FREIE UNIVERSITÄT

BERLIN

JOHN F. KENNEDY-INSTITUT FÜR NORDAMERIKASTUDIEN

ABTEILUNG FÜR WIRTSCHAFT

Working Paper No. 125/2001

ISSN 0948-9436

Nicola Jentzsch

The New Economy Debate in the U.S.: A Review of Literature

Abstract

After a short recession at the beginning of the 1990s, the United States entered its longest peacetime economic expansion in history. In the second half of the decade, the remarkable macroeconomic performance led to a controversy whether or not the U.S. economy had evolved into a "New Economy." This paper provides an overview of the debate in the U.S. It introduces different definitions of the New Economy and provides a new one that is quantifiable. A second aim of the analysis is to summarize the prevailing explanations for the observed macroeconomic development. The fundamental hypotheses of the New Economy proponents are identified and contrasted with their critics.

Free University Berlin
John F. Kennedy Institute
Section of Economics
Lansstr. 5 - 9
14195 Berlin
Germany
Tel. ++49 – 30 – 838.52.877
Fax. ++49 – 30 – 838.52.885
Mail. jentzsch@zedat.fu-berlin.de

Homepage: http://userpage.fu-berlin.de/~jentzsch/

JEL Classification: O10, O40, O51

Keywords: New Economy, economic growth, productivity, business cycle, NAIRU

Acknowledgements: This research has benefited from valuable discussions on this topic with many people. Special thanks to professor Carl-Ludwig Holtfrerich and Dr. Welf Werner as well as the students of the New Economy seminar and the colloquium at the John F. Kennedy Institute. Moreover, I would like to thank Stormy Mildner and Arnd Plagge who critically reviewed this paper and provided very valuable comments.

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I. Introduction

In the 1990s, the United States witnessed its longest economic expansion in its post-war history. In February 2000, this upswing even surpassed the 105-month expansion of the 1960s before economic growth started slowing in the last quarter of 2000.

Since the first quarter of 1993, real Gross Domestic Product (GDP) grew at an average annual rate of 4%. At the same time more than 22 million new jobs were created. The civilian unemployment rate dropped to 3.9% in September 2000 - the lowest rate in 30 years. While labor productivity growth had been sluggish in the 1973 – 1995 period (an average 1.4% per year), it accelerated remarkably in the second half of the expansion. From 1995 until 2000, it trended upward at an average annual rate of 3% (Council of Economic Advisors 2001, pp. 19-20). This unexpected productivity increase helped to keep inflation low. Thus, the core inflation rate (excluding volatile food and energy prices) remained within a range of 2%-3% per year in the 1990s despite a remarkably tight labor market.

This performance, on the other hand, was accompanied by a large increase of the U.S. trade deficit. It approached 4% of GDP in the second half of the 1990s, a rate that even surpassed the historical peak of about 3% in 1987 (Council of Economic Advisors 2001, p. 158, chart 4-4). Although the Federal Reserve (2000c, p. 4) warned that the current account imbalance could not continue without limit, the trade deficit was neither seen as good nor bad by the Clinton administration (Council of Economic Advisors 2000, p. 231).

There has also been a remarkable investment boom in the 1990s. Even after the downward adjustments in stock prices during 2000, the value of corporate stocks has nearly trebled in the decade. These developments have sparked a lively controversy whether or not the U.S. economy had evolved into a "New Economy."

It is always difficult to identify a debate's starting point, but especially since 1997 the term has witnessed an increasing use in numerous business press articles and research papers. The new paradigm's implications for economic growth and economic policy have also been a subject of debate in various New Economy conferences, like the "White House Conference on the New Economy" (April 5, 2000), the "Boston College Conference on the New Economy" (March 6, 2000) and the "New Economy Forum" at the University of California (March 9, 2000). At the

beginning of 2001, the Economic Report of the President officially stated that "profound changes in economic trends" (CEA 2001, p. 22) would justify the term New Economy. Four developments belong to these exceptional trends: a strong rate of productivity growth, low levels of unemployment as well as inflation, the disappearance of the federal budget deficits and the strong performance of the U.S. economy compared to other industrial economies.

The main purpose of the present paper is to provide an overview of the New Economy literature. In the second part of the paper, different definitions are contrasted with each other, starting with the broader ones and then focussing on the narrower definitions. Part III attempts to answer the question of whether or not general distinctions of Old and New Economy are advancing the analysis of the latter. The question of how to define the New Economy is addressed in part IV.

In the central part of the paper (part V) different explanations of the observed macroeconomic performance are summarized and different fundamental hypotheses are derived. In a second step, proponents and critics of these hypotheses are identified and their arguments are reviewed. Part V is meant to provide an overview of the sometimes confusing and contradictory discussion of the New Economy.

About 100 articles and research papers served as a basis for this review; however, only a selection of them is included in the present analysis. Since a wide range of experts contribute to the New Economy controversy, papers and articles by economists as well as government officials and business journalists are taken into account. These are claimed to be representative of the most important strands in the New Economy discussion.

Following the Department of Commerce (2000, p. 59, footnote 1) and various economists in the U.S., the strong rise in equity prices in the 1990s is not considered to be an essential component of the New Economy. Therefore (and for brevity), its effects on wealth and consumption will be excluded from the discussion.

II. Different Definitions of the New Economy

There is no common definition of the term "New Economy." This observation is all the more important since the widespread usage of the term evokes the impression of a general consensus among the economists using it. Bosworth and Triplett (2000a, p. 1) emphasize, "The 'new economy' discussion has been inconclusive, in part because the term 'new economy' means different things to different people."

The search for a definition leads to more or less broad descriptions of the character and main qualities of the New Economy. In many cases, these descriptions are not more than a general characterization of the macroeconomic performance of the U.S. in the 1990s.[1] Moreover, some of them confuse statistical indicators and fundamental assumptions, while other approaches offer a more technical view and equate the New Economy simply with Information Technology (IT) or the IT industry.

In general, any discussion must start with definitions, otherwise it will not become clear what the common basis of the discussion is. Given the aforementioned lack of a broad consensus among economists, this paper will present some of the recurring definitions found in the economic literature. They are used as a starting point for the discussion of the New Economy in the present paper. However, one has to acknowledge the vagueness of these definitions which is due to the evolving discussion. In part V of the paper, it will become clear that the debate has only started to become more precise on certain issues (in terms of studies published).

2.1 Major Broad Definitions

This section presents several general definitions. These definitions have been taken from a variety of sources, for example government agencies or research institutions.

The Bureau of Economic Analysis, for instance, describes the New Economy as the expansion of the U.S. economy in the 1990s, characterized by its "unprecedented length, strong growth in real GDP and per capita GDP, higher rates of investment as well as low inflation and unemployment." (Fraumeni and Landefeld 2000, p. 1)

Fraumeni and Landefeld identify several forces driving the New Economy, such as the impact of globalization, intensified international competition, and, most importantly, the impact of technological innovation over the last decades which appears to show results from the mid-1990s onwards. The Bureau points out that the

[1] The Clinton administration took this approach and defined the New Economy by its rapid productivity growth, rises in incomes, low unemployment and moderate inflation (CEA 2001, p. 23)

question of statistical measurement of the New Economy is one of utmost importance. Ultimately, only the statistics (and further research) can provide an answer to the question whether the New Economy is a statistical artefact, a cyclical phenomenon, a series of positive supply shocks or a fundamental structural change of the U.S. economy. The answer to these questions carries great implications for fiscal policy (i.e. budget and tax projections), the projected social security deficit and monetary policy. A detailed discussion of measurement problems will not be included in this paper, because there is already a variety of publications dealing with this issue (Bosworth and Triplett 2000b; David 1999; Dean 1999; Fraumeni and Landefeld 2000; Nakamura 1999; Nordhaus 2000; Triplett 1999).

Another general definition is provided by Davies et al. (2000). The authors describe the New Economy as a "new paradigm" stemming from the improved performance of the U.S. economy in recent years. Technical progress as well as globalization and structural changes in the product and labor markets are viewed as the driving forces of the new paradigm. Three characteristics of the New Economy are identified by Davies et al. (2000): first, greater stability of GDP and prices; second, a potential drop in the Non-accelerating Inflation Rate of Unemployment (NAIRU); and third, a possible gain in long-run productivity growth (Davies et al. 2000, p. 3).

According to the authors, the beginning of the New Economy dates back to 1995 and is characterized by "a marked improvement in real GDP growth, driven mainly by an improvement in long-run productivity growth, and to a lesser extend by a fall in the NAIRU." (Davies et al. 2000, p. 14) The authors do not answer the question of whether or not the high productivity gains can be sustained during the next downturn of the business cycle.

Atkinson and Court (1998) provide a further general definition of the New Economy. The authors (1998, p. 8) refer to a set of quantitative as well as qualitative changes that have taken place in the last 15 years and that have transformed the structure, function and rules of the U.S. economy. The authors observe a transformation to a "knowledge and idea-based economy" in which innovative ideas and technology are the keys to economic growth. Risk, uncertainty and constant change are described to be the norm in this kind of economy.

2.2 Narrow Definitions

The narrow definitions presented here enable their authors to conduct empirical studies. Gordon (2000, p. 2), for example, defines the New Economy as encompassing the "mid-1990s acceleration in the rate of price decline in computer hardware, software, and telephone services, the corollary of an acceleration of the exponential growth rate of computer power and telecommunications capability, and the wildfire speed of development of the Internet." Here, the New Economy is understood as equivalent to an acceleration in the rate of technical advance in IT in the second half of the decade, without taking into account its contributions prior to 1995.

In the debate, Gordon identifies the view that the New Economy represents a fundamental transformation of the U.S. economy as a widespread consensus. This transformation is claimed to eradicate not only the budget deficit, but also inflation and the business cycle. Furthermore, the transformation is claimed to accelerate the productivity growth trend. Gordon's empirical findings will be taken into consideration in section 5.2 of this paper.

Bosworth and Triplett (2000a) primarily adhere to a narrow definition, too, although such an approach only addresses one part of the New Economy notion. In their study, the New Economy embraces IT, namely computers, peripherals, computer software, communications and related equipment. Bosworth and Triplett explain that the spread of these new technologies is evident on the demand side of the economy (in terms of a boom in consumption spending and business investment), where an overwhelming portion of the growth in both has been caused by IT expenditures and investments. However, the diffusion of technologies is also apparent on the supply side of the economy. Here, it is manifested in the surge of productivity growth and a low inflation rate despite a very tight labor market.

Central to the analysis of Bosworth and Triplett is the role of IT as an accelerator of the economy's trend rate of output and productivity growth. More precisely, they distinguish between the contribution of IT to economic growth and labor productivity as well as its contribution to multi-factor productivity. It is important to add that their period of review spans the second half of the 1990s. Parallels might therefore be drawn to the technical and narrow approach chosen by Nordhaus (2000). The latter author defines the New Economy (sectors) as encompassing "machinery, electrical equipment, telephone and telegraph, and software." (Nordhaus 2000, p. 2). In his

view, these industries are somewhat more inclusive than a narrow definition, but there is still a complete set of accounts available for them. Taken together, these industries grew from a 3 percent share of real GDP (1977) to a 9 percent one (1998). Furthermore, these industries have contributed significantly to the economy-wide productivity growth (Nordhaus 2000, p. 4). The author's findings will also be taken into account in section 5.2.

III. Old Economy – New Economy: Some Distinctions

This section addresses the question whether or not the distinctions between Old Economy and New Economy (as implied by some of the definitions above) can help to advance the understanding of the latter. Both the broad and the narrow definitions have their strengths as well as their weaknesses.

In the broad definitions, some authors include the whole decade of the 1990s (Fraumeni and Landefeld 2000), while others review only the 1995 – 2000 period (Davies et al. 2000). Since the authors relate to a distinct period of the economic history of the U.S., they exclude all the years prior to these periods. In these papers, "old" refers to the years before the 1990s or before the year of 1995.

Another general distinction between Old and New Economy is proposed by Atkinson and Court (1998, p. 7). The authors summarize certain characteristics they attribute to both terms. These characteristics are divided into four major categories: economy-wide characteristics, industry, workforce and government. In the New Economy, markets are characterized as dynamic and companies are said to have an international scope of competition. The common organizational form reflecting this setting is the networked firm. In contrast to this, the Old Economy is based upon the notion of stable markets and companies that have a national scope of competition and a hierarchical bureaucratic structure (Atkinson and Court 1998, p. 7).

It is unnecessary to elaborate on the endless difficulties such a very general distinction poses. It only leads to further questions like: What are stable markets? When did companies start to develop an international scope of competition?[2] When did the Old Economy of the United States leave that form of existence behind and start its ascendancy to a new ("higher") one?

The narrow definitions, on the other hand, imply that all sectors *outside* the New Economy belong to the Old Economy. Nordhaus (2000, p. 12), for example, develops

[2] The Virgina Company, for instance, had an international focus, too, back in 1609.

this assumption. Such an approach raises questions about the importance of all other industries (employing IT) for the New Economy. The service sector in particular is intensively using IT (namely financial or medical services and the media). According to Nordhaus' approach, these industries would be classified as Old Economy which would then exclude them from further research. Such an approach is clearly underestimating the importance of these industries for the demand side as well as the supply side of the New Economy.

Currently, not a single sector of the U.S. economy is sheltered from the developments in IT. Even those which could not be more Old Economy like the seemingly archaic farm businesses. There are illustrative (and of course anecdotal) examples of farmers who track their cows via wireless transmitters, profile them, and use electronic markets on the Internet for procurement or distribution of their products.[3]

Greenspan (2000d, p. 3) states, "(...) in a meaningful sense, there is, with few exceptions, little of a truly old economy left. Virtually every part of our economic structure is, to a greater or lesser extent, affected by the newer innovations. No old-economy textile plant could exist in today's environment without technologies that Edmund Cartwright could never have imagined." Despite their narrow focus, however, the strength of those definitions is that they are based upon measurable aggregates, namely the IT industries.

In conclusion, these approaches as well as the reviewed definitions are not really satisfying and it is questionable to what extent they are helpful in advancing further research on the New Economy. The broad definitions are too general, moreover, they exclude certain time periods which is especially problematic such as that of the 1995 – 2000 period.

In the case of the narrow definitions, on the other hand, it is noticeably not clear why a whole "economy" should be equated with a "sector" or even just an "industry". In such narrow approaches, any industry that lies outside of the analyzed one is labelled as Old Economy and excluded from further research.

[3] See Grebb (2000) for an impressive example of such a high-tech farmer.

IV. What Is the New Economy?

After reviewing diverse definitions, it becomes clear that it is of utmost importance to distinguish "old" from "new". A number of economists have already addressed the "question of novelty" (see Blinder 2000; Bosworth and Triplett 2000a; Department of Commerce 2000; Gordon 2000; Liebowitz and Margolis 1996; Madrick 1999; Norton 2000; Stiroh 1999; Triplett 1999). The following section identifies new developments and proposes a new definition of the New Economy.

Keeping in mind the background of the macroeconomic performance of the U.S. (namely globalization and IT), one may ask to what extent this background can really be labelled as "new." Stiroh (1999) doubts the novelty of the current developments. He states, "(t)he U.S. economy in the 1990s is very different from what it was in the 1950s, but the 1950s were different from the early 1900s, and so on." (Stiroh 1999, p. 2) Seen from a different point of view - that of the bull market of the 1990s - Friedman (2000, p. 3) states, "So, if this is new, the 80s was new, if that was new, the 20s (were) new."

Since the debate emphasizes technological innovation, one must clarify that all technological developments to date have been based on some former invention. The telegraph network was the predecessor of the telephone network, and the microprocessor is not more than a further development of the transistor which was invented by William Shockley in 1947. This shows how difficult it is to draw an exact line that separates "old" from "new."

But there are certain developments which might be characterized as new (although they are also based on earlier inventions, too), because they can *only* be found in the 1990s. Most importantly, these include the interconnection of computers via the Internet on an international scale which has its roots in the launch of the World Wide Web by the CERN in 1990, the inclusion of commercial traffic on the Net in 1991 and the release of the Mosaic browser in 1993. Therefore, an important observation is that of the revolution in connectivity and the upsurge in creation, analysis and distribution of huge amounts of information on an international scale to an extent *not* seen before the 1990s. This revolution in information technology sparked a revolution in information availability,[4] a fact generally not included in the approaches mentioned above.

[4] Greenspan (2000a, p. 2) describes this as a "quantum jump" in information availability.

The following arguments lead to a definition of the New Economy which embraces several elements of the reviewed approaches. One can find at a more abstract level two recurring themes within these definitions. The first aspect is the definitions' object (i.e. the U.S. economy in general or a specific industry), the second aspect refers to the time-span (namely the 1990s or the 1995-1999 period).

Only the object, however, should be included in any definition, because the New Economy could theoretically emerge in other countries within periods other than the ones mentioned by the reviewed authors.

Difficulties arise in some definitions with the inclusion of the development's sources and its indicators. Furthermore, most of the reviewed proposals are not quantifiable, i.e. they provide no exact measurement that could be used for analyzing other economies. Therefore, a definition must encompass quantitative indicators which help to detect and analyze the emergence of the New Economy regardless of time and place. This paper tries to propose a new definition.

The New Economy is any economy that is characterized by these three central features:

1. The economy's information sector contributes more than 25% to the GDP growth rate.
2. In the economy's business sector, the Internet is adopted as an infrastructure for economic transactions by at least 25% of all businesses.
3. At least 25% of all households have a computer and access to Internet.

This is a technology-centred definition based upon the assumed "novelty" of large-scale IT adoption and interconnection.[5] The benchmark (or minimum standard) of 25 percentage points in each area is a statistical indicator that is claimed to be large enough to have a significant impact on the economy as a whole. Some other clarifications have to be made here.

First, the "information sector" can be defined according to the approach used by the Department of Commerce (2000, p. 23), which includes the industries software and software services, hardware, communications equipment and communications services. Another approach might be taken by defining the sector according to proposals of the OECD (2000, p. 7) which would enable international comparisons.

[5] There are other Internet indicators like hosts or Secure Socket Layer Servers that could be used in this definition.

Second, "economic transactions" could include in a narrow sense any activity of selling goods and services via the Internet. A broad approach, however, would include not only the sale process, but all information transactions by companies (i.e. the maintenance of a homepage).

The proposed definition does explicitly not include the consequences of the technology adoption. This question is left open for further research, diverse hypothetical assumptions as well as their possible falsification. For example, one might assume that the New Economy results in a revolution of information availability which then has further effects on the macroeconomic performance (of the United States, for instance). Guided by such an assumption, one might draw a causal relation between the revolution in information availability and the increased productivity growth rate.

However, "mono-causalities" have to be viewed cautiously. Often enough, they mislead further research because of their narrow focus. It seems possible that the positive development of the U.S. economy in the recent years could also be attributed to globalization, industry-wide deregulation, flexible labor markets and an anti-inflationary monetary policy. It is important to note that these aspects have not been characterized as "new" here. The novelty lies in the widespread IT adoption and the interconnectivity via the Internet, which enables market participants to use it as an infrastructure for economic transactions. Only further research will help quantify the contribution made by IT adoption and interconnectivity to the improvement of certain macroeconomic indicators.

These aspects lead to the next part of the paper. The following sections provide a structure for the New Economy debate. Within this structure, the different authors contributing to the debate will be classified according to their main focus. Ultimately, the paper attempts to provide a broad overview to foster a better understanding of the different hypotheses discussed under the New Economy banner.

V. New Categories for the New Economy Debate

In this part, the paper proceeds in the following way: each subsection will first identify a general fundamental hypothesis made by New Economy proponents. These are hypotheses about networks economics, IT and productivity, the new business cycle and inflation as well as the NAIRU. Second, these hypotheses will be explained in the context of their background assumptions. Since these arguments are controversial, they will be contrasted with the criticism articulated by the New Economy opponents. A general overview of the debate and the different authors is given in Table 1 in the appendix.

5.1 New Sources and Process of Growth

According to Stiroh (1999, p. 8), the debate on growth sources and processes is the "most extreme (...), the most interesting, the most controversial, and the hardest to prove" strand in the New Economy controversy. Compared to traditional views, it provides a different explanation of the sources of economic growth and the resulting growth process itself. The fundamental hypothesis as generally presented by various proponents is: Growth of the networked economy[6] is based on different sources than that of traditional economies, i.e. mainly human capital. Moreover, increasing interconnection alters the growth process of industries, therefore, new economic rules apply to the networked economy.

A further implication of this statement is that the IT-revolution is as great in its impact on economic development as the industrial revolution. How do New Economy proponents explain their claim?

5.1.1 Arguments for New Growth Sources and Processes

Proponents of the New Economy derive their assumptions from ideas of the New Growth Theory. The traditional Exogenous Growth Theory explains economic growth as a result of accumulation of (physical) capital, labor, and technical progress in a world of constant returns to scale, scarce resources and trade-offs in different production factor combinations. Theoretically, long-term growth depends on the growth of the labor force and technical progress.

[6] Other terms used synonymously are: information economy, e-conomy, knowledge economy.

An expanded version of this neoclassical model is the New Growth Theory or Endogenous Growth Theory,[7] which was developed by Romer (1986) and others. Romer (1986, p. 1003) emphazises three important elements: externalities, diminishing returns in the production of new knowledge and increasing returns in output production.

Externalities arise in the context of investments in new knowledge. The investing company cannot perfectly internalize advances in knowledge (like new research results), therefore, other businesses can capture such knowledge spill-overs and use them as a costless factor of production. Diminishing returns in knowledge production means that doubling inputs in research will not necessarily double the amount of new knowledge produced. Finelly, Romer (1986, p. 1003) assumes increasing returns in the production of consumption goods. Taken together, these assumptions lead to the result of a long-term growth that is mainly driven by the accumulation of knowledge.

In a further step, Weitzman (1998) shows that knowledge can build upon itself in a combinatoric feedback process. In his model, the ultimate limits to economic growth lie in the ability to process the abundance of potentially new ideas into a productive form and not so much in the ability to generate new ideas (Weitzman 1998, p. 357).

New Economy proponents include such observations into their assumption of a growing significance of human capital,[8] research and new ideas for economic growth. They conclude that in such a setting, no limits to growth exist and that scarcity is not as important as traditionally stated (Kelly 1996, 1997). However, Romer separates the world into physical objects (which are subject to scarcity and decreasing returns) and ideas (unlimited possibilities).

In the debate, the "New Economists" refer to these different sources of growth (knowledge, research, ideas) and assign a far greater importance to them (Atkinson and Court 1998; Kelly 1996, 1997; Mandel 1998; Nakamura 1999; Schwartz 2000).

Several other conclusions are drawn against this background. If knowledge increasingly becomes an important factor of production, then intellectual property rights may influence the market structure to a far greater extent than traditionally observed. That is, the right to exclude others from using knowledge may lead to

[7] In the neoclassical models, the growth rate in the long-term steady state is exogenous and cannot be influenced by economic policy. The New Growth Theory, on the contrary, explains economic growth within the model.

[8] Human capital is generally defined as knowledge and skills of workers.

temporary monopolies or market failure (if property rights are not optimally specified) despite free competition and low market entry barriers.

Positive spill-over effects (externalities) in knowledge production cannot be captured and privatized by the knowledge producing company. This might lead to market failure, because of imperfect incentives to invest in knowledge production.

Furthermore, increasing returns may lead to a process in which industries devolve into natural monopolies. The production of information goods in particular is based upon high fixed costs (e.g., the production of a Hollywood movie often requires a multi-million dollar budget), but each following unit (the copys of the movie) is produced at almost zero marginal cost (Romer 1990, p. 97; Varian 1999, pp. 21-24). This kind of production cost structure leads to economies of scale and exhibits the potential to create monopolies.

Closely related to this set of arguments are theories of non-linear growth processes, the second part of the hypothesis above. In this context, network characteristics are especially important, because they are said to lead to abnormal growth processes. Important features of networks are: 1. path dependence, 2. critical mass, 3. bandwagon-effect, 4. excess inertia and lock-in, 5. network externalities.

The first feature explains that networks depend on initial conditions (Arthur 1994, pp. 86-89). To prove this and the related lock-in effects, economists typically refer to the QWERTY problem (Brown 2000, p. 223; David 1985; Shapiro and Varian 1999, p. 233). QWERTY is a keyboard design which was originally developed for mechanical typewriters. It was introduced to slow down the typists and avoid the problem of jamming. This kind of mechanical problem does not exist anymore, however, the keyboard design is still in use today. It is therefore an example to show how typists got used to a nowadays second-best keyboard. The change to another, more productive one involves such high retraining and other standard-switching costs that it is more efficient to retain the QWERTY keyboard.

Another example is the VHS/Beta case. VHS and Beta are claimed to be technologically more or less the same, but for some arbitrary reasons, VHS penetrated the market (Arthur 1994, p. 82).

The path-dependance argument is supported by Weitzman (1998) who takes the history of inventions into account: "The degree of 'path dependance' becomes ever greater over time because the number of viable path-idea combinations *not* taken (...)." (Weitzman 1998, p. 357, emphasis in the original)

A second important network feature lies in the fact that networks have to reach a critical mass from which onwards they exhibit non-linear growth. The slope of such a technology adoption curve shows the "bandwagon-effect": the more users participate in the network the more will follow. Excess inertia is another feature, i.e. once a technology is adopted, a superior one can probably not penetrate the market due to high switching costs or other lock-in effects.

However, the feature currently receiving the greatest attention in the literature are network externalities. That is a positive or negative effect which is not compensated in a market-mediated manner. Metcalfe's Law states that the value of a network is proportional to the square of the number of nodes on the network. Technically the value of the network to all participants is proportional to $n(n-1) = n^2-n$ with n being the number of network participants. Therefore, "(a) tenfold increase in the size of the network leads to a hundredfold increase in its value." (Shapiro and Varian 1999, p. 184)

A typical example is the fax machine network (Kelly 1997, p. 149), where the first fax is useless, because there is no one else to fax to. However, the last fax sold in the market buys the whole network of connected faxes. Another example that is repeatedly mentioned is the telephone network.

Network externalities set off virtuous circles of positive feedback (i.e. increasing returns) and non-linear growth processes. In such models it is possible to observe multiple steady states, not just one optimal state (Arthur 1994, p. 81). Moreover, there is no guarantee that the steady state reached is optimal (Economides 2000, p. 29). In Economides' model of incompatibility, the total surplus is maximized in a monopolistic market structure, at a point where consumer surplus is minimized.

The proponents of the assumptions above derive several "new rules" from these observations. First, in a networked economy it cannot be guaranteed that one optimal steady state will be reached. Multiple (suboptimal) steady states are possible, despite conditions of free market entry and competition (Arthur 1994).

Second, it is not the market mechanism itself that selects the *best* technology, but independent initial conditions which lead to an adoption of *some* technology. Users of networks, even whole countries, can be locked-in in a minor technological path (Arthur 1994; Kelly 1997).

Third, network externalities are of greater importance today, since more industries are based upon networks. These networks are claimed to be a source of increasing returns as already explained above (Cohen et al. 2000; Economides 2000).

Fourth, the prevailing market structure will be monopolistic competition or at least characterized by temporary monopolies based on the cost structure described above.

Fifth, the value of products in a networked economy depends not so much on scarcity and on production costs, but on plentitude. Pricing of such goods is claimed to be reversed: the more, the cheaper despite increasing quality. One example is the microprocessor (Kelly 1997).

5.1.2 Arguments against New Growth Sources and Processes

The assumptions above have been questioned by a variety of economists. Shapiro and Varian (1999, pp. 1-2) establish, „Technology changes. Economic laws do not." For Stiroh (1999, p. 1) "old economics" still provides the best explanation for recent events and Stiglitz states that the old laws of economics are still true, but some of the characteristics of new technology are different from industrial technology. "You are going from investing in machines to investing in ideas." (Schiffrin 2000, p. 4) The present section will summarize the arguments of the critics of the aforementioned assumptions.

The first point (i.e. a networked economy does not necessarily reach one optimal steady state) is not widely discussed. Moreover, there are only a few critics who address the second assumption of arbitrary initial conditions and path dependence. Economides (1998), for instance, points out that the market has proven that the productivity of various keyboard layouts is comparable, thereby discarding the QWERTY example as not valid.

Since the late 1970s, most computers have offered a programmable keyboard that allowed the user to define different keyboard patterns including the DVORAK keyboard. Typists would have switched if the DVORAK keyboard would have been more productive. Economides concludes that there were no significant differences in the productivity of both keyboard designs. Addressing the VHS/Beta example, Economides (1998, p. 2) finds a simple reason for the observed market penetration by the VHS system: "VHS won through wide (and cheap) licensing of its technology."

The third point has been addressed by Krugman (2000). He criticizes the notion of networks as a source of increasing returns. Krugman refers to the history of the

telegraph to prove his point. The telegraph shows how the largest cities have been connected first. The following connections, therefore, did not necessarily add more conversations than the first ones, since smaller and smaller towns were connected to the network.[9]

The differences in city sizes explain why a network is not necessarily subject to increasing returns (Krugman 2000, p. 1). The base is getting bigger, but the cities connecting to the network are getting smaller, with the latter effect dominating.

Krugman's criticism is based upon observations made by DeLong (1997). DeLong states that the most valuable connections are created at first: "The first uses of modern telecommunications and computers (...) were the highest-value uses. Later uses are lower value uses (...)." (DeLong 1997, p. 3).[10] If they were higher-value uses, telecommunications and computers would have been applied to them already. However, in this context there remains the question of whether or not the net effect of the technology diffusion results in increasing or decreasing returns. "It can go either way," concludes Krugman (2000, p. 2).

"Almost any product with increasing or decreasing costs can be considered a network, as network is being used in the current literature: Additional consumption may raise or lower the cost of a product to other consumers and it may raise or lower the cost of substitutes and complements," criticize Liebowitz and Margolis (1996, p. 3). If fans of live music preferred big cities, because of a wider variety of acts, this would be an audience-network externality, the authors state. And if cooks find it easier to get preferred ingredients as the number of cooks increases and larger ingredient supplies are provided to the market, this can be classified as a gourmet-network externality (Liebowitz and Margolis 1994, p. 134).

Henwood supports Liebowitz and Margolis by pointing out that in fact *all* market participants *always* have been part of a larger system, connected not only by a web of formal and informal social bonds, but also by a "deeply powerful system, a market ruled by prices and money." (Henwood 1997, p. 1)

In their analysis, Liebowitz and Margolis differentiate two classes of network externalities: one is pecuniary in nature[11] and does not result in market failure, while

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[9] His example is the following: The interconnection of the two largest cities (with 120 and 60 inhabitants, respectively) creates 7200 possible connections. Adding the third city (with 40 inhabitants) creates another 7200 (180 • 40) connections. Now the network starts to run into decreasing returns, only 6600 conversations are added if a city of 30 inhabitants is connected (Krugman 2000, p. 2).

[10] This is sometimes called "DeLong's Law".

[11] These are external effects that work through the price system (Liebowitz and Margolis 1994, p. 135).

the other commonly treated externality cannot be classified as a network externality at all (Liebowitz and Margolis 1994, p. 135; 1996, p. 2). Another widespread mistake is, according to the authors, the theoretically undifferentiated treatment of direct and indirect network externalities. Especially the latter are in most cases not more than pecuniary externalities or a form of conventional market failure in upstream markets. Liebowitz and Margolis conclude that the empirical importance of network externalities and increasing returns has been largely overstated (Liebowitz and Margolis 1996, p.1). If they were as pervasive as the New Economy literature commonly assumes, most markets nowadays would fail.

Increasing benefits of networks by adding more users, Liebowitz and Margolis argue, are not realized, since most participants just call a small number of people (for example relatives). After the most frequently called parties are connected, it does not matter, how many other people are added to the network (Liebowitz and Margolis 1996, p. 14).

In regard to the fourth point above, the cost structure of knowledge-based goods, Liebowitz and Margolis (1996) state that research and development (the knowledge-based part of the costs) are not just incorporated in high *fixed* costs. They are also part of *variable* costs, in form of support or sales services. "Our claim is only that knowledge is always a component of goods, that the knowledge share of total cost is not necessarily greater now than it was in the past, and that the fixed-cost attribute of knowledge need not overwhelm other cost components." (Liebowitz and Margolis 1996, p. 14).

The fifth statement - reversed pricing - is criticized by DeLong (1997), who argues that the economy cycled through a number of changing leading sectors (textiles, transportation, construction) and in all of these sectors prices have declined although quality increased. A common mistake by proponents of the statement lies therefore in thinking that common features of the industrial society are unique to post-industrial society (DeLong 1997, p. 2).

5.2 Long-run Growth and Productivity

This part of the New Economy controversy is by far the most comprehensive and most widely discussed one in terms of studies published. The fundamental hypothesis as claimed by New Economy proponents in general is: IT increases productivity growth in the long run. Therefore, the U.S. economy enters a period of an increased

long-term GDP growth rate of 3.0 – 4.0% instead of 2.0 – 2.5% (as observed in the last 25 years). This accelerated GDP growth will not generate inflation due to the increase in productivity growth.

The question of productivity and long-run growth of GDP has far-reaching implications for fiscal policy (i.e. budget projections), monetary policy (i.e. interest rates) and the living standard of Americans in general. Why is the long-run growth rate so important?

Small differences in growth rates over a longer period of time yield huge differences in the standard of living. A rough measure is the "Rule of 72" (Norton 2000). It states that the time it takes to double living standards can be determined by dividing 72 by the growth rate r.[12] Accordingly, it would take 36 years to double living standards at 2% growth per year, but only 24 years at a 3% growth rate. Official forecasts predict real GDP growth rates in a range of 2.5% to 3% through 2006 (Council of Economic Advisors 2000, p. 87).

Small differences in forecasts also influence the expectations of investors and can create major differences in output. These are the reasons why this discussion probably constitutes the most important part of the New Economy debate. Several studies conducted in this field include a discussion of difficulties in measuring service sector output. In this paper, measurement problems are not discussed as already mentioned (for a detailed analysis of measurement problems see Bosworth and Triplett 2000b; David 1999; Fraumeni and Landefeld 2000; Nakamura 1999; Nordhaus 2000; Triplett 1999).

5.2.1 Studies and Explanations of Productivity Growth

In this section, different studies and their results are introduced at first; in a second step, the various explanations of the empirical findings are summarized. New Economy proponents commonly assume that the use of IT increases labor productivity and national output. The latter can theoretically be divided into wages and profits, and as a result both will rise (this example is taken from Blinder 2000, p. 1). Real wages increase as well, because of low inflation and since they are in most cases the major share of the income of Americans, wages are the central indicator of the living standard.

[12] It is important to acknowledge that this rule does not take labor force growth into account.

Many empirical studies in this field are introduced with the example of Solow's Paradox. In 1987, Robert Solow observed that one can see the computer everywhere but in the productivity statistics.

The earliest studies on IT and productivity growth were conducted in the first half of the 1980s and in fact, until lately, no significant evidence of a productivity enhancing effect of IT had been found. [13]

It has to be kept in mind that most of those studies are not strictly comparable, because they use different aggregates (economy-wide, industry-level or firm-level categories) and employ differing definitions of IT. Brynjolfsson and Yang (1996, p. 2) state, "(...) productivity measurement isn't an exact science; the tools are blunt, and the conclusions are not definitive."

On the macroeconomic level and on the firm-level, recent studies show a positive correlation of investment in IT and the acceleration of productivity growth. The results of industry-level studies, however, remain mixed (Brynjolfsson and Yang 1996). In general, it can be observed that the computer industry has witnessed strong productivity gains, while other industries have not gained to the same extent. The IT-intensive service industries[14] even recorded declining productivity in the 1990s (Department of Commerce 2000, p. 39). According to the Department of Commerce (2000, p. 40), IT-using service industries showed a negative growth rate of 0.3 percent a year (1990-1997), compared to 1.3 percent annual productivity gains by industries that used less IT equipment. These differing results have been contributed to measurement inconsistencies and conceptual problems.

However, since 1995 the statistics have revealed an increased productivity growth. Chart 1 in the appendix shows this break in the trend rate of productivity growth. It has its origin in the accelerating investments in IT that expanded capital deepening – i.e. the rise of capital relative to the amount of labor hours worked. These IT investments have been described as "unusually productive" (Department of Commerce 2000, p. 36) and they have contributed powerfully to productivity growth despite their small share of the total capital stock.

Therefore, only lately economists have started to credit IT for the increases in productivity growth as observed in the statistics since 1995. There are several reasons that account for the break in the productivity trend, namely official revisions of the methods used in adjusting for inflation and a new definition of sectors and spending

[13] For an overview of studies in this field see Brynjolfsson and Yang (1996).
[14] Finance, insurance and real estate are grouped under the category "IT-intensive industries."

categories. First, attention is increasingly paid to telecommunications equipment and software, because the Bureau of Economic Analysis changed the category to which software belongs from costs to investment in October 1999 (Department of Commerce 2000, p. 37). As a consequence, the growth rate of real GDP was raised by an average of 0.18 percentage point per year over 1987 – 1998 (Council of Economic Advisors 2000, p. 81).

Second, the Department of Commerce modified the definition of the IT sector – besides the hardware and software industry, information services are now included as well as the whole telecommunications industry.[15] The Department of Commerce introduced this broader definition in three reports about the digital economy (Department of Commerce 1998, 1999, 2000).

Third, the Bureau of Labour initiated a series of methodological improvements (beginning in 1995) to which the recent decrease in consumer prices may be in part attributable.

Fourth, in 1999 the Bureau of Labour switched to geometric instead of an arithmetic (fixed-weight) aggregation of price measurements to take substitution effects into account.[16] These statistical as well as methodological revisions contributed to the improvement of the macroeconomic indicators of the U.S. economy. They have not been without effects on the research in the field of IT and productivity.

Table 2 in the appendix shows the research design of different empirical studies. These studies are, as already noted above, not strictly comparable, but they show the results of differing IT definitions. The wider the definition of IT is, the more its contribution to productivity acceleration.

However, it is still too early to interpret these studies as an "emerging consensus on resolving the Computer Productivity Paradox" as is done by the Department of Commerce (2000, p. 37). Such an interpretation does not capture the differences of these works and the different conclusions derived by their auhors. Three will serve here as as examples to show these differences.

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[15]This newly created "information sector" in the North American Industry Classification System includes content providers like newspapers and radio stations as well.

[16]Other statistical and methological changes are revisions made in regular terms, for example the change of the base year from 1992 to 1996 to deflate nominal GDP with actual data or the replacement of the 1993-1995 market basket (from the 1982-1984 basket) in 1998 to take changing spending habits into account (Council of Economic Advisors 2000, p. 61)

Jorgenson and Stiroh (1999), for example, state that recent experience shows that much depends on productivity gains in the high-tech industries. The key source of the sustainability of growth therefore hinges on the pace of technical progress, productivity gains and price declines of the magnitude observed in the second half of the 1990s. Furthermore, empirical evidence of industry-level studies do not support the spill-over hypothesis forwarded by New Economy proponents, which states that spill-over effects cascade from IT producers onto other technology users in the rest of the economy.

Gordon (2000) points out that the entire trend acceleration in multi-factor productivity growth is found in the durable manufacturing sector (computers, peripherals, telecommunications, and other types of durables) – but not in the rest of the private economy that lies outside of the durables manufacturing sector and encompasses 88% of the U.S. economy. In this part of the economy, the Solow Paradox is still intact, Gordon states. Furthermore, multi-factor productivity growth has even decelerated in these sectors.

Nordhaus (2000), on the other hand, observes a clear rebound of labor productivity and emphazises the contribution of the New Economy industries since 1995. As shown in his study, the New Economy industries "logged a breathtaking increase in productivity of 13.3 percent per year in the last three years, which was approximately double that of the earlier period [1978-1995]." (Nordhaus 2000, p. 10)

There have been different explanations of Solow's paradox, which were summarized by Blinder (2000, p. 5). The Internet hypothesis focuses on the interconnection of computers as a pre-condition for the realization of derivative benefits that increase productivity. One supporter of this hypothesis is Greenspan (2000a, p. 1). The diffusion hypothesis argues that other technologies, too, had to diffuse over decades to have an observable impact on the economy. David (2000) as well as Cohen et al. (2000) support this view. One other explanation of the paradox has to be added to this list, i.e. the mismeasurement hypothesis. It states that there was an IT productivity revolution from the beginning of the IT diffusion on, but it has not been captured by the official statistics so far. Supporters of this hypothesis are Shepard (1997) and Nakamura (1999).

In the second part of our hypothesis, it is stated that the U.S. economy enters a period with an increasing long-term growth rate, namely an increased growth rate of 3.0 – 4.0%, instead of the 2.0 – 2.5% that were observed over the last 25 years.

This hypothesis is supported by Bluestone and Harrison (1997), Shepard (1997) and Mandel (1997). The background of this claim is that investment in IT, globalization and intensified competition are the driving forces behind an accelerated trend growth of the U.S. economy.

Bluestone and Harrison (1997) address this issue on a more theoretical level. They state that pessimism about future growth rates is in general based on questionable assumptions. In the traditional theory, the long-term growth rate cannot exceed the rate of labor force growth plus the rate of labor productivity growth. However, in the view of the authors, there is considerable evidence that both supply of labor and the potential growth of labor productivity are more elastic than the standard view admits.

Bluestone and Harrison assume that Americans work more if there are more jobs available. Such an increased labor supply shows up in two forms: first, in an increase of the labor force participation rate from 66.6% (1989-1994) to 67.3% in 1998 which added 1.4 million workers to the pool (Bluestone and Harrison 1997, p. 3). Second, it appears in the growth in hours worked. The authors (1997, p. 2) point out, that "(j)ust since 1991 (...) average hours worked per employee have increased by nearly 3 percent. That is the equivalent of adding 3 percent more workers to the American labor force if the average work effort had remained unchanged at its 1991 level."

Blueston and Harrison conclude that a good deal of labor supply is in the pipeline when labor demand exists to employ it. Based upon these assumptions, the authors claim another 0.3% to 0.4% growth annually in the labor force over the next decade and another 0.3% to 0.4% growth per year in productivity. This means that the economy can meet a 3% annual growth target, if it is not undermined by policy measures.

Bluestone and Harrison address another important point: the feedback loop between monetary policy, the investment climate and future growth expectations. Investments of private businesses depend to a crucial extent on future expectations. If business leaders believe that demand growth will slow in the future, they will reduce their investments – "producing the self-fulfilling prophecy of slow growth." (Bluestone and Harrison 1997, p. 6) If businesses expect that growth will be encouraged by

policy makers, they will invest. However, "(i)f the monetary authorities signal that 2.3 or 2.5 percent growth is the most we can achieve, then that is what we are going to get." (Bluestone and Harrison 1997, p. 6)

Shepard supports these claims. The author (1997, p. 5) states, "If we had listened to the sceptics and held growth to a 2.5% rate over the past 18 months, we would have given up $ 150 billion in economic output. The unemployment rate would have been half a percentage point higher, putting 750 000 people out of work." According to Shepard, a 3 – 4% growth rate is sustainable in the long run.

5.2.2 Critics of the Explanations of Productivity Growth

The aforementioned explanations have been challenged by a number of economists. The major criticism focussing on the explanations of Solow's paradox will be summarized here. In a second step, the assumption of an increased long-term growth rate is critically reviewed.

Gordon (2000), for example, criticizes the diffusion hypothesis. He argues that computers have been around for almost 50 years, therefore the diffusion hypothesis slowly loses its credibility. Computers had diminishing returns from early on, Gordon states, and it is likely that their greatest benefits lie in the past, *not* the future. As already mentioned, Gordon supports the concentration hypothesis, which upholds Solow's paradox. The author states that the productivity revolution has only happened in the computer and manufacturing sector, with no measurable effect on the rest of the economy.

Gordon denies the economic significance of the Internet in general. In his view, the Internet is not comparable to the great inventions of the past. Five major observations explain his assumption: first, the Internet substitutes the use of other media (because of the users' time constraints). Second, it redistributes rather than creates sales. Third, it duplicates already existing content. Fourth, the content of the Web is not truly new and fifth, productivity on the job is impaired by the growing use of business computers for private consumption purposes (Gordon 2000, pp. 35 - 43). Based upon these observations, Gordon rejects the Internet hypothesis as not valid.

The mismeasurement hypothesis, another explanation of Solow's Paradox, has also been criticized by a number of economists. Krugman (1997, p. 3) argues: "(...) we didn't know how to measure output in a medium-tech industrial economy, either." In his view, hidden improvements are less important than they were in the 1950s or

1960s, because direct-dial long-distance calling, for example, made more difference to the life of consumers than the Internet.

Since growth in measured productivity is not more than in GDP per worker, Krugman explains, a higher (unmeasured) productivity growth cannot be the explanation for the high - but measured - GDP growth. Official productivity estimates are based upon the same data that are used to construct estimates of the GDP. "Any understatement of one must therefore imply an equal understatement of the other (...)." (Krugman 1998, p. 39)

Blinder (1999, p. 6) supports Krugman in the mismeasurement controversy. "A productivity miracle based on the computer may be just around the corner. Perhaps. But, if so, it is around the *next* corner, not the *last* one." [emphasis in the original] According to Blinder, the supporters of the mismeasurement hypothesis must prove that these measurement errors have grown worse in the past.

Gordon (2000, p. 44) argues that most IT-intensive industries mainly provide intermediate goods. If computers have raised the output in these industries in a way that cannot be measured, some increase has to show up in the statistics of the final output of industries using this intermediate input. According to Gordon, this is not the case (at least not for multi-factor productivity).

Triplett (1999, p. 6) supports Gordon's observations, to him innovation is an indicator of productivity improvement. Triplett criticizes that a lot of economists have counted innovative products on an arithmetic scale – and found more of them. "They ought to be looking at a logarithmic scale, a scale that says you must turn out ever greater numbers of 'new things' (...) to keep the current rate of 'new things' up to the past." (Triplett 1999, p. 4)

Krugman (1998, pp. 34 – 35) challenges the hypothesis of an increased long-term GDP growth rate by referring to Okun's Law. This law offers an explanation of the relation of an economy's capacity utilization (as measured by the unemployment rate) and its growth rate. The long-term growth rate is defined as a growth rate of real GDP at which the unemployment rate neither falls nor rises, i.e. it remains constant. This trend rate has been estimated to be at 2.4% of real GDP growth for the U.S. economy. This rate defines the growth in the economy's capacity. According to Krugman, every percentage point added to the economy's growth rate (accompanied by a decline in the unemployment rate) represents a change in the utilization of the existing capacity.

As soon as the economy reaches its capacity limit, the bottlenecks in production facilities and the demands of workers for higher wages will trigger an acceleration of the inflation rate.

In Krugman's view, nothing in the recent experience suggests that the U.S. economy is capable of more than about 2.5% growth in an average year (Krugman 1998, p. 36).

In general, the economy's speed limit is calculated as the increase of labor force per annum and the annual rate of labor productivity growth. Since no one states that employment statistics are wrong, proponents of the New Economy point to the possible mismeasurement of productivity. Objections to this hypothesis have already been reviewed above.

The Department of Commerce states that growth of demand will sooner or later slow down to a level consistent with the growth of labor productivity plus the growth of the labor force. "In recent years, falling unemployment and a rising trade deficit have allowed demand growth to exceed trend growth in potential output. Neither of the first two trends can continue indefinitely." (Department of Commerce 2000, p. 63, footnote 6)

5.3 The "New Business Cycle"

This part of the New Economy debate revolves around the volatility of the business cycle. In the 1990s, the longest peacetime expansion of the U.S. economy sparked a discussion about whether or not the business cycle had changed in a fundamental way.

Business cycles are cyclical responses to demand-side and supply-side shocks or to changes in fiscal and monetary policy, producing macroeconomic instabilities. A typical business cycle has four stages: prosperity, transition, recession and depression.

In the stage of prosperity, future expectations are optimistic – businesses invest, demand is expanding, new jobs are created and wages rise. However, as soon as the economy reaches its capacity limit (namely full employment), the Federal Reserve will raise interest rates to avoid an overheating of the economy.

Moreover, the rise in hourly compensation demanded by workers may increasingly outpace the productivity growth and the unit costs will start to accelerate over time. Overall economic growth will eventually slow down. This influences future expectations, as a consequence pessimism spreads. Businesses predict that demand

will slow down even further. Investments will be reduced, costs will be cut, and workers will be laid off. The economy enters a recession and afterwards the stage of depression.

Usually, the Department of Commerce uses different basic indicators to determine economic fluctuations: real GDP growth, inflation rate, real hourly compensation, and growth of real profits. According to Greenspan (2000b), there are several early indicators of recessions, for example a slowdown of labor productivity or output growth, stagnating real wages and decreasing profits or decreasing consumer confidence.

However, since World War II., the U.S. business cycles have changed their appearing: contractions have become shorter, expansions longer, fluctuations in general have become less volatile (Council of Economic Advisors 2000, pp. 74 – 79). This can be proven by long-term comparisons of fluctuations in output, inflation and unemployment (see Chart 2 in the appendix).

Proponents of the New Economy claim that the business cycles have not only been tamed, but that the U.S. economy is on a steady growth path, which may be interrupted only by short and shallow recessions. In general, their fundamental hypothesis is: The driving factors behind the business cycle of the New Economy have changed. Nowadays, particularly IT investments are important. The features of these investments enhance the stability of business operations and therefore reduce the volatility of the business cycle.

The further implication of this hypothesis is that greater flexibility allows the economy to adapt more quickly to external shocks, volatile fluctuations are reduced and contractions as well as recessions will be shorter.

5.3.1 Explanations in Favour of a "New Business Cycle"

What is the explanation for the aforementioned hypothesis? There are competing explanations regarding the relation of driving factors of the business cycle and its reduced volatility. Three different but interrelated approaches are identified here. The first is the industry-centered explanation, the second is the information-centered approach, and third might be called multi-factor explanation. Conclusions drawn against their background vary widely and depend to a great extent on assumptions made concerning the characteristics of IT investments.

The industry-centered explanation claims that traditional indicators of the business cycle, like housing and automobiles, have lost their significance. Instead, the high-tech industry and the health sector are identified as driving forces of the business cycle. "In the past three years, the high-tech sector has contributed 27% of the growth in gross domestic product, compared with 14% for residential housing and only 4% for the auto sector." (Mandel 1997, p. 48)

The Department of Commerce emphasizes IT investments as well, but draws other conclusions. Some time in the future, the economy will slow down, squeezing the corporate cash flow that helps finance new investment and creating involuntary excess capacity and inventories, "While this should curb new investments to expand capacity, investments in IT should be far less affected." (Department of Commerce 2000, p. 63) This statement is based on the assumption that in most industries IT investments directly expand capacity to provide services; and a slowdown in demand will therefore be followed by a slowdown in IT investment. However, more important is that high-tech investments are commonly driven by pressures to keep up with competitors in terms of cost-cutting and consumer satisfaction. These characteristics will save IT investments from being cut in times of a demand slowdown. The Department of Commerce obviously emphasizes the cost-cutting and productivity-enhancing capabilities of IT, not its likely capacity-expanding character.

Closely interrelated with this set of arguments is the information-centered explanation. This view is supported by Greenspan (2000b) and partly by the Department of Commerce (2000) as well as by Mandel (1997). Here, information is the key: IT investments are claimed to have not only a capacity-enhancing and cost-cutting effect, they are also the foundation of a revolution in information availability. As generally known, information reduces uncertainty. Before the IT revolution, excess procurement and a doubling up of workers and inventories was essential to backup inevitable misjudgements, states Greenspan (2000b, 2000c). Decisions were made on the basis of obsolete information, sometimes hours or even days old and uncertainty about the state of the market prevailed.

But with increased IT investment and enhanced information distribution and analysis capabilities, uncertainty has been reduced. Redundancies in workers and inventories have been removed and market participants are able to react more quickly to changing conditions. Decisions, now based on better information, are supported by

sophisticated computer programs tracking hundreds of variables and adjusting production schedules and inventories. This implies a smoothing of the business cycle, since inventories are usually its most volatile component.

The third approach to explain the reduced volatility of the business cycle is the multifactor explanation. Weber (1997) states that modern economies operate differently than early twentieth-century economies, a fact that is revealed by the new business cycle. Weber finds six factors that have contributed to its favorable development: globalization of production, changes in finance, changes in employment, government policy, emerging markets, and IT.

Globalization means that the sensitivity of an economy to the conditions in another country is reduced, since there are several trading partners nowadays. Financial markets are linking capital to production in an increasingly efficient way, financial innovations in particular spread and diversify risk, thereby enabling easier risk management.

Industrial production moves slowly to emerging markets. In terms of employment, there is a shift from manufacturing to service jobs. Services are less cyclical than manufacturing due to the problems of building up inventories and in altering the rate on which services can be provided. And there are a lot of services (for instance the whole health sector) that are far less prone to macroeconomic fluctuations. Weber (1997, p. 70) states that these changes will tend to dampen business cycles and render them less prevalent and less severe than in the past. The significance of exogenous shocks is diminishing. However, it is important to note that Weber does not deny the existence of the fundamental forces of the business cycle, like mistakes made in monetary policy or technological change, "(t)hey will, however, be less important in a more flexible and adaptive economy that adjusts to shocks more easily and with less propensity for sparking a new cycle." (Weber 1997, p. 70)

Another explanation that is based on different factors is presented by Davies et al. (2000, p. 5). The authors argue that globalization and deregulation of key industries have reduced the volatility of the business cycle. This, however, leaves the long-run level of real GDP as well as its rate of growth relatively unchanged.

5.3.2 Arguments against a Modified Business Cycle

Since the debate of a new business cycle is by far not as important as the debate of the long-run growth trend, there are only a few economists that criticize the assumptions of the New Economy proponents. Mandel (1997, p. 48), for instance, is critical of the notion that the business cycle has been damped by IT investments. The author states that the business cycle has not vanished, rather high tech is more volatile than the automobile industry. The reasons for this are technology shocks which may emerge suddenly and which might set off major fluctuations.

In times of increasingly pessimistic future expectations, IT investment will be a tempting target for cutting costs. Non-essential high-tech investments will be delayed. A slowdown in high-tech spending could be the beginning of a slowdown of the overall economy and, according to Mandel, it could trigger a steep decline of the stock market. This clearly conflicts with the assumptions of the Department of Commerce, which states that the cost-cutting effects of IT saves those investments from being cut in a recession.

5.4 Inflation and the NAIRU

The debate about the inflation rate and the NAIRU is included here, since it was sparked by the macroeconomic development of the U.S. economy in the 1990s and also plays a role in the New Economy debate. The NAIRU debate is closely related to the business cycle discussion, but for clarification purposes, both strands are separated here.

In the 1960s, economists believed in a stable Phillips Curve. It described that unemployment could permanently be lowered but only at the cost of permanently higher (and constant) inflation. In the late 1960s, Friedman's analysis yielded the insight that the Phillips Curve represented only a short-term trade-off. Friedman developed the notion of a "natural rate of unemployment," a concept nowadays known as NAIRU.

Friedman explained that money supply growth reduces unemployment only temporarily, because prices would initially rise faster than wages. However, once workers realize that their real wages decline (adding to overall labor demand), they start to demand wage increases in line with the price increases. This leads to a decreasing labor demand that in turn affects the unemployment rate. The latter will

increase and eventually reach its original "natural rate" again. The NAIRU, therefore, is the unemployment rate consistent with a stable inflation rate.

If the NAIRU declines, there seems to be a decline in structural unemployment. In the short term, the GDP growth rate will rise above its long-term growth rate. The unemployment rate will decline further, but as soon as it reaches the NAIRU level and moves below this level, the inflation rate will accelerate. Eventually, GDP growth will decline to its long-term growth rate again.

In the 1980s, the NAIRU was estimated to be in the range of 5.5% - 6.5% (DeLong 2000, p. 1). In the 1990s, official statistics estimated the NAIRU to be at 5.75% (Council of Economic Advisors 2000, p. 87) and it was stated that any reduction of the unemployment rate below that point would accelerate inflation.

The same decade, however, seems to show a different trade-off than the one explained above. In 1999, unemployment stood at 4.2%, without any sign of an accelerating inflation rate (which hovered around 1.5%). This sparked a controversy about the level and the concept of the NAIRU. The proponents of the New Economy attribute the NAIRU decline to the factors already mentioned a few times in this paper, namely globalization and IT diffusion. Moreover, the proponents commonly assume that the NAIRU has declined in the New Economy, because of structural changes in the labor market and the resulting change in the development of the labor market. In their view, the U.S. economy can grow at an unemployment rate lower than the previously observed NAIRU without triggering any inflation.

The further implication of this hypothesis is that monetary policy should not act anti-inflationary as soon as an unemployment rate between 5.5% to 6.5% is reached. Anti-inflationary measures at that stage will only inhibit further economic growth.

5.4.1 Arguments for the Lower NAIRU

What is the common explanation for a decline in the NAIRU? Stiglitz (1997) emphasizes the "reversed wage-aspiration effect." The worker's demands for higher wages depend on the past rate of changes in wages. If a productivity upsurge is not recognized by market participants, real wage growth will be slower than productivity growth. Inflation will be tamed.

Stiglitz (1997, p. 7) identifies other factors that have contributed to a lowering of the NAIRU, i.e. increased competition in the product and labor markets plus a decreasing unionization. "Economists have good explanations for the undeniable fact

that the NAIRU has fallen in the last 15 years, and forces like demography and hysteresis will continue to put downward pressure on the natural rate," writes Stiglitz (1997, p. 10).

His points are echoed by Davies et al. (2000, p. 6). The authors assert that structural changes in the labor markets as well as wage discipline on the side of workers have contributed to the decline of the NAIRU. On the side of suppliers, globalization introduced disciplined price politics, while IT lowered the production costs and enhanced the productivity growth. These factors restrain price increases.

In conclusion, there are several aspects that affect the level of the NAIRU: competition on product markets, wage flexibility of workers, geographical as well as professional mobility of workers, union bargaining power, the level of unemployment benefits, and an adequate matching of job skills with jobs.

5.4.2 Critics of the NAIRU Concept

The notion of a permanently lower NAIRU level is criticized by Blinder (2000), who refers to temporary lags of expectations and the already mentioned "reversed wage-aspiration effect." Blinder, however, derives other conclusions than the ones mentioned above. Blinder states that in the 1970s, the productivity slowdown was not recognized by market participants for some time. Their decisions were based on excessively optimistic estimates of the productivity trend. Wage agreements were based on a high productivity trend estimate, which had actually declined. Compared to the lower productivity growth, wage agreements were too high and led to higher costs and inflation.

In the 1990s, however, this trend was reversed. An unrecognized productivity acceleration led to both higher employment and lower inflation, "(i)n the data, it will appear as if the NAIRU has declined. But as perceptions adjust to the new, faster pace of productivity gains, the apparent NAIRU should return to normal." (Blinder 2000, p. 7) In Blinder's view, the lower NAIRU level is just a temporary phenomenon.

The aformentioned favourable development of the inflation and unemployment rate also sparked a controversy about the NAIRU concept itself. The opponents of the concept interpret this development as a verification of their criticism.

For instance, Eisner (1995) criticizes the conventional formulation of the NAIRU and two of its fundamental assumptions, namely that any given rate of inflation is

self-perpetuating and that unemployment is seen as a key factor in changing inflation rates. The author points out, that "(t)he conventional model constrains the unemployment and inflation parameters in ways that are in fundamental conflict with the data." (Eisner 1995, p. 4) A lack of empirical support shows the deficient theoretical foundation of the NAIRU, Eisner states. Based on his tests, the author observed that once unemployment is below the NAIRU level, lowering unemployment may even further reduce inflation.

The changing relation between unemployment and inflation has also been the target of criticism by Galbraith (1996). He points at the fundamental deficiencies in the model and views the NAIRU as not precisely enough defined. Galbraith claims that rising inflation is essentially unpredictable. The shocks causing inflation may happen at high as well as low unemployment rates (Galbraith 1996, p. 3). In his rejection of the NAIRU concept, Galbraith is supported by DeLong (2000, p. 3) as well as Staiger et al. (1997). The latter summarize recent research and present new empirical evidence on the validity of the NAIRU in anticipation of increases in the inflation rate. Staiger et al. (1997, p. 45) conclude that other major indicators of inflation, like the capacity utilization rate in manufacturing or the index of new orders are outperforming the imprecise concept of NAIRU.

VI. Conclusion

This paper reviewed the New Economy debate in the second half of the 1990s and its different strands in the economic literature. It introduced different definitions of the New Economy and provided a new one that is quantifiable. Several arguments have been analyzed in the fields of growth sources and processes, productivity and long-term growth rates as well as the business cycle and the NAIRU. The prevailing hypotheses were identified and their proponents as well as opponents listed.

It will, of course, take some more time to answer all the questions related to the favorable macroeconomic development of the U.S. in the 1990s. At least some preliminary conclusions about the reviewed hypotheses might be drawn here.

First, it must to be stated that in the field of growth sources and new growth processes, there seems to be a lack of empirical studies that prove the assumptions claimed by New Economy proponents (as well as those of the opponents). Therefore, this strand of the literature remains speculative.

Compared to this, the discussion about the relation of IT and productivity yields insights into macroeconomic and firm-level productivity. Here, IT clearly contributes to an increased productivity growth. However, questions about the industry-level remain present and it is still too early to draw the conclusion of a higher growth rate that is sustainable in the long-run. It is an obvious fact that only long-term observations will help to separate cyclical from structural factors of the observed economic growth.

Only further research and further improvement of official statistics will provide answers to questions related to the observed productivity trends. Such statistical improvements should include new forms of service output as well as quality changes of products and services. Still the question remains whether the methods currently used in the U.S. can capture the full impact of information technology on economic performance.

The business cycle of the U.S. has in fact changed. This assertion can be supported empirically. However, it is not quite clear which factors have been the major driving forces behind this development, although different ones have been claimed to reduce the volatility of the cycle. Closely related to this strand of the debate is the NAIRU controversy. Here, the macroeconomic development and empirical evidence proved the supporters of a high NAIRU level wrong. However, too many questions remain about the concept itself, which is still controversial as shown in this paper.

It is remarkable how some of the authors reviewed in this paper reveal a very simple as well as static view of innovations like computers or the Internet. New Economy opponents claim that both offered the greatest benefits in the past, without taking developments into account that would not have been possible without IT. Nearly every new innovation nowadays is based on IT or at least information distribution via IT. Examples can be found in the fields of finance (i.e. risk management) and health (i.e. bio-technology and genetics). Even governmental administration can no longer be thought of without IT.

It is clear that there have always been different leading industries in the U.S. economy, such as textile and transportation. These industries have reshaped the

economy. At the end of the century, the information industry (IT, telecommunications and related services) is leading and it will continue to alter the U.S. economy.

The question to what extent this lead will rewrite economic theory has to be left open to further discussion. However, even in the future, markets will be driven by the forces of supply and demand and rationality (or irrationality).

In the next downturn – always starting with diminishing expectations for profits, revised growth projections and slowly decreasing consumer confidence – the statistics will show whether productivity gains can be sustained. The length of the downturn itself will answer the question whether or not the business cylce of the New Economy ends in only short and shallow recessions. If productivity gains are sustained, then the New Economy proponents will be closer to proving their claim of bearing witness to an industrial revolution.

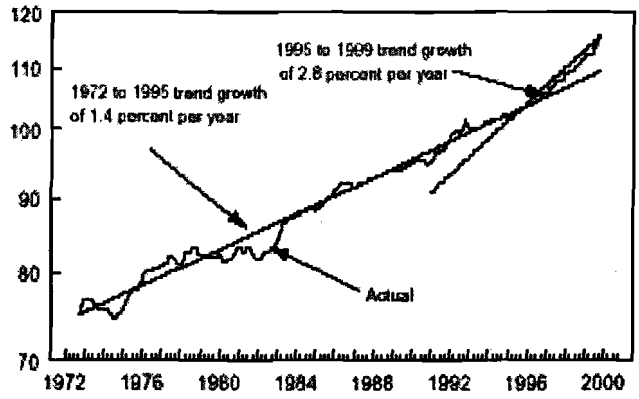
APPENDIX

Table 1

Proponents and Opponents of New Economy Hypotheses

Hypotheses	Proponent	Opponent	Undecided
1. Sources and Process of Growth			
1.1 Sources of Growth	Atkinson/Court (1998) Kelly (1996, 1997) Nakamura (1999) Schwartz (2000)		
1.2 Process of Growth	Economides (2000) Kelly (1997) Atkinson/Court (1998) Arthur (1994)	DeLong (1997) Liebowitz/Margolis (1996) Varian/Shapiro (1999) Krugman (1998) Henwood (1997)	Stiroh (1999)
2. Long-run Growth and Productivity			
2.1 Long-run Growth	Shepard (1997) Mandel (1997) Bluestone/Harrison (1997)	Krugman (1997) Gordon (2000)	Blinder (2000) Stiroh (1999)
2.2 Productivity	Nordhaus (2000) Jorgenson/Stiroh (2000)	Gordon (2000)	Davies et al. (2000)
3. The "New Business Cycle"	Weber (1997) Shepard (1997) DOC (2000) Davies et al. (2000)	Mandel (1997)	
4. Inflation and NAIRU	Davies et al. (2000) Stiglitz (1997)	Blinder (2000) Eisner (1995) Galbraith (1997) Staiger et al. (1997)	

Chart 1
The Trend Rate of Nonfarm Productivity Growth Accelerated After 1995
(Index 1992=100, log scale)



Source: Department of Commerce 2000, p. 1

Table 2

Contribution of IT Capital to the Acceleration of Labor Productivity Growth*

Overview of Studies

Studies**	Definition of IT	(1) Total IT Contribution (Percentage ponits)	(2) Productivity Acceleration (Percentage ponits)	(3) IT Share of Acceleration (Percent) [(1)/(2)] · 100
Oliner/Sichel (2000) 1996-99 over 1991-95	Hardware, software, telecom equipment	0.71	1.04	68.3
CBO (2000) 1996-99 over 1974-99	Hardware	0.60	1.10	54.5
CEA (2000) 1995-99 over 1973-95	Hardware, software	0.70	1.47	47.6
Jorgenson/Strioh (2000) 1995-98 over 1990-95	Hardware, software telecom equipment***	0.50	1.00	50.0
Whelan (2000) 1996-98 over 1974-95	Hardware, software, telecom equipment	0.73	0.99	73.3
Gordon (2000) 1995-99 over 1972-95	Hardware	0.62	0.81	76.5
Nordhaus (2000) 1996-98 over 1978-95	Hardware, software, telecom equipment	0.65	1.82	35.7

Source: Department of Commerce 2000, p. 38, expanded by the author

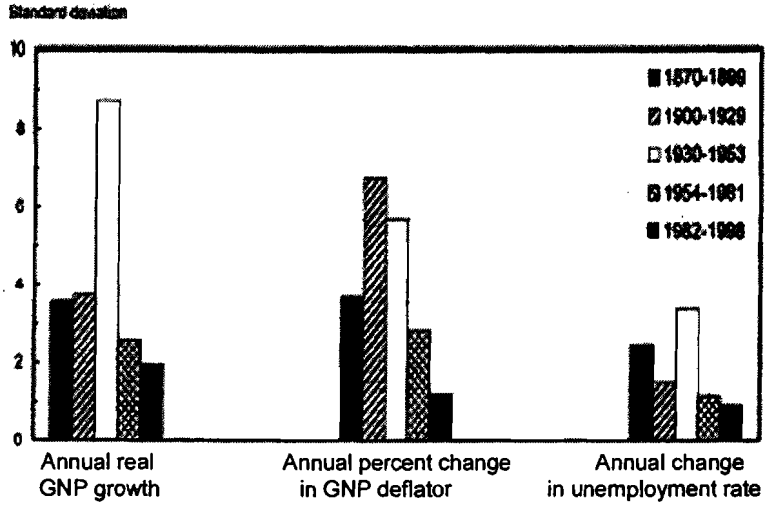
* U.S. private non-farm business sector, in percentage points.

** The studies are not strictly comparable, since the authors use different definitions of IT and relate to particular time periods. Other factors contributing to labor productivity growth acceleration are not identified in the table, since it is intended to highlight the contribution of IT to the acceleration of labor productivity growth.

*** Jorgenson and Stiroh include in IT "capital services" from computer, software and communications equipment.

Chart 2

Fluctuations in Output, Inflation, and Unemployment
Business cycle fluctuations have been less severe on average in the second half of the 20th century than in earlier periods



Source: Council of Economic Advisory 2000, p. 76

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April 2001