<b>Nr.</b>	<b>Autor</b>	<b>Titel</b>	<b>CC</b>
10-2010	Rahel Aichele, Gabriel Felbermayr	KYOTO AND THE CARBON CONTENT OF TRADE	ECO
11-2010	David E. Bloom, Alfonso Sousa-Poza	ECONOMIC CONSEQUENCES OF LOW FERTILITY IN EUROPE	HCM
12-2010	Michael Ahlheim, Oliver Frör	DRINKING AND PROTECTING – A MARKET APPROACH TO THE PRESERVATION OF CORK OAK LANDSCAPES	ECO
13-2010	Michael Ahlheim, Oliver Frör, Antonia Heinke, Nguyen Minh Duc, and Pham Van Dinh	LABOUR AS A UTILITY MEASURE IN CONTINGENT VALUATION STUDIES – HOW GOOD IS IT REALLY?	ECO
14-2010	Julian P. Christ	THE GEOGRAPHY AND CO-LOCATION OF EUROPEAN TECHNOLOGY-SPECIFIC CO-INVENTORSHIP NETWORKS	IK
15-2010	Harald Degner	WINDOWS OF TECHNOLOGICAL OPPORTUNITY DO TECHNOLOGICAL BOOMS INFLUENCE THE RELATIONSHIP BETWEEN FIRM SIZE AND INNOVATIVENESS?	IK
16-2010	Tobias A. Jopp	THE WELFARE STATE EVOLVES: GERMAN KNAPPSCHAFTEN, 1854-1923	HCM
17-2010	Stefan Kirn (Ed.)	PROCESS OF CHANGE IN ORGANISATIONS THROUGH eHEALTH	ICT
18-2010	Jörg Schiller	ÖKONOMISCHE ASPEKTE DER ENTLOHNUNG UND REGULIERUNG UNABHÄNGIGER VERSICHERUNGSVERMITTLER	HCM
19-2010	Frauke Lammers, Jörg Schiller	CONTRACT DESIGN AND INSURANCE FRAUD: AN EXPERIMENTAL INVESTIGATION	HCM
20-2010	Martyna Marczak, Thomas Beissinger	REAL WAGES AND THE BUSINESS CYCLE IN GERMANY	ECO
21-2010	Harald Degner, Jochen Streb	FOREIGN PATENTING IN GERMANY, 1877-1932	IK
22-2010	Heiko Stüber, Thomas Beissinger	DOES DOWNWARD NOMINAL WAGE RIGIDITY DAMPEN WAGE INCREASES?	ECO
23-2010	Mark Spoerer, Jochen Streb	GUNS AND BUTTER – BUT NO MARGARINE: THE IMPACT OF NAZI ECONOMIC POLICIES ON GERMAN FOOD CONSUMPTION, 1933-38	ECO

<b>Nr.</b>	<b>Autor</b>	<b>Titel</b>	<b>CC</b>
24-2011	Dhammika Dharmapala, Nadine Riedel	EARNINGS SHOCKS AND TAX-MOTIVATED INCOME-SHIFTING: EVIDENCE FROM EUROPEAN MULTINATIONALS	ECO
25-2011	Michael Schuele, Stefan Kirn	QUALITATIVES, RÄUMLICHES SCHLIEßEN ZUR KOLLISIONSERKENNUNG UND KOLLISIONSVERMEIDUNG AUTONOMER BDI-AGENTEN	ICT
26-2011	Marcus Müller, Guillaume Stern, Ansgar Jacob and Stefan Kirn	VERHALTENSMODELLE FÜR SOFTWAREAGENTEN IM PUBLIC GOODS GAME	ICT
27-2011	Monnet Benoit, Patrick Gbakoua and Alfonso Sousa-Poza	ENGEL CURVES, SPATIAL VARIATION IN PRICES AND DEMAND FOR COMMODITIES IN CÔTE D'IVOIRE	ECO
28-2011	Nadine Riedel, Hannah Schildberg- Hörisch	ASYMMETRIC OBLIGATIONS	ECO
29-2011	Nicole Waidlein	CAUSES OF PERSISTENT PRODUCTIVITY DIFFERENCES IN THE WEST GERMAN STATES IN THE PERIOD FROM 1950 TO 1990	IK
30-2011	Dominik Hartmann, Atilio Arata	MEASURING SOCIAL CAPITAL AND INNOVATION IN POOR AGRICULTURAL COMMUNITIES. THE CASE OF CHÁPARRA - PERU	IK
31-2011	Peter Spahn	DIE WÄHRUNGSKRISEUNION DIE EURO-VERSCHULDUNG DER NATIONALSTAATEN ALS SCHWACHSTELLE DER EWU	ECO
32-2011	Fabian Wahl	DIE ENTWICKLUNG DES LEBENSSTANDARDS IM DRITTEN REICH – EINE GLÜCKSÖKONOMISCHE PERSPEKTIVE	ECO
33-2011	Giorgio Triulzi, Ramon Scholz and Andreas Pyka	R&D AND KNOWLEDGE DYNAMICS IN UNIVERSITY-INDUSTRY RELATIONSHIPS IN BIOTECH AND PHARMACEUTICALS: AN AGENT-BASED MODEL	IK
34-2011	Claus D. Müller- Hengstenberg, Stefan Kirn	ANWENDUNG DES ÖFFENTLICHEN VERGABERECHTS AUF MODERNE IT SOFTWAREENTWICKLUNGSVERFAHREN	ICT
35-2011	Andreas Pyka	AVOIDING EVOLUTIONARY INEFFICIENCIES IN INNOVATION NETWORKS	IK
36-2011	David Bell, Steffen Otterbach and Alfonso Sousa-Poza	WORK HOURS CONSTRAINTS AND HEALTH	HCM
37-2011	Lukas Scheffknecht, Felix Geiger	A BEHAVIORAL MACROECONOMIC MODEL WITH ENDOGENOUS BOOM-BUST CYCLES AND LEVERAGE DYNAMICS	ECO
38-2011	Yin Krogmann, Ulrich Schwalbe	INTER-FIRM R&D NETWORKS IN THE GLOBAL PHARMACEUTICAL BIOTECHNOLOGY INDUSTRY DURING 1985–1998: A CONCEPTUAL AND EMPIRICAL ANALYSIS	IK



<b>Nr.</b>	<b>Autor</b>	<b>Titel</b>	<b>CC</b>
39-2011	Michael Ahlheim, Tobias Börger and Oliver Frör	RESPONDENT INCENTIVES IN CONTINGENT VALUATION: THE ROLE OF RECIPROCITY	ECO
40-2011	Tobias Börger	A DIRECT TEST OF SOCIALLY DESIRABLE RESPONDING IN CONTINGENT VALUATION INTERVIEWS	ECO
41-2011	Ralf Rukwid, Julian P. Christ	QUANTITATIVE CLUSTERIDENTIFIKATION AUF EBENE DER DEUTSCHEN STADT- UND LANDKREISE (1999-2008)	IK

<b>Nr.</b>	<b>Autor</b>	<b>Titel</b>	<b>CC</b>
42-2012	Benjamin Schön, Andreas Pyka	A TAXONOMY OF INNOVATION NETWORKS	IK
43-2012	Dirk Foremny, Nadine Riedel	BUSINESS TAXES AND THE ELECTORAL CYCLE	ECO
44-2012	Gisela Di Meglio, Andreas Pyka and Luis Rubalcaba	VARIETIES OF SERVICE ECONOMIES IN EUROPE	IK
45-2012	Ralf Rukwid, Julian P. Christ	INNOVATIONSPOTENTIALE IN BADEN-WÜRTTEMBERG: PRODUKTIONSCLUSTER IM BEREICH „METALL, ELEKTRO, IKT“ UND REGIONALE VERFÜGBARKEIT AKADEMISCHER FACHKRÄFTE IN DEN MINT-FÄCHERN	IK
46-2012	Julian P. Christ, Ralf Rukwid	INNOVATIONSPOTENTIALE IN BADEN-WÜRTTEMBERG: BRANCHENSPEZIFISCHE FORSCHUNGS- UND ENTWICKLUNGSAKTIVITÄT, REGIONALES PATENTAUFKOMMEN UND BESCHÄFTIGUNGSSTRUKTUR	IK
47-2012	Oliver Sauter	ASSESSING UNCERTAINTY IN EUROPE AND THE US - IS THERE A COMMON FACTOR?	ECO
48-2012	Dominik Hartmann	SEN MEETS SCHUMPETER. INTRODUCING STRUCTURAL AND DYNAMIC ELEMENTS INTO THE HUMAN CAPABILITY APPROACH	IK
49-2012	Harold Paredes- Frigolett, Andreas Pyka	DISTAL EMBEDDING AS A TECHNOLOGY INNOVATION NETWORK FORMATION STRATEGY	IK
50-2012	Martyna Marczak, Víctor Gómez	CYCLICALITY OF REAL WAGES IN THE USA AND GERMANY: NEW INSIGHTS FROM WAVELET ANALYSIS	ECO
51-2012	André P. Slowak	DIE DURCHSETZUNG VON SCHNITTSTELLEN IN DER STANDARDSETZUNG: FALLBEISPIEL LADESYSTEM ELEKTROMOBILITÄT	IK
52-2012	Fabian Wahl	WHY IT MATTERS WHAT PEOPLE THINK - BELIEFS, LEGAL ORIGINS AND THE DEEP ROOTS OF TRUST	ECO
53-2012	Dominik Hartmann, Micha Kaiser	STATISTISCHER ÜBERBLICK DER TÜRKISCHEN MIGRATION IN BADEN-WÜRTTEMBERG UND DEUTSCHLAND	IK
54-2012	Dominik Hartmann, Andreas Pyka, Seda Aydin, Lena Klauß, Fabian Stahl, Ali Santircioglu, Silvia Oberegelsbacher, Sheida Rashidi, Gaye Onan and Suna Erginkoç	IDENTIFIZIERUNG UND ANALYSE DEUTSCH-TÜRKISCHER INNOVATIONSNETZWERKE. ERSTE ERGEBNISSE DES TGIN- PROJEKTES	IK
55-2012	Michael Ahlheim, Tobias Börger and Oliver Frör	THE ECOLOGICAL PRICE OF GETTING RICH IN A GREEN DESERT: A CONTINGENT VALUATION STUDY IN RURAL SOUTHWEST CHINA	ECO

<b>Nr.</b>	<b>Autor</b>	<b>Titel</b>	<b>CC</b>
56-2012	Matthias Strifler Thomas Beissinger	FAIRNESS CONSIDERATIONS IN LABOR UNION WAGE SETTING – A THEORETICAL ANALYSIS	ECO
57-2012	Peter Spahn	INTEGRATION DURCH WÄHRUNGSUNION? DER FALL DER EURO-ZONE	ECO
58-2012	Sibylle H. Lehmann	TAKING FIRMS TO THE STOCK MARKET: IPOS AND THE IMPORTANCE OF LARGE BANKS IN IMPERIAL GERMANY 1896-1913	ECO
59-2012	Sibylle H. Lehmann, Philipp Hauber and Alexander Opitz	POLITICAL RIGHTS, TAXATION, AND FIRM VALUATION – EVIDENCE FROM SAXONY AROUND 1900	ECO
60-2012	Martyna Marczak, Víctor Gómez	SPECTRAN, A SET OF MATLAB PROGRAMS FOR SPECTRAL ANALYSIS	ECO
61-2012	Theresa Lohse, Nadine Riedel	THE IMPACT OF TRANSFER PRICING REGULATIONS ON PROFIT SHIFTING WITHIN EUROPEAN MULTINATIONALS	ECO

<b>Nr.</b>	<b>Autor</b>	<b>Titel</b>	<b>CC</b>
62-2013	Heiko Stüber	REAL WAGE CYCLICALITY OF NEWLY HIRED WORKERS	ECO
63-2013	David E. Bloom, Alfonso Sousa-Poza	AGEING AND PRODUCTIVITY	HCM
64-2013	Martyna Marczak, V́ctor Ǵmez	MONTHLY US BUSINESS CYCLE INDICATORS: A NEW MULTIVARIATE APPROACH BASED ON A BAND-PASS FILTER	ECO
65-2013	Dominik Hartmann, Andreas Pyka	INNOVATION, ECONOMIC DIVERSIFICATION AND HUMAN DEVELOPMENT	IK
66-2013	Christof Ernst, Katharina Richter and Nadine Riedel	CORPORATE TAXATION AND THE QUALITY OF RESEARCH AND DEVELOPMENT	ECO
67-2013	Michael Ahlheim, Oliver Frór, Jiang Tong, Luo Jing and Sonna Pelz	NONUSE VALUES OF CLIMATE POLICY - AN EMPIRICAL STUDY IN XINJIANG AND BEIJING	ECO
68-2013	Michael Ahlheim, Friedrich Schneider	CONSIDERING HOUSEHOLD SIZE IN CONTINGENT VALUATION STUDIES	ECO
69-2013	Fabio Bertoni, Tereza Tykvová	WHICH FORM OF VENTURE CAPITAL IS MOST SUPPORTIVE OF INNOVATION? EVIDENCE FROM EUROPEAN BIOTECHNOLOGY COMPANIES	CFRM
70-2013	Tobias Buchmann, Andreas Pyka	THE EVOLUTION OF INNOVATION NETWORKS: THE CASE OF A GERMAN AUTOMOTIVE NETWORK	IK
71-2013	B. Vermeulen, A. Pyka, J. A. La Poutré and A. G. de Kok	CAPABILITY-BASED GOVERNANCE PATTERNS OVER THE PRODUCT LIFE-CYCLE	IK
72-2013	Beatriz Fabiola López Ulloa, Valerie Møller and Alfonso Sousa- Poza	HOW DOES SUBJECTIVE WELL-BEING EVOLVE WITH AGE? A LITERATURE REVIEW	HCM
73-2013	Wencke Gwozdz, Alfonso Sousa-Poza, Lucia A. Reisch, Wolfgang Ahrens, Stefaan De Henauw, Gabriele Eiben, Juan M. Fernández-Alvira, Charalampos Hadjigeorgiou, Eva Kovács, Fabio Lauria, Toomas Veidebaum, Garrath Williams, Karin Bammann	MATERNAL EMPLOYMENT AND CHILDHOOD OBESITY – A EUROPEAN PERSPECTIVE	HCM

<b>Nr.</b>	<b>Autor</b>	<b>Titel</b>	<b>CC</b>
74-2013	Andreas Haas, Annette Hofmann	RISIKEN AUS CLOUD-COMPUTING-SERVICES: FRAGEN DES RISIKOMANAGEMENTS UND ASPEKTE DER VERSICHERBARKEIT	HCM
75-2013	Yin Krogmann, Nadine Riedel and Ulrich Schwalbe	INTER-FIRM R&D NETWORKS IN PHARMACEUTICAL BIOTECHNOLOGY: WHAT DETERMINES FIRM'S CENTRALITY-BASED PARTNERING CAPABILITY?	ECO, IK
76-2013	Peter Spahn	MACROECONOMIC STABILISATION AND BANK LENDING: A SIMPLE WORKHORSE MODEL	ECO
77-2013	Sheida Rashidi, Andreas Pyka	MIGRATION AND INNOVATION – A SURVEY	IK
78-2013	Benjamin Schön, Andreas Pyka	THE SUCCESS FACTORS OF TECHNOLOGY-SOURCING THROUGH MERGERS & ACQUISITIONS – AN INTUITIVE META- ANALYSIS	IK
79-2013	Irene Prostoplow, Andreas Pyka and Barbara Heller-Schuh	TURKISH-GERMAN INNOVATION NETWORKS IN THE EUROPEAN RESEARCH LANDSCAPE	IK
80-2013	Eva Schlenker, Kai D. Schmid	CAPITAL INCOME SHARES AND INCOME INEQUALITY IN THE EUROPEAN UNION	ECO
81-2013	Michael Ahlheim, Tobias Börger and Oliver Frör	THE INFLUENCE OF ETHNICITY AND CULTURE ON THE VALUATION OF ENVIRONMENTAL IMPROVEMENTS – RESULTS FROM A CVM STUDY IN SOUTHWEST CHINA –	ECO
82-2013	Fabian Wahl	DOES MEDIEVAL TRADE STILL MATTER? HISTORICAL TRADE CENTERS, AGGLOMERATION AND CONTEMPORARY ECONOMIC DEVELOPMENT	ECO
83-2013	Peter Spahn	SUBPRIME AND EURO CRISIS: SHOULD WE BLAME THE ECONOMISTS?	ECO
84-2013	Daniel Guffarth, Michael J. Barber	THE EUROPEAN AEROSPACE R&D COLLABORATION NETWORK	IK
85-2013	Athanasios Saitis	KARTELLBEKÄMPFUNG UND INTERNE KARTELLSTRUKTUREN: EIN NETZWERKTHEORETISCHER ANSATZ	IK

<b>Nr.</b>	<b>Autor</b>	<b>Titel</b>	<b>CC</b>
86-2014	Stefan Kirn, Claus D. Müller-Hengstenberg	INTELLIGENTE (SOFTWARE-)AGENTEN: EINE NEUE HERAUSFORDERUNG FÜR DIE GESELLSCHAFT UND UNSER RECHTSSYSTEM?	ICT
87-2014	Peng Nie, Alfonso Sousa-Poza	MATERNAL EMPLOYMENT AND CHILDHOOD OBESITY IN CHINA: EVIDENCE FROM THE CHINA HEALTH AND NUTRITION SURVEY	HCM
88-2014	Steffen Otterbach, Alfonso Sousa-Poza	JOB INSECURITY, EMPLOYABILITY, AND HEALTH: AN ANALYSIS FOR GERMANY ACROSS GENERATIONS	HCM
89-2014	Carsten Burhop, Sibylle H. Lehmann-Hasemeyer	THE GEOGRAPHY OF STOCK EXCHANGES IN IMPERIAL GERMANY	ECO
90-2014	Martyna Marczak, Tommaso Proietti	OUTLIER DETECTION IN STRUCTURAL TIME SERIES MODELS: THE INDICATOR SATURATION APPROACH	ECO
91-2014	Sophie Urmetzer, Andreas Pyka	VARIETIES OF KNOWLEDGE-BASED BIOECONOMIES	IK
92-2014	Bogang Jun, Joongho Lee	THE TRADEOFF BETWEEN FERTILITY AND EDUCATION: EVIDENCE FROM THE KOREAN DEVELOPMENT PATH	IK
93-2014	Bogang Jun, Tai-Yoo Kim	NON-FINANCIAL HURDLES FOR HUMAN CAPITAL ACCUMULATION: LANDOWNERSHIP IN KOREA UNDER JAPANESE RULE	IK
94-2014	Michael Ahlheim, Oliver Frör, Gerhard Langenberger and Sonna Pelz	CHINESE URBANITES AND THE PRESERVATION OF RARE SPECIES IN REMOTE PARTS OF THE COUNTRY – THE EXAMPLE OF EAGLEWOOD	ECO
95-2014	Harold Paredes-Frigolett, Andreas Pyka, Javier Pereira and Luiz Flávio Autran Monteiro Gomes	RANKING THE PERFORMANCE OF NATIONAL INNOVATION SYSTEMS IN THE IBERIAN PENINSULA AND LATIN AMERICA FROM A NEO-SCHUMPETERIAN ECONOMICS PERSPECTIVE	IK
96-2014	Daniel Guffarth, Michael J. Barber	NETWORK EVOLUTION, SUCCESS, AND REGIONAL DEVELOPMENT IN THE EUROPEAN AEROSPACE INDUSTRY	IK

## IMPRINT

University of Hohenheim

Dean's Office of the Faculty of Business, Economics and Social Sciences

Palace Hohenheim 1 B

70593 Stuttgart | Germany

Fon +49 (0)711 459 22488

Fax +49 (0)711 459 22785

E-mail [wiso@uni-hohenheim.de](mailto:wiso@uni-hohenheim.de)

Web [www.wiso.uni-hohenheim.de](http://www.wiso.uni-hohenheim.de)