

Jochen Dehio, Roland Döhrn, Rainer Graskamp,
Klaus Löbbe, Hans Dietrich von Loeffelholz,
Waike Moos and Michael Rothgang

New Economy

The German Perspective

Heft 70



Duncker & Humblot · Berlin

Rheinisch-Westfälisches Institut für Wirtschaftsforschung

Vorstand:

Prof. Dr. Christoph M. Schmidt, Ph.D. (Präsident),

Prof. Dr. Ullrich Heilemann (Vizepräsident),

Prof. Dr. Wim Kösters

Verwaltungsrat:

Heinrich Frommknecht (Vorsitzender);

Eberhard Heinke, Dr. Dietmar Kuhnt, Dr. Henning Osthues-Albrecht
(stellv. Vorsitzende);

Prof. Dr.-Ing. Dieter Ameling, Manfred Breuer, Prof. Dr. Walter Eberhard,

Prof. Dr. Harald B. Giesel, Marianne Halstrick-Schwenk, Dr. Thomas Köster,

Hartmut Krebs, Rolf Hermann Nienaber, Heinz Putzhammer,

Dr. Günter Sandermann, Dr. Gerd Willamowski

Forschungsbeirat:

Prof. David Card, Ph.D., Prof. Dr. Clemens Fuest, Prof. Dr. Walter Krämer,

Prof. Dr. Michael Lechner, Prof. Dr. Till Requate, Prof. Nina Smith, Ph.D.,

Prof. Dr. Harald Uhlig, Prof. Dr. Josef Zweimüller

RWI : Schriften Heft 70

Schriftleitung: Prof. Dr. Christoph M. Schmidt, Ph.D.

Redaktionelle Bearbeitung: Joachim Schmidt

Jochen Dehio, Roland Döhrn,
Rainer Graskamp, Klaus Löbbe,
Hans Dietrich von Loeffelholz,
Waike Moos and Michael Rothgang

New Economy – The German Perspective

RWI : Schriften

Heft 70

Jochen Dehio, Roland Döhrn, Rainer Graskamp,
Klaus Löbbe, Hans Dietrich von Loeffelholz,
Waike Moos and Michael Rothgang

New Economy

The German Perspective



Duncker & Humblot · Berlin

Bibliografische Information Der Deutschen Bibliothek

Die Deutsche Bibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <<http://dnb.ddb.de>> abrufbar.

Alle Rechte vorbehalten
© 2003 Duncker & Humblot GmbH, Berlin
Fotoprint: Berliner Buchdruckerei Union GmbH, Berlin
Printed in Germany

ISSN 0720-7212
ISBN 3-428-11327-6

Gedruckt auf alterungsbeständigem (säurefreiem) Papier
entsprechend ISO 9706 ☺

Preface

For many observers the beginning of a dynamic economic and stock market upswing in the U.S. in the mid 1990s marked the start of a new era, the times of the *new economy*. This phenomenon has been under intense discussion ever since – both in the political arena as well as among scientists. Thereby the somewhat glamorous term *new economy* reflects the conviction held by its proponents that the use of new technologies will lead to a never ending acceleration of technological progress and economic welfare.

The origins of this development date back a long time: More than 30 years ago, the starting point was the basic innovation “digitilization”. Production as well as application of information and communications technologies (ICT) are based on this principle. At the beginning of the seventies, the first microprocessor was produced. Some ten years later, the first personal computer was brought onto the market. The commercial use of the Internet has begun in the mid nineties. In view of the economic boom in the U.S. accompanying the introduction of the Internet, the question arises as to what extent the *new economy* actually has exerted lasting positive effects on productivity – not only in the United States, but also worldwide.

Inspired by these developments, the Federal Ministry of Economics and Technology commissioned RWI, Essen, to study the driving forces of the *new economy*. In this report, the trends of the ICT sector and of the use of ICT products are analyzed with respect to the overall economic effects in Germany in comparison to the U.S. Further analyses were carried out regarding the intensity and effects of *e-business*. Finally, the influence of different methods of price measurement on productivity was analysed, since this is important for international comparisons of total factor productivity. The study culminates in a growth accounting calculation separating the contributions to economic growth by capital, labor, and technological progress.

The study was conducted by RWI’s research group “Industrial Organisation and Industry Studies” in close co-operation with Prof. *Robert J. Gordon* (NBER and Northwestern University). Professor Gordon is one of the most

eminent experts in matters of the *new economy*. The project was directed by Klaus Löbbe. Preliminary results were presented and discussed by experts on November 9, 2001 during a workshop organized by the Federal Ministry of Economics and Technology in Berlin. The study was finished in 2002. Prof. *Francesco Daveri* (University of Parma), an acknowledged scientist in the empirical analysis of the effects of the *new economy*, provided useful comments in the course of this publication's preparation. We heartily thank him, as we do Professor Gordon and all other researchers involved in this study.

Essen, June 2003

Rheinisch-Westfälisches Institut
für Wirtschaftsforschung

Christoph M. Schmidt

Contents

Introduction	15
Chapter 1	
Economic Development in Germany and the U.S.	19
1. Long-Term Trends	19
2. Labor and Capital Productivity.	25
3. External Trade and Foreign Direct Investment	33
4. Public Finance	35
Chapter 2	
ICT and Earlier Technological Revolutions	41
1. Fundamental Technological Revolutions in Historical Perspective.	42
2. Analysis of Historical Time Series	47
3. Historical Trend Growth of the Production Potential.	52
4. Concluding Remarks	55
Chapter 3	
Volume and Growth of the ICT Sector	57
1. Definitions and Data Base	57
2. International Comparison	59

3.	ICT Sector by Industry	64
3.1	United States.	64
3.2	Germany	67
4.	Concluding Remarks	72

Chapter 4

ICT Use		73
1.	Economic Effects of ICT Use.	74
1.1	Framework for the Analysis	74
1.2	Effects on Industry Level Productivity.	76
1.3	ICT Use in the Service Sectors and Innovative Activity	79
2.	ICT Use in Germany	81
2.1	General Indicators	81
2.2	E-commerce	86
2.2.1	Internet Use	86
2.2.2	Internet and e-commerce in Light of the Stock Markets	87
2.2.3	E-commerce Market	90
2.2.3.1	Definition of e-commerce.	90
2.2.3.2	Effects	92
2.2.3.3	Evaluation of Selected Market Studies	93
2.2.3.4	Prospects.	95
2.2.3.5	Overall Economic Effects.	99
2.2.3.6	Policy Interventions in Germany	101
3.	Concluding Remarks	103

Chapter 5

Macroeconomic Consequences of ICT		105
1.	Methodological Approach	105
2.	Data Availability	108
2.1	Data on ICT Investment and Other Economic Indicators	108
2.2	Labor Quality	110
3.	Growth Accounting Analysis.	110
3.1	Calculation Procedure	110
3.2	Results	112
3.3	Cyclical Effects and Multifactor Productivity Growth	114

4.	Influence of Deflating Methods on Measured Growth	115
4.1	Initial Situation	115
4.2	Deflating of GDP	117
4.2.1	Methodology of the German National Accounting.	117
4.2.2	Using of Fisher-Chain Indices by the BEA	119
4.3	Quality Effects.	121
4.3.1	Elimination of Quality Effects in German National Accounting	121
4.3.2	Use of Hedonic Techniques by the BEA.	122
4.4	Software-Hardware Relations	123
4.5	Macroeconomic Impacts of Methodological Adjustments in Germany	124
5.	Trends of Total Factor Productivity and Capital Deepening . .	125
6.	Concluding Remarks	129

Chapter 6

Summary and Conclusions		132
1.	Issues and Objectives of the Study	132
2.	Economic Development in Germany and the U.S.	134
3.	ICT and Earlier Technical Revolutions	135
4.	ICT Sector	137
5.	Sectoral Use of ICT	139
6.	Macroeconomic Consequences of ICT	141
7.	Fields of Activity and Economic-Political Implications.	143

Bibliography		148
---------------------	--	-----

List of Tables

Table 1:	Productivity in the Non-Farm Private Business Sector . . .	26
Table 2:	Fiscal Indicators in Germany.	36
Table 3:	Fiscal Indicators in the United States	37
Table 4:	Federal Outlays by Major Spending Category in the United States	39
Table 5:	Growth of GDP and Labor Productivity in Historical Perspective	47
Table 6:	Size and Growth of the ICT Sector in International Comparison	60
Table 7:	Contribution of the ICT Sector to Economic Growth and Employment	61
Table 8:	Production, Value Added and Labor Productivity in the German ICT Sector.	63
Table 9:	Gross Output and Gross Domestic Income in the U.S. ICT Sector	65
Table 10:	Gross Output of the U.S. ICT Sector, in Chained 1996 Prices.	66
Table 11:	Value Added and Employment in the German ICT Sector by Industry.	68
Table 12:	Production and Value Added in the ICT Sector in Germany.	69
Table 13:	Production and Market Volume in the ICT Sector in Germany.	70
Table 14:	ICT Equipment and Use	82

Table 15:	Telecommunications (TC) Infrastructure Equipment and Use	83
Table 16:	Telecommunications Charges and Revenue of TC Enterprises	84
Table 17:	Projection of e-commerce Sales until 2010	94
Table 18:	ICT and Non-ICT Capital Stock in Germany and the United States	112
Table 19:	Decomposition of GDP Growth into its Components	113
Table 20:	Growth Effect of ICT Capital in Selected Studies	114
Table 21:	Deflating of the GDP by Several Basis Years – an Illustration	119

List of Figures

Figure 1:	Long-Term Development of GDP in Germany and the United States	20
Figure 2:	Long-Term Development of Employment in Germany and the United States	21
Figure 3:	Estimated Trend Growth Rate of GDP in Germany and the United States	23
Figure 4:	Estimated Trend Growth Rate of Consumer Price Index in Germany and the United States	24
Figure 5:	Labor Productivity in Germany and the United States. . .	25
Figure 6:	Estimated Trend Growth Rates of Sectoral Labor Productivity in West-Germany.	27
Figure 7:	Sectoral Labor Productivity in Germany	28
Figure 8:	Sectoral Labor Productivity in the United States	29
Figure 9:	Capital Productivity in Germany and the United States . .	30
Figure 10:	Sectoral Capital Productivity in Germany	31
Figure 11:	Sectoral Capital Productivity in the United States	32
Figure 12:	Openness of the Economy	34
Figure 13:	Gross Federal Debt in the United States	38
Figure 14:	Federal Budget in the United States	40
Figure 15:	Long-term Development in Germany and the United States.	50
Figure 16:	Estimated Trend Growth Rates of Historical Time Series in Germany and the United States.	53
Figure 17:	Software Capital Stock and Labor Productivity Change . .	77

List of Schedules	13
Figure 18: Productivity Change in Service Sectors	80
Figure 19: Share of Innovative Business Firms	81
Figure 20: Households with Internet Access in Germany	87
Figure 21: Annual Fluctuation Margins and Stock Exchange Turnover of the NASDAQ Composite Index.	88
Figure 22: Trend Component of Total Factor Productivity in Germany and the United States	127
Figure 23: Capital Deepening in Germany and the United States. . .	129

List of Schedules

Schedule 1: Framework for Data Collection: ICT Production and Demand	58
Schedule 2: Framework for Data Collection: ICT Use, Productivity and Final Demand	75

Introduction

Already since the beginning of the year 2001, and even more so since the terror attacks in the United States in early September, economic growth has been declining in most parts of the world. The decline ends, at least temporarily, a long lasting phase of accelerated growth. This protracted growth had contributed to a rapidly rising real income and the creation of a great number of attractive jobs in the U.S. and some other countries for several years. The associated combination of accelerated growth and monetary stability was often addressed as the emergence of a “new economy” (see, e.g., Bosworth, Triplett 2000; Bryson 2001; David 2001; Jorgenson, Stiroh 2000b; Nordhaus 2001a; Oliner, Sichel 2000). This new era was supposed to lead the U.S. to yet another “golden age” of growth and full employment, making the stagflation of the seventies and the productivity slowdown of the eighties as a forgotten historical episode. Many observers assumed that the driving force of this “new economy” – primarily the development and the increasing diffusion of new technologies, especially the information and telecommunications technology (ICT) – would lead to an ever accelerating factor productivity and the creation of new jobs, to low inflation and increasing “sustainable” real income.

However, the existence of a “new economy” in the U.S. is not an undisputed fact. In the U.S.-American literature there is an intensive discussion about the role of cyclical components and capital deepening on the one hand, and the contribution of technical progress (or total factor productivity) and falling ICT prices on the other hand (see, e.g., Blinder 2000; Davies et al. 2000). Lower restrictions regarding trade in goods and capital, an investment-friendly environment and a willingness to foster intensive competition, the associated adaptations of corporate structures, a skilful macroeconomic policy (a good mix between fiscal consolidation and countervailing monetary policy) and singular events (so-called peace bonus, drop in raw materials prices) are also important for the existence of the “new economy”. Last but not least there was a debate in the U.S. economic literature about the appropriate calculation and statistical determination of labor and total factor productivity, qualifying the large growth figures to some extent (see, e.g., Boskin et al. 1996; Gordon 1999d; Triplett 2001).

From the European, and especially the German perspective, further factors that could have contributed to economic growth and employment should be pointed out. One can refer to the extension and more intense implementation of the European Community, the reunification of Germany and some structural reforms, such as the deregulation of several sectors, the privatization of public enterprises, reforms in public procurement and the creation of new instruments for business finance (Neuer Markt and venture capital, e.g.). These changes in the legal and institutional framework and structural reforms might also have contributed to the accelerated change in sectoral structures, numerous mergers and acquisitions and the creation of new enterprises. All this resulted in a higher degree of competition and a greater share of small and medium-sized enterprises. Nevertheless, during the nineties economic growth in most European countries was modest – and proved not sufficient in reducing the high unemployment rate. Under these conditions, the debate about the “new economy” in the U.S. was observed more and more carefully in most European countries.

At first glance, the attractiveness of the “new economy” concept has decreased markedly since the bursting of the speculative bubble on the stock markets (especially the Nasdaq Market and the Neuer Markt). But one should bear in mind that the connection between both phenomena is weak: While at the micro-economic level the valuation of individual companies is at issue, at the macro-economic level it is the development of total factor productivity which is of interest. Yet, up- and downswing of the NASDAQ or the Neuer Markt since 1997 reflect at least the changing role of technical progress.

For these reasons, a detailed analysis of the “new economy” and its components is still necessary. This requires – first of all – a theoretically sound, but practicable definition of the term “new economy”. Following the recent literature (OECD 2001b), this study classifies an economy as a “new economy”, if there is a remarkable acceleration of real growth in total output, value added, employment and/or labor productivity that can be mainly attributed to

- an improved quality of labor measured as an increase in educational attainment or in the level of post-secondary skills,
- an extended use of physical capital, above all ICT capital, and
- a rising multi-factor productivity (MFP), that is an increase in production and/or productivity which exceeds the gains resulting from intensified utilization of intermediate inputs or production factors (labor or capital).

Empirically, the MFP is usually calculated as the residual of a production function estimate. This procedure requires numerous, and partly restrictive, assumptions. Its main focus is necessarily on the long-run development of the economy, over and above its cyclical up- and downswings. The factors that may

have caused an increase in MFP are (1) an accelerating technological progress, (2) a higher degree of competition which pushes prices closer to marginal costs, or (3) a rising efficiency in the overall production and distribution process, either by the introduction of new organizational methods in management or by the use of new techniques (e.g., ICT techniques).

Against this background a comparative study is conducted on the importance of the phenomenon of the “new economy” and its driving forces in the United States and in Germany. In this context, the following questions need to be answered:

- Does the recent acceleration in the growth of U.S.-productivity really imply a fundamental change in the long-lasting trend of a protracted productivity slowdown? Which differences exist between the United States and Germany, with respect to long-term economic growth and employment, factor productivity and inflation? Which U.S.-German differences can be observed across the different sectors of the economy?
- How can these differences be explained? What is the importance of technological, cyclical and statistical (new methods for price measurement, calculation of nominal or real input and output figures etc.) factors for this change?
- Is ICT really a basic technology in the sense that it fundamentally alters the production process in the overall economy? Alternatively, are the production and productivity effects only confined to the ICT-sector?
- Do the general and sector-specific economic advantages arising from ICT correspond to those experienced during earlier technological revolutions (rise of the railways, widespread use of electricity and the automobile)? Based on historical experience, how long does it usually take for new technologies to diffuse into the German economy? What is the realistic time scale for catching up with the U.S. economy in terms of ICT penetration?
- Are there spillover effects from the ICT-sector into the remaining sectors of the economy? In which way do ICT-technologies change the internal production processes and the organization of work in the various sectors and/or firms? Which role do the new technologies play in the optimization of production processes as well as for the reduction in transaction costs (B2B, B2C)?
- What is the structural framework and which are the supporting macroeconomic policies that will foster the further development of the “new economy”? Could more intense efforts by economic, social, educational and research policy help Germany to catch up to other economies, particularly to the United States?