

Employment, Productivity and Output Growth

**by Oliver Landmann
University of Freiburg i.Br.**

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Institut für Allgemeine Wirtschaftsforschung
Abteilung für Wirtschaftstheorie
Universität Freiburg
Platz der Alten Synagoge
79085 Freiburg
Tel 0761/203-2326
Fax 0761/203-2405
e-mail oliver.landmann@vwl.uni-freiburg.de

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I Introduction¹

1. Motivation of the Paper

The purpose of this paper is to clarify the links between employment, productivity and output growth, with a particular focus on the changing nature of these links over different time frames. The paper will raise issues that are central to the 2003 World Employment Report's overarching theme of poverty reduction and productivity. Paul Krugman (1990) once remarked that for the economy as a whole, there are only three things that are really important: productivity, income distribution, and unemployment. "If these things are satisfactory, not much else can go wrong, while if they are not, nothing can go right".² He may not have been referring to poverty reduction in particular. Nevertheless, his statement captures the principles of poverty reduction almost by definition. For policymakers, the message might appear straightforward: In order to overcome widespread poverty, all you need to do is to maintain full employment, foster productivity growth and eliminate the outer left-hand tail of the income distribution. If it were only that simple!

The message can be turned around: Where poverty persists, it is because policymakers fail to take effective measures against unemployment, low productivity and income inequality. Or they might not know what these measures are. This is where macroeconomic theory and evidence are called for to identify the principal determinants of employment, productivity and the income distribution, as well as to point out possible tensions between them. Some of the links between these concepts which have attracted attention in economic research as well as in public policy debates are sketched in Figure 1. Seven channels of mutual influence can be distinguished:

Figure 1: Income distribution, employment, productivity and production are closely intertwined

¹ This paper has benefited from valuable research assistance by Andreas Pollak.

² Krugman (1990), p. 7.

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- (1) The distributional importance of the employment situation stems from the simple fact that nothing breeds poverty as much as unemployment does. At the same time, if unemployment is highly concentrated among the least skilled workers, as it is in most industrial economies, the expansion of employment may necessitate the creation of a large number of low-wage jobs and thereby add to the inequality of earnings.
 - (2) In turn, any attempt to override market forces on labor markets for the sake of correcting the primary income distribution can have far-reaching repercussions on the volume and structure of employment. This can be seen most clearly in economies where labor market outcomes are strongly shaped by collective wage bargaining arrangements and where the institutional framework gives special interests ample leeway in the pursuit of their distributional concerns. Wage policies have traditionally been used to influence both the aggregate labor share and the structure of earnings across occupations and skill groups.
 - (3) A large literature has investigated the role of the income distribution in facilitating or hindering sustained productivity growth. Among the relevant considerations are the effect of the income distribution on social stability and the ability of the legal framework to safeguard the property rights of individuals and companies who invest in physical and human capital as well as in new ideas.
 - (4) As a consequence, the growth path of aggregate productivity is likely to affect the distribution of income. A prominent example of how that relationship might look is the much-discussed Kuznets curve hypothesis.
 - (5) How does productivity affect employment? This question has worried academic economists and ordinary citizens literally for centuries. While no one can deny that rapid and sustained productivity growth has lifted advanced industrial nations to their present-day standards of living and has allowed them to eradicate, by any historical standards, the curse of mass poverty, the technological innovations and capital-intensive investments that were the sources of this very productivity growth, have in turn been feared for the mass-scale destruction of jobs for which they have often and rightly been held

responsible. As pointed out later in this paper, it is not possible to detect an effect of productivity growth on aggregate employment in long-term time-series data. But economic growth continues to go hand in hand with structural change, which entails a fair amount of "creative destruction", to use Schumpeter's famous phrase. Old jobs are lost in declining industries and new jobs are created in the expanding sectors of the economy. The non-negligible costs of this structural adjustment augment the clout of political forces resisting such change.

- (6) Considerable ambiguity also surrounds the implications of employment dynamics for productivity growth. Standing out among the contentious issues is the proper interpretation of the US-European employment and productivity differential over the past few decades. The US economy has successfully integrated large numbers of labor market entrants into the ranks of employed workers while at the same time turning in a dismal productivity performance. In stark contrast, the core of the European Union, consisting of the continental 'Big Three' (Germany, France, Italy), has suffered from rising unemployment in the face of only moderate labor force growth, but has at the same time clearly outperformed the United States in terms of productivity growth - which naturally raised the question of a possible trade-off between unemployment and productivity growth (Gordon 1997). Is low productivity growth the price the US had to pay for its 'employment miracle'? In view of the close relationship between the productivity of labor and the level of real wages, such a trade-off would also imply a conflict between employment growth and real wage growth.

No such conflict is suggested, on the other hand, by the strong positive correlation of employment and labor productivity over the business cycle. The fact that the rise of European unemployment began exactly at the time of a sharp slowdown of productivity growth in the 1970s and the more recent observation of a substantial acceleration of productivity growth in the United States (often associated with the 'New Economy') coinciding with record low unemployment also cast doubt on the notion of a conflict between a high pace of job creation and rapid productivity growth.

- (7) No ambiguities of any kind are involved in the simple logic that links employment and

productivity with the aggregate output of an economy: It is always true that aggregate employment is the ratio of aggregate output and the average productivity of labor - simply because the average productivity of labor is defined that way. Of course, there are other productivity concepts such as the productivity of capital or the total factor productivity which cannot be put in relation to employment quite as easily, but which are important for the theoretical or empirical analysis of economic growth. However, it is fair to say that labor productivity, defined as output per person or output per hour, is the concept politicians or the media have usually in mind when they loosely talk about 'productivity'.

Just because it is always true, the fundamental identity which relates employment to output and labor productivity is a starting point for much popular thinking about the determination of employment. A fair deal of this thinking is grossly misleading as it tends to ignore that one can never get a theory out of an identity without imposing some reasonable causal structure and some potentially falsifiable assumptions. Nevertheless, the identity can serve a useful purpose in organizing our thinking about the various forces governing observed patterns of employment, productivity and output growth.

The paper will for the most part focus on the nature of the mutual interdependence of employment, productivity and output as summarized in Figure 1 by the links (5), (6) and (7). It will become clear in various places, however, that these links cannot be fully understood if their interaction with the income distribution is ignored. Therefore, distributional issues will pop up every then and now in the following sections.

2. Organization of the paper and preview

As indicated above, the fundamental identity linking employment, output and labor productivity provides a convenient starting point for a systematic discussion of many popular concepts relating to the determination of employment and unemployment. Concepts such as a 'socially necessary' rate of growth are directly derived from the fundamental identity. So is the widely held belief that rapid productivity growth destroys jobs and thereby reduces the

scope for employment growth. *Section II* takes a critical look at these and related notions. The major point to emerge from this review is that any reasonable statement about causation requires a sound analytical framework for the explanation of productivity growth and unemployment. The outlines of such a framework are sketched in the remainder of that section. In particular, it will be argued that it is useful to distinguish between an analysis of the forces shaping the long-run equilibrium paths of output, employment and productivity on the one hand and the forces causing temporary deviations from these equilibrium paths on the other hand. We will also see, however, that the need for such a distinction is not universally accepted by macroeconomists and that even for those who accept the usefulness of the distinction, it is quite difficult at times to draw a sharp line separating long-run equilibrium trends from short-run disequilibrium phenomena. This is why section III of the paper is organized around three different time frames: the short run, the medium run and the long run.

Section III starts with the cyclical behavior of employment and productivity. As is well known, both of these macroeconomic variables are strongly and robustly pro-cyclical. Closely related to this observation is Okun's Law which relates output growth to changes in the unemployment rate. The paper cites some quantitative evidence on these regularities and points to considerable variation both across time and across countries.³ Robust as some of the facts may be, their theoretical interpretation remains highly controversial in business cycle theory. Again, what is at issue is the direction of causation. Whereas proponents of the theory of real business cycles believe that fluctuations in both productivity and employment are mostly driven by technological shocks, the central pillar of keynesian theory is the view that cyclical output movements are due to changes in aggregate demand and that the pro-cyclical behavior of employment and productivity can be explained by sluggish and incomplete adjustment of labor demand to such demand-side disturbances. Which of these interpretations is correct matters a great deal for the determination of proper policy responses to the business cycle. A case in point is the present macroeconomic malaise in Japan where output, employment and productivity are all dramatically depressed as compared to trends reigning up to a decade ago (Prescott 2002, Hayashi/Prescott 2002).

³ For a more detailed discussion of Okun's Law, the reader is referred to the companion paper by Pollak (2002).

In the second part of Section III, the paper takes up the behavior of employment and productivity as they unfold beyond the business cycle. Here the crucial link is the intreraction of productivity growth with the process of wage formation. Of course, wages are an important determinant of employment in the short term as well. But at least according to keynesian reasoning, it is the relation of nominal wages to nominal aggregate expenditure, rather than to productivity, that matters for real effective demand and hence for the short-term determination of employment (Landmann 2001). The medium-term labor market equilibrium, in contrast, strongly depends on the relation of real wage aspirations to aggregate labor productivity. Whenever real wage claims get out of line with the underlying productivity trend, or when productivity growth is subject to sustained changes that are not fully being taken into account by wage setters, this will be reflected in the level of equilibrium unemployment. The recent history of the major OECD economies contains a number of episodes that illustrate the usefulness of thinking along these lines. In particular, the paper will repeatedly refer to the much-debated differences in the employment and productivity performances of the United States and the European Union.

Taking an even longer view, the final part of section III looks at the interaction of productivity growth and unemployment along an equilibrium growth path. The long-term concept of an equilibrium growth path takes into account the endogenous response of capital formation to the evolution of both employment and productivity. Moreover, modern developments in the theory of endogenous growth open a number of avenues along which links between productivity growth and unemployment can be investigated (Calmfors/Holmlund 2000). Some of the models contain explicit accounts of the process of creative destruction which can be easily combined with flow models of the labor market. Other theories focus on the skill bias of technological change which has repercussions on employment if wage differentials (skill premia) are rigid. Yet another approach emphasizes the role of employment for human capital accumulation and hence productivity growth. Finally, labor and product market regulations that restrict the entry of new firms and the reallocation of jobs towards rapidly growing high-tech sectors may well act as a drag not just on employment, but also on productivity growth (Scarpetta et al. 2002).

Section IV summarizes the findings and draws some conclusions.

II How Productivity and Employment are Linked: Some Facts and a Theoretical Framework

1. The ‘fundamental identity’: its uses and misuses

It is not feasible to think of employment, productivity and aggregate output as independently determined variables. If productivity is measured as output per person or output per hour worked, i.e. as the productivity of labor input, the three variables are linked, as a matter of pure arithmetic, by the so-called ‘fundamental identity’

$$\text{Output} \equiv \text{Employment} \times \text{Productivity},$$

which, for small rates of change, can approximately be translated into

$$\text{Output Growth} \cong \text{Employment Growth} + \text{Productivity Growth}.$$

This means, for example, that any given rate of output growth can be achieved either with high productivity growth and low employment growth, in which case the employment intensity of economic growth is said to be low, or conversely with low productivity growth and high employment growth (a high employment intensity).

There is always a temptation of jumping from such truisms which must be true by necessity to statements about cause and effect. The following explanation of Germany’s unsatisfactory employment growth is a typical example for this type of reasoning:

”Economic Growth in Germany has a low employment intensity. Because average labor productivity has risen relatively fast, employment has not shown the desired increase despite economic growth.”⁴

At least implicitly, this wording suggests that employment would have shown the desired increase if only labor productivity had risen relatively less fast. Of course, this conclusion is

no longer true by arithmetic necessity. It is only true if the rate of output growth can be taken as somehow given or at least as sufficiently independent of productivity growth.

A similar tacit assumption underlies much hypothesizing about the alleged "end of work" (Rifkin 1994). The presumption here is that the rapid productivity advances achieved in the course of economic development is inevitably leading to a progressively dwindling number of jobs as less and less workers are needed to do the socially necessary work. In a best-selling book, titled "Die Globalisierungsfalle" ("The Globalization Trap"), two German journalists report the dramatic vision of what they brand the "20:80 society":

"20 percent of the working-age population would suffice in the upcoming century to keep the world economy going... One fifth of all job-seekers would suffice to produce all the goods and high-value services that the global society will be able to afford."⁵

Again, the loss of jobs is predicated on some exogenous limitation of the rate of output growth, in this case by what people "can afford". It is not clear at all that this assumption of a predetermined path of output growth can be reasonably justified. Thus, the cited vision of the "20:80 society" immediately raises the question of why a society that becomes ever more productive should not also become wealthier so as to be able to afford what it can produce. Incidentally, this question was raised and affirmatively answered by 19th century French economist Jean-Baptiste Say who thereby made his way into the world's economics principles texts as the father of "Say's Law". Every version of the 'end-of-work' story ignores Say's Law in assuming, in one way or another, that there is a fixed amount of work to be done and that, therefore, increased productivity means less jobs. The labor market literature refers to this fallacy as the "lump of labor fallacy".

A possible source of confusion is a so-called „fallacy of composition“, an illicit generalization of partial-equilibrium insights which ignores the general-equilibrium properties of the system as a whole . There is nothing wrong with the prediction of falling employment in a particular sector if that sector experiences rapid productivity growth while at the same time facing stagnant demand. This is in fact the story behind the falling employment share of agriculture

⁴ CESifo Forum, Editorial, Summer 2000, p. 46.

⁵ Martin/Schumann (1996), p. 12 (translation by the author).

which has characterized the development of the industrial economies for more than a century. Of course, this loss of jobs in agriculture did not translate into unemployment, but paved the way for an offsetting expansion of employment in the rest of the economy. More generally, the enormous productivity advances which the industrialized nations have realized since the onset of the industrial revolution have differed among sectors and thus contributed to structural change, but they have certainly not produced anything faintly resembling a systematic destruction of employment opportunities.⁶ Quite to the contrary, the growth of jobs has easily kept pace with an unprecedented expansion of the labor force. Individuals have made rational use of their increased productivity in part by raising their consumption levels and in part by enjoying more leisure.⁷

Another application of the fundamental identity that takes one of the three elements as given is the concept of a "socially necessary rate of growth". Here it is the growth rate of productivity which is regarded as exogenous (perhaps as determined by technological progress). One can then ask by how much output must grow in order to generate a desired volume of employment. The answer is branded the "socially necessary rate of growth". Again, this raises the question of how the 'necessary' growth rate could possibly be engineered and whether the required policy moves would leave productivity growth unaffected. One can think of carefully defined settings in which the concept makes sense. In fact, the "employment threshold" of economic growth, to be discussed in more detail below, is a closely related notion.

The main message to remember at this point is that the fundamental identity - much as it is often made appear otherwise - does not convey any information about cause and effect among the three variables involved. Only when a reasonable hypothesis on the behavior of at least one of the variables is introduced, can the identity be used to deduce non-empty implications of the hypothesis for the other two variables.

The identity is most useful for an analysis of the link between the productivity of labor and the material well-being of the population. As labor productivity can be defined as output per

⁶ For a succinct discussion of this point, see Krugman's essay „The Accidental Theorist“, reprinted in Krugman (1999), pp. 18-23.

⁷ For an effective and readable refutation of the 'end-of-work' view of the world, see Rojas (1999).

person, the two concepts are often used almost synonymously. However, the most common indicator of material well-being, per capita income, is defined as the ratio of national income to the total population that must be supported by that income. Of course, output per head of the population depends not only on the productivity of labor, but also on the volume of labor devoted to the production process - or as van Ark and McGuckin (1999) have aptly put it: "Productivity is only one of the factors determining living standards. Living standards also depend on 'how many mouths need to be fed' from what is produced."⁸

The point can easily be seen and quantified if the fundamental identity above is augmented so as to express output in relation to the number of "mouths to be fed" and to make explicit the determinants of the volume of employment:

$$\begin{aligned}
 \underbrace{\frac{\text{Gross Domestic Product (GDP)}}{\text{Total Population}}}_{(6)} &\equiv \underbrace{\frac{\text{GDP}}{\text{Hours worked}}}_{(1)} \cdot \underbrace{\frac{\text{Hours worked}}{\text{Persons employed}}}_{(2)} \cdot \underbrace{\frac{\text{Persons employed}}{\text{Labor Force}}}_{(3)} \cdot \underbrace{\frac{\text{Labor Force}}{\text{Working Age Population}}}_{(4)} \cdot \underbrace{\frac{\text{Working Age Population}}{\text{Total Population}}}_{(5)} \\
 \text{Per-Capita-Income} &\equiv \left(\frac{\text{Labor}}{\text{Productivity}} \right) \cdot \left(\frac{\text{Working}}{\text{Hours}} \right) \cdot \left(\frac{\text{Employment}}{\text{Rate}} \right) \cdot \left(\frac{\text{Participation}}{\text{Rate}} \right) \cdot \left(\frac{\text{Age}}{\text{Structure}} \right)
 \end{aligned}$$

In this relationship, labor productivity is defined as GDP per hour worked so that employment is measured by total hours worked which can be expressed as the product of the four factors numbered (2) to (5). Of these factors, the (relative) size of working-age population is determined by demographics. The other three, however, reflect the economic and sociological forces shaping participation decisions, working habits and employment status. As van Ark and McGuckin (1999) demonstrate in an illuminating empirical study (from which the quote above was taken), the utilization of the potential labor force varies substantially across countries and this variation makes a large difference for per capita incomes. Their results are summarized for 22 OECD members in Table 1. All figures in Table 1 refer to the year 1997 and are expressed in percent of the OECD average. Purchasing power-adjusted exchange rates are used for the international comparison of productivity and income levels. The countries are

⁸ van Ark/McGuckin (1999), p. 39.

ranked by the algebraic difference between their relative productivity position and their relative per capita income position.

Table 1: A Quantification of the augmented fundamental identity for 22 OECD countries⁹

Belgium, on top of the table, has the highest labor productivity of all countries considered, but its per capita income is barely above the OECD average. This is because Belgians work less than average hours, suffer from more than average unemployment and, most importantly, have the lowest participation rate in the sample. The latter clearly reflects the widespread practice of early retirement. Whereas the participation rate of Belgian "prime-age" males (i.e. men aged 25-54) is well above 85% and thus in the same range as in other countries, only 35% of older male workers (55-64 years) belong to the labor force, compared to an average of 48% in the European Union, 66% in the USA and around 79% in Japan and Switzerland.¹⁰ On the other end of the Table, Japan trails Belgium with respect to productivity by more than a third, but nevertheless manages to churn out a higher per capita output because the Japanese, by every measure of labor utilization, work much harder.

Of course, the augmented identity linking columns (1)-(6) in Table 1 cannot serve as a basis for causal inferences any better than the simpler identity with which we started out above. After all, it is still an identity. But if the simpler identity is in fact often misused to support claims about cause and effect, the augmented identity evidently offers additional opportunities for doing so. For anyone willing to believe that the total number of hours worked by a given working age population is limited by the productivity with which workers produce a given GDP, it is a small step to the conclusion that the employment rate of an economy can be raised by either lowering working hours, which would spread the work among a larger number of workers, or by lowering the participation rate, which would reduce the number of workers competing for jobs. Both routes have been tried in practice. Working hours can be reduced

⁹ While the data in Table 1 are from van Ark/McGuckin (1999), the Table is reproduced here from a write-up on the van Ark/McGuckin-Study in the CESifo Forum, Summer 2000, p. 47.

¹⁰ The latter figures refer to the year 1999 and are taken from Jackman (2001), Tables 2 and 3. The participation rate of Belgian women aged 55-64 are way below the OECD average as well.

either by shortening the workweek or by promoting part-time work. One way of reducing the participation rate is by offering generous early retirement schemes.

The „mathematics“ of such policies appears unassailable: Any given number of hours worked per working age population - i.e. any given product (2)·(3)·(4) in the augmented identity - requires the employment rate (3) to rise in proportion if either working hours (2) or the participation rate (4) are reduced. What is assailable, however, is the ‘lump of labor’ assumption that the number of hours worked would remain unchanged in such a scenario. To the extent that this assumption is false, any policy aiming at a better balance of supply and demand by reducing the effective volume of labor supplied will fail.

The data in Table 1, above, do not permit a serious empirical judgment about any of the above propositions. Nor do they warrant firm conclusions on the effectiveness of ‘employment policies’ directed towards the total volume of labor supplied. However, a few suggestive observations can be made. If there were something to the claim that rising productivity eats up jobs, one might expect to find above average unemployment in countries with above average productivity, and *vice versa*. In fact, no such correlation can be found in the data of Table 1 if a formal regression is run for the 22 countries displayed.

Not surprisingly, however, there is a very robust correlation between the productivity variable (1) and per capita income in column (6). For every percentage point by which the labor productivity of a country rises in relation to the OECD average, the relative income per head of that country is augmented by .78 percentage points. Higher productivity thus translates into higher income and output, though it is not a one-for-one relationship. Making use of the fundamental identity, we can express the same point by observing that every additional percentage point of relative labor productivity chips some .22 percentage points off relative total annual hours worked per head of the population. Since the employment rate does not vary systematically with the level of productivity, the inverse response of total labor input appears to reflect a labor supply response. This is exactly the pattern of behavior one would expect from rational households: As the return to labor rises, households enjoy their growing prosperity partly in the form of higher income and partly in the form of more leisure (the well-known income effect of the theory of labor supply).

If it were correct that the employment situation can be enhanced by cutting working hours (job sharing, shorter work week) or by lowering participation (early retirement schemes), one might expect to find working hours and labor market participation inversely related to the employment rate. Again, no such relationship can be detected in the data of Table 1. Quite to the contrary, the correlation between the employment rate and the participation rate is strongly positive. All of the countries with less than average employment rates in the upper part of Table 1 also have less than average participation rates whereas all five countries in the bottom part of the Table have above average employment and participation rates. The positive correlation is statistically robust. On the other hand, there is no significant correlation between working hours and the employment rate. High unemployment can go together with above average working hours as in Spain or with below average working hours as in Germany and France.

It is worth emphasizing once more that no firm causal inferences can be drawn even where correlations between indicators do exist. The simple bivariate covariations considered here do not control for third factors that might be at work in addition to any direct channels of causation linking the variables. However, the observation that employment rates and participation rates typically deviate in the same direction from their respective means in our sample of OECD countries clearly fails to support the proposition that a reduction of labor supply facilitates the realization of high employment rates. The positive correlation of employment and participation appears more suggestive of a world in which unemployed workers, discouraged by their unsuccessful job search efforts, leave the labor force¹¹ or in which societies defensively respond to high unemployment by actively shrinking the labor force, e.g. by offering the unemployed generous terms for early retirement. Of course, such measures do not solve the underemployment problem, but merely help keep the unemployed out of the unemployment statistics. In all likelihood, such cosmetic operations exacerbate the unemployment problem as they weaken the corrective forces inherent in the economy and soften the political pressure to do something about the problem.

¹¹ The labor market literature refers to this phenomenon as the “discouraged worker effect”.

2. Employment Growth vs. Productivity Growth: An Atlantic Divide?

As we have argued above, the age-old presumption that excessive productivity growth limits the scope for job creation and employment growth cannot be based on the fundamental identity. This does not mean, of course, that the presumption has been laid to rest nor, for that matter, that it is wrong. Nothing has done more to keep the notion of a trade-off between employment and productivity alive than the comparative evolution of these two key variables in the United States and the European Union since 1970.¹² Table 2 displays the relevant data. For both the United States and the European Eunion (EU 11), the Table decomposes the growth of aggregate output, in accordance with the fundamental identity, into the contribution of employment growth and the contribution of labor productivity growth, respectively.

Table 2: **Employment and Productivity in the United States and Europe, 1970-2000**

From 1970 to 1990, the rate of annual output growth was similar in the United States (3,2%) and in Europe (2,8%). However, whereas Europeans relied almost exclusively on productivity growth to increase their output, US output growth in the same period was much more labor intensive as employment growth contributed two thirds of that growth. Not surprisingly then, Europe achieved much higher productivity growth than the United States in the 1970-90 period, but at the same time trailed the United States badly in terms of job creation. The bottom line was that, in a way paradoxically, Europe was much less successful in providing a slowly growing labor force with jobs than the United States was in integrating a much more rapidly expanding labor force into the labor market. As pointed out in the introduction, above, this observation was widely regarded as a corroboration of the propositions that any given output growth can be generated either with a high or a low employment intensity, that it is a

¹² The US-European employment and productivity differential has generated a large literature. A particularly perceptive analysis is given by Gordon (1997). The World Economic Outlooks by the International Monetary Fund (1995, 1999) have repeatedly addressed the issue as well.

matter of choice which of the two models is followed and that, by implication, the United States and Europe opted for different models.

In view of the importance of the unemployment rate in the preference system of economic policy, there can be little doubt about which model is preferable, given that the USA engineered an “employment miracle” while at the same time Europe experienced an ever deepening unemployment crisis. Of course, one might question the wisdom of the US model on the grounds that it required a much higher work effort for roughly the same output increase. As early as 1987, Richard Freeman remarked critically:

”Despite the fact that employment/population rates and annual hours per employee increased in the United States relative to OECD-Europe, *per capita GDP grew at the same 1.3 percent rate*. From this perspective, Americans worked harder for the same gain in living standards as Europeans... In sum, the United States paid more for its improved employment and unemployment position relative to OECD-Europe than is recognized by those who peddle flexible decentralized labor markets, US-style, as the 1980’s Economic Cure-All.”¹³

The crucial question, however, is whether the contrasting productivity-employment combinations realized by the United States and Europe, respectively, can in fact be regarded as a matter of choice in the sense of representing different desired realizations from largely the same set of options. Is a lackluster productivity performance the price to be paid for the maintenance of full employment and a rapidly expanding work force?

Doubts about the notion of an employment-productivity trade-off are suggested by the numbers for the 1990s in which the relative productivity performance of the United States and the European Union underwent a fundamental change. In particular in the second half of that decade, the United States experienced a marked acceleration of productivity growth which is widely attributed to the growth of the ‘New Economy’, i.e. the spread of information and telecommunication technologies. For the first time in the post-war era, the United States outperformed Europe in terms of productivity growth. This ‘productivity miracle’ did in no way put an end to the ‘employment miracle’ of the preceeding decades. To be sure, employment growth slowed somewhat, but this was clearly due to slower labor force growth,

¹³ Freeman (1988), p. 289-90 (emphasis in the original).

as evidenced by the almost continuous fall of the unemployment rate throughout the decade - from 5,6% in 1990 to little more than 4% in 2000. In the same decade, European productivity growth did not go up, but down, with no noticeable effect on employment growth. The productivity slowdown, which continued a trend that had started as far back as in the 1970s, translated almost entirely into slower output growth. The growth rates in Table 2 are given for the period 1991-2000 rather than 1990-2000 for the European Union in order to eliminate the only substantial, but artificial one-time upward shift in the employment series: the inclusion of some 10 million East Germans in the employment statistics.

Much as the Atlantic Divide of the 1970s and 1980s may have fostered the notion of an employment-productivity trade-off, no such trade-off is suggested by the time-series behavior of employment and productivity relative to each other on each side of the Divide. Figure 2 displays the evolution of the unemployment rate and the growth rate of labor productivity in Germany and the United States for the four decades since 1961. In Germany, which in this respect can be considered as fairly representative for the big economies of continental Europe, both the unemployment rate and productivity growth exhibit clear trends: Whereas productivity growth slowed down from one decade to the next, the unemployment rate moved the other way. Anyone looking for a connection between the changes of the two variables, or for a theory that could rationalize such a connection, would hardly start with the notion of an employment-productivity trade-off. Rather, the bar chart appears to reflect a world in which “good things go together”, as Krugman (1994) once put it, which could mean that high productivity growth is good for employment, that low unemployment is good for productivity growth, or that both are reflections of some underlying quality which determines the overall performance of the economy (“competitiveness” perhaps?).

Figure 2: Productivity growth and unemployment in Germany and the United States, 1961-2000

A less unambiguous picture emerges from the experience of the United States where neither the unemployment rate nor productivity growth appear to be subject to monotonous trends. What can be said, though, is that the much-discussed productivity slowdown of the 1970s coincided with a substantial increase in unemployment. The productivity slowdown has been

reversed by the year 2000 and so has the increase in unemployment. There is anything but a close inverse relationship between unemployment and productivity growth, however. During the 1980s, for example, both variables were higher on average than in the preceding decade.

What is the moral of all this evidence? Depending on the particular angle from which it is viewed, different conclusions seem to follow. Some observations have suggested a trade-off between employment and productivity growth, some observations suggest the opposite, and yet another position is that that we should not expect any strong relationship between productivity growth and unemployment trends at all.¹⁴ Clearly, in order to proceed further from this point, we need some conceptual structure reaching far beyond the fundamental identity. It is to some basic elements of such a conceptual structure that we now turn.

3. On the Determination of Employment and Productivity

Ongoing productivity growth is the defining property of what economic historians refer to as the era of “modern economic growth” by which they mean the roughly 200 years since the onset of the industrial revolution. This ongoing productivity growth has brought an unprecedented increase in the standard of living to those countries which industrialized their economies early and successfully.¹⁵ There is virtually unanimous agreement today on the essential sources of such ongoing productivity growth: technological progress and the accumulation of capital. Modern research has also made clear that capital must be interpreted very broadly in this context to include not just the sum of all tangible physical assets required for the production of goods and services, but also the non-tangible investments that generate productive payoffs to the economy, in particular human capital (education) and know how (research and development).

Of course, there have been technological advances and capital accumulation long before the advent of the industrial revolution. But as Thomas Malthus and other 19th century thinkers argued, such growth impulses had never set off ongoing per-capita growth because of limits

¹⁴ This is the position argued, among others, by Krugman (1994).

¹⁵ For a neat textbook exposition of the history of economic growth, see DeLong (2002), Chapter 5.

imposed by natural-resource scarcity or by diminishing returns to capital and, most importantly, because they led to increases in the sustainable level of population whereby productivity and living standards were pushed back down to their subsistence level and population growth brought to a halt. There are two distinguishing features which set apart the growth process started by the industrial revolution from the many earlier growth episodes and were responsible for the sustained per-capita growth that ensued. The first feature was an acceleration of technological progress to a pace high enough for overcoming the growth-restraining elements of the Malthusian trap. The preceding increase in world population and the development of property rights which strengthened the incentives for finding and introducing new and better methods of production are commonly given credit for this acceleration of technological progress.¹⁶ The second feature was the demographic transition, i.e. the stabilization of populations on a high level in spite of - or as modern population theory would argue: because of - real per-capita income levels far above subsistence.

These two features of the era of modern economic growth, ongoing technological progress at a non-decreasing pace and a population growth rate which does not endogenously and automatically accelerate in response to rising per-capita incomes, are at the center of Robert Solow's celebrated neoclassical model of economic growth, by now almost half a century old.¹⁷ Whereas Solow made the anti-Malthusian assumption of exogenous population growth, he took explicit account of the endogenous response of the capital stock and the capital-labor ratio to technical change and population growth. His principal and well-known insight was that the fraction of output devoted to investment affects the levels of the time paths along which aggregate output and labor productivity evolve, but not their long-term growth rates. This is not to deny, of course, that additions to the capital stock contribute to output growth. But the endogenous nature of capital stock growth implies that the equilibrium growth rate of labor productivity is uniquely determined by the rate of technical change. More specifically, Solow expressed output Y expressed as a function of capital input K , labor input L , and the state of technology A in the following way:¹⁸

¹⁶ See North (1981) and Jones (2000).

¹⁷ For an exposition, with enlightening observations on more recent developments, see Solow (2000).

¹⁸ The reasons for including the state of technology as a multiplying factor of labor input are of a technical nature and beyond the scope of this paper.

$$3.1 \quad Y = F(K, A \cdot L)$$

If, as Solow assumed, capital and labor exhibit constant returns to scale and factors of production are paid their marginal products, the production function (3.1) implies that the growth rate of output, $\hat{Y}$, is determined by the growth rates of capital and labor input, $\hat{K}$ and $\hat{L}$, respectively, plus the rate of (labor-augmenting) technical progress, $\hat{A}$, according to

$$3.2 \quad \underbrace{\hat{Y}}_{\left(\begin{smallmatrix} \text{rate of} \\ \text{change of} \\ \text{output} \end{smallmatrix} \right)} = \underbrace{\alpha}_{\left(\begin{smallmatrix} \text{capital} \\ \text{share in} \\ \text{national} \\ \text{income} \end{smallmatrix} \right)} \cdot \underbrace{\hat{K}}_{\left(\begin{smallmatrix} \text{rate of} \\ \text{change} \\ \text{of capital} \\ \text{input} \end{smallmatrix} \right)} + \underbrace{(1-\alpha)}_{\left(\begin{smallmatrix} \text{labor share} \\ \text{in national} \\ \text{income} \end{smallmatrix} \right)} \cdot \left(\underbrace{\hat{A}}_{\left(\begin{smallmatrix} \text{rate of} \\ \text{technical} \\ \text{change} \end{smallmatrix} \right)} + \underbrace{\hat{L}}_{\left(\begin{smallmatrix} \text{rate of} \\ \text{change in} \\ \text{labor} \\ \text{input} \end{smallmatrix} \right)} \right)$$

which can equivalently be expressed as

$$3.4 \quad \underbrace{\hat{Y} - \hat{L}}_{\left(\begin{smallmatrix} \text{rate of} \\ \text{change of} \\ \text{labor} \\ \text{productivity} \end{smallmatrix} \right)} = \underbrace{\alpha}_{\left(\begin{smallmatrix} \text{capital} \\ \text{share in} \\ \text{national} \\ \text{income} \end{smallmatrix} \right)} \cdot \underbrace{(\hat{K} - \hat{L})}_{\left(\begin{smallmatrix} \text{rate of} \\ \text{change} \\ \text{of capital} - \\ \text{labor ratio} \end{smallmatrix} \right)} + \underbrace{(1-\alpha)}_{\left(\begin{smallmatrix} \text{labor} \\ \text{share in} \\ \text{national} \\ \text{income} \end{smallmatrix} \right)} \cdot \underbrace{\hat{A}}_{\left(\begin{smallmatrix} \text{rate of} \\ \text{technical} \\ \text{change} \end{smallmatrix} \right)}$$

In contrast to the ‘fundamental identities’ discussed above, equations (3.2) and (3.3) are not true by definition. They are valid descriptions of reality only to the extent that Solow’s assumptions on the form of technological progress and on the operation of markets are correct. It is easy to show that the rate of growth of capital input must converge to the rate of output growth under Solow’s assumptions - which broadly corresponds to what can be observed over the history of capitalist development. If the capital stock grows at the same rate as output in long-run equilibrium ($\hat{K} = \hat{Y}$), equation (3.3) simplifies to

$$\begin{aligned}
 3.4 \quad \underbrace{\hat{Y} - \hat{L}} &= \underbrace{\hat{A}} \\
 \left(\begin{array}{c} \text{rate of} \\ \text{change of} \\ \text{labor} \\ \text{productivity} \end{array} \right) &= \left(\begin{array}{c} \text{rate of} \\ \text{technical} \\ \text{change} \end{array} \right).
 \end{aligned}$$

This is the result mentioned above: The equilibrium growth rate of labor productivity is uniquely determined by the rate of technical change. Moreover, the continued improvement of (average and marginal) labor productivity growth translates into steadily increasing labor demand, which in turn leads to real wage growth at the same rate of technical change, $\hat{A}$, given Solow's assumption of an exogenously determined labor supply (population) and a constant employment rate (full employment).

While all of this is very much in line with the stylized facts of economic growth, it is well recognized that Solow's theory leaves open one crucial question: What drives productivity growth?¹⁹ While the theory gives a clear answer to this question on a purely formal level (productivity growth is driven by technical change), the real question, of course, concerns the driving forces of technical change. Recent research emphasizes a number of factors, including investment in broadly defined capital, spillovers from research and development, international integration and the conditions for structural change, to name but a few. The employment rate as such is in general not regarded as directly important for the process of technological change in this literature. But it is easy to imagine indirect channels of influence running from the labor market to the determination of productivity growth - most importantly, perhaps, the role of labor market flexibility as a precondition for productivity-enhancing factor reallocation and the effect of labor market conditions on human capital formation. We will return to these links in section III, below.

The neoclassical theory of output and productivity growth assumes permanent market clearing on the labor market and hence full employment of the labor force. When the theory was

¹⁹ This question and recent efforts to answer it are the subject of a very useful survey by Stiroh (2001).

developed, this assumption could easily be justified as a reasonable property of a long-run equilibrium. Unemployment was regarded as a temporary problem of deficient aggregate demand to be analyzed within the framework of short-run keynesian theory and curable by means of standard countercyclical monetary and fiscal policies. It was not until the 1970s and 1980s that high unemployment, particularly in Europe, came to be understood as a long-run equilibrium phenomenon, persisting beyond the ups and downs of the business cycle and immune to monetary or fiscal quick fixes. Also, it was quickly realized that this change of paradigm in employment theory did not require any fundamental overhaul of the reigning paradigm of growth economics. Even though Solow had assumed full employment, what his model really required was the anti-Malthusian exogeneity of labor input, which could easily be reconciled with a model of non-zero equilibrium unemployment.

As a matter of fact, the standard theory of equilibrium unemployment fits into neoclassical growth theory perfectly well as it revolves around the interaction of wages and prices. Of course, the level and rate of change of labor productivity play an essential part in this interaction. The central idea in explaining how the labor market finds an equilibrium at less than full employment is that under conditions of imperfect competition on goods and labor markets, both prices and wages are shaped by the market power of firms, workers, and the organizations representing them. The rents that each side can expect to extract from its markets depend on the state of the economy and, in particular, on the state of the labor market.

Figure 3 illustrates the argument. The underlying assumption here is that the labor force is a given quantity which does not vary with the real wage level. The horizontal axis depicts employment, the vertical axis depicts the ratio of the real wage level (RW) to the long-run equilibrium productivity trend A - where A is the technology variable defined in equation (3.1), above. Thus, equilibrium productivity is assumed to be determined by the state of technology of the aggregate economy along the lines of neoclassical growth theory as explained by equations (3.2) - (3.4). This specification emphasizes that persistent unemployment can be regarded as an integral equilibrium feature of a growing economy.

Figure 3: The standard model of equilibrium unemployment

The positively sloped wage-setting curve in Figure 3 expresses the hypothesis that an increase in the employment rate of the labor force leads wage-setters to aim for higher expected real wages. This hypothesis has solid empirical support and can be rationalized in a number of ways. Where collective wage-setting prevails, higher employment strengthens the bargaining position of unions. Where wages are set by firms competing for workers, efficiency wage theory predicts that employers offer wages above market-clearing levels in order to get a better performance from every hour of work they pay for. Whenever the employment situation and thus outside opportunities of workers improve, employers need to raise this wage premium in order to maintain the proper incentives.

The price-setting curve indicates the real wage level, again in relation to the underlying *trend* path of labor productivity, implied by the pricing behavior of firms as they set their prices on the basis of marginal cost (mainly marginal labor cost). This implied real wage is closely related to the *actual* productivity of labor. How it varies with changes in the employment rate depends on the time frame of the analysis. In the long-term growth equilibrium of an economy, the capital stock adapts to any level of employment so as to establish the steady-state capital-labor ratio. Since the productivity of labor reflects the state of technology and the capital-labor ratio, and since the long-term capital-labor ratio is independent of employment, the long-term price setting curve reflects a unique level of labor productivity and an implied real wage level determined by the state of technology regardless of the employment rate. Therefore, the long-term price setting curve is drawn as a horizontal line in Figure 3. As long as the capital-labor ratio has not yet converged to its equilibrium level, a period which can be referred to as the medium term, any expansion of aggregate employment runs into diminishing returns so that the actual real wage implied by the pricing behavior of firms falls with increasing employment. This is why the medium-term price setting curve slopes downward in Figure 3.

Equilibrium in this framework means that the competing income claims of wage and price setters are consistent with aggregate disposable income.²⁰ Employment thereby assumes the role of an equilibrating variable which endogenously adjusts to the level where the real wage desired by wage-setters and the real wage implied by price-setting behavior coincide. In this equilibrium, the real wage level follows a growth path determined by the growth of the productivity of labor, along the lines spelled out by growth theory. With the ratio of the real wage level to the long-term productivity trend depicted on the vertical axis in Figure 3, the long-term equilibrium of the system can be represented as a stationary equilibrium point. This means that, in equilibrium, price setters allow prices to fall short of wage growth by the rate of long-term productivity growth while wage-setters factor in this same long-term productivity growth into their wage demands.

The economic forces that drive employment and unemployment to their equilibrium levels involve the interaction of the wage-price process with the aggregate demand management of fiscal and monetary policymakers. At employment rates above the equilibrium level, wage setters aim at real wages in excess of what the productivity of labor and the market power of producers permit. As price setters respond with marked-up prices, a wage-price spiral is set in motion which results in accelerating wage and price inflation. If fiscal and monetary policies refuse to accommodate the acceleration of inflation, which they sooner or later must if they are committed to the preservation of a working system of monetary exchange, the inflationary pressure and the non-accommodating stance of demand policy combine to depress effective demand in real terms. The ensuing fall of output and employment reduces the inflationary pressure to the point where the inflation rate is stabilized and equilibrium is reestablished.

Armed with this framework for the simultaneous determination of productivity growth and employment, we are now in a position to address the questions of how productivity and employment respond to exogenous shocks and structural breaks and how their interaction evolves over time. The theoretical framework outlined in this section suggests a distinction between three different time frames:

²⁰ The classic reference for models of equilibrium unemployment based on this idea is the monograph by Layard, Nickell and Jackman (1991).

1. In the short run, the economy is out of equilibrium. Output, employment and productivity deviate from their trend paths. The short-run changes of these variables reflect the forces of the business cycle. Standard macroeconomic theory traces these cyclical fluctuations to nominal rigidities or to deviations of realized prices and wages from expected values in the face of aggregate demand disturbances. An alternative interpretation is that of a competitive market economy which remains in permanent equilibrium, but is constantly exposed to real disturbances, in particular productivity shocks. Empirically, the short-run fluctuations of productivity and employment are strongly and positively correlated.
2. In the medium run, nominal wages and prices can be regarded as flexible, expectational errors are eliminated, but the capital stock has not yet adjusted to its steady-state path. In this time frame, there is scope both for a positive and a negative association between employment and productivity, depending on the exogenous forces that cause the two variables to change.
3. In the long run, nominal wages and prices are flexible, expectational errors are absent, and the capital stock has fully adjusted to its steady-state path. Whereas there is some theoretical speculation about channels of interaction that could connect the long-run trends of productivity growth and employment, the empirical picture does not suggest an important role for such an interaction.

Needless to say, this categorization of time frames radically cuts through the complex lag structures present in a dynamic economy. Ultimately, the legitimacy of this systematization hinges on its ability to help explain the changing nature of the employment-productivity relationship over time and space. Much as that relationship may change with the time horizon adopted, there is one common thread not to be lost at any point: In each case, the way employment and productivity move in relation to each other cannot properly be understood without reference to a coherent theoretical framework which treats the realizations of both variables as joint endogenous outcomes of a general equilibrium (or disequilibrium) system responding to exogenous disturbances. In general, the pattern of relative employment and productivity changes crucially depends on the type of disturbance causing it.

III Employment and Productivity: From the Short Run to the Long Run

1. The Short-Run: Cyclical Fluctuations of Employment and Productivity

The cyclical behavior of employment and productivity is one of the most thoroughly studied phenomena of applied business cycle research. The evidence is very clear and robust. Both variables are strongly and robustly pro-cyclical. According to Romer (2001), the US economy went through nine recessions during the postwar period of 1947-1999. In all of these recessions, employment fell. In eight of nine cases, output per hour in nonfarm business fell as well. Output falls by 4,7% relative to its long-term growth rate in an average recession, employment falls by 3,6% and nonfarm output per hour falls by 1,9% (again, relative to their respective long-term growth rates).²¹ Thus, employment and productivity fluctuate substantially over the business cycle, though not quite as strongly as output, and they generally move in the same direction.

Figure 4 illustrates the cyclical behavior of output and employment for Germany, from 1966 to 2000. Clearly, the two variables fluctuate in a highly synchronized way. Output growth exceeds employment growth by the rate of productivity growth (again, the ‘fundamental identity’ at work). With the exception of one single year (1980), the rate of change of labor productivity is positive. Moreover, output growth fluctuates more widely than employment growth. As a result, the difference between the two growth rates is always larger in booms than in recessions - which means labor productivity is solidly pro-cyclical.

Figure 4: Output growth and employment growth in Germany, 1966-2000

Since the labor force does not remotely fluctuate as much as employment over the cycle, the cyclical behavior of employment translates quite directly into a cyclical pattern of the

²¹ Romer (2002), Table 4.3, p. 172. Note that the changes in employment and output per hour do not add up to the change in output because output and employment refer to the aggregate economy whereas output per hour refers to nonfarm business.

unemployment rate. The relationship between output growth and changes in the unemployment rate is so close and robust that it has attained the rare status of an economic „law“: Okun’s Law, named after Arthur Okun’s (1962) path-breaking empirical study which found a fall in output of 3% relative to the normal trend growth rate to be associated with a 1 percentage-point increase in the unemployment rate. Okun’s Law has been retested and remeasured time and again for innumerable countries and time intervals.

Some recent estimates for 15 OECD countries as well as a selective survey of the relevant literature can be found in a companion piece to this background paper (Pollak 2002). The major findings of this and related research can be summarized as follows:

- On the whole, Okun’s Law holds up well for most countries. However, Okun’s coefficient, which links the change in the unemployment rate to output growth, exhibits substantial variation across time and space.
- In some cases, like Japan and Switzerland, the relationship between unemployment and growth was extremely loose in early periods because the unemployment rate remained low and almost constant over the business cycle. As unemployment began to increase in these countries and as it responded more strongly to cyclical output variations, Okun’s coefficient could be estimated more reliably.
- In most countries, Okun’s coefficient fell considerably over the last 30 years. This means that the response of unemployment to cyclical output variations has become stronger. Today, a fall in the unemployment rate by 1 percentage point is in general associated with an extra 1.5 to 2.5 percentage points of GDP growth rather than the 3 percentage points of Okun’s original study.
- Regressions of the change in unemployment on output growth also yield estimates of the so-called „employment threshold“ - the rate of output growth that must be exceeded for the unemployment rate to start falling. From the ‘fundamental identity’, it is evident that this „employment threshold“ must be closely related to the rate of productivity growth and to the rate of change of the labor force. In many countries, the threshold rate has gone

down over time - a development which has been widely hailed as „favorable“ for the labor market and for employment policy. In view of the fact that lower „employment thresholds“ were in most cases due to a marked productivity slowdown, their desirability is far from obvious.

- Whereas variations in the intercept of Okun's equation lend themselves to a relatively straightforward interpretation in terms of productivity and labor force growth, the factors behind the cross-country variation and the secular decline of Okun's regression coefficient are not quite as clear. Most explanations focus on institutional properties of the labour market. In lightly regulated economies such as the United States, firms can easily lay off and hire workers when economic conditions change. Therefore, the response of unemployment to changes in output growth is stronger and quicker, and Okun's coefficient is smaller than in more heavily regulated economies. In the same vein, the fall of Okun's coefficient which can be observed in many countries may be related to labor market reforms that have more recently been attempted in some countries.
- An alternative, but by no means mutually exclusive, explanation for the tendency of Okun's coefficient to fall over time might start from the observation that the higher coefficients of past times were in general associated with much lower unemployment rates. One can think of cyclical output fluctuations as movements up and down the Beveridge curve of an economy.²² Whenever the unemployment-vacancy ratio changes - as it typically does over the business cycle -, a larger fraction of that change is reflected in movements of the unemployment rate rather than the vacancy rate if the unemployment rate is high, and the vacancy rate accordingly low, to begin with. Conversely, when the unemployment rate was low in most (European) economies in the 1960s and 1970s, there was relatively less scope for unemployment to fluctuate over the business cycle so that any given change of the unemployment rate was associated with a larger movement of output.

²² The Beveridge curve is an inverse statistical relationship between the unemployment rate and the vacancy rate. It indicates that the vacancy rate typically rises as unemployment falls during a boom, and *vice versa* in a recession. On the Beveridge curve, see Blanchard/Diamond (1989).

- Interestingly, though, the severity of economic crises experienced by different countries does not seem to be an important factor in accounting for changes in Okun's coefficient over time. Many countries that have experienced long recessions, accompanied by drastic increases in unemployment, display remarkably stable coefficients.²³

Okun's coefficient is rarely found to fall short of unity. Unless there is substantial cyclical variation in the labor force, a coefficient above unity means that the response of employment to changes in output is less than proportional in the short run. As demonstrated by Figure 4, above, this in turn entails a procyclical behavior of labor productivity. Incidentally, this „stylized fact“ of the business cycle is not easily explained by standard keynesian textbook accounts of cyclical output and employment variations. According to textbook theory, changes in effective demand are the dominant cause of short-run output changes which in turn lead to adjustments of the work force as dictated by production requirements. Virtually all production functions commonly used in macroeconomic reasoning imply that, with other factor inputs held constant, labor is subject to diminishing returns. Since there is little short-run variation in the capital stock, these production functions would lead us to expect a more than proportional response of employment to cyclical, demand-induced output changes - which would amount to a counter-cyclical behavior of labor productivity. But this is the opposite of what we can see in the data. The only way to reconcile the keynesian view of the business cycle with the pro-cyclical behavior of productivity is to take account of labor hoarding during recessions. Labor hoarding means that firms do not adjust their work forces all the way down to the absolute minimum during recessions. Rather, experience shows that they prefer to keep more workers on their payrolls than they actually need during a recession in order to avoid adjustment costs and to be ready for the next recovery.

The point is illustrated in Figure 5 where the top panel depicts a production function which links output to employment and whose curvature expresses the hypothesis of diminishing returns to labor. According to keynesian theory, the cyclical variation of output and employment is caused by fluctuations of aggregate demand. In the figure, aggregate demand is assumed to fluctuate between Y_B^d (in a boom) and Y_R^d (in a recession). If firms strictly stayed

²³ For a more detailed account of the empirical findings and for further references to the literature, see Pollak (2002).

on their production function in accommodating the fluctuations of demand, they would move between points B and R' . Obviously, average labor productivity - which can be measured by the slope of a ray through the origin - is higher in point R' than in point B . If firms hoard labor during a recession, however, they rather move off the production function to a point like R where labor productivity is lower than in the boom point B .

**Figure 5: The cyclical fluctuations of employment and productivity:
the keynesian interpretation**

The lower panel of Figure 5 depicts the effective labor demand as implied by the decision to let employment fluctuate between points B and R in the top panel - the „employment function“ in the language of John Maynard Keynes (1936). The movements of effective labor demand in relation to the labor force L^S generate the ups and downs of unemployment that we observe in the course of the business cycle. No particular cyclical behavior of the real wage level can be derived from this analysis without further assumptions on the relative flexibility of nominal wages and prices. But with a suitable description of nominal adjustment processes, the keynesian disequilibrium account of the business cycle is certainly capable of capturing the weakly pro-cyclical behavior of real wages suggested by the data.²⁴

This keynesian theory has not gone uncontested, of course. The major present-day challenge to keynesian thinking is Real Business Cycle (RBC) theory. This theory grew out of the new classical revival that shook macroeconomics in the 1970s. The core message of the new classicists is that business cycles should and can be explained without abandoning the general equilibrium paradigm of the perfectly competitive market economy which has served microeconomic analysis so well. Early attempts at implementing this research program resulted in a monetary theory of the business cycle based on rational expectations, market-clearing and the distinction between anticipated and unanticipated monetary shocks, as pioneered by Robert Lucas (Lucas 1981). Because of conceptual and empirical weaknesses, the new classical monetary theory of business cycles was superseded later on by RBC theory

²⁴ This statement does not apply, however, to Keynes's original exposition of his theory nor to most textbook expositions which follow him in assuming sticky wages and perfectly flexible prices, thereby implying counter-cyclical real wages along with counter-cyclical productivity.

which operates with essentially the same competitive equilibrium model of the real economy, but ignores monetary shocks as a source of business fluctuations and instead places the emphasis on real shocks, in particular on technology shocks.²⁵

The debate between the keynesian tradition in the theory of business cycles and the RBC view is primarily a debate about the right vision of how a market economy is functioning and hence about the right approach to stabilization policy. What is of interest in our context is how keynesian theory and the RBC model differ in their account of the cyclical behavior of employment and productivity. The main difference is easily stated: Since the RBC school views technology shocks - i.e. shocks to the technology variable A in the neoclassical growth model, above - as the driving force of the business cycle, fluctuations in aggregate labor productivity are at the very root of the business cycle rather than just a secondary consequence as in the keynesian model.

Again, a diagram is helpful in setting out the argument. In Figure 6, the top panel demonstrates how exogenous productivity shocks displace the aggregate production function, thus generating a business cycle. F_B is the production function during a boom, F_R is the production function during a recession. The productivity shocks affect not only the average productivity, but also marginal productivity of labor and hence the demand for labor, as shown in the bottom panel of Figure 6. In contrast to the keynesian model, labor demand here is not derived from the production level and labor hoarding behavior of demand-constrained firms, but represents the profit-maximizing response of competitive firms to whatever real wage they face on a cleared labor market. Together with the assumption of a highly elastic supply of labor, the RBC model thus implies a shifting labor market equilibrium and predicts a cyclical behavior of real wages and employment which is fairly similar to the stylized facts established by empirical business cycle research: employment strongly pro-cyclical, real wages weakly pro-cyclical. The fluctuations of employment as derived from the model of the labor market (bottom panel) combine with the shifts of the production function in the top panel to account for the cyclical behavior of aggregate output.

²⁵ An instructive and very accessible introduction to the debate on RBC theory is provided by the exchange between Plosser (1989) and Mankiw (1989).

Figure 6: The cyclical fluctuations of employment and productivity as seen through the lens of Real Business Cycle Theory

Figures 5 and 6 are drawn in such a way that the points *B* and *R* represent exactly the same configurations of output, employment and the real wage in both panels of both figures. It thus becomes clear that the two theories explain the same facts, but in completely different and contradictory ways. Apart from other differences, they are at odds on the nature of the causal relationship linking employment and productivity. According to RBC theorists, the cyclical behavior of labor productivity largely stems from exogenous technology shocks to which producers and workers adjust their output and employment decisions. Keynesians, in contrast, attribute the cyclical variation of output mainly to exogenous changes in aggregate demand and explain the pro-cyclical behavior of productivity in terms of the lagged adjustment of employment. The only thing the two approaches have in common are the raw facts.

Which of these interpretations is correct matters a great deal for the formulation of the proper policy response to employment fluctuations. Proponents of the RBC view do not think that the business cycle inherent poses a policy problem, but view it as an expression of how a system of competitive markets efficiently handles a stochastic and unpredictable business environment in which it has no choice but to operate. What policy can do according to this view, is to make sure markets are left free to react to exogenous shocks in as efficient a manner as possible and, equally important, to avoid becoming a source of unpredictable disturbances itself. Real shocks that emanate from government behavior, in particular major changes in regulatory, spending and tax policies, play a quantitatively important role in empirical applications of RBC theory. The keynesian position, in contrast, is well known: Since it takes business downturns and the concomitant unemployment as first-hand evidence of a deeply rooted failure of the market system in dealing with the vagaries of private spending behavior, it calls for corrective action directed towards the stabilization of aggregate demand growth.

This is not the place to discuss in depth the merits of and objections against the two theories. Suffice it to say that keynesian theory has long been criticized for its lack of convincing

microeconomic foundation, i.e. essentially for assuming rather than proving the market imperfections and coordination failures that it stipulates are at the root of the business cycle. Keynesians have quickly refuted the initial claim by new classicists that the lack of microfoundations condemns the keynesian paradigm to empirical failure. In fact, they have responded to this challenge by developing a large number of interesting ideas about the microeconomic sources of macroeconomic market failure.²⁶

A major objection against RBC theory is that it, too, prejudices its case by attributing to exogenous changes of technology all output movements which it cannot directly trace to changes in labor or capital input. With this procedure, it is all but a foregone conclusion that technology shocks explain the business cycle for the most part. Moreover, the alleged technology shocks do not easily lend themselves to independent verification. There is no scope for monetary disturbances to play a destabilizing role. The high elasticity of labor supply which is crucial for generating employment variations of a realistic dimension is not confirmed by microeconomic studies of household behavior. Most importantly perhaps, the market-clearing framework appears unsuitable to account for widespread involuntary unemployment. Of course, there are answers to most of these objections. The RBC paradigm can accommodate unemployment if it is augmented by a search-theoretic model of labor market flows. Also, it can account for real wage rigidity if combined with an efficiency wage theory or a wage bargaining model of the labor market. It can account for monetary disturbances if a nominal rigidity is thrown in at the right place. Technology shocks can be interpreted broadly to encompass changes in the regulatory environment or in exogenous factor input prices.

Nevertheless, it must be said that adherence to the RBC view carries the risk of encouraging dangerous inaction in the face of a really deep crisis. What was the technological regress that drove the world economy into the Great Depression of the 1930s? What helped the world economy out of the Great Depression again if not a massive recovery of demand? Which technology shock has caused Japan's present paralysis? Remarkably, there are answers even to these questions. In recent research, Prescott (2002) and Hayashi/Prescott (2002) conclude that

²⁶ Most of these developments are well surveyed by George Akerlof (2002), one of the pioneers of new keynesian thinking.

a standard neoclassical growth model plus the assumption of a sudden and exogenous fall in the growth rate of total factor productivity (TFP) growth is perfectly able to replicate the path of the Japanese economy in the 1990s. „The only puzzle is why the TFP growth was so low subsequent to 1990“, they add.²⁷ However, their efforts to solve this puzzle do not go beyond the conjecture that subsidies to inefficient firms and declining industries might be the culprit. The recommendation that follows with unflinching logic is to end those subsidies and perhaps to correct some other distortions.

Of course, it is hard to disagree with the diagnosis that the elimination of distorted incentives which prevent resources from being allocated to their best uses must ultimately be a good thing for productivity. But it is very hard to believe that Japan did not have these problems before 1990. If the conventional wisdom is right, which maintains that the deep crisis of the Japanese economy reflects a collapse of domestic demand in the wake of a burst asset price bubble, eliminating distortions will not remotely be enough to heal the patient. What is needed is massive reflation.²⁸ Hayashi and Prescott are not willing to acknowledge a causal role for the burst asset price bubble. In their view, the chain of causation runs from the productivity problem to the bubble rather than the other way round: The high asset prices and buoyant investment spending reflected the expectation of continued high productivity growth. It all collapsed when the overoptimistic expectations failed to materialize.²⁹

The bottom line is this: Different accounts of the cyclical behavior of output, employment and productivity may coexist and they may all satisfy the minimum requirement of consistency with the stylized facts. But they differ in their assessment of cause and effect and thus cannot agree on the proper policy response. The problem is that any action based on a false diagnosis can cause serious harm to the economy. If the RBC view of the world is correct, keynesian stabilization policies represent a misguided attempt to smooth a stochastic dynamic process that cannot be smoothed and is not in need of smoothing. If the keynesian view of the world is correct, however, the recommendation of microeconomic reforms as a cure for Japan-style

²⁷ Hayashi/Prescott (2002), p. 20?.

²⁸ Among the many blueprints for a revival of effective demand in Japan, Krugman's (1998) plan of a credible inflation target and Svensson's (2001) proposal of a price level target supported by exchange rate depreciation have perhaps received the most attention.

²⁹ See Hayashi/Prescott (2002), p. ??.

economic stagnation is much like treating pneumonia with aspirin on the grounds that the patient's behavior does not contradict the hypothesis of an exogenous bout of fever.

2. The Medium Run: Shocks and Institutions

The discussion of the short run has made no reference to the model of unemployment determination described in Figure 3, above, because the theory of the cyclical fluctuations of employment and productivity essentially concerns the deviations from equilibrium unemployment. As we move beyond the time frame of the typical business cycle, however, and look at developments over 5, 10 or 15 years, the properties of the equilibrium itself move to the center of the stage. The current consensus in the theory of unemployment maintains that any analysis of changes in equilibrium unemployment must revolve around two key concepts: shocks and institutions.³⁰ The basic idea is that the labor market is subject to exogenous shocks such as changes in underlying productivity growth, energy prices, real interest rates or taxation. Whether or not such shocks affect equilibrium unemployment, and how they affect it, depends in important ways on the institutional set-up of the labor market. Labor markets differ in the extent of social insurance and employment protection extended to workers, they differ in the legal framework governing wage negotiations and in many other rules of the game.

Since labor market institutions are widely blamed for causing high unemployment, in particular in Europe, they are frequently referred to as „labor market rigidities“ (e.g. by Siebert 1997). A central tenet of the ‘shocks and institutions’ view is that institutions by themselves explain relatively little as they have changed nowhere as dramatically as unemployment has. But they mediate the impact of shocks and thus have the potential to explain why countries differ so much in their response to essentially the same shocks. The relation between institutions and labor market outcomes clearly involves a two-way interaction: Institutions shape the employment effects of shocks, but the state of the labor market in turn feeds back into the evolution of the institutional framework. A case in point is the increase in the

³⁰ This point of view has recently been emphasized by Blanchard (2000) and Blanchard/Wolfers (2000), in particular. But it is also the organizing idea in the approach taken by Layard et al. (1991).

generosity and duration of benefits with which legislators responded to rising unemployment in many countries.

What is the role of productivity in all this? Productivity is central to the determination of equilibrium unemployment because it affects both the wage setting and the price setting function which jointly determine the position of the equilibrium. Thus, structural breaks in the underlying productivity trend are a potentially important source of disturbances on labor markets. Moreover, there are repercussions to productivity whenever the system adjusts to other exogenous shocks, particularly to shocks that affect capital formation.

Two instances of important changes in productivity trends have received particular attention in the literature: the worldwide productivity slowdown of the 1970s and the astonishing acceleration of productivity growth in the United States since the mid 1990s. The logic by which such changes affect equilibrium unemployment is easily explained with the help of Figure 3. Since both the wage setting and the price setting schedule are defined in terms of the real wage relative to trend productivity, it is obvious that the equilibrium point can remain unaffected by productivity shocks only if such shocks are fully and immediately taken into account in wage setting as well as in price setting decisions. But this does not appear to happen. While productivity changes find their way into the mark-up calculations of price setters with very little delay, wage setters take much longer to adjust their real wage targets to reality. In terms of the model in Figure 3, this means that whenever productivity grows faster than wage setters' wage aspirations, the wage setting curve shifts downwards. As a consequence, real wages fall relative to the path of trend productivity and the equilibrium unemployment rate falls as well. The opposite happens in the event of an unanticipated productivity slowdown.

The history of post-war Europe provides a number of case studies which illustrate this mechanism. In the two decades after the end of World War II, spectacular growth rates were achieved, especially in Germany where the scope for reconstruction and catch-up was immense. Germany's famous *Wirtschaftswunder* was not only a growth miracle but also an employment miracle as a very high unemployment rate - above 10% in 1950 - was quickly brought down notwithstanding the huge immigration flows from the East. One of the key

ingredients to this employment miracle were decreasing labor costs and widening profit margins.³¹ Interestingly, this pro-growth stance of wage policy was not the result of weak unions or conscious modesty on the part of workers. Quite to the contrary, wages rose rather fast in those boom years. But unit costs were kept in check by the unexpectedly high productivity growth which the economy managed to sustain year after year. Wage setters could not fail to take note of the exceptional productivity gains, but they simply did not believe they were sustainable.³²

Eventually, the high post-war productivity growth rates did prove unsustainable, of course. But this did not happen until the early 1970s. When it happened, wage setters were again ill-prepared for the change. As Bombach (1985, p.96-97) aptly put it: „Unions became growth-conscious just when growth slowed down.“ The adjustment was complicated by the coincidence of the productivity slowdown with other major macroeconomic turbulences, in particular the first oil-price shock, the end of fixed exchange rates and the first serious recession of the postwar era. Therefore, the secular break in the productivity trend could not easily be disentangled from the short-run effects of demand-side disturbances.

An explicit simulation of the dynamic adjustment process by which wage setters revised their estimate of underlying productivity growth downwards was conducted by Blanchard (2000). Using a simple adaptive mechanism to model the expectations of productivity growth, Blanchard easily managed to construct a plausible scenario in which the „comprehension lag“ of wage setters (a term he attributes to Robert Solow) extends to a decade and beyond. In the interim, the misperception of the productivity trend causes excessive wage pressure, reduced profit margins and higher unemployment. Blanchard’s conclusion from this exercise is that „the slowdown in [total factor productivity] growth in the mid-1970s can potentially explain much of the increase in European unemployment at least over the following 10 years, perhaps up to the mid or late 1980s.“³³

³¹ A detailed account of the rise and decline of the German miracle, and of labor market developments in particular, can be found in Giersch/Paqué/Schmieding (1992).

³² See Giersch/Paqué/Schmieding (1992), p. 76-78.

³³ Blanchard (2000), Lecture 1, p. 11.

In view of the rational expectations paradigm that is by now so widely accepted among macroeconomists of all persuasions, the plausibility of a result based on such slow learning is certainly open to some doubt. It is indeed remarkable that wage-setting, under a wide variety of labor market settings, seems to adapt to changes in the pace of inflation with much less delay than to changes in productivity growth. One possible explanation for this asymmetry may lie in the fact that changes in underlying productivity trends are much more difficult to detect than price changes, not only because of the cyclical component in the productivity figures, but also because the observed behavior of productivity is not independent of the type of wage policy pursued. As long as wage claims are based on an extrapolation of past productivity growth when in fact technical change has slowed, wage pressure is being built up and employment falls. This causes the economy to go through a phase of above-normal capital intensity. Since the productivity of labor is positively related to the capital-labor ratio, the downward adjustment of actual productivity growth is delayed and hence less likely to be factored into wage settlements right away. Although previous rates of real wage growth are no longer warranted in view of declining technological progress, they appear to „pay for themselves“ in terms of measured productivity - at least for a while.

As time goes by, firms adjust their investment spending downwards in an effort to reestablish their optimal capital-labor ratios. Through this ongoing disinvestment, the medium-term price-setting curve of Figure 3 shifts downwards and moves the economy towards its long-term price-setting curve. In the process, the underlying productivity slowdown becomes increasingly visible in the data and the adverse repercussions on employment are reinforced and prolonged. The endogenous adjustment of capital formation thus turns out to be a very important element in the chain of events leading up to the parallel deterioration of productivity growth and employment which is so evident for Germany in Figure 2, above.

Even though this account goes some way towards explaining how the productivity slowdown of the mid 1970s could have had much deeper and longer-lasting labor market effects than one might believe at first sight, the exogenous productivity shock cannot be the whole story. Indeed, other mechanisms have been identified that must have contributed to the simultaneous weakening of productivity growth and labor demand in much of Europe over the last decades. One factor that has received a great deal of attention in the literature is the increasing burden

of taxation in general, and the taxation of labor in particular. With respect to the labor market, the effects of rising labor taxes and of an exogenous productivity slowdown are almost identical: Both reduce the feasible growth rate of net real wages. Both would hardly affect gross wages and employment under conditions of perfect real wage flexibility. But with limited real wage flexibility, they both lead to higher unemployment and falling investment, along with lower output growth. A recent study by Daveri and Tabellini (2000) confirms and quantifies these effects of labor taxes, conditional on the type of labor market institutions. Thus they find that „higher tax rates on labor are indeed shifted onto higher gross wages in continental Europe, but not in the other OECD countries“ and that, as a consequence, „the high positive correlation between tax rates on labor income and unemployment is clearly a phenomenon of continental Europe...“³⁴

In addition to the productivity slowdown and the increasing taxation of labor, which can both be regarded as exogenous forces directly operating on the equilibrium of the labor market, another development is widely suspected to have contributed, in a less direct manner, to slower growth and higher unemployment: the high level of real interest rates prevailing in the 1980s and much of the 1990s.³⁵ The steep rise of interest rates from the low - in some cases even negative - levels of the 1970s clearly had an adverse impact on capital formation, thus reinforcing the disinvestment incentives that were already in place in the wake of the productivity slowdown as discussed above. In terms of Figure 2, an increase in capital costs, by reducing the equilibrium capital-labor ratio, shifts the long-run price-setting schedule downwards and thus exacerbates the tension between the real wage aspirations of wage-setters and the real wage level warranted by the productivity of labor and the market power of firms. Again, there is a presumption that wage setters should be capable of adjusting to whatever the equilibrium level of the capital-labor ratio happens to be in the long run. But in the medium run, while the process of scaling down wage aspirations remains incomplete, the slowdown in the growth of the capital-labor ratio reduces both productivity growth and employment.³⁶

³⁴ Daveri/Tabellini (2000), p. 54 and 52, respectively.

³⁵ See Blanchard (2000), Lecture 1 (section 3) and Phelps (1994).

³⁶ For a model of the interaction between capital costs and real-wage rigidity as well as some empirical evidence on the importance of capital costs for investment in the case of Germany, see Landmann/Jerger (1993).

The productivity slowdown, the rising rates of labor taxation and high real interest rates are best seen as complementary explanations for the severity and persistence of the poor employment, investment and productivity performance in much of continental Europe over the last three decades. The model sketched in Figure 2, above, demonstrates how all these explanations fit into a framework of medium-term analysis which can account for a negative correlation between productivity growth and unemployment well beyond the ups and downs of the business cycle.

Is this framework suitable to accommodate the diverse picture conveyed by cross-sectional (cross-country) data? As hypothesized by the shocks-cum-institutions approach, it should be possible to trace international differences in the evolution of unemployment either to the differential intensity of the shocks hitting different countries or to differences in the country-specific institutions that determine the shock-absorbing capabilities of an economy. More specifically, if the United States experienced a much smaller increase in equilibrium unemployment than continental Europe after the mid 1970s, this can be attributed both to smaller shocks - a less pronounced productivity slowdown and at most a moderate increase in labor taxes - and to a more flexible labor market which did not translate these shocks into higher unemployment to the same extent as Europe's less flexible labor markets did. Some of the increase in equilibrium unemployment of that time was in fact explained by an adverse shift in the composition of the US labor force which was in part reversed more recently.³⁷

How, then, does our analytical framework accommodate the Atlantic Divide documented in Table 2, i.e. the coincidence of low unemployment, high employment growth and low productivity growth in the United States as compared to high unemployment, low employment growth and high productivity growth in Europe throughout the 1970s and 1980s? The answer is that the difference in average productivity growth as such has little to do with, but reflects the specific historical context of the growth process on each side of the Atlantic. Starting from much lower levels of productivity in the aftermath of World War II, Europe was on a path of convergence and catch-up associated with substantially higher productivity growth than that realized by the technological leader, the United States.

³⁷ See Shimer (1998).

The convergence process did not by any means create the differential labor market performance, but the sharp productivity slowdown which was inevitable in Europe as the convergence process was nearing completion did strain the limited adjustment capability of Europe's social fabric and thereby contributed to the deterioration of the employment situation, as discussed above. In short, the trade-off between productivity growth and employment growth suggested by Table 2 is spurious.³⁸ The attainment of full employment does not come at the cost of poor productivity growth. High productivity growth does not limit the scope for expanding employment. If anything, the opposite is true.

One proviso to be attached to this clear-cut conclusion concerns a compositional bias that egalitarian wage policies and the design of social safety nets have inflicted on European employment. By squeezing the dispersion of earnings, these policies have virtually priced the low-wage segment of the economy out of the market. This may have caused an upward bias to measured average productivity as well as to the average real wage level. It has certainly caused unemployment disproportionately to afflict unskilled labor. As a consequence, any successful attempt to reintegrate these unemployed into the employment system might well have an adverse impact on aggregate productivity and real wage averages. What is important from a political angle, though, is that any such productivity or wage effect is merely a statistical mirror image of a changing composition of the work force and, therefore, does not imply an income loss of any sort for hitherto employed persons.³⁹

If the spurious nature of the alleged productivity-employment trade-off required any further proof, it is provided by the astonishing acceleration of U.S. productivity growth in the 1990s. For the first time since the end of World War II, the United States surpassed Europe in terms of productivity growth on a sustained basis. Thus, the U.S. productivity miracle marks the end of the Atlantic Divide as far as superior European productivity performance is concerned. However, the Divide is still there in terms of labor market performance. In fact, it grew wider as the U.S. unemployment rate fell to levels not seen since the 1960s while unemployment in the major economies of continental Europe remained stubbornly high. Moreover, the exceptionally low U.S. unemployment rate cannot entirely be dismissed as a by-product of an

³⁸ This point was forcefully made by Gordon (1997).

³⁹ The relation between the inequality-unemployment trade-off and the aggregate productivity performance is discussed more thoroughly in Landmann (2000).

overheated economy, but clearly reflected a fall in the equilibrium rate of unemployment as well. Otherwise, inflation would have shown signs of renewed acceleration, which it did not.

Among the many factors that have been considered as proximate causes of this favorable combination of low unemployment and low inflation, the unexpected acceleration of productivity growth not surprisingly is a prime suspect. In a recent study, Ball and Moffitt (2001) have presented an estimate of equilibrium unemployment based on a Phillips curve model for the United States. The distinguishing feature of that model is that productivity growth feeds one-for-one and rapidly into the price-setting equation whereas wage increases are determined largely by unemployment and past wage increases. This means that changes in productivity growth are reflected in wage-setting behavior only with a considerable lag. With this simple set-up, Ball and Moffitt are capable of explaining a large part of the variation in equilibrium unemployment since the early 1960s, and its fall in the 1995-2000 period in particular.⁴⁰ Thus, notwithstanding all the differences in historical and institutional circumstances, this explanation of the most recent U.S. jobs miracle tells much the same story as did earlier accounts of the productivity-employment link during Germany's post-war *Wirtschaftswunder*.

3. The Long Run: An Iron Law

Whatever the employment effects are that exogenous shocks might engender in the medium term by displacing either the wage-setting or the price-setting curve, they all depend on the imperfect adaptation of wage-setting behavior to changes in the evolution of feasible net real wages. The implied co-movements of employment and productivity depend on the nature of the shocks that are hitting an economy and on the adjustment dynamics both of wage-setting behavior and of capital formation. Clearly, the reference point for any description of such adjustment dynamics is a long-run equilibrium defined by two key properties: the absence of any misperception of feasible wages on the part of wage-setters and the absence of any

⁴⁰ A closely related analysis leads Lynch and Nickell (2001, p. 558) to the conclusion that the unexpected acceleration of total factor productivity growth by about 0.6 percentage points might have temporarily contributed some 0.36 to 0.6 percentage points to the fall of U.S. equilibrium unemployment since 1995.

discrepancy between actual and desired capital stocks on the part of firms. As pointed out above, the transition paths leading up to a long-run equilibrium can be quite complicated and drawn out. So why should we bother considering the implications of an equilibrium which is so remote that new shocks are likely to hit and to set in motion new adjustment dynamics long before the economy gets even close to eliminating any previous disequilibrium? After all, John Maynard Keynes famously warned us to give too much thought to a long run we might not live to see. As a matter of fact, the bulk of practically relevant questions concerning the determination of employment fall in the domain of the short run and the medium run - which is why these two time frames have received most of the attention in this paper. But some of the long-standing concerns about a market economy's capability of maintaining full employment in the face of ongoing technological progress and capital-labor substitution - from Thomas Malthus and Karl Marx in the 19th century up to present-day „end-of-work“ doomsters - really do refer to the very long-term trends of employment and productivity. This is why we briefly return to them at this point.

We have already discussed at length above what economic theory can tell us about the determination of long-term productivity trends. What about the determination of employment and unemployment in the long run? Here is what an authoritative textbook on unemployment theory says about this question:

”Despite all [the variation of unemployment over time], unemployment is untrended over the very long term. This is a key point. It suggests that ultimately there are very powerful mechanisms at work which have forced the number of jobs to respond to huge changes that have occurred in the numbers of people wanting to work. It also suggests that in the long term productivity and taxes have no impact on unemployment.”⁴¹

This is indeed a key insight. Its empirical support in long-term unemployment data is so strong that it seems safe to say that this is about as close to an iron law as macroeconomics is likely to get. What it means is that in spite of the numerous imperfections that prevent the labor market from operating in the manner of a regular competitive market, the forces of law and supply have always been strong enough in the long term to bring the number of jobs

⁴¹ Layard et al. (1991), p. 5.

roughly in line with the size of the labor force, no matter how much the number of workers has increased or how much productivity growth has reduced the labor requirement per unit of output. As Lindbeck (1993) has rightly emphasized, this does not mean that the equilibrium rate of unemployment is some sort of a natural constant to which the actual unemployment rate must sooner or later converge. Changes in the composition of the labor force, in the properties of the matching process, in the design of the social safety net, in labor market legislation and in related institutional rules of the game can hardly fail to be reflected in the very long-term average rate of unemployment.⁴² But given these structural characteristics of the system, one would not expect even drastic changes in exogenous parameters such as productivity, the labor force, aggregate demand or the level of taxation to have a permanent effect on the unemployment rate once the short-run and medium-run adjustments have run their course - unless, of course, such exogenous shocks feed back into the institutional framework of the labor market.

Having said this, it must be acknowledged that recent theoretical research has identified a number of channels through which the equilibrium rate of unemployment and the process of economic growth could potentially affect each other even in the very long run. Among the effects considered in this research are the following:⁴³

- *The capitalization effect*: In a model of unemployment in which the hiring of workers is costly, more rapid growth raises the rate of return on hiring and may thereby lower equilibrium unemployment.
- *Creative destruction*: If economic growth brings about structural change, more rapid growth raises the rate of job destruction and may thereby raise frictional and structural unemployment.
- *Biased technological change*: If technical change affects the structure of labor demand, favoring skilled labor at the expense of the unskilled, if wage differentials are rigid, and if the structure of labor supply is slow in responding to the changed skill requirements, more rapid growth may raise equilibrium unemployment.

⁴² See Lindbeck (1993), p. 9.

⁴³ The following paragraphs borrow from Calmfors/Holmlund (2000), section 4.

- *Joint determination of unemployment and growth*: The same political and institutional framework that shapes the operation of the labor market may also affect the dynamism of economic growth. To take an example, a society which values „social justice“ highly relative to the efficient operation of markets is prone to run redistributive policies that interfere both with the allocative role of the labor market and with the incentives to invest. Such a society may be expected to experience both higher unemployment and lower growth in the long run than a society with broad support for a market-friendly economic environment. In a similar vein, a recent OECD study argues that labor and product market regulations which restrict the entry of new firms and the reallocation of jobs towards rapidly growing high-tech sectors may well act as a drag not just on employment, but also on productivity growth.⁴⁴

Some of these hypotheses may sound more convincing than others. They all share the lack of systematic empirical evidence that might support or refute them. Until this changes, the presumption that the determinants of long-run productivity growth and of long-run equilibrium unemployment are largely independent appears to be a reasonable working hypothesis.

⁴⁴ See Scarpetta et al. (2002).

IV Summary and Conclusion

1. The links between employment, productivity and output growth discussed in this paper are central to the 2003 World Employment Report's overarching theme of poverty reduction and productivity. Where poverty persists, it invariably does so because societies fail to deal effectively with unemployment, low productivity and income inequality.
2. Employment, the productivity of labor and aggregate output are linked by the so-called „fundamental identity“. While this identity can play a useful role in organizing our thinking about the links between the three variables, it cannot justify any inferences about cause and effect.
3. Perhaps the best-known misuse of the „fundamental identity“ is the widely-believed assertion that too high a rate of productivity growth can crowd out employment growth and thereby become a source of unemployment. This assertion is based on the „lump of labor“ fallacy and has no empirical support.
4. Equally popular, and equally based on the „lump of labor“ fallacy, is the proposition that unemployment can be alleviated by shrinking the effective supply of labor - be it by shortening working hours or by reducing labor market participation. Again, there is no empirical support for the belief that either policy works. Across OECD countries, there is no significant correlation between working hours and the employment rate whereas the correlation between the employment rate and the participation rate is strongly positive. This empirical picture is consistent with the view that societies suffering from high unemployment defensively respond by cosmetic operations which do not address the roots of the problem, but keep the unemployed out of the unemployment statistics.
5. Nothing has done more to keep the notion of a trade-off between employment and productivity alive than the opposite labor market experiences of the United States and the European Union since 1970. Over the 1970s and 1980s, the United States and the European Union achieved quite similar rates of output growth with totally different employment intensities. The U.S. „jobs miracle“ was widely attributed to the high employment intensity of output growth in the United States whereas the European unemployment crisis was blamed on excessive capital-labor substitution which entailed

too low an employment intensity of growth. However, it is highly misleading to represent the different employment elasticities on each side of the „Atlantic Divide“ as a matter of choice in the sense of different desired realizations from largely the same set of options. Rather, the fast pace of job creation in the United States was to a large extent the mirror image of an equally rapid labor force growth while Europe experienced unusually high productivity growth as a corollary of the post-war convergence process. In the course of the 1990s, the relative productivity performance of the United States and Europe was reversed, mainly due to the extraordinary pick-up of U.S. productivity growth. At the same time, the relative rates of employment creation continued to diverge in favor of the United States, thus further discrediting the notion of a trade-off between employment and productivity.

6. Turning from the cross-country evidence to the time-series behavior of employment and productivity growth within countries, the following empirical picture emerges: Employment and productivity are strongly and positively correlated over the business cycle as both variables fluctuate in a robustly pro-cyclical way. The positive correlation appears to survive beyond individual business cycles as the rate of productivity growth is subject to occasional changes such as the productivity slowdown of the 1970s or the pick-up of U.S. productivity growth associated with the „New Economy“ in the 1990s. In an even longer-term perspective, encompassing several decades and more, productivity and employment evolve along largely independent paths.
7. The theoretical framework commonly used to account for the evolution of productivity over time and the theory of equilibrium unemployment are related: Standard growth theory explains productivity growth in terms of technological progress and capital accumulation, with the latter endogenously adjusting to the former so that steady-state productivity growth is equal to the rate of technological progress. Equilibrium employment and unemployment, in turn, are analyzed by modern employment theory in terms of the interaction of wage setting and price setting both of which can be thought of as responses to productivity growth. Thus, output, productivity and employment are best understood as resulting from a process of joint determination. Their variation through time reflects the response of wages, prices and quantities (both stocks and flows) to a multitude of exogenous shocks hitting the economy.

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8. The most widely accepted explanation for the pro-cyclical comovements of productivity and employment rests on two pillars: the hypothesis that the slow adjustment of nominal wages and prices translates demand-side disturbances into cyclical output movements; and the hypothesis that adjustment costs prevent employment from adjusting to changes in output without delay. An alternative interpretation is proposed by real business cycle (RBC) theory. This approach looks at business fluctuations as the optimal dynamic response of a competitive general-equilibrium system to real shocks, in particular exogenous productivity shocks. While both theories are consistent with some major stylized facts of the business cycle, they lead to radically different attitudes towards stabilization policy. If the RBC view is correct, keynesian policies are ineffective and possibly even counter-productive. What RBC theorists propose, therefore, to handle a situation such as Japan's current economic malaise is essentially microeconomic structural reforms. However, such advice is bound to prolong and exacerbate high unemployment and low productivity if the situation in fact calls for massive demand-side reflation, as the keynesian view suggests.
 9. To explain changes in unemployment that persist beyond individual business cycles, the modern theory of unemployment is focusing on the interaction of shocks and institutions. The shocks affect equilibrium unemployment mainly because wage setters are slow to take them into account. Labor market institutions determine the dimension of such effects as well as their persistence. Among the shocks that have caused major changes in equilibrium unemployment, structural breaks in the trend path of productivity have repeatedly played an important role. Even for the United States whose flexible labor market might be expected to absorb such shocks relatively quickly, it can be demonstrated that unexpected changes in productivity growth affect equilibrium unemployment because the wage-setting process is slow to respond. The fall in U.S. equilibrium unemployment since 1990 is a case in point. In this way, productivity shocks easily explain the positive correlation of productivity and employment trends in the medium run, but so do other shocks once the endogenous response of capital formation is taken into account.
 10. If shocks affect unemployment only because of various adjustment lags, as most theories maintain, it does not come as much of a surprise that changes in productivity, the labor

force, aggregate demand or the level of taxation appear to lose any influence on unemployment once the time frame is extended to the very long run. Although the unemployment rate is trendless in any truly long-term perspective, it is not a natural constant. Its long-term average level inevitably reflects the structural and institutional characteristics of the economy.

11. A low unemployment rate and rapid productivity growth are the hallmarks of a successful economy and thus top priorities of economic policy. Popular thinking about these two variables often tends to regard them as conflicting targets. In fact, as this paper has argued, they are interrelated in many complex ways and the nature of the mechanisms linking them changes with the time frame adopted. But on the whole, there is more harmony than conflict between them, and their mutual interdependence is weaker in the long run than in the short run. No policy action that promises to raise long-term productivity growth should ever be rejected on the grounds that it might cost jobs in the short term. And no policy action that promises to lower equilibrium unemployment should ever be rejected on the grounds that it might create a low-productivity economy.

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**Components of per capita income in an
international comparison, 1997**
(in % of the OECD average)

Country	GDP per hour worked (1)	Effect of annual working hours (2)	Effect of employ- ment rate (3)	Effect of participa- tion rate (4)	Effect of age structure (5)	Per capita income ^{a)} (6)
Belgium	128	- 5	- 3	- 19	- 1	101
France	123	- 9	- 6	- 9	- 2	97
Nether- lands	121	- 26	2	- 4	2	96
Greece	75	- 4	- 2	- 11	1	58
Italy	106	- 11	- 5	- 1	2	91
Spain	84	13	- 14	- 13	2	71
Ireland	108	5	- 4	- 12	- 3	95
Germany ^{b)}	105	- 5	- 3	- 4	2	96
United Kingdom	100	- 9	0	3	- 2	92
Turkey	36	2	0	- 8	- 1	29
Finland	93	0	- 7	2	0	88
Sweden	93	- 3	- 3	6	- 4	88
Norway	126	- 17	4	12	- 4	122
Austria	102	- 4	3	- 2	1	100
Australia	96	0	- 1	2	0	97
Canada	97	2	- 2	2	2	100
Portugal	56	2	0	1	1	60
United States	120	- 1	3	9	- 2	128
New Zealand	69	8	1	3	- 1	79
Denmark	92	0	1	9	1	103
Switzer- land	94	0	3	12	1	111
Japan	82	10	4	6	4	106
OECD ^{c)}	100	0	0	0	0	100
^{a)} Total of the columns (1) to (5). - ^{b)} Including former East Germa- ny. - ^{c)} All listed countries.						

Source: US Department of Labor, Monthly Labor Review, July 1999, p. 36.

Table 1: A quantification of the augmented fundamental identity for 22 OECD countries

	1970 - 1990	1990 - 2000
United States		
Employment	2,1	1,3
Productivity	1,1	1,9
Output	3,2	3,2
Europe (EU 11)		
Employment	0,4	0,6 ¹⁾
Productivity	2,4	1,5 ¹⁾
Output	2,8	2,1 ¹⁾

annual growth rates (in %); Source: OECD

¹⁾ 1991 - 2000

Table 2: Employment and Productivity in the United States and Europe, 1970 - 2000

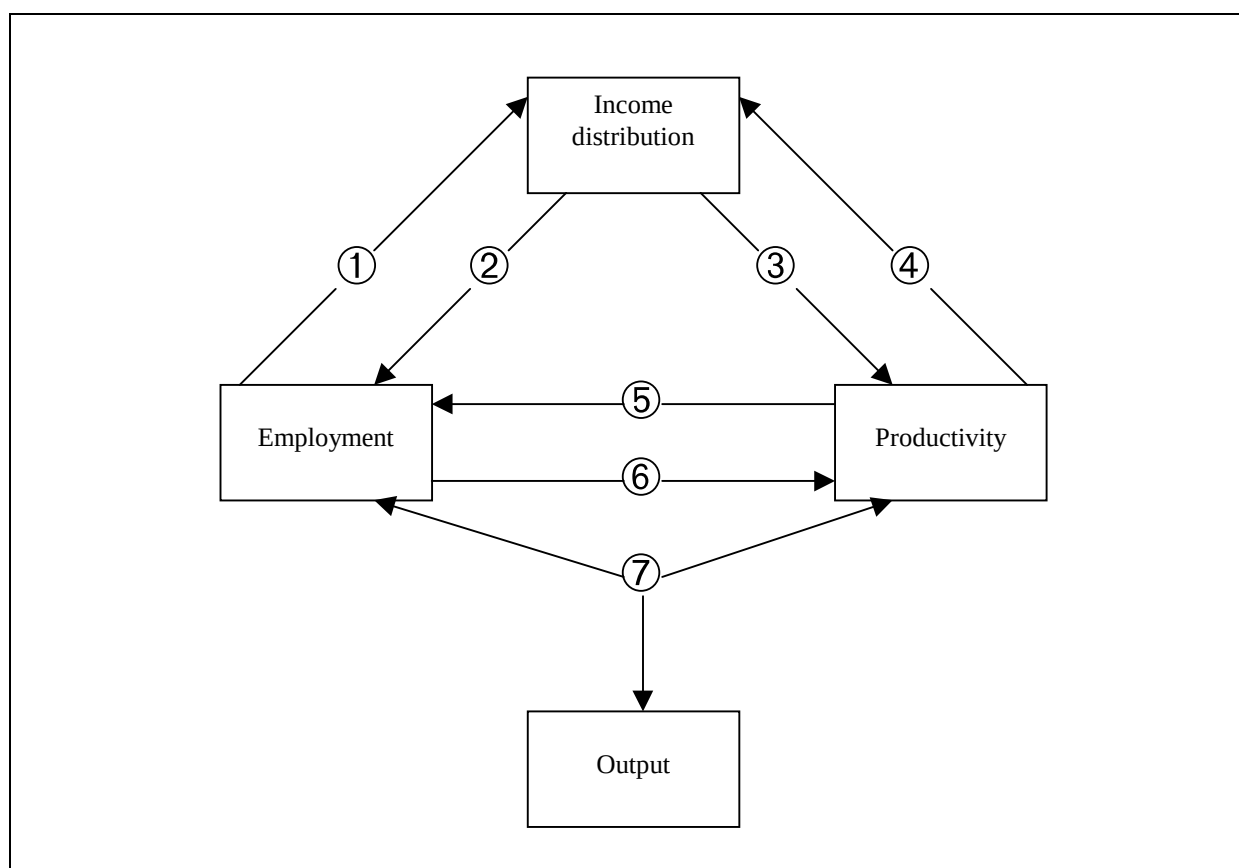


Figure 1: Income distribution, employment, productivity, and production are closely intertwined

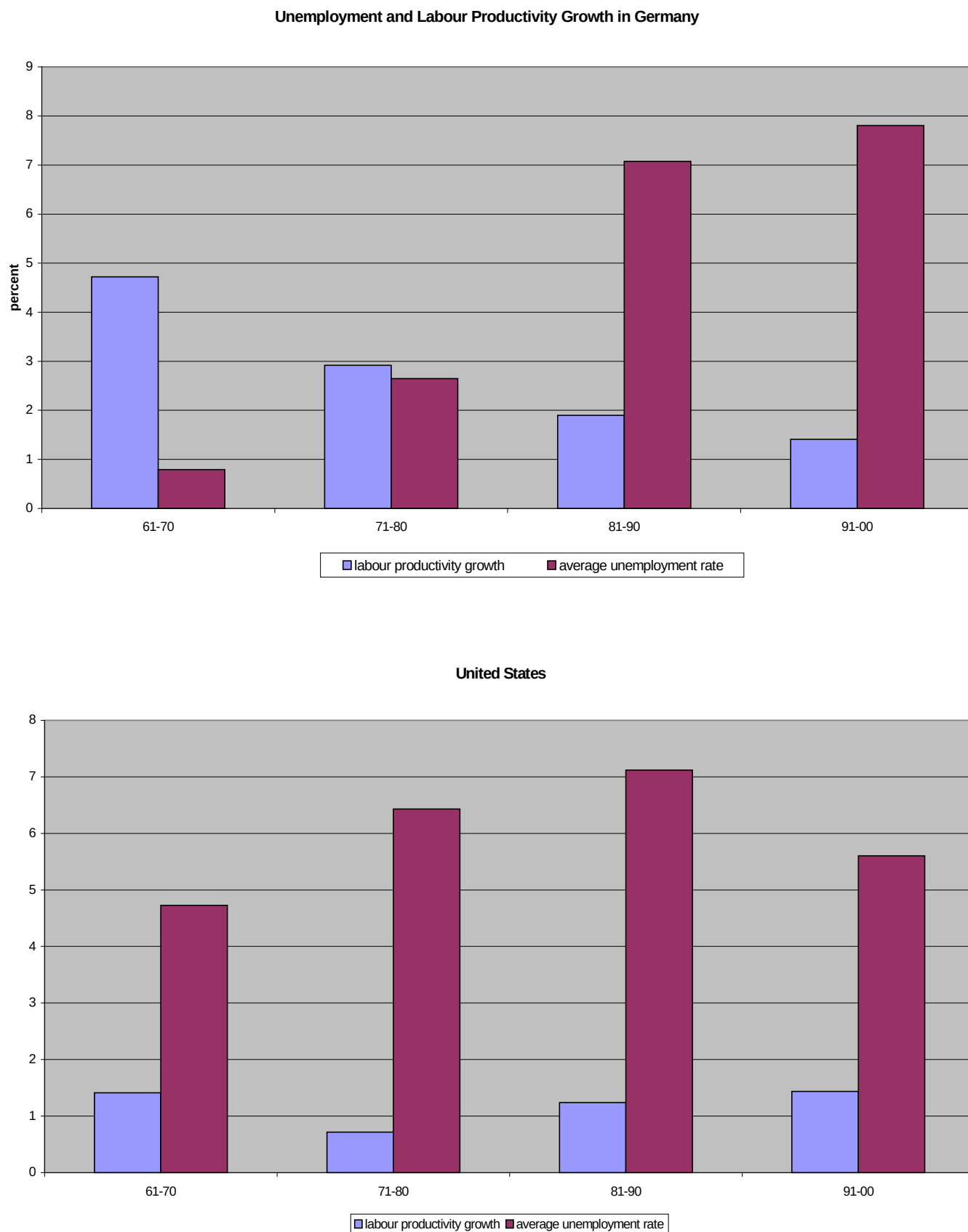


Figure 2: Productivity growth and unemployment in Germany and the United States, 1961-2000

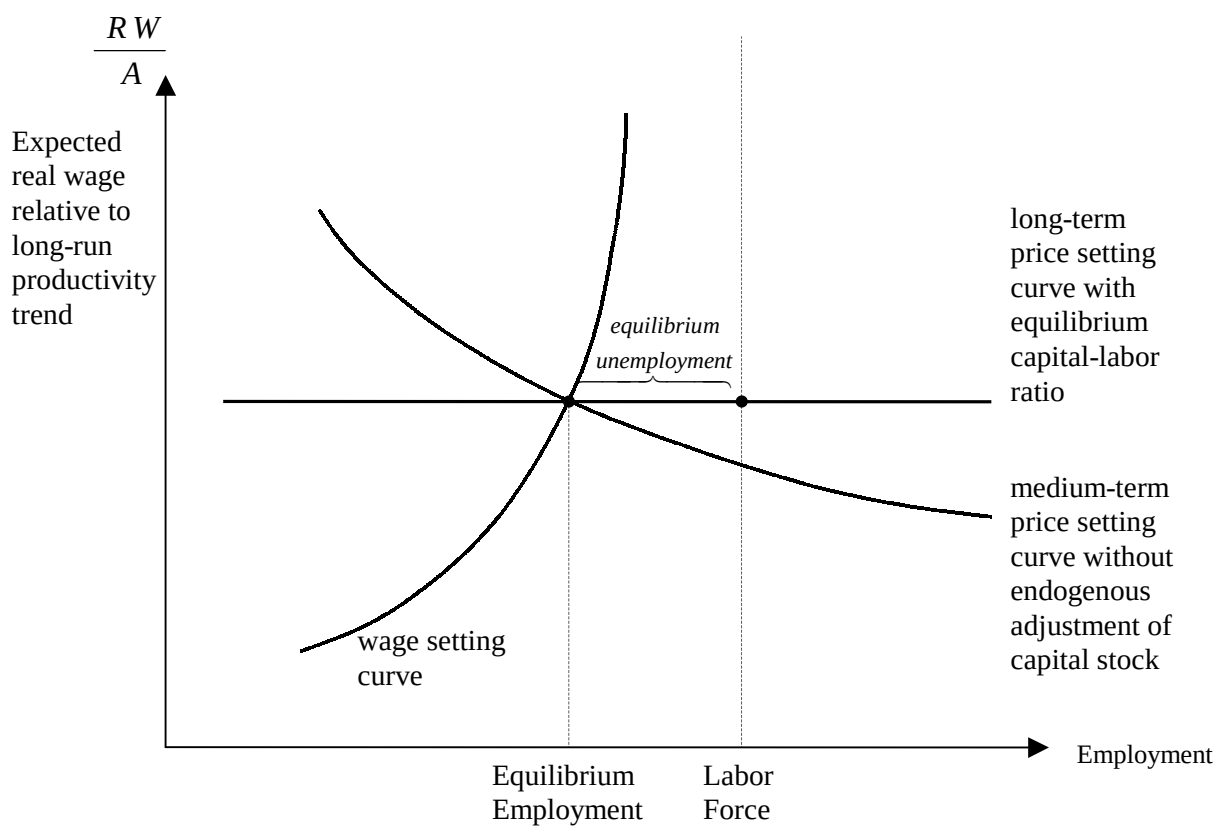
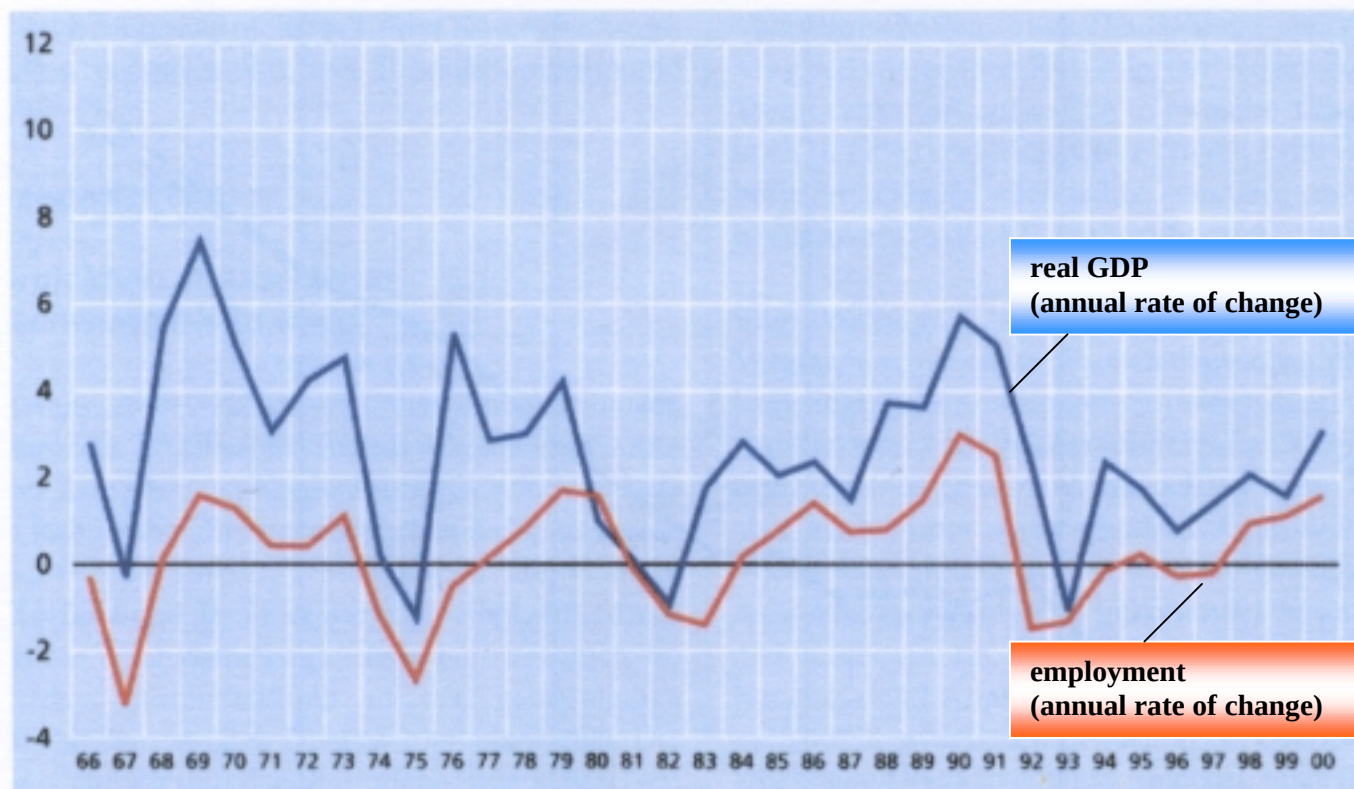


Figure 3: The standard model of equilibrium unemployment



until 1991: West Germany
from 1992: Germany

Source: Bundesministerium
der Finanzen

Figure 4: Output growth and employment growth in Germany, 1966-2000

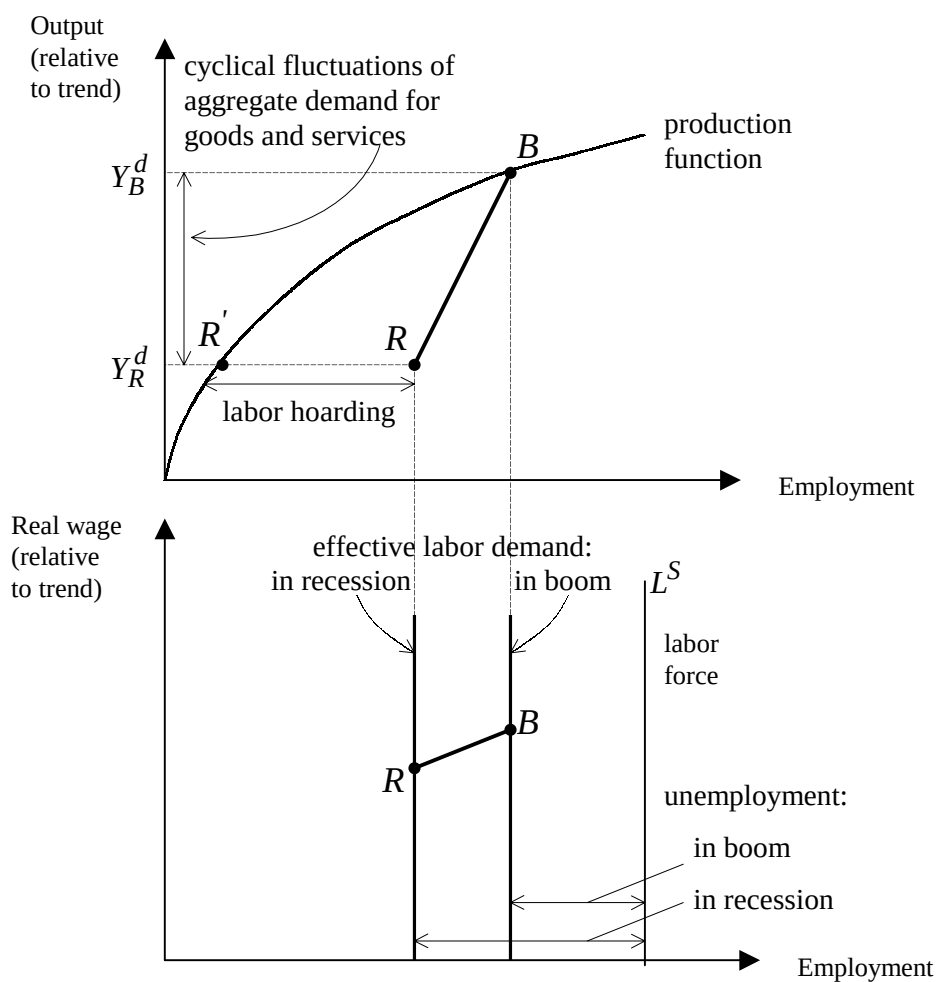


Figure 5: The cyclical fluctuations of employment and productivity: the keynesian interpretation

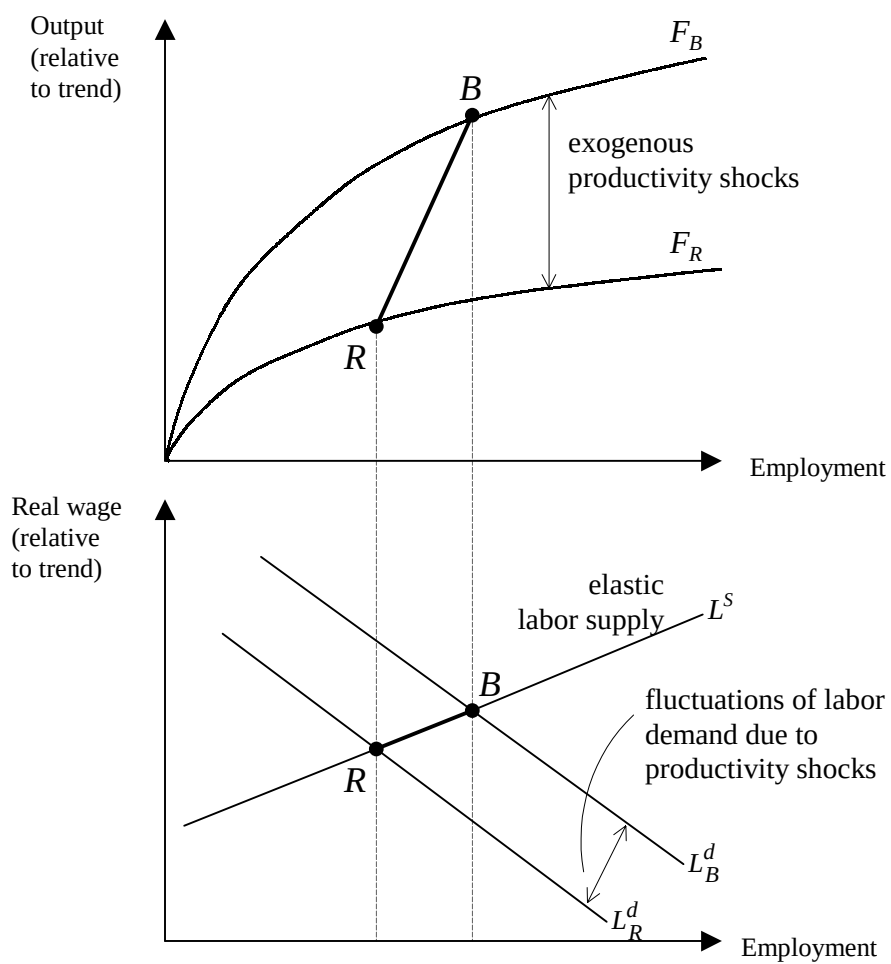


Figure 6: The cyclical fluctuations of employment and productivity as seen through the lens of real business cycle theory