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New Economy – an Assessment from a German Viewpoint

Executive Summary

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Executive Summary

1. Issues and Objectives of the Study

Since the beginning of the year 2001 – and not only since the terror attacks in the United States in early September – the economic growth in most parts of the world is declining. With that, at least temporarily a long lasting phase of accelerating growth in America and some other countries has come to its end, which had contributed to a rapid rising real income and the creation of a great number of (mostly) attractive working places for several years. This combination of accelerated growth and monetary stability was often addressed as „new economy“ that should lead the Americans to a golden age of growth and employment – and make forgotten the stagflation of the seventies and the productivity slowdown of the eighties. Many observers assumed – and some of them do it even today - that the driving forces of this „new economy“ (primarily the development and the increasing diffusion of the information and telecommunications technology (ICT)) have led to the accelerating factor productivity and the creation of new jobs, to low inflation and increasing „sustainable“ real income.

The existence of a „new economy“ in the U.S. for itself and the implications of the information and telecommunications techniques as a driving force was, however, not undisputed. In the U.S.-American literature there was an intensive discussion about the role of cyclical components and capital deepening on the one hand, the contribution of technical progress (or total factor productivity) accompanied by falling ICT prices on the other hand. Other authors pointed out, that more open frontiers for goods and capital, an investment friendly environment and a willingness to be intensely competitive and adaptable with regard to corporate structure and human resources, were responsible for the existence of the „new economy“. Some economists referred to a skilful macroeconomic policy (fiscal consolidation and positive response from monetary policy) and singular events (peace bonus, drop in raw materials prices), too. Last but not least there was a debate in the US-American economic literature about the appropriate calculation and statistical determination of labor and/or total factor productivity.

In Europe and especially in Germany there are further causes that could have contributed to economic growth and employment. It could be referred to the extending and deepening of the European Community, the reunification of Germany and to a lot of structural reforms (the deregulation of several sectors, the privatization of public enterprises, reforms in public procurement and the creation of new instruments for financing (*Neuer Markt* and Venture Capital, e.g.). These changes in the legal and institutional framework and structural reforms induced an intensified shift between industries and branches, 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 enterprises. Nevertheless, during the nineties the economic growth in the most European countries was almost modest – and not sufficient to reduce the high unemployment. 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 term “new economy” has decreased since the breakdown of the speculation bubble on the stock markets (especially the Nasdaq Market and *Neuer Markt*). But one should bear in mind that there is only a small bridge between both phenomena: the macro-economic question of the factors driving total factor productivity on the one hand and the more or less micro-economic question of the valuation of a number of companies. The up- and downswing of the Nasdaq or *Neuer Markt* since 1997 reflect only partly the changing role of technical progress.

For this reason the study has tried to give a detailed analysis of the “new economy”, especially to the following questions:

- Does the acceleration in the growth of US-productivity really imply a fundamental change in the long-lasting trend of productivity slowdown? Which differences between the United States and Germany do exist with respect to long term economic growth and employment, factor productivity and inflation? Which differences can be observed between the different sectors of the economy?
- How can these differences be explained? What is the importance of technological, cyclical and statistical factors for this change (new methods for price measurement, calculation of nominal or real input and output figures etc.)?
- Are the ICT-technologies really a basic technology in the sense that they can fundamentally change the methods of production in the overall economy? Or, are the production and productivity effects only confined to the ICT-sector?
- Do the general and particular economic advantages of the new ICT technologies correspond to those of earlier technological revolutions (rise of the railways, widespread use of electricity and the automobile)? Going by past experience, how long does it usually take for new technologies to make an appearance and spread in Germany? What is the realistic time scale for catching up?
- Are there spill-over effects from the ICT-sector into the remaining sectors of the economy? Can "thresholds", "critical values" or "network effects" be described, where advances in productivity begin to have a really substantial effect? In which way do ICT-technologies change the internal production processes and the organization in the sectors and/or firms?
- Which impacts and obstacles in the use of new technologies can be obtained on the macro and/or micro level? What role do market entries and exits play? Which role do the new technologies play in the optimization of production processes as well as the reduction in transaction costs (B2B, B2C)?
- What structural framework conditions and supporting macroeconomic policies could be necessary for the development of a "new economy"? What can economic, social, educational and research policy do beyond its current efforts to help Germany catching up to other economies, particularly the United States, as quickly as possible?

2. Economic Development in Germany and the USA

For analysing the differences between the United States and Germany with respect to long run economic growth and employment, factor productivity and inflation, one has to focus on changes in the growth path of the economic aggregates. The cyclical fluctuations are of minor interest in this context. A well known method to identify the trend growth path of the potential growth rate of economic aggregates while neglecting the cyclical fluctuations is smoothing the corresponding time series with the Hodrick-Prescott Filter. With the HP-filter it is possible to solely identify the long term trend component of a time series. If one assumes that a trend in a time series only changes, if there are structural changes in the economy and the technology, the HP-filter is a suitable instrument to analyse the question, whether the US

times series since 1990 are driven by different structural – not cyclical – forces than in former times.

Focussing on the German time series one has to bear in mind the structural break in the data between 1990 and 1991 because of the German re-unification. To get rid of this structural break and to avoid having to different pieces of times series, the two parts of the series are connected by estimating a growth rate between 1990 and 1991. Nevertheless, the German data are biased by the economic effects of the re-unification, so that those effects jam the effects of a potential beginning of a New Economy or a potential backlog of the application of ICT in Germany. Focussing on the trend growth rates of the HP-filtered time series one can see that

- since 1991 there is a diverging development in the trend growth of GDP in the US and in Germany; the average trend growth rate in the US has accelerated from 2.8 percent in 1990 to 3.8 percent in 2000, whereas the German trend growth rate has started on nearly the same level in 1991, but has slowed down to 1.8 percent;
- the US trend growth rate of employment (between 1.5 and 2 percent) has always been higher than in Germany (below 0.5 percent). The working-age population in the U.S., however, has had a lower growth rate than employment, so the achievement of 1.5 to 2.0 percent in employment growth reflects a decline in the NAIRU and a decline in the unemployment rate.
- the trend growth rate of labor productivity has always been higher in Germany than in the US, however, since 1995 for the first time the velocity of the US productivity growth has – now with 2.5 percent – surpassed the corresponding German rate with 1.3 percent.
- in Germany the sectoral disaggregated labor productivity growth rates are growing with a different - the highest in manufacturing the lowest in services sector - rate each but with a nearly constant velocity. In the U.S., the growth rates are accelerating, however, with a different acceleration rate in each sector. The manufacturing sector is contributing strongly to this accelerated growth of labor productivity. In the services sector in the first half of the nineties there had been a very slight reduction in the level of labor productivity, however since 1995 the reduction has slowed and in the end of the nineties there are again small but positive growth rates of labor productivity. In Germany also in the services sector, there is a small but positive growth rate of labor productivity. So in the U.S., the effects of an acceleration of productivity growth are not only shown up in the ICT sector, but also in the manufacturing sector. Nevertheless, no significant productivity acceleration effects in the services sector could be seen until now.
- although the German inflation was higher than in the U.S. for 1992 to 1995, and was considerably lower for 1996 to 2000 there is a long-term tendency of a decreasing trend in the CPI-growth rates in both countries, however, the German growth rate is - because of the different weight of the economic target or price stability in both countries - slightly lower, however, the differences have generally decreased in the course of time.

Focussing on the development of the trend growth rates of the main economic aggregates, there is especially in the nineties a different development in Germany and the US. Tracing

back the causalities to the different development is difficult, because of the different structural framework in both countries and the special effects of the German re-unification. Ascribing the driving forces of this different development only to the ICT is a too narrow point of view. The application and diffusion of ICT is not a special feature of the nineties, it has already started 30 years ago. What is new in the nineties is the internet and the consequences of its increasing use, which have not been reflected in the data yet. The former consequences concerning productivity figures in the application of ICT could be rather seen in the manufacturing sector, however, it seems to be plausible that in the future the service sector will be also affected positively by spill over effects.

3. ICT and Earlier Technical Revolutions

One of the main issues of the study refers to the question whether the general and particular economic advantages of the new IT technologies correspond to those of earlier technological revolutions and to what extent ICT technologies can be regarded as a fundamental technology in the sense that it fundamentally changes the way of industrial production and induces far-reaching changes in corporate organization and working processes. In this context historical time series which cover the period until 1870 are analysed to compare the effects of ICT with earlier fundamental technologies (e.g. the railway, the combustion engine, the electric motor, or the automobile) and to find out how long it usually takes for new technologies to make an appearance and are widely spread, especially in Germany?

Economic growth and structural change is not a continuously phenomenon but occurs in steps, however, the structural change itself is induced by innovations. The definition of innovation does not only mean the transformation of scientific knowledge in new products and production processes but also contains new organizations of firms, institutions and labor. In this context the economic development of the last 200 years can be divided in five large cycles, i.e. the Kondratieff cycles, each of it caused by different fundamental technologies. The fundamental innovations induce changes in the methods of production on the overall economy which accompanied by changes in the structure of valued added. They are often followed by incremental or derivative innovations which induce a “bandwagon effect” and which rather refer to the application and dispersion of the new products, production processes or institutions. If those incremental innovations complement one another and lead to synergetic effects, they can cause a sustainable acceleration of the growth path of an economy, until their benefits are exhausted.

The first Kondratieff cycle based on the use of the stationary steam engine and ended in the middle of the 19th century. The steam engine caused the industrial revolution, the existence of firms as institution and a shift from agricultural workers to industrial workers. The second cycle based on the mobile steam engine and – in combination with the knowledge of steel processing – the railway totally changes the infrastructure. The third cycle started in the begin of the 20th century and ended in the second world war. This period can be characterized by the widespread application of electricity, the electric motor, radio and telephone and as production process the mass production. In the U.S. the diffusion of electricity and the development of the automobile were simultaneous, and the electrification of manufacturing and the widespread use of the automobile reached their peak in the 1920s. The fourth cycle started after the second world war and based on the improvement of the existing technologies. Important innovations are the petrochemicals followed by innovations in the plastic materials and textiles based on mineral oil, and finally the computer and the microchip. In Europe the diffusion of the automobile was delayed in comparison to the U.S. until after World War II, never-

theless, electricity has, too, become widespread already in the third cycle. The fourth cycle was ended by the oil crisis in the early seventies. Since then there is a fundamental structural change in the economy mainly driven by an increasing international division of labor, the globalisation process, an increasing impact of information as a production factor, accompanied by the increasing importance of the information technology. Furthermore, there is an enormous technical progress in the biotechnology and the genetics which lead to new and growing markets. Those changes are often interpreted as a fifth Kondratieff cycle (Nefiodow, 1990).

Comparing all those fundamental technological innovations and driving forces of economic growth during the past 200 years, one can find the tendency of an increasing service intensity and a qualitative change in communication structures, connected with the dispersion and application of the innovations in the economy. However, the productivity effects within the service sector are more difficult to evaluate than in the manufacturing sector because the input and the output in the former are more difficult to define than in the latter.

Furthermore, accelerated growth in connection with a fundamental innovation, its diffusion and the emerging structural change develops more easily, if there is a innovation friendly economic and social framework and the different interest groups are open-minded and willingly to adopt the innovations (Müller-Armack, 1981). For this reason the US might have had the better preconditions for the diffusion and adoption of ICT, while in Germany especially during the nineties the challenges of the re-unification have to be mastered and have engaged the forces. Besides the special effects of the German re-unification, during the nineties some further structural changes stood in the foreground: During the second part of the nineties in Germany a lot of structural reforms and deregulation took place, while in the US those reforms have already been carried out earlier. So in the nineties the diffusion of ICT took place on the one hand in highly competitive and quickly changing markets but on the other hand, the structural framework was more constant and easier to predict than in Germany.

Analysing the long term time series of the trend growth of GDP and productivity, which cover the important fundamental innovations of the past one can see, that

- the velocity of GDP growth since the nineties in the US is not higher than in some time intervals of the past, for example after 1930 and in the fifties. Intervals of long term economic growth have always be followed by intervals of lower growth rates, so till now the pattern of the recent development is not extraordinary. However, the recent upswing in the US looks similar to upswings in the past, which were induced by fundamental innovations. However, till now, ICT has not caused greater but rather smaller effects on the economy than earlier technical revolutions.
- in Germany the recent trend growth rates of GDP are far away from those which can be connected with an upswing because of a fundamental technical innovation, although at the end of the observed time series there is at least a turning point which has changed the direction of the trend growth upwards.
- concerning labor productivity the trend growth rate in the US has for the first time since the end of the twenties surpassed the corresponding German rate. The US trend growth rate of labor productivity is rather characterized by a downward tendency since the begin of the fourties, however since the eighties there is the changing point with till then increasing rates. In Germany the deceleration of the trend growth rate of labor productivity started in 1960 and – neglecting the short term effects of re-

unification – still continues. However, the long term deceleration of German productivity growth since 1960 is not unusual because after the period of rebuilding after World War II in a situation where there was nearly no physical capital but a lot of human capital an extraordinarily fast but only temporary productivity growth would be expected which could not last forever after the rebuilding process had been largely complete.

- the usual time lag between the date of the technological innovation and the widespread application of this innovation, which induces a structural change of the existing economic situation, is about half of a century.
- the invention of the computer takes place more than fifty years ago, the widely spread application began in the seventies and eighties, so that on the one hand a large part of the productivity effects occurred already in the past. On the other hand, a lot of effects will only show up in the future, because a lot of problems concerning the information technology have still to be solved, for example, the efficient transformation of information in useful knowledge.
- the internet can be interpreted as an incremental innovation which has followed the technical innovation of computers. The economic effects of the internet, however, have not shown up until now because the time interval is too short.

4. Volume and Growth Position of the ICT Sector

Following a widespread assumption, in the highly industrialized economies of the western hemisphere, the ICT sector has grown much faster than other industries and substantially contributed to the overall employment – at least since the middle of the nineties. But in contradiction to this, the empirical evidence shows substantial differences among the countries. According recent OECD publications, the ICT sector is of substantial importance for the overall value added and employment primarily in the United States and the United Kingdom and in some smaller countries like Finland and Sweden, but of limited importance especially in Germany and in Italy, France and Japan. With the exceptions of Finland, Japan and Sweden, all selected countries are net importer of ICT products.

To examine the position and the perspectives of the German ICT industries in detail, RWI has made some efforts to implement the ICT definition of the OECD with the help of official datasets and to calculate time series for the development of the different product groups and service categories in Germany and the USA. The results underline, that the ICT sector lies in Germany far behind the US in respect to the share in the value added of all private enterprises (excluding agriculture and forestry as well as dwellings) of 6.6 % resp. 11.0 %, namely referring to the production of ICT goods in the manufacturing industry (hardware 1.8 %, compared with 2.8 %) as well as in ICT services (software 4.8 % compared with 8.3 %). Nevertheless, in the period from 1995 until 2000 the German hardware producers could increase their value added more rapidly than the software producers – in contrary to the USA where the development was mainly driven by the service companies. All in all, the ICT sector has increased by a nominal rate of above 5.6 % per year more than each other sector; something similar holds for the USA. Owing to the low share in the overall value added, the direct contribution of the ICT sector to the economic growth in Germany, however, can be estimated to only 0.2 percentage points per year (i.e. but for of the ICT sector in Germany, the overall economic growth would have been lower by this margin). In the case of the USA, this direct impulse can be calculated to 0.5 %.

In Germany, the changes in employment of the ICT sector turned out to be decidedly disappointing, even in the field of hardware there were job cuts. Mainly two reasons are responsible for that: On the one hand, the industrial production in the field of office and data processing machines has been up to recent past still characterized by the “classical” typewriting and calculating machines, copiers, cash registers and franking machines; in the following years this sector had to cut jobs to a great extent and to give up manufacturing plants. The capacity and employment cutback could not be compensated by the producers of mainframe computers and desktop computers or peripheral devices. Additionally, the leading suppliers have carried out outsourcing of parts of their production to legally and economically independent enterprises of the service sector. On the other hand, in the last years the basic conditions and organizational structures haven changed decisively. As a consequence of the market openness and the far-reaching privatization, the competitive pressure and the need to rationalize has increased considerably. Although numerous suppliers entered the market and the established companies broadened their performance range, the number of the employed people declined markedly because the activities in the fields like premium rate services, broadcasting and broad band cable, information and innovation management or investment management have been outsourced to others companies of other sectors and given governmental tasks to the state.

According to the data taken as a basis here, in the year 2000 in Germany scarcely 1.1 mill. people or 3.4 % of the private business sector employment worked in the field of ICT employed (in comparison: the ICT sector of the USA employed 5.7 million people, that means 5.1 % of all employed). In Germany like in the USA the ICT sector contributed directly only a little amount (by at most one-tenth percentage points) to the overall economic employment growth.

All in all, the results confirm on the one hand, that the ICT sector was a dynamic factor of the economy in the US as well as in Germany, at least in the nineties. He has contributed substantially and directly to economic growth and productivity acceleration by offering an attractive product. But it is to be assumed, too, that the ICT sector was driven by a long-lasting cyclical upswing especially in the United States and by the corresponding investments in ICT hardware and software - and/or an as-yet unidentified factor having little relation to the New Economy and computer use (see the contribution of Robert J. Gordon in the annex). However, the conclusion is hardly to be drawn that the substantial growth differences between the US and the German economy can be attributed to the different shares of ICT production alone. On the other hand, the results lead to the assumption that the recent cyclical downswing and especially the breakdown in the “New Market”-sector on the stock markets will be only temporary. In the near future, the ICT sector will regain its position as growth factor – for products, investment and – at least in the long run – for new and attractive jobs.

Further conclusions about the reasons of the changed price position of the ICT sector cannot unfortunately be drawn because of the restricted data availability. It would be welcome if there were, for example, data about the input structure by kind of goods as well as domestic or foreign suppliers in order to be able to estimate the cross-border impacts of the ICT sector in that way. Herewith, further characteristics of the German ICT industry such as a stronger concentration on the West European region is to be expected. In contrast to that, the US-American producers are obviously connected to a greater extent with the suppliers from abroad, for example, from Ireland or the Asian-Pacific region. Not least at all, these connections may haven contributed to the fact, that the American ICT producers are more competitive than the German producers and to the fact that the Asian threshold countries could surmount the Asian crisis in 1997/98 very quickly. There is also considerable information need

in respect of capital input: A carefully calculated actual investor's accounting could contribute to the explanation of the high productivity in the ICT sector. But this accounting could also make visible to what extent in the last years excess capacities have been built up which after the burst of the speculative bubble on the New Market haven been proven as unprofitable investment and could be therefore written off.

5. Use of ICT-Technologies and Economic Consequences in Selected Sectors

In respect to ICT use, the New Economy in the present is mostly associated with

- immediate productivity increases as a result of ICT input in production of goods and services,
- development of E-commerce as new market-place for goods and services.

However, by looking at structural aspects on the industry and microeconomic level more deeply, the underlying processes become more obvious. There is no simple linear relationship between ICT use and productivity. Complementary investments and changing business processes are in most cases the crucial prerequisite for productivity increases to arise. On this background, E-commerce represents an indicator for one aspect of a whole range of changing firm-internal and external business processes in the value added chain. The future task of economic analysis at the microeconomic and industry level will be to uncover the connection between these changes and business performance at the micro, industry and macro level.

Even though the exact mechanisms that establish the connection between ICT production and productivity growth are still unclear, the importance of ICT infrastructure for international competitiveness is unquestioned: The liberalisation of the information- and telecommunications service industry in Germany has provided the precondition for a future reduction in the cost of telecommunication services and therefore an increase in the use of ICT. Presently, Germany is lagging behind countries like the United States that have deregulated their communications sector earlier in respect to usage of telephone services, internet and E-commerce. Great efforts in respect to price, quality and efficiency of the supplied services as well as increased R&D expenditure will be necessary in order to catch up to nations like the United States, but also other European nations like Sweden and the United Kingdom.

In order for e-commerce sales to develop dynamically in the coming years, broadband Internet access should be provided as far as possible. Guaranteeing this will require considerably more investment in the network infrastructure. Negative developments in world technology stock markets have created doubts about the profitability of these investments, but the downward trend in the stock markets has not broken the dynamic of infrastructure investments in any lasting way. Growth has just been somewhat slower at the most.

The usual business with e-commerce has partly been replaced, but new products or product combinations have also been offered. This concerns B2B-e-commerce (online purchases of input goods and services between companies) as well as B2C-e-commerce (online distribution from companies to the final consumer). From e-commerce one expects to develop new distribution and procurement channels, a reduction in transaction, distribution and marketing costs and therefore lower input and consumer prices, an increase in productivity, competitiveness, market transparency and finally, an increase in real income.

Depending on the particular estimate, worldwide e-commerce sales in 2001 amounted to just about 1 or 2 percent of world gross output value. However, the growth rate of e-commerce sales will be very high in the coming years. Germany's share in worldwide e-commerce sales will increase considerably, as Germany already has a highly modern network infrastructure, is a leader with respect to B2B-platforms, and has large growth reserves in the field of mobile communications. By the year 2010 Germany – according to own projections – will further close the gap with the USA. In B2B area, some 30 percent of inputs will be conducted via the Internet in these countries by then. The share of worldwide e-commerce sales in the world production will be 8 percent in 2010, according to the results of this projection.

The trend in e-commerce sales still does not say anything about the accompanying productivity, cost and income effects. One indicator of the estimation of the overall economic effects of e-commerce is the influence on gross domestic product growth, although it is uncertain whether all utility aspects connected with e-commerce or the Internet are in fact reflected here. Some econometric studies that assume declining input prices and increasing productivity, also assume that a change in the level will occur caused by e-commerce over the long run with respect to gross domestic product (which may well be above 5 percent). However, there will not be a lasting increase in the growth rate, that means that the long-term growth path will not be permanently affected.

In the future, all enterprises as far as possible should be in a position to use the Internet for the intermediate trade (B2B) or as a distribution marketing channel (B2C). This requires, among other things, the successful integration of e-business applications in existing IT-systems, more legal security in worldwide trade via the Internet and the implementation of internationally accepted industry standards for online transactions. Additionally, the further rapid expansion of e-commerce activities does not depend solely on greater ICT-investments, but also on the success of efforts to make e-business more attractive and, above all, more secure.

6. Macroeconomic Aftermath of ICT Technologies

6.1. Results of a Growth Accounting

By looking at the results of the growth accounting analysis, one has to bear in mind that the possibilities to compare macroeconomic developments in the United States and Germany is restricted by the availability of matchable data. With the statistical data for each country by itself, much more possibilities to analyze the effect of IT on growth performance do exist. This chapter tackles these data inconsistency problems in order to gain comparable measures of the ICT effects for both countries to give an answer to the question whether or to what extent the “New Economy Effect” that was observed in the US could also be seen in the statistical evidence for Germany. The calculations of growth effects are based on official data from the Statistisches Bundesamt for Germany, from the Bureau of Economic Analysis and the Bureau of Labour Statistics for the US and partly from the OECD. Detailed information was needed for the separation of high-tech-capital (computers, software, communication equipment) from the rest of the capital stock.

The growth rates for the productive ICT and non-ICT capital stock for Germany and the United States were computed separately by using the perpetual inventory method. For the US, a noticeable increase in the ICT capital stock can be observed from the calculations. This growth was accelerating especially for computer hardware but also for communications equipment in the second half of the nineties. The acceleration of the hardware capital stock growth in the second half of the nineties partly reflects the sharper price decline which again

has to do with shortening production cycles and sharp competition in semiconductor industry and other suppliers of the producers of PCs. For Germany, the data tell a somewhat different story. The computer hardware capital stock does also show an acceleration in the second half of the nineties, even though the increase was less pronounced than in the US. In the explanation of this trend, one has to bear in mind that the US price deflator was used to deflate the nominal investment data for Germany. For communications equipment and software, the growth rate of the capital stock decreased in the second half of the nineties. This observation has to do with backlog demand shortly after the reunification and certainly also with the characteristics of the business cycle in the 1990s.

The analysis of growth effects is based on the calculated capital stocks. It uses a standard growth accounting framework that has been applied to calculate the growth contribution of ICT investment for the US. The results are summarized in the table 7-1.

- In the United States, GDP growth in the nineties was strongly driven by ICT capital accumulation. On the average, the ICT accumulation accounted for 0.68 percentage points of the 3.65 percentage points increase in GDP during the nineties while non-ICT capital accumulation accounted for 0.51 percentage points. The labor force increase accounted for a 0.99 percentage point increase in production. Multifactor productivity increased by 1.47 percentage points. However, this indicator includes several different factors. There is a cyclical effect that is difficult to quantify. In addition to the increase in efficiency of production itself, human capital accumulation is included in the estimate of multifactor productivity.
- Notably, the data on the US growth performance in the nineties show an increase in the growth performance at the end of the nineties while past business cycles were characterized by a slowing of growth performance in the end of the cycle. While the growth effect of the labor force increased from 0.76 to 1.21, the contribution of the ICT capital rose from 0.42 percentage points at the beginning of the nineties to 0.92 in the second half of the nineties. Most of this increase can be accounted for by the expansion of the hardware capital stock. Also multifactor productivity rose from 1.09 to 1.88 percentage points.
- The economic performance in Germany during the nineties was far less dynamic than in the United States. The available data show that the contribution of the ICT capital to the actual growth of GDP during the nineties (2.33 percentage points) was 0.44 percentage points, whereas the contribution of the other capital stock accounted for 0.93 percentage points. While capital deepening during the nineties was more intensive in Germany than in the US, ICT technologies played a much less distinctive role. The evidence of a more pronounced, more labor-intensive but less capital intensive upswing in the United States could already be observed in the eighties. Additionally, the much less important role of total factor productivity for the growth performance in Germany that could already be observed in earlier years becoming more important in the nineties.

Table 7-1

Growth Accounting - Results
Decomposition of GDP Growth, 1980-2000, into its Structural Components
- Annual Percentage Points -

	1980/90	1990/00	1990/95	1995/00
1 GDP Growth				
United States	3,35	3,65	2,65	4,64
Germany	2,43	2,33	2,15	2,52
2 Contribution of Labor				
United States	1,40	0,99	0,76	1,21
Germany	0,26	0,03	-0,44	0,41
3 Contribution of Capital deepening (box 4 + box 5)				
United States	1,08	1,19	0,80	1,55
Germany	0,99	1,37	1,54	1,21
4 ICT-Capital				
United States	--	0,68	0,42	0,92
Germany	--	0,44	0,44	0,45
5 Other capital				
United States	--	0,51	0,38	0,63
Germany	--	0,93	1,10	0,76
6 Multifactor Productivity (box 1 - box 2 and 3)				
United States	0,87	1,47	1,09	1,88
Germany	1,18	0,93	1,05	0,90
Own calculations based on data from BEA, BLS and Statistisches Bundesamt.				
RWI				

- By comparing the growth performance in Germany in the first and the second half of the nineties, considerable differences can be observed. The first half of the nineties was dominated by an increase in the “other capital stock” which dominated especially in the years 1992 and 1993 with growth effects of the non-ICT capital stock of above 2 percentage points in these two years. This investment boom was mainly associated with German re-unification. In the second half of the nineties, the growth effect of the hardware capital stock doubled from 0.16 to 0.30 percentage points which is well below the US figure. While the growth effect of the communications capital stock was above the value for the United States, the lagging of the German ICT-Investment is

mainly due to lower investment in IT hardware and software. As far as this difference accounts for a missing or less pronounced over-investment in ICT capital in Germany in the second half of the nineties, the long-term effects could be not as bad as it might appear at the first glance.

- For the comparison of the effects of the New Economy in Germany and the US that is launched in this study, the identification of the cyclical effects of the productivity increase in the US in the second half of the nineties poses a substantial problem. Irrespective of these technical problems, the relative growth contribution of the computer and semiconductor sector in Germany is much lower in Germany than in the US. Thus, the resulting direct productivity effects – which cannot be calculated exactly for Germany because of a lack of data on the sectoral level - are much smaller. For Germany, the increase of total factor productivity shows no acceleration in the second half of the nineties. Thus, there is no evidence for a productivity effect in the ICT-using sector in Germany.

6.2 Influence of Different Deflating Methods on the Level of the Real Macroeconomic Growth

For international comparisons of the price- and productivity-development as well as the real growth of the gross domestic product, the methods applied to the deflating of time series plays an important role. According to the so-called „Boskin Report”, an overestimation is determined of the stated rates of inflation in the year 1996, because of different methodical changes were introduced in the USA (chained Fisher-indices and hedonic price-indices). Therefore, the question arises how these methods – which are also to be introduced in Germany in the near future – have an effect on the real growth rates.

The so-called „substitution bias“ in the USA is eliminated typically by using chained Fisher-indices. In this respect, no distortions of the reported real growth rates come up because of the changes in the price- and quantities-structures, whereas in Germany an update of the basic-year takes place only every five years. For this reason, the „substitution bias“ in Germany will be eliminated only with a time-lag. As a result of this, the growth rates of Germany are slightly overestimated from time to time by approximately one to two tenth-percentage points in comparison to those ones of the USA.

In the USA, hedonic price-indices are used for the elimination of quality effects. By using regression-analytical procedures, separation of quality- and pure price-effects takes place. The BEA estimates their contribution to the real growth in the USA in the average on a quarter percentage point per year. On the basis of the more minor importance of the ICT-sector, an implementation of hedonic techniques in Germany might have a lower effect. According to own calculations, in the second half of the nineties, the real growth increased in the USA because of the use of hedonic techniques by 0.3 percentage points whereas in Germany there would have been an increase of just under 0.2 percentage points per year.

All in all, in the second half of the nineties the macroeconomic growth in Germany would have hardly turned out to be higher than one until two tenth-percentage points an average, if the chained Fisher-indices and hedonic price-indices had been used. Only a minor part of the differences in the growth rates which could be observed between Germany and the USA in the recent years can therefore be explained by the use of different deflating methods. By the way, chained indices will be introduced in Germany in the year 2005 at the latest and hedonic price-indices as well in several years.

7. Fields of Activity and Economic-political Implications

As the study at hand shows, the provision and application of ICT have contributed to the development of new and international competitive goods and services, to the introduction of more efficient types of business and company organization and to more intensive utilization of the benefits of the sectoral and international labor division. The accompanying high level of corporate investment in the realignment of production and distribution concepts has stimulated demand and created numerous new and attractive jobs – not just in the field of ICT. Higher real income, but also greater options and conveniences with respect to the supply of goods and services have been made available to consumers. It is true that losses of employment have occurred in other fields (the Old Economy), but this is mainly the expression of the sectoral, regional and institutional structural change which usually accompanies and supports long-term growth.

Above all, the development and spreading of the basic innovation that was derived from the digitalization of information some thirty years ago and which subsequently led to the development of modern ICT and the manifold applications based on this are regarded as the driving force of the New Economy. The overall economic significance of ICT must be – even after the bursting of the speculation bubble at the technology stock exchanges – rated as just as great as before, since under economic considerations, the point is less the assessment of particular enterprises, but rather primarily the influence of technical progress on long-term production and employment potential. Additionally, however, some other factors have also influenced the utilization of technical progress and the development of the total factor productivity in the nineties: Worthy of mention are, among others, economic components, falling prices for raw materials as well as hardware and software, capital intensification within the scope of a more investment-friendly environment as well as the opening of national borders for the free exchange of goods, services and capital. Furthermore, factors of monetary and fiscal policy as well as the worldwide trend towards globalization have also been significant.

The aforementioned factors have also played a role in Germany, although the intensity of these factors has been different. In this case, a further specific factor was particularly important against the background of continuing European integration: The German reunification. In addition, some structural reforms which had previously already been largely accomplished in the USA were only belatedly initiated in Germany, such as the deregulation and the privatization of various sectors combined with appropriate changes in the legal and institutional general setting. Similar to the situation in the USA, an intensification of competition and the augmentation of sectoral structural change were also involved in this regard. Ultimately, new instruments of enterprise funding were also introduced with added force (venture capital, technology stock exchanges) which had long been quite usual in the USA and which were abundantly used there, accompanied among others by an increase in business start-ups as well as mergers and acquisitions. In addition to the lower level of ICT diffusion, the fact that the European economy and, due to reunification the German economy in particular, were faced with considerable adjustment problems owing to the outlined structural changes that can be regarded as an explanation for the lagging economic growth in Europe in comparison with the USA, particularly in the second half of the nineties.

While it is comparatively easy to document the direct contribution to growth of the ICT sector in retrospect, the effects related to its utilization are less conclusive, as the most recent data available do not yet correspondingly reflect these effects. The result is that there is substantial potential in this area with regard to the realization of cost reduction and productivity effects.

The economic slowdown and the collapse of the technology stock exchanges which have recently been observed worldwide should be considered as a temporary development. The deployment and utilization of ICT will continue to be connected with rapid technological and organizational progress which should contribute to the acceleration of production growth and productivity in the future.

The study in question is primarily designed as an analysis. Its intention was to explore the theoretical and empirical background of the economic differences in development between the USA and Germany during the last decade. Proposals for concrete measures in individual policy areas can and should not be made here. Nevertheless, it becomes visible that there are expectations on politics in three central fields of activity to support structural change and to secure the position of Germany in international technology competition.

(1) *Field of Activity "Complementary Investments and Human Capital":* Complementary investments and changed business procedures are an essential prerequisite for creation of increases in productivity. Although the exact mechanisms creating the connections between the productivity growth and utilization of ICT goods remain unclarified, there is no doubt about the central significance of the ICT infrastructure for the international competitiveness of a country. Even if the future development of the utilization of ICT cannot be conclusively determined at present, one can assume that the direct effects connected with the production of ICT goods only represent one aspect with regard to the overall economic effects of the New Economy. They are the starting point of a myriad of interactions within the entire value added chain that ultimately radiate out to the whole economic system and the society.

Human capital plays a central role in the realization of those productivity effects linked with ICT. This is necessary in order to convert the information provided by new technologies into knowledge which can then be utilized within the scope of value added processes. This is a special task for the governmental education policy. The curricula of general and vocational schools as well as universities (including universities of applied science) should be adjusted to the modified technical and economic conditions and the sufficient endowment of these educational institutions should be guaranteed. In addition, an improvement in research collaboration via reinforced networking of universities, publicly supported research facilities and the business sector should be striven for. This, for instance, was accomplished in the USA and is regarded as one of the essential reasons for the attainment of the leading position of the USA in the field of ICT.

(2) *Field of Activity "Promotion of Innovations and Deregulations":* The technological changes in the New Economy take place in very long intervals. The interval between the time of the technological innovation and its broad application generally takes about half a century. These long-term (so-called Kondratieff-)cycles are respectively initiated by basic technological innovations. They induce changes in the production processes throughout the economy accompanied by modifications in the value added structure, and are normally the catalyst for incremental follow-up innovations which predominantly effect the application and diffusion of the new products and processes. If the innovations correspond to one another in a complementary relationship leading to synergy effects, a sustainable change of the growth path of a national economy is generated until their utilization capacity is exhausted. The acceleration of growth in the USA in the nineties resembles the development of previous basic innovations; in Germany, however, the trend growth rate is still far from this, although a turning point is at least becoming apparent recently.

Accordingly, it will be the task of economic and technology policy to support the process of catching-up. In doing so, the diffusion of basic innovation takes place more rapidly in an environment that is demonstrating innovation-friendly rather than in an environment that impedes its diffusion. An important role is played in this regard by the adaptation of the institutional setting through which the development of the new markets could be supported in the future. The preconditions for more intensive utilization of ICT goods and services have also been created by the liberalization on ICT services. Nevertheless, at present there is still a considerable backlog in comparison with the USA, which had already deregulated its telecommunications sector with regard to telephone services, the internet and e-commerce previously. Therefore, more effort is still required in Germany in order to compensate for this competitive disadvantage. To this end, the provision of a suitable physical and financial infrastructure for the foundation of enterprises in the field of technology as well as the financing of their internal and external growth should be guaranteed, e.g., by creating markets that are right for venture capital.

(3) *Field of Activity "General Setting for E-Commerce"*: The electronically supported trade (e-commerce) represents a partial aspect of changing internal and external business processes within the framework of the entire e-business sector. With the expansion of e-commerce, new channels of distribution and procurement can be opened up and a reduction of transaction, distribution and sales expenses can be achieved connected with decreasing intermediate input and consumer prices, gains in productivity, competitive intensification, an increase in market transparency and, ultimately, an increase in real income. Germany has good infrastructural preconditions for being able to play an important role in e-commerce in the future, since the network infrastructure is ultra-modern and there are still large growth reserves in the field of mobile radio service, for example. Although it is questionable as to what extent the economic growth path will be considerably affected by e-commerce on a long-term basis, a positive scale effect should at least become evident on a medium-term basis with regard to the level of the gross domestic product, provided that the expected effects of productivity occur.

The growth rates of e-commerce sales will probably be very high in the next few years. However, a particular precondition for this is the increased expansion of internet accessibility on the basis of broadband technology. In addition, the economic, institutional and legal general setting should be structured in such a way that e-commerce can undergo dynamic development. This concerns, for example, regulations for electronic business and electronic signatures or the law of liability for cross-border online trade. In addition, efforts should be intensified to increase the security of internet transactions, since this medium is still – at least subjectively – regarded by many market participants as too insecure. Finally, existing competitive disadvantages for enterprises active in e-commerce (e.g., in the administrative and fiscal political field, i.e. with regard to the obligation to pay value added tax) should be removed where possible.

As far as policy intends to occupy itself with the outlined fields of activity it should nevertheless restrict such action to the establishment of the organizational and institutional framework that could contribute to a stronger diffusion of ICT and its more intensive utilization, even if this only means the removal of impediments disturbing the application of these technologies. The creation of the general setting that promote the further expansion of ICT and its utilization would contribute to overcoming the present weakness of growth in Germany and would open perspectives for taking on a more active part in international location competition than at present. The objective of future research work of the structural changes of ICT and the applications that are based upon it in the wake of the New Economy will be, among others, to provide further indications for the concrete arrangement of the economic policy, institutional

and legal environment and to examine the related effects on overall economic development and sectoral structural change.