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Recent Trends in Dutch Labor Productivity: the Role of Changes in the Composition of Employment

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Preface

Average annual growth in labor productivity (GDP per hour worked) fell from 5% at the beginning of the 1970s to about 2% in the early 1980s. This was followed by a further decline to about 1% in the mid-1980s. It is sometimes argued that this is worrying, since advances in material well-being ultimately require productivity growth. Others have argued that the recent slowdown is in part due to the rising employment share of workers with lower levels of productivity, possibly as a consequence of government policies in this area. To the extent that the latter explanation is correct, the productivity slowdown is only temporary.

This report attempts to measure the contribution of changes in the composition of employment to aggregate labor productivity growth. Due to data limitations final conclusions proved to be somewhat elusive, but on balance the available evidence indicates that employment composition effects did play a role in the productivity slowdown. Research on the determinants of labor productivity growth continues.

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F.J.H. Don, director

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Chapter 1 Introduction and summary

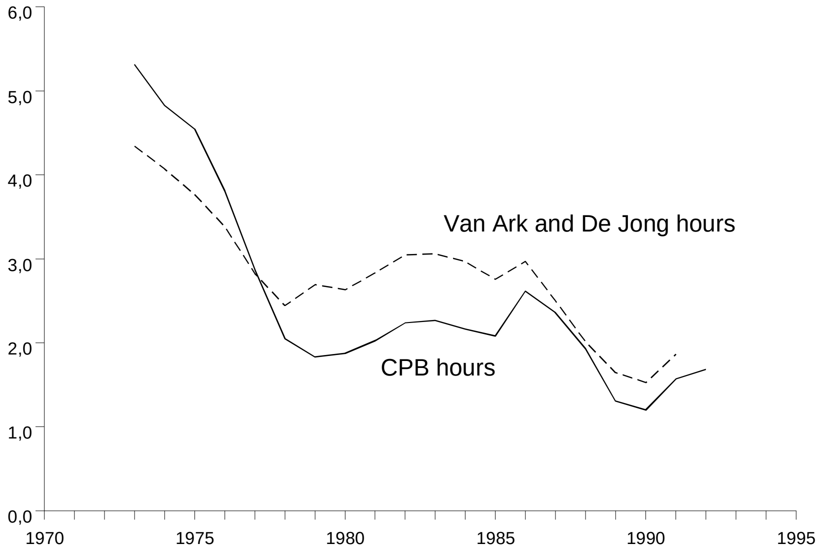
This report assesses some aspects of recent labor productivity growth in the Netherlands. An answer is sought to the following two questions:

1. *Has there been a decline in labor productivity growth since the mid-1980s, both compared to the preceding period and compared to other OECD countries?*
2. *Have changes in the composition of employment lowered labor productivity growth since the mid-1980s?*

The motivation of the first research question is as follows. It has been argued that labor productivity growth in the Netherlands lags behind labor productivity growth in other European countries in recent years (see De Haan and Van Ark, 1996, p. 518, CPB, 1996, p. 106). The extent of this relative slowdown will be assessed in chapter 2, which documents Dutch labor productivity performance after 1970. As a proxy for productivity we will use *real GDP per hour worked*; *unless indicated otherwise, we use GDP as a shorthand expression for real GDP*.

Measuring and comparing GDP per hour worked is compounded by all sorts of data problems, discussed in chapter 2. As a consequence GDP per hour worked is surrounded by a considerable margin of error. Nevertheless, chapter 2 concludes that there has indeed been a decline in Dutch productivity growth after 1985 of about 1% per year. See figure 1.1.

Figure 1.1 The Netherlands: GDP-growth per hour worked, 7-year moving average



The figure shows 7-year moving averages of GDP-growth per hour worked, based on two different series for hours worked. The differences between the two series are further discussed in chapter 2. Both series show a clear slowdown since the mid-1980s, from an average annual growth rate of about 2% to 3% to a growth rate of 1% to 1½%. Compared to what happened in the 1970s, this is a fairly modest decline.

GDP-growth *per head* (GDP divided by total population) shows a more favorable development than GDP-growth *per hour worked*, at least since about 1980. Figure 1.2 shows a 7-year moving average for GDP-growth *per head*. In contrast to the growth rate of GDP *per hour worked*, the growth rate of GDP *per head* has increased since 1985.

Figure 1.2 The Netherlands: GDP-growth per head, 7-year moving average

The difference between GDP-growth *per hour worked* and GDP-growth *per head* since the mid-1980s suggests an increase in either the number of hours per worker or the employment/population ratio, or both. Hours per worker fell continuously over the whole period 1970-1995, due to reductions in the number of hours per full-time worker and an increase in the employment share of part-time workers. But the employment/population has increased sharply, as shown in figure 1.3. Job-growth has raised the employment/population ratio from 38% in 1983 to 43% in 1995.

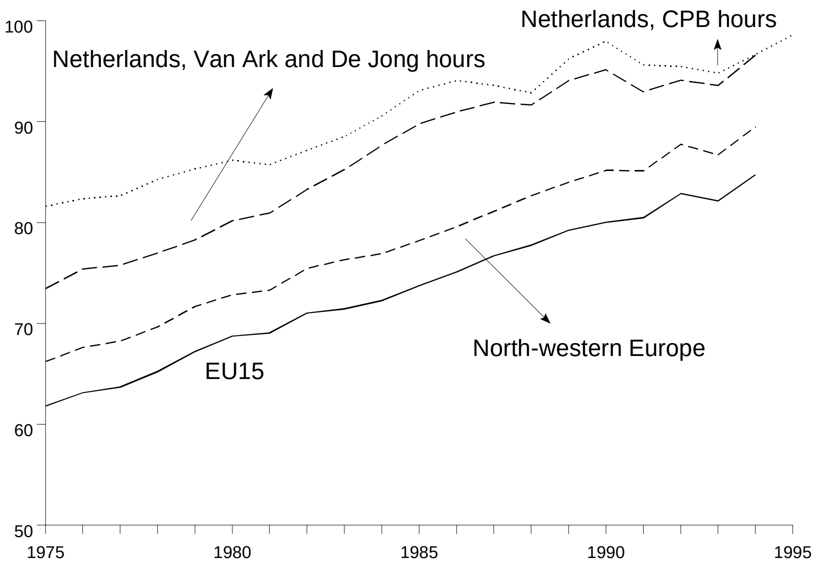
Figure 1.3 The Netherlands: employment/population ratio

How does the Dutch experience compare with those of other countries? An international comparison of GDP *per hour worked* shows that during the past two decades the Netherlands has consistently ranked amongst the two or three countries with the highest level of GDP per hour worked. But countries with lower GDP per hour worked are closing in. This is shown in figure 1.4, which presents GDP per hour for the Netherlands, the average (weighted with total hours worked) of North-western Europe, and the average of the EU15, using the US as the benchmark country (US = 100).[1] The Netherlands has been catching up with the US, and at this macro-level the scope for further catching up seems almost exhausted. Moreover, the Netherlands outperforms both the EU15 and North-western Europe in terms of the level of GDP per hour. However, the difference is becoming smaller: there has been a sharp decline in relative GDP per hour of the Netherlands compared to North-western Europe and the EU15 after 1985. Part of the explanation is to be found in the major restructuring of the Dutch economy which took place in the early 1980s. The Netherlands, with its open economy and energy intensive production structure, was severely affected by the second oil-crisis in 1979. This shock led to a far-reaching and long overdue restructuring process,

[1]Excluding Luxembourg for which we have no data on hours worked, and using West-Germany for the whole period.

involving massive lay-offs and large numbers of firms going bankrupt. This boosted Dutch productivity, and accounts for the relative increase in the Netherlands' GDP per hour around 1985. In other major countries in North-western Europe this restructuring process took place later, which partly explains the relative fall in Dutch labor productivity after 1985.

Figure 1.4 GDP per hour worked, US=100



Chapter 2 rounds off with a brief overview of *sectoral* productivity differences. Sectoral productivity comparisons are hampered by even bigger data limitations than comparisons of GDP per head. Still, the received wisdom is that the Netherlands is especially productive in manufacturing relative to other countries, but lags behind in services. As a consequence, a shift in output from manufacturing to services could result in a fall in total labor productivity growth. It is shown that these sectoral shifts account for only a minor part of the productivity decline: of the fall in productivity after 1985 of ½ to 1%, only 0.2%-point can be attributed to sectoral shifts.

Chapter 3 turns to the second research question of the report: *Have changes in the composition of employment lowered labor productivity growth since the mid-1980s?* In particular, has the employment share of workers with below-average productivity increased? Of course, this is only one of several possible explanations for the observed slowdown in (relative) productivity growth since the mid-1980s. Other possible explanations are a slowdown in technological progress; convergence of countries with a lower productivity level than the Netherlands; and a slowdown in the growth of the capital/labor ratio. The report does not assess the validity of these other explanations: the focus is on employment composition effects.

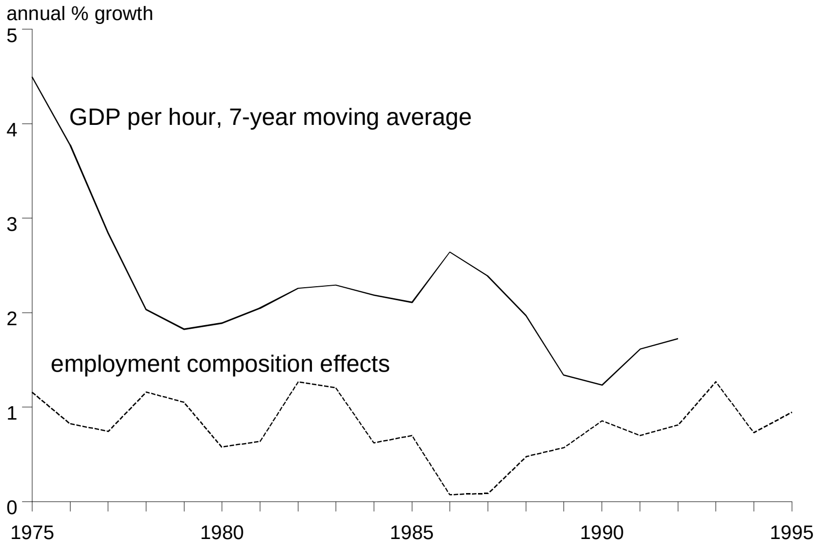
It is of interest to know whether employment composition effects have played a role for the following reason. Government policies aimed at improving the employment of the long-term unemployed and the low-skilled (wage moderation, lowering the minimum wage in real terms, wage subsidies, and direct employment creation) may well have increased employment of low-productive workers. If such composition effects do indeed explain some or all of the slowdown in productivity, then this is obviously less worrying than if the decline in productivity growth is due to a fall in the rate of technological progress, or to a fall in the rate of investment.

We analyze employment composition effects only for the Netherlands; data limitations make a similar analysis for other countries infeasible. Employment composition effects are estimated in the following manner. Four dimensions of the quality of the labour force are distinguished: age, gender, education and full- time/part-time employment. In addition, sectoral productivity differences are taken into account. Since direct data on productivity differences across workers are not available, we have to measure productivity differences indirectly. We shall assume that wage differentials reflect productivity differences, an assumption that is commonly made in this type of studies. This assumption allows us to use relative wages in order to calculate the effect of changes in employment composition along each of the four dimensions just mentioned on productivity growth.

The main result is presented in figure 1.5, which shows the estimated effect of changes in employment composition on labor productivity per hour worked. Also included is growth in GDP per hour worked.

Figure 1.5 shows that there is *no* evidence that measured employment composition effects have lowered labor productivity per hour worked since the mid-1980s. In fact, the reverse is true: after a declining positive contribution until 1986, this contribution increased thereafter.

Figure 1.5 Employment composition and labor productivity growth



So *measured* employment composition effects do not explain the decline in productivity growth since the mid-1980s – and the sensitivity analyses in chapter 3 show that this is a robust conclusion. However, we only measure some aspects of the changing composition of employment. Some characteristics which could be important at the bottom-end of the labor market, such as fluency in Dutch and (un)employment history, could not be included in the analysis due to data limitations. In addition, productivity depends not only on characteristics that can be measured objectively, but also on characteristics such as reliability, flexibility and social skills. The fact that employers spend considerable resources on interviewing job candidates shows that such characteristics are important.

Suppose then that the employment share of workers with a low score on these *unmeasured* characteristics has increased. If we maintain the assumption that wage differentials reflect productivity differentials, then this should show up in the wage distribution: the left tail of the wage distribution should have become fatter in recent years, or in non-technical terms: the percentage of jobs paying a real wage below a certain (low) threshold level should have gone up. This has indeed happened: the percentage of jobs (in full-time equivalents) paying hourly wages less than about 14 guilders has increased fairly rapidly in recent years. A simple calculation on the basis of shifts in the wage distribution shows that the growth of employment in low-paid (and, by assumption, low-productivity) jobs accounts for a productivity slowdown after 1985 of about 0.2% to 0.3% per year.

One possible explanation for the increase in the share of low-paid workers is the freezing in nominal terms of the minimum wage during much of the 1980s and the early 1990s. Simulations using MIMIC, CPB's applied general equilibrium model, indicate that of the decline in productivity after the mid-1980s of ½% to 1%, a sizeable part (20% to 40%) can be attributed to the minimum wage freeze. This amounts to a slowdown of 0.2% per year.

Balancing these various findings, we conclude that *measured* changes in the composition of employment cannot account for the productivity slowdown after 1985. However, changes in the wage distribution as well as model simulations indicate that employment of low-productive workers has increased, and that this may account for about 20% to 40% of the productivity slowdown.

What explains the remainder of the productivity decline? An answer is beyond the scope of this report, but work in progress at CPB, which focuses on changes in inputs at the sectoral level, will hopefully provide some of the answers in the near future.

Chapter 2 GDP per head and per hour worked

"..productivity measurement is far from a settled matter among economists." (Jorgenson, 1993, p. 50).

2.1 Introduction

In this chapter we do three things. First, we discuss measurement issues and methodological problems that arise in international productivity comparisons. As illustrated by the quote from Jorgenson, a leading researcher in the field, opinions differ as to the appropriate way to measure and compare productivity levels across countries. We will not give a detailed exposition of these issues (see e.g. Van Ark, 1996, and Van der Wiel, 1996). Instead, we sketch the main problems and their implications for international productivity comparisons. We will devote relatively much space to problems surrounding the measurement of actual annual hours worked since this is an important variable in our calculations.

The second topic of this chapter is developments in GDP per head and per hour worked in the Netherlands during the period 1970-1995 (sections 2.3 and 2.4). GDP-growth per *head* first declined from about 3% per year in the 1970s to 1% in the early 1980s. Since the mid-1980s, GDP-growth per head has picked up again, and in the early 1990s it was back at an annual trend of about 2%. GDP-growth per *hour worked* shows a different time pattern. First, there was a sharp decline in GDP-growth per hour after the mid-1970s, from 5% or more to about 2% in the early 1980s. This was followed by a modest further decline to about 1% to 1½% after 1985. We conclude that although there has been a decline in labor productivity growth after the mid-1980s, the big productivity slowdown took place much earlier, in the mid-1970s. It should be added that the productivity slowdown after the mid-1980s is larger if we focus on value added per hour worked in the business sector, rather than in the economy as a whole.

The third topic of this chapter is an international perspective of recent Dutch performance. In section 2.5 we show that changes in the international ranking of the Netherlands in terms of GDP per head often depend on small changes in GDP per head. Once it is acknowledged that international GDP comparisons are surrounded by an error margin of at least 5 percent, the changes in the Dutch relative position over the past two decades become far less dramatic. Section 2.6 turns to GDP *per hour worked*. It is shown that the Netherlands have consistently ranked very high in terms of GDP per hour worked, although the Dutch lead has become much smaller in recent years. Section 2.7 briefly summarizes some data on international productivity comparisons at the sectoral level. Section 2.8 presents conclusions.

2.2 Measurement & method

The meaning of GDP per head or per hour comparisons

GDP per head is frequently used as a rough-and-ready indicator of economic welfare. But do differences in GDP per head really measure differences in welfare? One view, espoused by Dowrick and Quiggin (1994), is that: "constant price measures of "real GDP" should be used with circumspection when comparisons are being made of countries at a similar level of development. *In particular, we call into question the common practice of citing small movements up or down the international league tables as an indicator of policy success or failure.*" (p. 340, italics added). Elsewhere, Dowrick proposes a confidence interval of 10% for GDP levels based on PPPs (Dowrick, 1996, p. 1776).

In this report, our primary interest is in international comparisons of *productivity*, not welfare. Therefore, we want to know whether GDP per unit of labor is a useful proxy for labor productivity. Although measuring productivity would seem a less ambitious objective than measuring welfare, there are still a number of problems with using GDP per hour for comparing labor productivity across countries. To start with, GDP only measures *marketed* output: goods and services produced for own consumption are excluded. The importance of production for own use differs across countries. Take for example child care. As recently stressed by Rosen (1996), in Sweden a very large chunk of child care is provided by paid professionals, while in other countries child care is to a larger extent provided by household members on an unpaid or informal basis. Thus, in Sweden child care services are to a much larger degree included in GDP than in a country like Italy.

More generally, the estimated size of the informal economy differs enormously between countries. One estimate puts Italy at the top with informal GDP amounting to 26% of official GDP, Switserland at the bottom with 6%, and the Netherlands somewhere in the middle with 13% (The economist, 3 May 1997, p. 76).[2]

These considerations imply that GDP per worker or per hour are imperfect indicators of labor productivity. This does not make them useless, but it does suggest that not too much should be made of small differences between countries or small changes over time, since these need not reflect real differences or changes in output.

PPPs

In order to make international comparisons of GDP, one needs a set of prices for comparing the output of various countries. But which set of prices? The usual approach, adopted by the OECD, Eurostat, and others, is based on Purchasing Power Parities

[2]Others put the size of the informal economy in the Netherlands at less than 1% of GDP (Van der Werf and Van der Ven, 1996).

(PPPs).[3] PPPs are calculated as follows. First, in each country involved in the comparison prices are collected for a large number of goods and services.[4] Second, for each item or group of items a relative price ratio between two countries is calculated using the countries' own currencies, yielding what one might call "micro-PPPs".[5] Third, an overall PPP for GDP comparisons between these two countries is calculated from a weighted average of these "micro-PPPs", using as weights the expenditure shares of the country itself, of the other country, or a geometric average of the two, yielding a Paasche, Laspeyres, or Fischer index, respectively. Because of so-called *substitution bias*, these three indexes will in general not be the same (see Dowrick and Quiggin, 1997). Appendix 1 shows the range between the Paasche and Laspeyres indexes of GDP per head for comparisons of the Netherlands and 16 other developed countries. It turns out that the average (unweighted) difference between the Paasche and Laspeyres indexes was 5% in 1980 and 6% in 1990.

The three types of PPPs just mentioned -Paasche, Laspeyres, and Fischer- are all *bilateral* PPPs, suitable for comparing GDP levels of a given pair of countries. These bilateral PPPs are in general not *transitive*. This means that comparing France directly with Germany through the France/Germany PPP yields a different result than comparing France and Germany through a third country, for example the US. Therefore, PPPs used in the international databases of the OECD or the PWT have been *multilateralized*, which does make them usable for comparing country i with all other countries. There are a number of methods for achieving such "multilaterization". The OECD publishes

[3]Another way of comparing output internationally is based on Unit Value Ratios. While PPPs are calculated on the basis of information about what the consumer has to pay for a certain basket of goods in different countries, UVRs are based on a comparison of what producers receive per unit of output. For sectoral productivity analyses this has the advantage that international comparisons are not affected by differences in tranport costs, wholesale & retail margins, costs of insurance etc. UVRs, like PPPs, are based on a sample of products. Therefore, UVRs calculated from these samples are estimates of true UVRs, that would be obtained if all goods were included in the comparison. Timmer (1996) presents estimates of the variance surrounding these estimates. He concludes: "90% Confidence intervals for the total manufacturing Laspeyres and Paasche UVRs ranged from ±4% to ±11% for the comparisons involving high productivity countries only." (Timmer, 1996, p. 28).

[4]For example, for the calculation of the 1990 PPPs, Eurostat compiled prices for 2 553 items (Maddison, 1995, p. 162).

[5]The detailed price comparisons required for calculating PPPs have only been made for a few years. For EU countries, 1991-94, for non-EU OEUD countries 1990 and 1993. For earlier years, PPPs were calculated using relative domestic GDP-inflation rates.

PPPs, based on two different methods.[6] Appendix 1 presents the two sets for 1993, the last year for which results are available. Again, the differences are substantial. For example, moving from the EKS method to the GK method raises German GDP relative to Dutch GDP by 3½ % in 1993. The important point for our purposes is that there is no unambiguously ideal method for constructing PPPs. The choice between the various alternatives has to be made on the basis of a trade-off of various desirable index number properties.[7]

Errors in the measurement of inflation

Errors in the measurement of price inflation constitute another potential source of bias. In the US a vigorous debate is going on about a possible upward bias of the CPI. The Boskin Committee concluded, in a report published in November 1996, that the CPI contains an upward bias of 1.1% per year, a conclusion that was subsequently supported by the chairman of the Federal Reserve System (the central bank), Alan Greenspan. However, the alleged bias is based on findings for a specific group of goods, namely goods for which such a bias was suspected. This may have influenced the results (Wiggers, 1997).

Little is known about the size of this bias in the Netherlands. One can only hope that measurement problems are more or less the same in different countries, in which case the implications for international comparisons will be minor (see also CPB, 1997, p. 34).

Errors in the measurement of quality

[6]One set is based on the Geary-Khamis (GK) method, the other on the Elteto-Köves-Sculc (EKS) method. The "official" PPP, used by the OEUD and the EU, is based on the EKS approach for the following reason: "When the GK method is used, a country whose price structure is very different from the structure of the average prices used in the aggregation process will be shown as having higher volume levels than it would have had if average prices [..] had been used. [..] This is not a problem when the EKS method is used and, for this reason, EKS results are considered to be better suited for comparisons of [..] GDP. On the other hand, the GK method provides results that are *additive*, that is the real values of aggregates are the sum of the real values of their components" (OEUD, 1996, p. 4).

[7]In a similar vein, The Economist recently stated that "Calculating PPPs is more an art than a science" (April 16, 1997, p.35). Clear-cut results can only be obtained. for special cases. See Dowrick and Quiggin (1997), who use the representative agent assumption along with homothetic preferences to derive a so-called *perfect Afriat index* of relative GDP per capita.

A final issue concerns the (mis)measurement of quality improvements. This is obviously related to mismeasurement of inflation, but there is an additional point that arises in sectoral analyses. If some quality improvements in services are not recorded, then productivity growth in services is underestimated. However, since many services are an input to manufacturing, calculated productivity growth in manufacturing will be too *high*. In CPB (1997) and Van der Wiel (1997) it is estimated that if measured price inflation in the services sector is biased upwards by 1½%, then labor productivity in services will be biased downwards by 1% and labor productivity in manufacturing will be biased *upwards* by ½%. Thus, the real productivity differential between manufacturing and services may be smaller than it appears to be from official statistics. For the purposes of this report, the important implication is that the shift in output from goods to services explains less of the slowdown in productivity growth than would be the case without such biases.

Hours worked

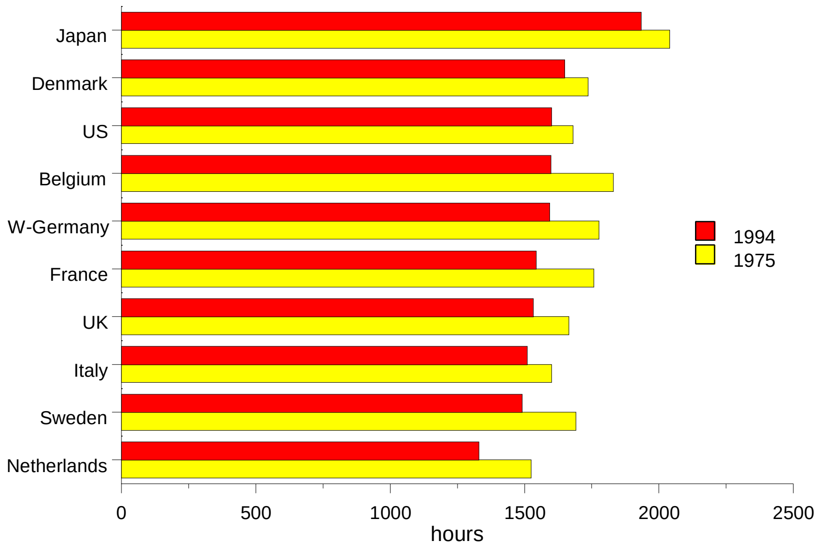
International productivity comparisons are sometimes made on the basis of GDP or value added per *worker* (see e.g. Bernard and Jones, 1996, European Commission, 1996). However, hours worked per worker show large variations across countries, as shown in figure 2.1. Amongst the countries included in figure 2.1, the Netherlands has the lowest number of hours worked per person employed, with the annual number of hours per worker 30% lower than in Japan. The difference is partly caused by the relatively large share of part-time workers in the Netherlands. Clearly, output per *worker* in the Netherlands would be lower even if output *per hour worked* were the same or even somewhat higher than in Japan. This suggests that the preferred denominator in productivity comparisons is actual hours worked.

However, data on hours worked are often of poor quality. The only international database of actual average annual hours worked per person employed is the compilation of Maddison (1991, 1995).[8] Maddison frankly admits that creating an international database of hours worked is hindered by severe data problems: "Working hours data are among the weakest used here. Most of the regular estimates presently available cover

[8]The OECD regularly produces a table on average annual hours worked per person employed in a number of countries and for a number of years. However, these data ".. are intended for comparisons of trends over time; *they are unsuitable for comparisons of the level of average annual hours of work for a given year.*" (OECD, Employment Outlook 1996, p.190, my italics JMP). The US Bureau of Labor Statistics also produces international series on hours worked, but these refer to manufacturing only.

only part of the labour force (usually industrial workers), and not all of them reflect changes in holidays and vacations." (Maddison, 1991, p. 255).[9]

Figure 2.1 Annual hours worker per person employed

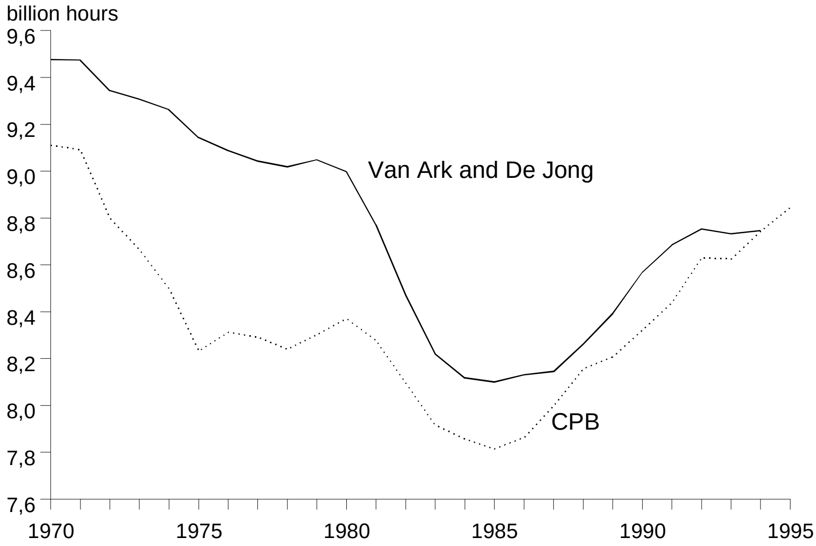


For the Netherlands, Van Ark and De Jong (1996) present a time series for annual hours worked that is partly based on the Maddison data, supplemented with data from other sources. Figure 2.2 shows this series along with a second series constructed by CPB for the purpose of this report. Box 2.1 describes the differences in methodologies used,

[9]Another problem is that available statistics on hours worked *may* relate to contractual hours, which often differs from actual hours worked. The most important reasons for this difference are sickness and overtime. However, it is not always clear to which concept the available series relate, actual or contractual. According to Maddison: "For Belgium, Denmark, Italy, Japan, Norway and Sweden the basic estimate of hours worked for the post-war period *seemed* to exclude time lost on sickness." (Maddison, 1991, p. 258, italics added). In cases where the series do refer to contractual hours, the amount of time lost due to sickness is not always known, and an assumption has to be made. Maddison again: "For Canada, the loss was assumed to be the same as in the USA (3.5 per cent). In Australia, Austria, Finland, and Switzerland, a 5 per cent working-time loss was assumed from this cause from 1950 onwards." (ib., p. 258).

while box 2.2 presents some background information on hours worked in the Netherlands.

Figure 2.2 The Netherlands: total hours worked 1970-1995



Although both series refer to the same concept, namely actual hours worked, they show large differences, particularly in the 1970s. Since a one percent difference in hours worked translates into approximately a one percent difference in output per hour, this has implications for comparisons of the level of GDP per hour. In addition, since the Van Ark and De Jong series shows a sharper decline in the early 1980s than the CPB series, growth of GDP per hour during this period will be substantially higher if the Van Ark and De Jong series is used than if the CPB series is used. Note however that there can be no doubt that 1985 was a watershed in terms of employment growth. In that year, the sharp decline in employment in hours that had started in 1980 turned into a sharp increase and by 1995 employment in hours was almost back at its 1970 level. Because of large reductions in the average length of the working week during this period, partly due to the sharp increase of the employment share of part-time workers, employment in persons was even 26% *higher* in 1995 than it was in 1970.[10]

[10]Including small part-time jobs; employment in persons in 1995 was 17% higher than in 1970 if only jobs of at least 12 hours per week are included.

Construction of series on total hours worked: the Netherlands

Time-series on actual annual hours worked are not available from official statistics and must be constructed by the researcher by combining the available data on hours per worker with data on employment. For the Netherlands there are at least two ways in which this can be done. First, one may multiply series of labor years, i.e. employment in full-time equivalents, with time series on contractual hours worked per full-time worker, making allowance for sickness and overtime. This is the procedure underlying the total hours series used in the text. In formula:

*CPB-hours= (labor years employees + number of self-employed)**
*(contractual hours employees) **
(1-0.01%sickness-0.01*%overtime)*

Data on labor years and contractual hours are taken from Statistics Netherlands, 1996, table 3.5. The sickness percentage is calculated from CPB, 1997, table A7, where we have assumed an equal sickness percentage for employees and self-employed. Overtime is fixed at 1.9% per year, which is the average of the percentages for 1984, 1988 and 1992 reported in box 2.2.

Second, one may use data on paid hours per worker published in the monthly Social Economic Statistics of Statistics Netherlands, and multiply this by total employment, again making allowance for sickness. This is the procedure used by Van Ark and De Jong (1996).

Structure of actual hours worked in the Netherlands

Data on actual hours, as opposed to contractual hours, are not being collected annualy in the Netherlands. However, countries of the European Union collect such data every four year in the context of a study of labour costs. The survey covers only the industrial sector. The first year in which the quadrennial survey was carried out is 1984, and currently data are available for 1984, 1988 and 1992. The 1996 data are currently being processed by the CBS. The table summarizes the findings from the three surveys.

The Netherlands: Components of actual hours worked per full time worker, in mining, industry, utilities & construction

	1984	1988	1992
contractual hours	1799	1742	1729
sickness	−158	−158	−150
short leave	−4	−8	−10
schooling	−0	−3	−1
reduction labor time	−3	−0	−0
strikes	−0	−0	−0
weather leave (vorstverlet)	−4	−0	−2
overtime	30	37	33
actual hours worked	1658	1608	1596
in % of contractual hours			
	100	100	100
sickness	−8,8	−9,1	−8,7
short leave	−0,2	−0,5	−0,6
schooling	−0,0	−0,2	−0,1
reduction labor time	−0,2	−0,0	−0,0
strikes	−0,0	−0,0	−0,0
weather leave (vorstverlet)	−0,2	−0,0	−0,1
overtime	1,7	2,1	1,9
actual hours worked	92,2	92,3	92,3

Source: Statistics Netherlands 1995

Conclusions
How large is the margin of error in international comparisons? Producers of datasets sometimes provide their own assessment of this margin. For the Penn World Table, Heston and Summers indicate that "By and large, among rich countries comparisons are likely to be correct within say 5-10 percent; comparisons of poor countries with rich ones may be subject to errors twice as large." (Heston and Summers, 1996, p. 22). For the OECD data, "..the OECD advises that differences of less than 5% in countries' GDP per head are not meaningful" (The Economist, 27-4-97, p. 35). Unfortunately, neither source gives a confidence interval. Note that these margins relate to GDP per head, not to GDP per hour worked. Since population is measured quite accurately while, as we have argued, hours worked are surrounded by substantial uncertainty, the margin surrounding GDP per hour worked must be larger than this 5%.[11] Moreover, reported margins are seldom based on a rigorous statistical procedure.[12] Rather, they seem to be based on some (intuitive?) judgement of the producers of the datasets. It is therefore easy to be sceptical about these error margins. After all, producers of datasets want their datasets to be used, and this is not achieved by reporting large error margins. In section 2.5 we will simply assume a fairly modest margin of error of 5% in either direction, and show that this already has substantial effects on some international comparisons.

2.3 The Netherlands: GDP per head

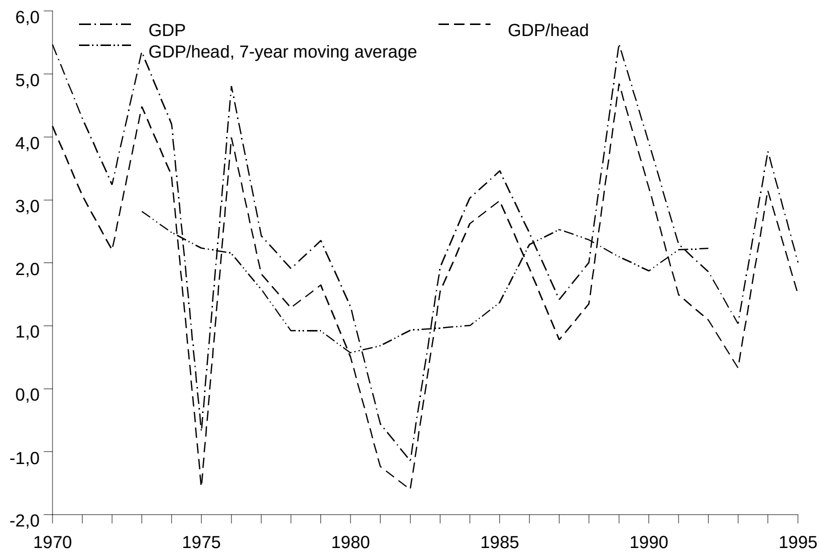
Figure 2.3 shows the growth rate of GDP per head for the period 1970-1995, along with GDP growth itself and a 7-year moving average of GDP growth per head.[13] A period of 7 years roughly correspronds to the average length of the Dutch business cycle. The growth rate of GDP per head is always slightly below the growth rate of GDP itself, due to population growth. The 7-year moving average of the growth rate shows a clear U-shape: starting at about 3% in the mid-70s, the average growth rate falls to about 1% in the early 1980s and then increases again to a level of about 2%.

[11]Unless the two errors are positively correlated, but it is not clear why this should be the case.

[12]Timmer, 1996, is an exception, but his calculations refer to one source of error only, namely price conversions.

[13]The real GDP series is taken from the 1995 National Accounts. Apart from a PPP conversion factor, this is identical to the GDP series in the OEUD databases.

Figure 2.3 GDP-growth per head



2.4 The Netherlands: GDP per hour worked

We now turn to growth in GDP per hour worked. We seek an answer to the following question: *Has labor productivity growth, proxied by GDP per hour worked, declined after 1985?*

The answer is given in figure 2.4, which shows 7-year moving averages of GDP-growth per hour, using both the CPB series and the Van Ark and De Jong series for hours worked. The reason for using moving averages rather than the annual growth rates themselves is that the latter fluctuates a lot from one year to the next.[14] Both series show

[14] Because of the procyclical nature of productivity growth, one should compare similar points in the business cycle. Appendix 2 presents growth triangles that allow the reader to choose any base-year after 1975 and any end-year until 1995, and look up the growth rate of GDP per hour over this period. In this way, it is easy to check whether the statements in the text are sensitive to the choice of period. One explanation for the procyclical nature of productivity is labor adjustment costs. If these are large, then firms will not lay-off workers during a period of slack. Since adjustment costs differ across countries (for instance because of differences in institutionally determined firing costs), the cyclicality of productivity also differs. Other possible explanations are variations in

a clear decline after 1986. The decline is most pronounced when the Van Ark and De Jong series is used, from about 3% to about 1½% to 2%. When the CPB series is used, GDP-growth per hour falls from about 2% to about 1% to 1½% per year.

Figure 2.4 GDP-growth per hour

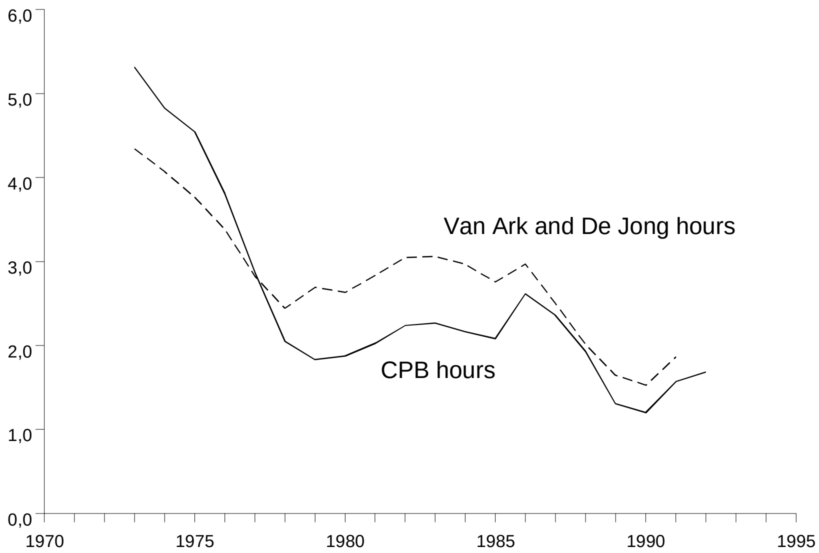


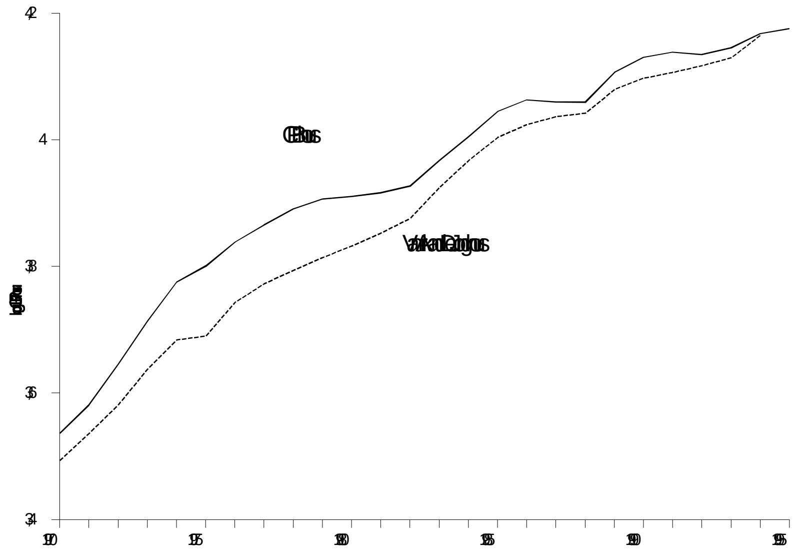
Figure 2.5 shows the slowdown in another way. The figure shows the logarithm of GDP as well as the logarithm of GDP per hour. The slopes of the lines correspond to growth rates: an upward-sloping straight line implies constant growth, a upward-sloping line with a decreasing slope corresponds to a fall in the growth rate. Again the figure shows a clear slowdown after 1985.

Note however that the really big productivity slowdown takes place in the mid-1970s, when productivity growth falls from about 5% per year to about 2% per year. This experience was shared by other industrialized countries (see Bruno and Sachs, 1985). For Europe, Wolff (1996) mentions two main factors behind the productivity slowdown. First, the scope for cathing-up with the U.S., the productivity leader during the period 1950-1973, had largely been exhausted. Second, growth in the capital/labor ratio fell after 1973. Wolff also argues that the slowdown after 1973 was to be expected, since the

overtime (which our data do not contain), increasing returns at the firm level, measurement error, or positive externalities (Baily, Bartelsman and Haltiwanger, 1996).

high productivity growth during the period 1950-1973 was an historical aberration: "[I]t is fruitful to consider the 1950-73 period as the aberrant one and the post-1973 period as a return to normality, rather than the reverse." (Wolff, 1996, p. 1254).

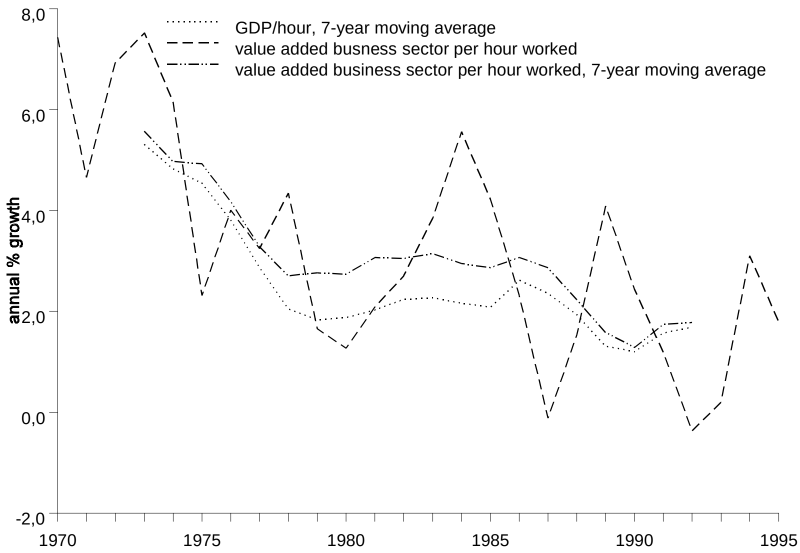
Figure 2.5 Log GDP per hour in the Netherlands



Productivity measurement in government services and non-business services is even more hampered by data problems than in other sectors, so it is interesting to see whether excluding these sectors leads to substantially different conclusions. Figure 2.6 shows the growth rate of value added per hour worked in the business sector for the period 1970-1995. Also shown are the 7-year moving average of this series, and the 7-year moving average of GDP per hour worked, reproduced from figure 2.4. It turns out that the productivity fall after 1985 is more substantial when we focus on the business sector alone, from almost 3% to about 1% to 1½%.[15]

[15]An explanation for these differences is beyond the scope of this report. Current CPB research will hopefully explain some of the sectoral differences in productivity growth. This research focuses on the effects of changes in the capital/labor ratio and on changes in sector structure.

Figure 2.6 GDP-growth per hour and real value added growth per hour in the business sector



What explains the difference between GDP-growth *per hour worked* and GDP-growth *per head* since the mid-1980s? There are two possibilities: either there was a rise in the number of hours per worker, or the employment/population ratio has increased. Figure 2.7 shows that hours per worker fell continuously over the whole period 1970-1995. Behind this are reductions in the number of hours per full-time worker, as well as an increase in the employment share of part-time workers. But the employment/population ratio has increased, as shown in figure 2.8. Fast growth in the number of jobs has raised the employment/population ratio from 38% in 1983 to 43% in 1995.

Figure 2.7 The Netherlands: Hours per worker (including part-time workers)

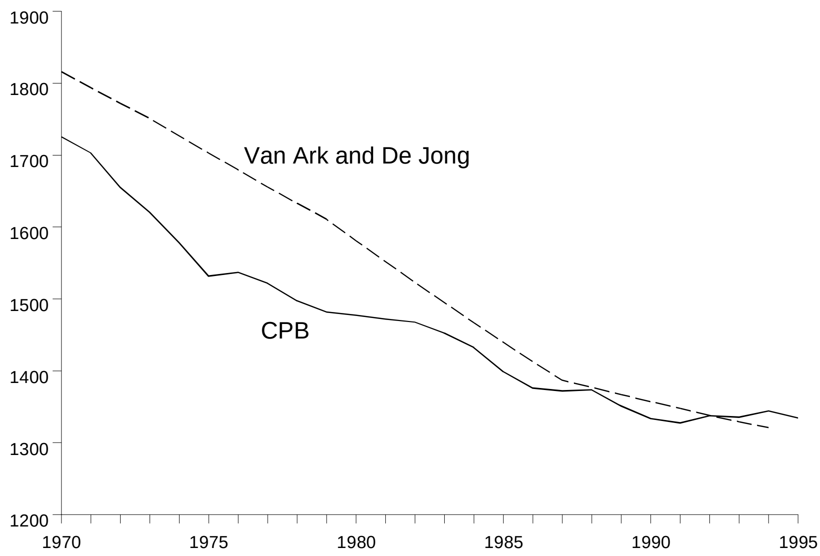
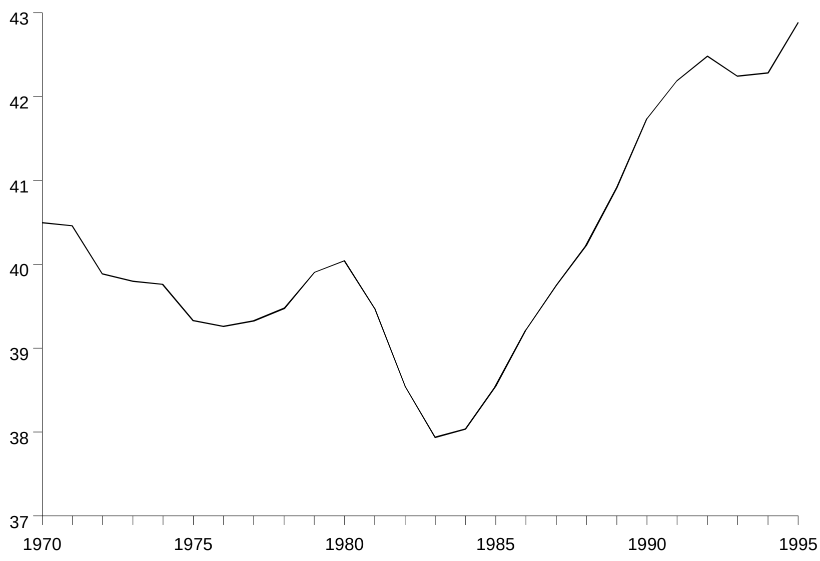


Figure 2.8 The Netherlands: Employment/population ratio



2.5 International comparisons of GDP per head

This section presents comparisons of GDP per head between the Netherlands and other OECD countries.[16] Figures 2.9 and 2.10 show the rank of the Netherlands in the league of nations. Figure 2.9 shows the Dutch position in the EU15, figure 2.10 shows its position in the OECD. Each figure contains two lines, one showing the standard ranking (each country with GDP per head higher than the Netherlands is ranked higher), the other showing a ranking based on the criterion that a country is only ranked higher than the Netherlands if its GDP per head is at least 5% higher. If GDP per hour in the comparison country is between 95% and 105% of Dutch GDP, then the two countries obtain the same ranking. The idea behind this modified ranking is that comparisons of GDP per head are surrounded by a margin of error, as was argued in section 2.2.

Clearly, allowing for a 5% margin matters quite a lot, especially for the Dutch position in the EU15 league. The standard ranking indicates a sharp deterioration from the late 1970s until 1989, but if allowance is made for a margin of error of ±5%, little remains visible of this deterioration. Can we conclude from this that no substantial deterioration in the Dutch relative position took place? The answer is of course that we cannot. First, there still *is* a worsening in the Netherlands' relative position, both in the EU15 league and in the OECD league. In the latter case, the deterioration remains pronounced even with our modified ranking. Second, what is not clearly visible may still be there: the sharp fall in the relative position of the Netherlands after 1985 indicated by the standard ranking may well have been real, only we cannot be sure due to measurement problems. Third, GDP per head is not the only relevant statistic. We know

[16]GDP series in PPPs from different sources also differ in some cases. Appendix 3 presents a detailed comparison of data sources. It turns out that most of the differences across sources can be attributed to differences between the PWT series on the one hand, and the OECD series on the other hand. A likely explanation for this is that the PWT PPPs are constructed differently: since the PWT includes all countries in the world (except the very small ones), the "multilaterization" is based on different weighting than in the construction of the PPPs in the OECD datasets. In this section we will use GDP levels expressed in PPPs from the Comparative Tables in OECD National Accounts, 1996 edition. The Comparative Tables contain series for post-unification Germany, but the available time series for hours worked prior to 1989 (from the Deutsches Institut fuer Wirtschaftsforschung, DIW) refers to West Germany only. We therefore include West Germany in our comparison of GDP per hour worked in section 2.6. GDP data for West Germany are taken from the country tables in the OEUD National Accounts, 1996 edition, converted to dollars using the PPPs for Germany from the Comparative Tables.

that the early 1980s were very difficult years for the Dutch economy, with high numbers of firms going bankrupt, sharp increases in unemployment, and unsustainable government deficits. The received view, based on more information than only GDP per head, is that the Netherlands was performing much worse than many other countries in North-western Europe.

Figure 2.9 Rank of the Netherlands in the EU15 league

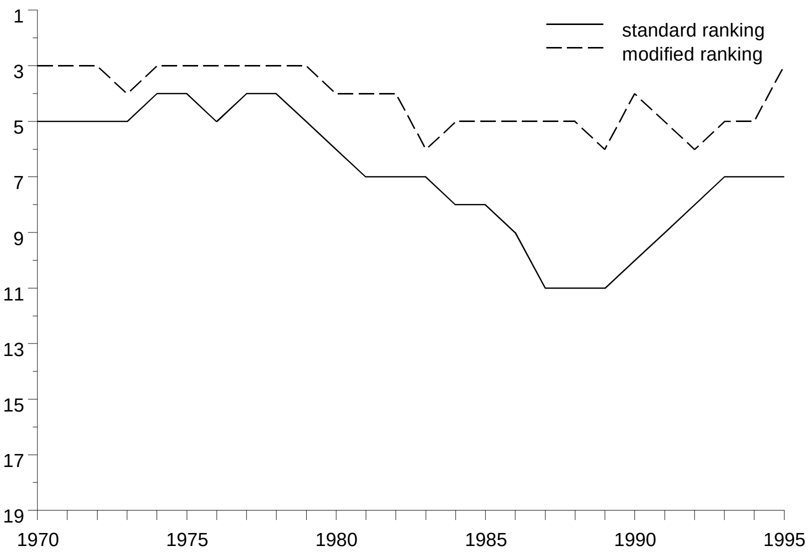
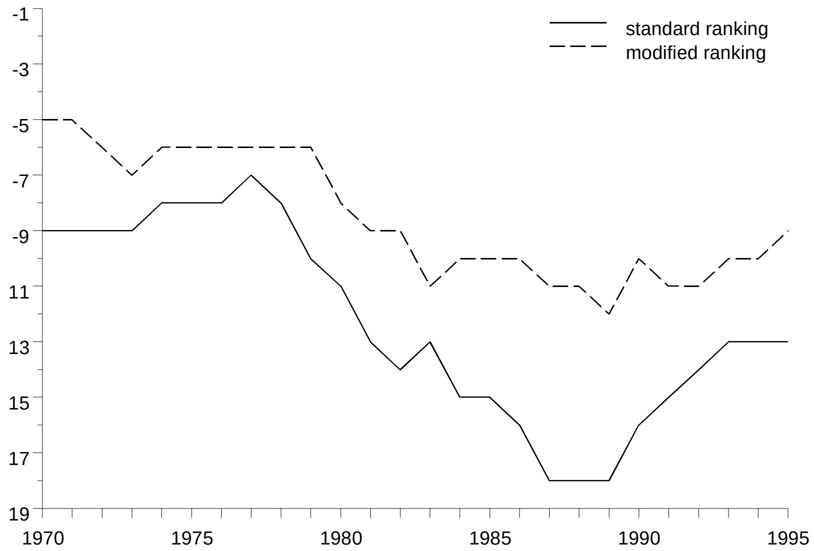
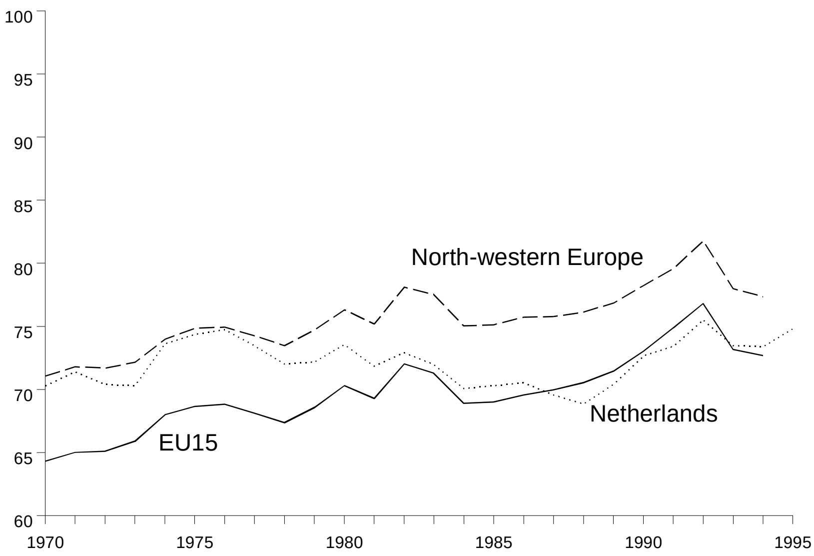


Figure 2.10 Rank of the Netherlands in the OECD league



Another yardstick for judging a countries' success (in addition to its position in a league table) is relative GDP per head. For the Netherlands, the reference group could be the OECD, the EU15, or, still more narrowly, North-western Europe, the reference group used by De Haan and Van Ark (1996) in their assessment of the recent Dutch performance and comprising Austria, Belgium, Denmark, Finland, France, West-Germany, the Netherlands, Norway, Sweden, Switserland and the UK. Figure 2.11 shows GDP per head relative to the US for The Netherlands, the (population weighted) averages of the EU15 and North-western Europe. Clearly, the relative position of the Netherlands deteriorates up to 1988 and shows some improvement thereafter.

Figure 2.11 GDP per head, US=100



2.6 International comparisons of GDP per hour worked

Turning to GDP *per hour worked*, the variable we are really interested in from the perspective of this report, the relative position of the Netherlands improves considerably, reflecting both relatively low participation rates and a low number of hours per person employed. Table 2.1 presents bilateral comparisons for a subsample of OECD countries for which data on annual hours worked could be constructed; the methodology and data used in constructing hours data are discussed in Appendix 4. The table shows that in terms of GDP per hour worked, the Netherlands has been among the two or three highest ranking of the countries included in the table. Only the US, and at the end of the period Belgium, have higher GDP per hour worked. Allowing for a plausible margin of uncertainty surrounding international comparisons of GDP per hour of at least 5% puts the Netherlands at a shared first or second position in 1994/5.

Table 2.1 Relative GDP per hour worked, US=100

	1975	1980	1985	1990	1994/5
Austria	68	76	76	83	91
Australia	68	70	72	73	71
Belgium	67	77	83	91	104
Canada	76	77	79	79	78
Denmark	60	62	65	68	77
Spain	43	49	57	60	64
Finland	52	55	60	70	79
France	70	78	86	95	95
Greece	41	47	46	49	55
Italy	70	78	79	87	93
Japan	42	47	51	61	66
Mexico	67	74	67	60	70
Netherlands	82	86	93	98	99
Norway	56	69	70	82	89
Portugal	27	32	34	38	46
Sweden	63	72	69	73	73
UK	61	65	71	75	77
W-Germany	67	75	81	89	98
Switzerland	68	73	69	80	79
Rank NL	2	2	2	2	3
PM: Rank NL GDP/head	8	10	13	14	11

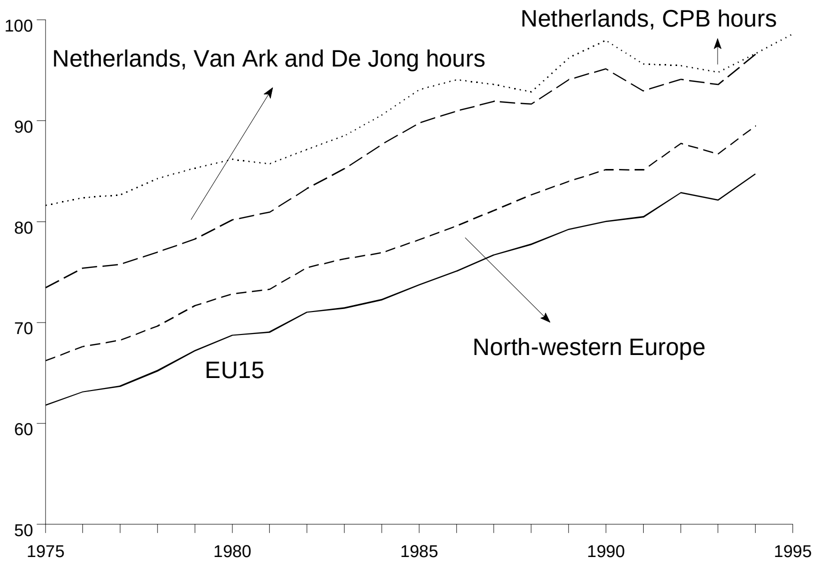
Sources: CPB, OECD, DIW

However, a less favorable impression is given in figure 2.12, which presents indexes of GDP per hour for the Netherlands, the US, the average (weighted with total hours worked) of North-western Europe, and the average of the EU15.[17] Indexes may change over time without affecting the ranking of countries and in that sense indexes contain more information than rankings. The Netherlands has clearly been catching up with the US, and at this macro-level the scope for further catching up seems almost exhausted. Moreover, the Netherlands outperforms both the EU15 and North-western Europe in terms of the level of GDP per hour. However, the Netherlands' lead is becoming smaller: there has been a sharp decline in relative GDP per hour worked of the Netherlands compared to North-western Europe and the EU15 after 1985. Part of the explanation is the major restructuring of the Dutch economy which took place in the early 1980s. The Netherlands, with its open economy and energy intensive production structure, was relatively hard hit by the second oil-crisis in 1979. The ensuing restructuring involved

[17]Excluding Luxembourg for which we have no data on hours worked, and using West-Germany for the whole period.

massive lay offs and large numbers of bankruptcies. This boosted Dutch productivity, and accounts for the relative increase in the Netherlands' GDP per hour around 1985. In other major countries in North-western Europe this restructuring process took place later, which partly explains the relative fall in Dutch labor productivity after 1985.

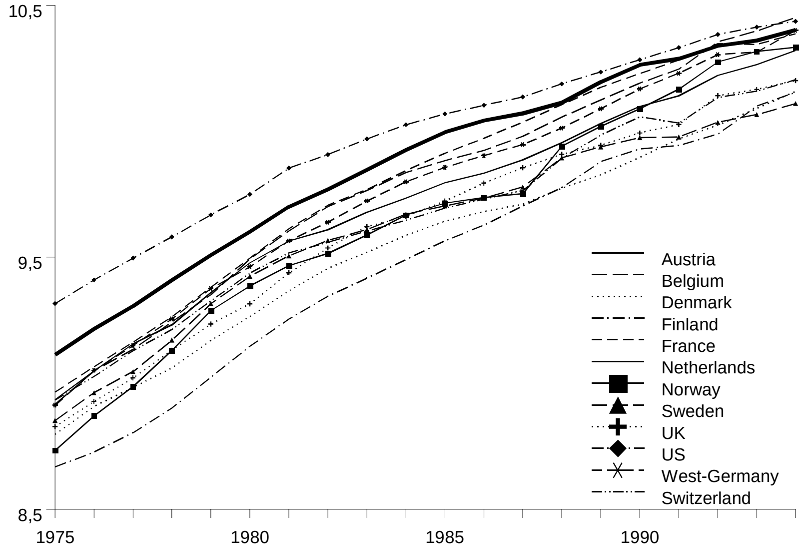
Figure 2.12 GDP per hour worked, US=100



Which countries have outperformed The Netherlands in recent years? To answer this, figure 2.13 presents GDP per hour worked for the US and for the countries of North-western-Europe. The bold line in the figure represents the Netherlands. As already indicated, the Netherlands has ranked amongst the most productive countries during the whole period 1975-1995. It is also evident that there has been convergence in the level of GDP per hour: the bandwidth between the most productive and the least productive country declines over time. The Netherlands has lost ground to Belgium, Finland, Denmark, Norway and West-Germany in recent years. But note that Finland and Denmark started in 1975 with a level of GDP per hour that was only 2/3 and 3/4 of the Netherlands' level. In these cases, a narrowing of the gap with the Netherlands should not be seen as a sign of weak Dutch performance, but rather as a sign that these countries are catching up. This may be a good thing even from the perspective of narrow Dutch self-interest: if other countries become more efficient, the Netherlands *may* benefit through an improvement of its terms of trade (for the theory behind this, see Krugman and Obstfield, 1991, pp. 36-38).

In another case – Norway – the relative Dutch decline is not the consequence of superior Norwegian economic policies but of a natural resource boom. Indeed, during the mid-1990s Dutch GDP per hour increased relative to Norway. This leaves only Belgium and (West)-Germany as two examples that could indicate a relative worsening of Dutch performance since the mid-1980s.

Figure 2.13 Log GDP per hour worked, various countries
*(**bold** line corresponds to the Netherlands)*



2.7 Sectoral productivity comparisons

This section briefly discusses international productivity comparisons at the level of broad sectors of the economy, manufacturing and services. OECD-data suggest that the Netherlands has a high productivity level in manufacturing but that it does worse in services. See table 2.2. However, this finding is surrounded by even more uncertainty than GDP per hour, due to the additional problems of measuring productivity at the sectoral level. Briefly, the additional problems are:
- The need for double deflation: both output and input must be deflated, and in general the price increases of the two will differ. However, often data limitations make double deflation infeasible, so that in practice single deflation is used, i.e. the same deflator is used for deflating sectoral output and input (Pilat and Van Ark, 1993, and the critical comments by Jorgenson, 1993).

- Spillover of measurement errors, which cancel out at the macro-level. As already indicated in section 2.2, measurement problems in services may bias estimates of services productivity downward and bias estimates of manufacturing productivity upward. This indicates that measurement errors have the biggest impact at the sectoral level. At the macro-level the two errors tend to cancel out.
- Lack of data on hours worked at the sectoral level.

Table 2.2 Relative value added per hour worked, 1990, NL=100

	Manufacturing	Services
Japan	80	77
W-Germany	95	127
France	110	135
UK	85	90
USA	114	123

Source: Van der Wiel, 1996/CPB, 1996, based on OECD-data.

Given these difficulties, it is perhaps not surprising that different researchers obtain different results. For example, van der Wiel (1996) finds that the PPP-based method of the OECD and the UVR-based method of Van Ark and others at the University of Groningen yield quite different results for the relative performance of Dutch manufacturing in 1987 (see table 2.3). The most striking case is the comparison between the Netherlands and France. According to the OECD-data, France was more productive in manufacturing than the Netherlands in 1987, but according to Van Ark the Netherlands had a substantial lead.

Table 2.3 Manufacturing productivity (per worker) according to two different sources, 1987

NL=100	Japan	W-Germany	France	UK	US
OECD	97	94	110	92	128
Van Ark (ICOP)	92	85	86	65	120

Source: Van der Wiel, 1996, p. 60

Despite the problems surrounding comparisons at the sectoral level, it is interesting to take a closer look at manufacturing productivity. Table 2.4, based on the Van Ark data, shows that labor productivity per hour in manufacturing in the Netherlands is higher than in all major OECD countries, in most cases *much* higher.

Table 2.4 Value added per hour worked, manufacturing, US-100

	1950	1973	1987	1994
The Netherlands	37.2	91.3	105.4	108.8
West Germany	32.4	79.6	82.2	85
France	38.3	73.3	84	90.5
UK	38.2	52.4	58	70.1
Sweden	49.7	88.7	87.4	91.8
US	100	100	100	100
Japan	11.8	49.2	67.5	76.1

Source: Van Ark, 1996

It is also interesting to have some idea of the difference in the level of productivity between manufacturing and services. This is shown in table 2.5, which presents value added per *contractual* hour worked in manufacturing as a percentage of value added per hour in business services in the Netherlands. Contractual hours differ from actual hours worked because of sickness, overtime etc. However, we have no data on sickness and overtime at the sectoral level. Table 2.5 shows that productivity in manufacturing has been higher than productivity in services since 1980. The difference has increased over time, and in 1995 value added per hour worked was about 25% higher in manufacturing.

Table 2.5 Productivity per contractual hour, manufacturing and business services index business services = 100

	1970	1975	1980	1985	1990	1995
business services	100	100	100	100	100	100
manufacturing	105	102	99	111	119	127

Source: CPB

This finding – that productivity in manufacturing is higher than in services – suggests that sectoral shifts partly explain changes in productivity growth. The share of manufacturing in output and employment has declined, while the share of services went up. Because labor productivity in services is lower, this leads to lower overall labor productivity. But this effect ios not very large, as shown in table 2.6. Table 2.6 shows average annual labor productivity growth per hour worked in the Dutch business sector for four sub-periods. Also shown is the contribution to labor productivity of changes in sectoral employment shares. It turns out that the contribution is minor. Productivity in the business sector falls from 3% per year in 1980-1986 to 1.4% per year in the period 1987-1995, a fall of 1½%. About 0.2%-point of this, or 13%, can be attributed to sectoral shifts. The contribution to GDP per hour worked, the measure of overall productivity growth employed in this report, is even smaller. The difference between the business sector and GDP consists mainly of government and non-business services (in

Dutch: kwartaire diensten). The employment shares of these two sectors have hardly changed since 1980, and add up to about 25%. This implies that only .15%-point (0.2x0.75) of the fall in GDP-growth per hour can be attributed to sectoral shifts.

Table 2.6 Contribution of sectoral shifts to labor productivity growth

	1971-1979	1980-1986	1987-1990	1991-1995
labor productivity growth business sector	4.7	3	1.7	0.9
contribution sectoral shifts	0.4	0	−0.2	−0.4

Source: CPB, 1996, p. 106, unpublished updates

It is important to stress that faster productivity growth in manufacturing does *not* imply that policymakers should favor manufacturing over services, e.g. through subsidies. First, productivity growth makes the economy as a whole richer. If part of the additional income is spent on services rather than on manufacturing goods, then apparently this is what consumers prefer. According to standard economic theory, policies that interfere with consumer preferences by favoring manufacturing over services are detrimental to economic welfare. Second, if the share of manufacturing in GDP falls due to foreign competition, standard economic theory again indicates that policies to stop this (through subsidies or protectionism) will lower economic welfare. Third, although standard economic theory (which assumes well-functioning markets) does not always apply, government failure may be even worse than market failure. This is the lesson from the unfavorable experience of the Netherlands and other countries with past industrial policies. In this context a knowledgeable trade-economist argues: "Policies would do better to focus on two things: first, on improving worker training and education and otherwise promoting and facilitating firms' and workers' adaptation to technological and organizational change and second, on compensating the less fortunate through transfer mechanisms that do not distort incentives to hire or work" (Lawrence, 1996, p.15).

2.8 Conclusions

The conclusions of this chapter can be summarized briefly:

1. Because of measurement error and conceptual issues, GDP *per hour worked* is an imperfect indicator of (relative) labor productivity. Therefore not too much should be made of small differences across countries or over time.
2. GDP-growth *per head* in the Netherlands has increased since the recession of the early 1980s, from an average annual growth rate of about 1% to about 2%.
3. GDP-growth *per hour worked* fell sharply in the second half of the 1970s, from more than 5% per year to about 2% per year. Since the mid-1980s there has been a further decline from about 2% to about 1% per year. However, value added per hour in the business sector, arguably a better proxy for productivity, showed a larger fall from almost 3% to just over 1%.
4. These two facts – a recovery of GDP-growth *per head* and a worsening of GDP-growth *per hour worked* – imply that hours worked per head have increased substantially since the mid-1980s. This in turn is due to the sharp increase in the number of persons employed since 1985.
5. There is clear evidence of a *relative* decline in the growth of Dutch GDP *per head* compared to other countries until 1988, and of a subsequent recovery.
6. The Netherlands still ranks very high in terms of GDP *per hour worked*. However, the lead of The Netherlands over other countries is diminishing. This may be interpreted as a relative worsening of the Netherlands' performance, which sounds as a bad thing. But it may also be interpreted as a sign that other countries are catching up technologically, which may be a good thing even from a perspective of narrow Dutch self-interest.
7. At the sectoral level, Dutch productivity is very high in manufacturing compared to other countries, but probably relatively low in services (compared to Germany and France). However, sectoral comparisons are even more complicated by measurement issues than are comparisons at the level of the whole economy. Sectoral shifts have had only a minor impact on productivity growth in the Netherlands.

Chapter 3 Employment composition and labor productivity growth

3.1 Introduction

This chapter presents an empirical analysis of the effect of changes in the composition of employment on labor productivity growth. An answer is sought to the following question: *have changes in the composition of employment had a negative effect on labor productivity growth since the mid-1980s?* Suppose the answer is affirmative, for instance because goverment policies have been succesful in raising employment of workers with low productivity. Then there is no need to worry if this results in somewhat lower productivity growth. Things are different if the productivity slowdown is caused by a fall in the rate of technological progress, in which case there is more ground for worrying. Worries are perhaps also warranted if the slowdown is caused by a decline in the growth of the capital/labor ratio, an explanation suggested by Wolff (1996).[18]

Ideally, an analysis of the effect of changes in employment composition on aggregate productivity would use data on the productivity of different types of labor. We have no direct information on productivity differences between workers with different characteristics. Therefore, we follow the standard practice in this type of studies and assume that wage differentials by age, education, gender, and part-time/full-time employment reflect productivity differentials.[19] This is quite a strong assumption because wages are determined by a host of other factors besides productivity. For example, if employers have monopsony power then the wage will be below the workers' marginal product. Union bargaining may also lead to deviations of wages from marginal products (although in some union models firms are on their labor demand curve). Another problem is that wage differentials reflect the private return to education or other characteristics, which may differ substantially from the social return. For example, Murphy et al. (1991) present evidence suggesting that a high percentage of law students among college students has a *negative* impact on economic growth! Furthermore, wage differentials in the Netherlands may be much smaller than productivity differences

[18]To some extent an increase in the employment share of workers with low productivity and a decline in the growth of the capital-labor ratio are two sides of the same coin: if employment growth of the unskilled is (partly) the result of a fall in the cost of unskilled labor, then substitution between capital and unskilled labor would lead to a fall in the capital/labor ratio. Such a neo-classical substitution process should not be seen as a problem.

[19]Examples of other studies making this assumption are Van Soest et al., 1994, Jorgenson et al., 1987, Oulton and O'Mahony, 1994, and Bernard and Jones, 1996.

because of solidaristic elements in wage setting. And finally, the existence of long-term contracts may lead to short-run deviations of the wage from the marginal product of labor (see Griliches, 1990, p. 194). By performing sensitivity analyses, we will attempt to assess whether the results are affected by these possibilities.

A limitation of our approach is that we only take into account those characteristics for which we have data. Some characteristics which could be important, such as fluency in Dutch and (un)employment history, could not be included in the analysis due to data limitations. In addition, productivity is determined not only by characteristics that can be measured objectively, but also by characteristics such as reliability, flexibility and social skills. Since employers spend considerable resources on interviewing and screening job candidates, such characteristics are probably important.

Suppose then that the employment share of workers with a low score on these unmeasured characteristics has increased. If we maintain the assumption that wage differentials reflect productivity differentials, then this should show up in the wage distribution: the left tail of the wage distribution should have become fatter in recent years, or in non-technical terms: the percentage of jobs paying a (real) wage below a certain (low) threshold level should have gone up. We will assess whether this has indeed happened through an analysis of the distribution of hourly wages for 1979, 1985, 1989 and 1994.

The chapter is structured as follows. Section 3.2 describes changes in the composition of employment since 1975. Section 3.3 presents the methodology for calculating composition effects. Section 3.4 presents the main results in a number of graphs, along with sensitivity analyses. Section 3.5 takes a closer look at the wage distribution, and asks whether the share of low paid jobs has increased in recent years. Section 3.6 uses MIMIC, CPB's applied general equilibrium model, to analyze the effects of the minimum-wage freeze during much of the 1980s and the early 1990s on labor productivity growth. Section 3.7 contains some remarks on the importance of micro-economic studies for enhancing our knowledge of the determinants of productivity growth. Section 3.8 concludes.

3.2 Trends in the composition of employment, 1975-1995

Time series on changes in the structure of employment for the period 1975-1995 are presented in appendix 5. Figures 3.1 – 3.7 summerize these data graphically. What we are looking for is a structural break around 1985, preferably a sharp one. We only find one such break, namely in the age composition. The age of the average worker, weighted by working time, rose from 36 to 37 years after 1987. Another relevant summary statistic for the changing age distribution is the share of older workers (50-plus), which had been declining from about 18% in 1975 to about 14% in 1991. In 1991 the trend was reversed, and the employment share of older workers climbed to 15% in 1995.

Figure 3.1 Employment share women

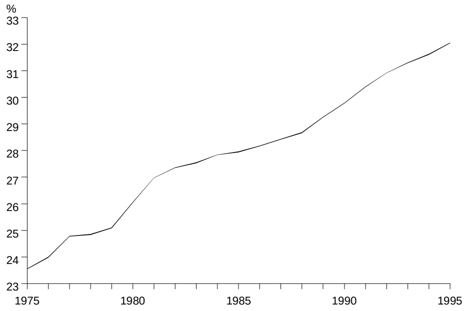


Figure 3.2 Average age of persons employed

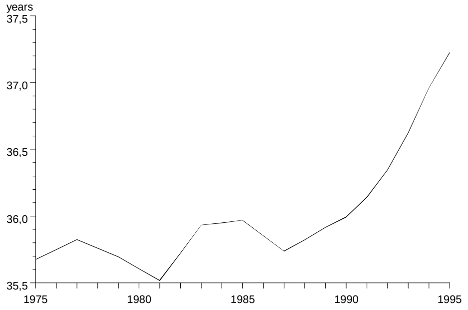


Figure 3.3 Employment share 50-plus

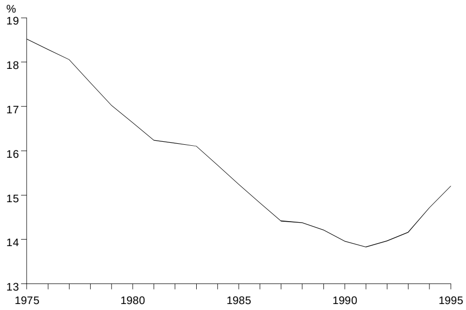


Figure 3.4 Employment share partime workers

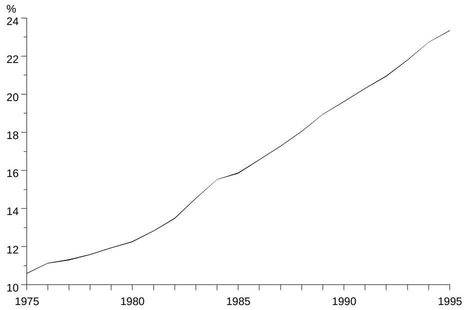


Figure 3.5 Employment share low-skilled

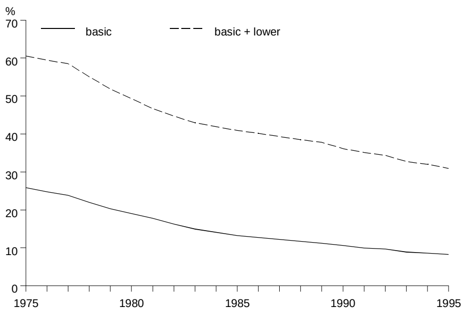
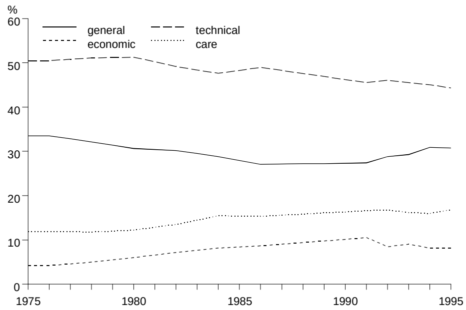


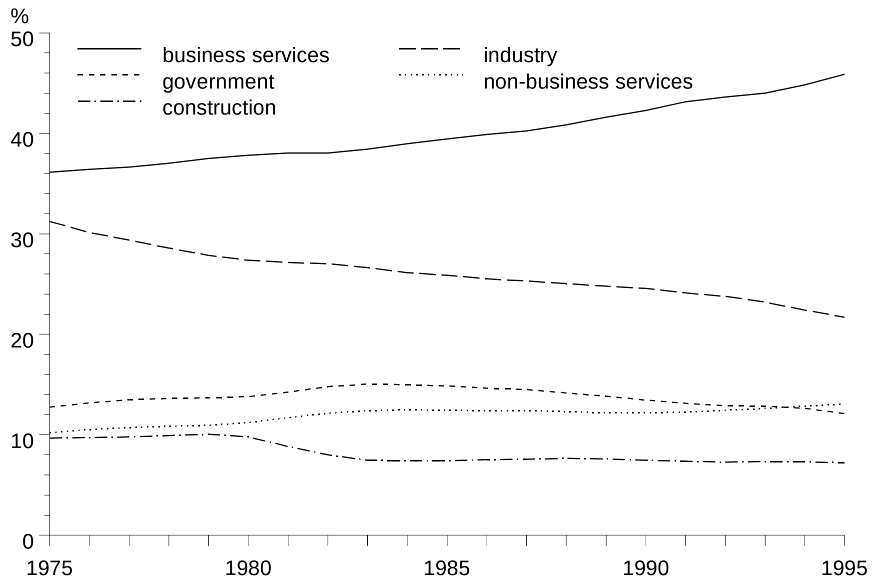
Figure 3.6 Employment share low-skilled by type of education



There have also been changes in other dimensions of the structure of employment, but these changes have all been fairly smooth. The employment share of women rose steadily from 1/4 in 1975 to 1/3 in 1995, and the share of part-time workers rose from 10% to almost 25% over the same period. The share of low-skilled workers declined from 60% in 1975 to 30% by 1995; the share of the lowest segment within the low-skilled category fell even faster, from about 25% to 10%.

Sectoral changes in employment shares were substantial over this period, but again the changes were rather continuous, as shown in figure 3.7. An exception is the fairly sudden fall in the employment share of construction in the early 1980s.

Figure 3.7 Employment shares by sector



3.3 Employment composition and labor productivity: methodology

Put simply, our methodology amounts to calculating the change in the weighted sum of the employment shares of the various types of labor (distinguished by gender, age, education, full-time/part-time employment, and sector) using hourly wage rates as weights. Readers not interested in technical details can skip the rest of this section, which presents some details of our methodology. Appendix 6 discusses the assumptions under which this methodology yields a valid index of employment composition effects.

The starting point in our estimate of composition effects is a standard semi-log wage equation:

$$\ln w_{i,t} = \alpha_t \cdot X_{i,t} + \epsilon_{i,t}$$

where X_i is a vector of dummies that measure personal characteristics of individual i, α_t is a vector of coefficients, $\epsilon_{i,t}$ is an error term and t is a time subscript. Using the estimated coefficients from this wage equation, one may calculate the change in the average wage due to changes in the composition of employment. If it is assumed that wages marginal productivities, and that production is characterized by constant returns to scale, then the change in the average wage rate equals the change in labor productivity (appendix 6 discusses why these assumptions are needed). The effect of changes in employment composition on macro-productivity may now be calculated as follows. Let y_t indicate a vector of employment shares by gender, age, education etc. in year t. Then the percentage growth in productivity that can be attributed to changes in the composition of employment (COMP), is given by:

$$COMP_t = \alpha_{t-1} \cdot (y_t - y_{t-1})$$

where we have made use of the fact that ln(1+δ)=δ for small δ. This equation says that the percentage change in productivity between year t and year t+1 that can be attributed to changes in employment composition equals the weighted sum of changes in employment shares, using the estimated coefficients as weights. It follows that the contribution of a characteristic (e.g. age) is given by the change in the employment shares of this characteristic multiplied by the relevant coefficients. Sensitivity analysis can be performed by varying the coefficients α_t.

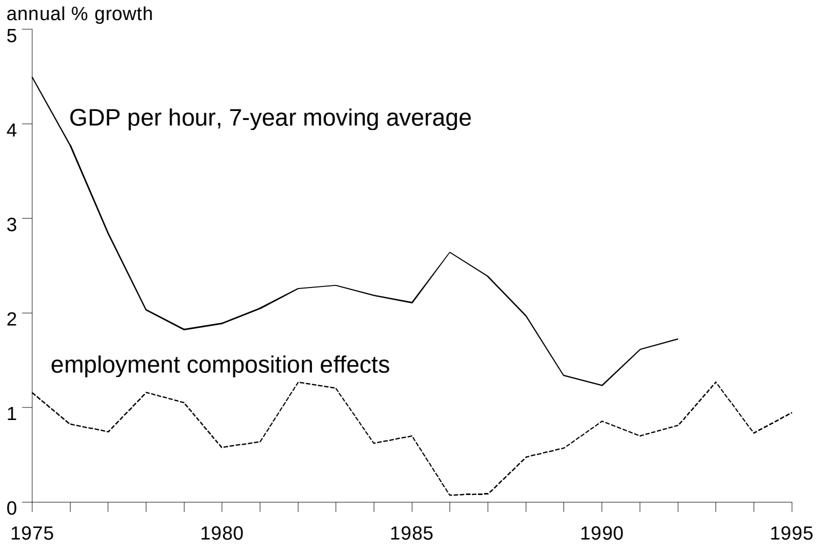
In order to estimate the weights α_t, we estimated wage equations for three different years (1979, 1989 and 1992). Estimation results are presented in appendix 7. For other years the α_t were obtained by interpolation. Wage equations for 1979 and 1989 were estimated using the Wage Surveys (*Loonstruktuuronderzoeken*) for these years. After 1989 no Wage Survey was carried out, but a wage equation for a recent year (1992) could be estimated using the AVO-data. The AVO-data do not contain information about educational type, so we are forced to assume that diffences according to educational type no longer exist in 1992.[20] For other years, coefficents for the wage equation were obtained by interpolation.

3.4 Composition effects

Figure 3.8 shows the contribution of changes in the employment composition to the growth of GDP per hour worked. Also included is the growth in GDP per hour worked itself, based on the CPB hours (using the Van Ark and De Jong series for hours worked does not alter the conclusions).

[20] This is of course unrealistic in view of the substantial differences that we find in 1979 and 1989. Fortunately, it turns out that using the coefficients from the 1989 wage equation for the whole period 1989-1995 yields virtually the same results.

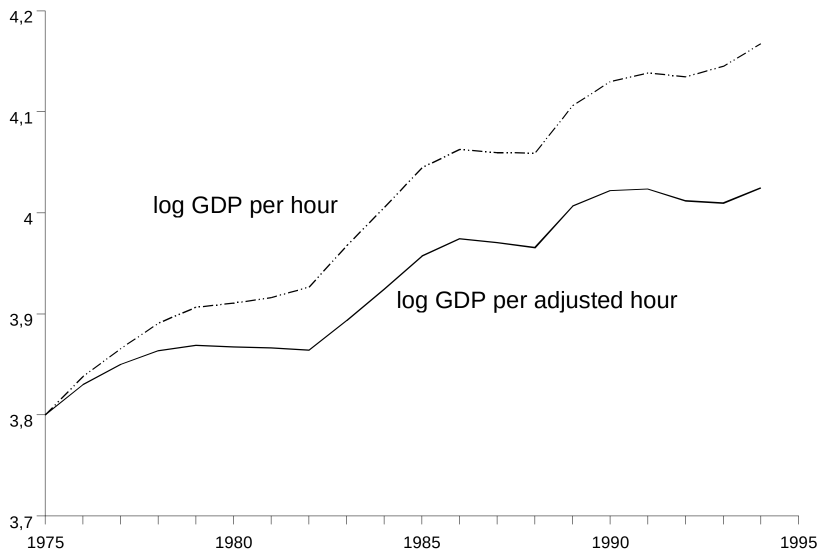
Figure 3.8 Employment composition and labor productivity growth



The figure shows that there is *no* evidence that employment composition effects have contributed to the fall in labor productivity growth since the mid-1980s. In fact, the figure suggests a declining contribution until 1986, and a rising contribution subsequently.

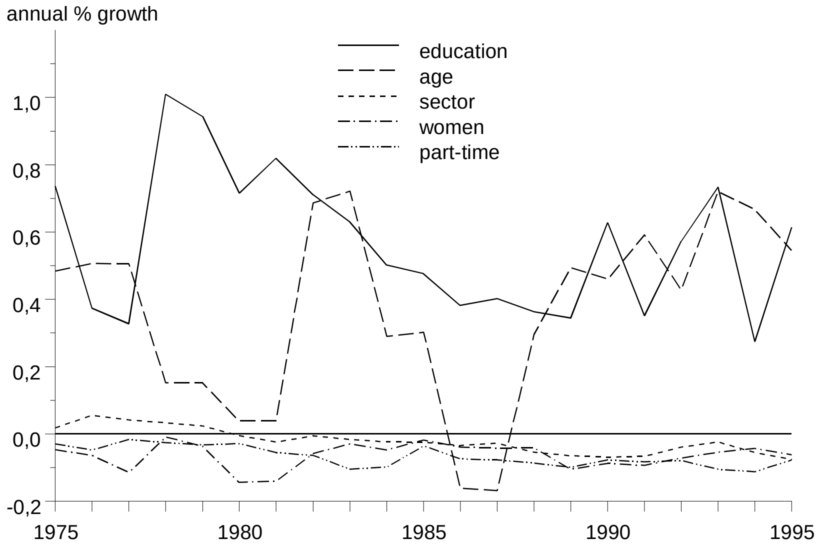
This conclusion is perhaps more forcefully conveyed in figure 3.9, which shows the logarithm of GDP per hour, as well as the logarithm of GDP per hour *adjusted for the composition of employment*. This adjustment is achieved by multiplying actual hours worked by our (cumulative) estimate of the composition effect. In effect, we multiply actual hours worked in each year after 1975 by an index of the "quality" of the average hour worked. This yields a series of employment measured in hours of constant 1975 "quality". The slopes of the lines correspond to growth rates. As was shown in chapter 2, the slope of log GDP per hour is less steep after 1985 than before 1985. If employment composition effects would explain this, then this change in slope should disappear if we switch to GDP per adjusted hour. However, the reverse happens: the change in the slope in GDP per adjusted hour is much *more* pronounced than in GDP per unadjusted hour. Indeed, GDP per adjusted hour *falls* in 1992 and 1993. This means that taking into account changes in the composition of employment does not explain the productivity decline but rather makes the puzzle worse.

Figure 3.9 GDP per hour and per adjusted hour, log-scale



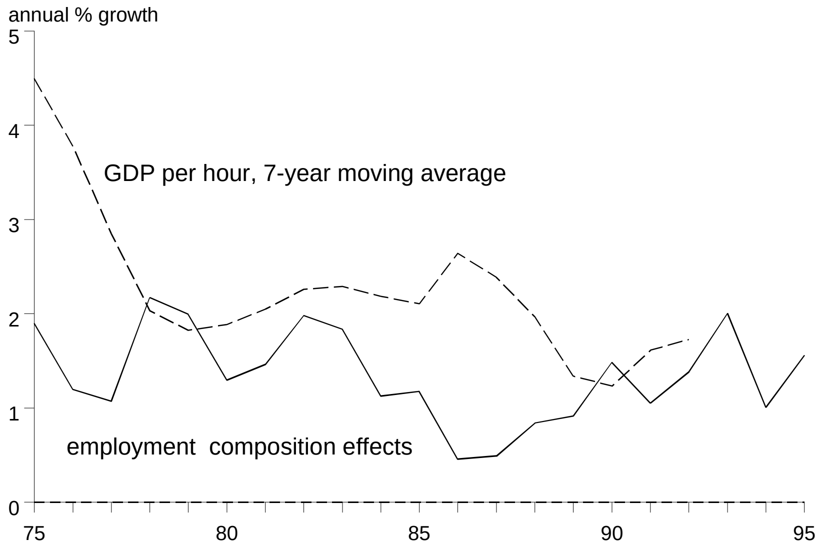
A breakdown of the employment composition effect into the various components is shown in figure 3.10. The figure shows the percentage change in productivity that can be attributed to changes in employment composition for each of the five variables studied. Thus the education line in figure 3.10 indicates that changes in the educational composition of employment have had a positive effect on productivity throughout the period. Clearly, changes in the educational composition and in the age composition account for the lion's share of the total composition effect. The age effect goes up in the 1990s, and because older workers earn more our methodology counts this as a positive composition effect, i.e. the rise in the average age has raised average productivity. This may be correct. The small share of the 50-plus population which is employed may well be the most productive share. But there may also be reasons other than productivity why wages rise with age, in which case imputing higher productivity to older workers on the basis of their higher wages would be wrong. Unfortunately it is beyond the scope of this report to analyze this further.

Figure 3.10 Breakdown of employment composition effects



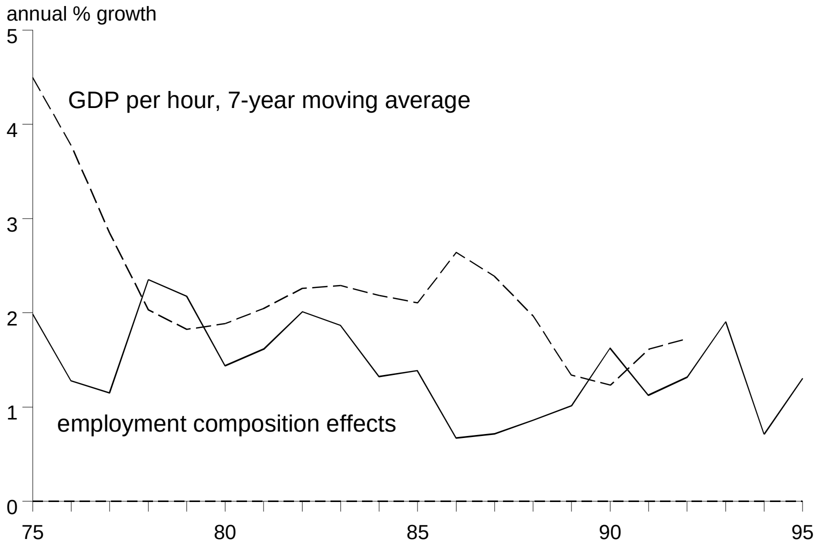
In order to assess the sensitivity of these results to the assumption that wage differentials correspond to productivity differentials, we perform two simple sensitivity checks. The first check consist of doubling the estimated coefficients for education. The idea is that productivity differentials between high and low-skilled workers may only partially be reflected in wage differentials, e.g. because of solidaristic elements in wage setting. The result is shown in figure 3.11. Composition effects become larger over the whole period, but still fail to show a decline after the mid-1980s.

Figure 3.11 Sensitivity analysis: doubling coefficients on education



As a second sensitivity check, we investigate what happens if older workers are paid more than their marginal product. To this end we lower the estimated coefficients of the age dummies for workers of age 50 years and older by 50%. This amounts to assuming that wages of older workers exceed their productivity by 100%. The result is shown in figure 3.12. Again the conclusions are not altered by this sensitivity check.

Figure 3.12 Sensitivity analysis: effect of lowering coefficients for age 50-plus



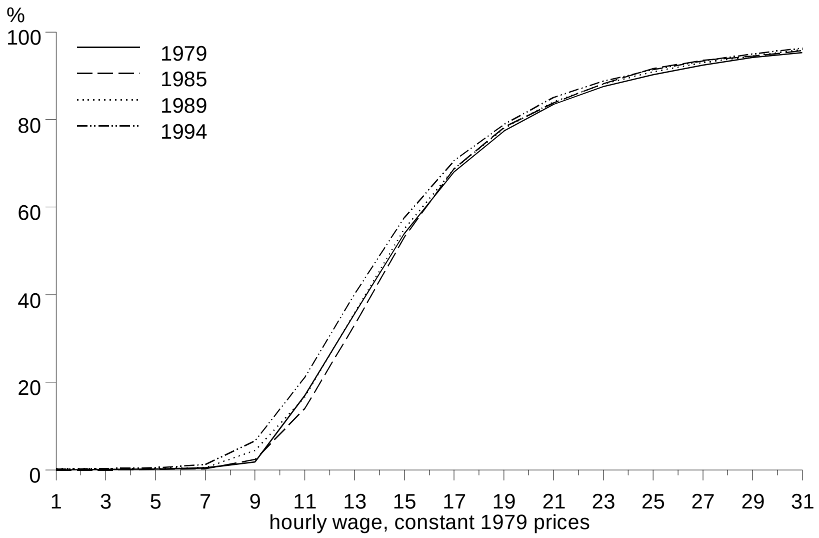
3.5 Shifts in the wage distribution

As indicated in the introduction to this chapter, a limitation of our approach is that we only take into account those characteristics for which we have data. It is interesting to assess whether the findings thus far accord with what has happened to the wage distribution. On the hypothesis that wage differentials reflect productivity differentials, an increase in the number of people employed below a certain (low) wage level would indicate that employment of low-productivity workers has increased.[21] Figure 3.13 shows wage distributions for 1979, 1985, 1989 and 1994, based on the Annual Survey of Wages and Employment, carried out by Statistics Netherlands. Wages for 1985, 1989

[21] Another possibility is that productivity has declined over the relevant range without changes in the skill level of workers, for example because of a fall in the capital/labor ratio or because of technological decline. The first possibility can be excluded: work in progress at CPB shows that the capital/labor ratio has been fairly constant during the 1980s and 1990s. The second possibility - technological decline - can be dismissed as being simply not plausible.

and 1994 have been deflated back to the level of 1979.[22] In calculating these distributions, workers of age less than 23 years old have been omitted because their wages are very strongly affected by the minimum youth wage. The minimum youth wage increases sharply with age, and as a result the age-earnings profile for young workers is very steep (about 16% per year). It is hard to believe that productivity rises that fast with experience.

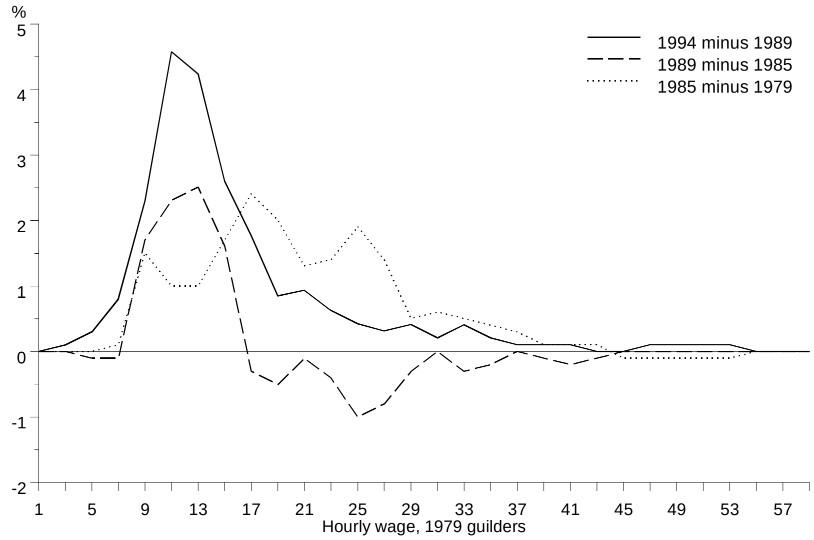
Figure 3.13 Shifts in the cumulative wage distribution, 1979-1994



From figure 3.13 we conclude that there is some evidence of a leftward shift of the distribution. In order to bring this out more clearly, figure 3.14 presents changes in cumulative wage distributions over time. Figure 3.14 should be read as follows. The vertical axis shows the *change* in the percentage of workers earning less than a certain hourly wage in constant 1979 guilders. The hourly wage rate in 1979 guilders is shown on the horizontal axis. Clearly, the percentage of jobs (in full-time equivalents) paying hourly wages of less than about 14 guilders has increased fairly rapidly in recent years.

[22]As deflator we used contractual wage increase plus *wage drift* as the deflator. This yields virtually the same results as the GDP-deflator.

Figure 3.14 Differences between cumulative wage distributions



In order to assess the impact of these shifts in the wage distribution (interpreted as shifts in the *productivity* distributio) on labor productivity, we carry out some simple calculations. First we calculate, for each of the periods 1979-1985, 1985-1989 and 1989-1994, excess employment growth in low-wage groups (by which we mean employment growth over and above aggregate employment growth). We then calculate how much higher the average hourly wage would have been if excess employment growth in low-wage groups had in fact been zero. This figure, expressed as a percentage of the actual wage, is an estimate of the effect of the increase in the employment share of workers with lower productivity on aggregate labor productivity growth. Table 3.1 shows the results from this calculation. The first two columns show that low paid employment grew more rapidly than did total employment.[23] The third column shows that this has lowered labor productivity growth, by 0.1%-points per year during the period 1979-1985 and by 0.3%-points per year during the period 1989-1994.

[23]However, this critically hinges on the exclusion of workers of age younger than 23 years. If these workers are included, growth in low-paid employment is only marginally higher than aggregate employment growth.

Table 3.1 Effect on labor productivity of above-average employment growth of low-wage workers

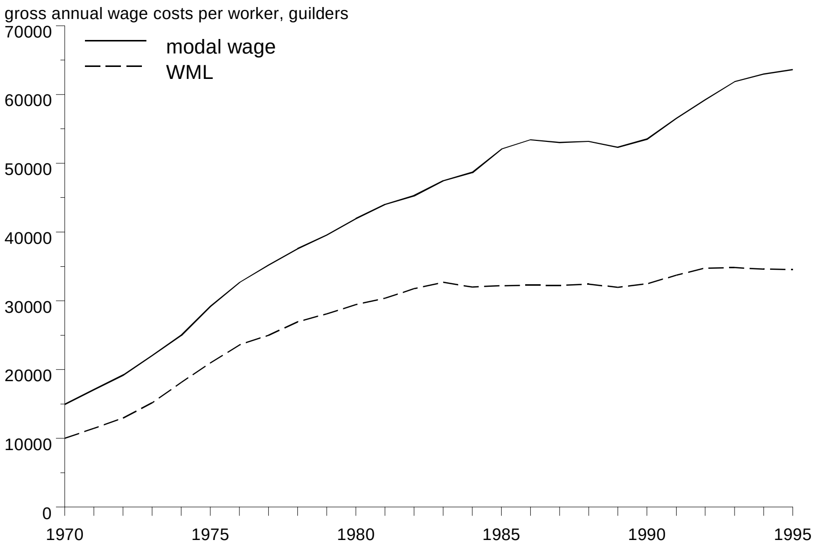
	employment growth total	low wage[a]	productivity effect
	average annual % growth		
1979-1985	−0.5	0.0	−0.1
1985-1989	1.8	3.9	−0.2
1989-1994	0.9	3.2	−0.3

[a] <14 guilders/hour, real 1979 guilders.

3.6 The minimum-wage freeze

One likely factor behind the shift in the wage distribution is the freeze of the statutory minimum wage. Until the early 1980s, the statutory (legal) minimum wage (WML) was kept at about 70% of the wage of a *modale werknemer*, i.e. a worker earning the modal wage. The automatic linkage of the statutory minimum wage to contractual wages was set aside in 1983, and the minimum wage was held constant in nominal terms for much of the 1980s. The minimum-wage was frozen again at the beginning of the 1990s. As a result, wage costs at the minimum wage increased at a much slower pace than did wage costs at the modal wage, as shown in figure 3.15. As a result of the freeze, the hourly minimum wage was about 10% lower in real terms in 1994 than in 1979.

Figure 3.15 Minimum wage and modal wage



The minimum-wage freeze may have increased employment of low-productive workers and lowered productivity growth.[24] Simulations with CPBs applied general equilibrium model MIMIC indicate that the minimum-wage freeze had reduced labor productivity by about 3% in 1995. This estimate is arrived at as follows. First, we calculate what the wage costs at the minimum wage would have been in 1995 if the statutary minimum wage had continued to follow the modal wage. The difference between this series and *actual* wage costs at the minimum wage is the wage gap attributed to the freeze. The gap amounts to about 25% in 1995.[25] Next we employ MIMIC to simulate the effect of

[24]Policies that raise employment of low-skilled workers may raise labor productivity growth through other channels. In particular, they may boost investment and the capital stock per worker, thereby attenuating or even reversing the negative composition effect on labor productivity. The net effect on labor productivity is therefore an empirical matter. This capital-accumulation effect has recently been stressed by Gordon (1997) in his comparison of labor productivity growth in the US and Europe.

[25]In calculating the gap, we assume that the modal wage would have been the same without the freeze. This is not entirely correct. Without the freeze, replacement rates would have been higher (through the link between social assistance and the official minimum wage), exerting an upward influence on the wage. However, also

lowering the minimum wage by 25%. For this purpose we use simulation results published in Gelauff and Graafland (1994, tables 10.5, p. 207 and 10.8, p. 213). From these simulation results one may conclude that lowering the minimum wage scales by 10% leads to a fall in productivity of 0.5%. Although the official minimum wage was 25% percent, not 10%, lower in 1995 than without the freeze, it is reasonable to suppose that minimum wage scales in collective wage agreements (CAOs) have only partly been affected by the freeze. By using the simulation results based on a 10% lowering of minimum wage scales we assume that lowering the official minimum wage by 1% translates into a 0.4% decline in minimum wage scales in CAOs.

However, this is not the whole story. Since the level of social assistance is closely linked to the statutory minimum wage, we must include also the effect of lowering social benefits by the same amount. Simulation results indicate that lowering social benefits by 10% decreases labor productivity by 1%. By combining the two results, we conclude that a fall in the minimum wage along with a fall of social benefits of 25%, leads to a fall in labor productivity of 3% (½%+2½x1%). This is the cumulative effect over the whole period 1983-1995, implying that the average annual growth rate of labor productivity was about 0.2% lower than it would have been without the freeze. Accordingly, MIMIC indicates that a sizeable part (20% to 40%) of the actual decline in productivity after the mid-1980s of ½% to 1%, can be attributed to the minimum wage freeze.

3.7 The need for micro studies

It is fair to say that this report does not yield final answers to the questions posed. Further research into the consequences of increasing employment of low productive workers, and more generally about the factors underlying productivity growth, is needed. Researchers increasingly turn to micro-economic analysis at the firm level (see Bartelsman and Doms, 1997, for a survey). By adopting a micro-perspective it becomes possible to do justice to the enormous heterogeneity underneath the aggregate data that we have been working with. A micro-perspective also allows one to address important policy issues which cannot be analyzed at the macro-level. Examples are the role of competition in enhancing productivity growth; the role of firing constraints (which may result in labor slack during periods of recession and thus to lower average productivity over the cycle); the importance of reallocation of labor and capital from inefficient firms to efficient firms; and the role of institutions in alleviating the so-called *hold-up problem*, which arises when agents are unable to make credible promises (Teulings

unemployment would have been higher, exerting a downward influence on the wage. In MIMIC the first effect dominates, implying that the gap correctly calculated (i.e., using the modal wage that would have applied without the freeze) is even bigger than 25%.

1996). Recent developments in productivity research suggests that these issues may be very important for understanding the causes of productivity growth (see Caballero and Hammour, 1996). Thus, although our current state of knowledge about the determinants of productivity is unsatisfactory, recent contributions hold the promise of a substantial improvement in our understanding in the not too distant future.

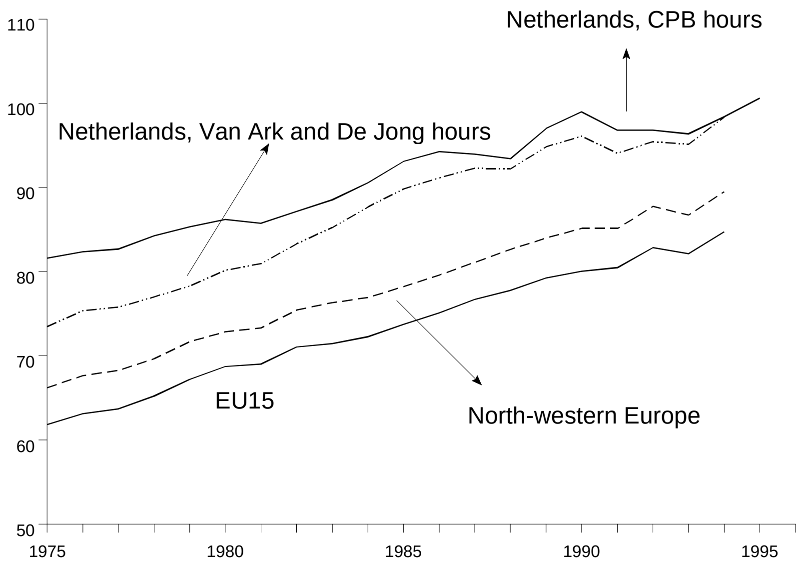
3.8 Conclusions

1. Using data on age, education, gender, working time, and sector of employment, we only detect a structural break in the age composition of employment since the mid-1980s. The average age has increased somewhat, and the share of older workers has clearly gone up, a sharp reversal of the trend in earlier years.
2. Changes in employment composition (i.e., changes in age, education, gender, working time, and sector of employment) are combined in a single index, roughly defined as a weighted average of these changes using wage differentials as weights. If it is assumed that wage differentials reflect productivity differentials, then this index measures the change in productivity that can be attributed to changes in employment composition. The index does not fall after 1985, implying that the productivity slowdown after 1985 must be caused by other factors.
3. An analysis of shifts in the wage distribution indicates that the share of low-paid jobs has increased. Assuming that wages reflect productivity, this would imply that the employment composition has shifted to less productive workers – contrary to what our employment composition index shows. One interpretation is that although *measured* changes in employment composition do not explain the decline in productivity-growth after 1985, *unmeasured* changes did play a role. A simple calculation shows that the growth of employment in low-paid (and by assumption low-productivity) jobs accounts for a productivity slowdown after 1985 of 0.2% to 0.3% per year.
4. These changes in the wage distribution are partly explained by the minimum wage freeze during much of the 1980s and the early 1990s, and the associated freeze of social assistence benefits. Model simulations indicate that the freeze accounts for a slowdown of annual productivity growth of 0.2% since the mid-1980s, a substantial part (20% to 40%) of the actual decline of ½% to 1%.
5. Even if we adjust for employment composition effects, we still find that the lead of The Netherlands in terms of GDP per hour over the EU and North-western Europe declines after the mid-1980s.[26] This is shown in figure 3.16, which reproduces figure 2.12 except that the series for The Netherlands are increased by 0.2% per year after

[26]This assumes that such employment composition effects played no role in other countries.

1985 in order to adjust for employment composition effects. Note that with this adjustment GDP per hour in The Netherlands rises above the US level. This points once more to the possibility that there may be no more scope for further catching-up with the US..

Figure 3.16 GDP per hour worked, US=100



Appendix 1 Relative GDP per head using different PPPs

Table A1.1 The Netherlands: relative GDP per head using Laspeyres and Paasche PPPs, NL=100

	1980 Paasche	Laspeyres	difference	1990 Paasche	Laspeyres	difference
Canada	128	119	9	133	123	10
US	127	115	12	154	139	15
Norway	118	108	10	106	100	6
Luxembourg	115	104	11	133	125	8
W-Germany	109	108	1	120	116	4
Denmark	109	104	5	114	109	5
France	106	103	3	116	110	6
Belgium	104	102	2	105	103	2
Australia	92	88	3	112	110	2
Japan	89	83	6	119	115	4
UK	89	85	4	102	99	3
Italy	87	83	4	106	100	6
Spain	71	71	1	82	78	4
Ireland	66	62	4	73	71	2
Greece	62	57	5	60	55	5
Portugal	53	49	4	68	60	8
Average difference			5			6

Source: Calculated from Dowrick and Quiggin, AER, March 1987, table 2, pp. 50-51.

Table A1.2 Multilateral PPPs using two methods

	PPPs: national currency per US dollar. 1993			PPPs: national currency per Dutch guilder. 1993		
	EKS	GK	% difference	EKS	GK	% difference
Belgium	37.30	36.29	−2.7	17.51	17.99	2.7
Denmark	8.79	8.32	−5.3	4.13	4.13	0.0
France	6.57	6.32	−3.9	3.08	3.13	1.5
Germany	2.10	2.06	−1.8	0.99	1.02	3.6
Netherlands	2.13	2.02	−5.3	1.00	1.00	0.0
UK	0.64	0.63	−0.5	0.30	0.31	5.0
Austria	13.90	13.82	−0.6	6.53	6.85	4.9
Finland	6.09	5.81	−4.6	2.86	2.88	0.7
Sweden	9.83	9.62	−2.2	4.62	4.77	3.3
Switserland	2.13	2.05	−3.7	1.00	1.02	1.6
Norway	8.93	8.18	−8.4	4.19	4.05	−3.3
US	1.00	1.00	0.0	0.47	0.50	5.6
EU12	0.93	0.94	1.0	0.44	0.46	6.6
OECD	1.13	1.10	−3.0	0.53	0.54	2.4

Note: The OECD reports on which this table is based use different base "countries" for EKS PPPs and GK
PPPs: for EKS, US=1 is used, while for GK, OECD=1 is used. In order to make the two sets comparable, we have converted the GK PPPs to base US=1.
Sources: calculated from OECD, 1995, 1996.

Appendix 2 Growth triangles for GDP per hour

This appendix presents *growth triangles* containing annual growth rates of GDP per hour worked for all possible subperiods after 1975. The first table is based on the CPB-hours series, the second on the hours series of De Jong and Van Ark. The tables should be read as follows. Each entry shows the average annual growth rate between year t and year t+x, where year t is given by the labels in column 1, and year t+x is given by the labels in row 1. Thus, the reader may chose any base year after 1975 and any endyear until 1995, and look up the average annual growth rate during this period. In this way, it is easy to check whether the conclusions are sensitive to the choice of period.

Table A2-1 *GDP per hour worked. average annual growth rate 1975-1995. CPB-hours*

	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
75	3.8	3.3	3.2	2.7	2.3	2.0	1.8	2.1	2.3	2.5	2.4	2.2	2.1	2.2	2.2	2.1	2.0	1.9	1.9	1.9
76		2.7	2.8	2.4	1.9	1.6	1.5	1.9	2.1	2.3	2.3	2.0	1.9	2.1	2.1	2.0	1.9	1.8	1.8	1.8
77			3.0	2.2	1.6	1.3	1.3	1.7	2.1	2.2	2.2	2.0	1.8	2.0	2.1	2.0	1.8	1.8	1.8	1.7
78				1.5	0.9	0.8	0.9	1.5	1.9	2.1	2.1	1.9	1.7	1.9	2.0	1.9	1.7	1.7	1.7	1.7
79					0.3	0.5	0.6	1.5	2.0	2.3	2.2	1.9	1.8	2.0	2.0	1.9	1.8	1.7	1.7	1.7
80						0.6	0.8	1.9	2.4	2.7	2.6	2.1	1.9	2.2	2.2	2.1	1.9	1.8	1.8	1.8
81							1.0	2.5	3.0	3.2	3.0	2.4	2.1	2.4	2.4	2.2	2.0	1.9	1.9	1.8
82								4.0	4.0	3.9	3.4	2.7	2.3	2.6	2.6	2.4	2.1	2.0	2.0	1.9
83									4.1	3.9	3.3	2.4	2.0	2.3	2.4	2.2	1.9	1.8	1.8	1.7
84										3.6	2.9	1.8	1.5	2.0	2.1	1.9	1.6	1.5	1.6	1.5
85											2.1	0.9	0.8	1.6	1.8	1.6	1.4	1.3	1.4	1.3
86												−0.3	0.1	1.4	1.7	1.5	1.2	1.2	1.3	1.2
87													0.6	2.3	2.4	2.0	1.5	1.4	1.5	1.4
88														4.0	3.3	2.5	1.8	1.6	1.6	1.5
89															2.6	1.7	1.1	1.0	1.2	1.1
90																0.8	0.3	0.5	0.8	0.8
91																	−0.2	0.3	0.8	0.8
92																		0.8	1.3	1.2
93																			1.9	1.4
94																				0.9

Table A2-2 GDP per hour worked. average annual growth rate 1975-1995. Van Ark and De Jong hours

	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
75	5.4	4.1	3.6	3.2	2.9	2.8	2.7	3.0	3.1	3.2	3.1	2.9	2.8	2.8	2.8	2.6	2.6	2.5	2.5
76		2.8	2.7	2.4	2.3	2.2	2.3	2.6	2.9	2.9	2.9	2.7	2.6	2.6	2.6	2.5	2.4	2.3	2.3
77			2.6	2.3	2.1	2.1	2.1	2.6	2.9	2.9	2.9	2.7	2.6	2.6	2.5	2.4	2.3	2.3	2.3
78				1.9	1.8	1.9	2.0	2.6	2.9	3.0	2.9	2.7	2.5	2.6	2.5	2.4	2.3	2.2	2.3
79					1.8	1.9	2.1	2.7	3.1	3.1	3.0	2.8	2.6	2.7	2.6	2.5	2.4	2.3	2.3
80						2.1	2.2	3.1	3.4	3.4	3.2	3.0	2.7	2.8	2.7	2.5	2.4	2.3	2.4
81							2.3	3.6	3.9	3.8	3.5	3.1	2.8	2.8	2.7	2.6	2.4	2.3	2.4
82								4.8	4.7	4.2	3.8	3.3	2.9	2.9	2.8	2.6	2.5	2.3	2.4
83									4.6	3.9	3.4	2.9	2.5	2.6	2.5	2.3	2.2	2.1	2.2
84										3.3	2.8	2.3	2.0	2.2	2.2	2.0	1.9	1.8	1.9
85											2.3	1.8	1.6	1.9	1.9	1.8	1.7	1.6	1.8
86												1.3	1.2	1.8	1.8	1.7	1.6	1.5	1.7
87													1.1	2.1	2.0	1.8	1.7	1.5	1.8
88														3.0	2.5	2.0	1.8	1.6	1.9
89															2.0	1.5	1.4	1.3	1.7
90																1.0	1.1	1.0	1.6
91																	1.2	1.1	1.8
92																		1.0	2.1
93																			3.3

Appendix 3 GDP per head in different datasets

Table A3.1 shows relative GDP levels of the Netherlands vis-a-vis a number of other countries, using five different series (for West Germany only three series are available), two based on the OECD Economic Outlook, two on the Penn World Table and one from the OECD Standardized National Accounts. The final year in this comparison is 1992 because this is the last year of the current Penn World Table (Mark 5.6).

Table A3.1 The Netherlands: Relative GDP per head

		1970	1975	1980	1985	1990	1992
	different sources, various countries,						
USA	OECD Outlook, constant 1991 prices,	144	139	143	152	148	143
	OECD Outlook, current prices, current	146	138	140	148	144	138
	PWT, current prices current PPPs	140	131	135	144	136	134
	PWT, chain index	141	133	136	144	139	135
	OECD NA, current prices current PPPs	142	134	136	142	138	132
UK	OECD Outlook, constant 1991 prices,	94	92	91	96	99	93
	OECD Outlook, current prices, current	94	93	92	97	100	96
	PWT, current prices current PPPs	90	86	90	97	98	94
	PWT, chain index	93	91	90	97	101	96
	OECD NA, current prices current PPPs	94	93	92	97	99	96
France	OECD Outlook, constant 1991 prices,	103	106	110	111	112	110
	OECD Outlook, current prices, current	100	103	107	108	109	109
	PWT, current prices current PPPs	99	99	103	106	105	105
	PWT, chain index	100	100	104	106	107	105
	OECD NA, current prices current PPPs	103	105	108	109	109	109
Belgium	OECD Outlook, constant 1991 prices,	94	98	103	103	105	105
	OECD Outlook, current prices, current	92	96	101	101	103	108
	PWT, current prices current PPPs	91	94	98	98	103	104
	PWT, chain index	91	94	98	98	102	102
	OECD NA, current prices current PPPs	92	96	101	101	103	108
Sweden	OECD Outlook, constant 1991 prices,	110	110	105	109	106	99
	OECD Outlook, current prices, current	109	109	106	110	107	97
	PWT, current prices current PPPs	118	118	109	117	112	106
	PWT, chain index	117	117	110	117	113	105
	OECD NA, current prices current PPPs	111	110	106	110	107	97
Switzerland	OECD Outlook, constant 1991 prices,	149	137	137	138	134	128
	OECD Outlook, current prices, current	148	135	134	135	132	129
	PWT, current prices current PPPs	133	122	121	129	129	125
	PWT, chain index	141	127	127	129	127	120
	OECD NA, current prices current PPPs	148	135	134	135	132	129
West-Germany	PWT, current prices current PPPs	102	99	106	109	113	116
	PWT, chain index	102	98	106	109	110	111
	OECD NA, current prices current PPPs	104	102	109	113	115	120
NW-Europe	PWT, current prices current PPPs	98	96	101	105	106	105
	PWT, chain index	99	98	101	105	106	104
	OECD NA, current prices current PPPs	101	101	104	107	108	108

Source: own calculation on the basis of sources listed

Appendix 4 Construction of total hours worked for other countries

This appendix describes the construction of the total hours series for other countries than the Netherlands. The starting point are data on average annual hours worked per person employed. The main source for these data is Maddison (1991, 1995). He presents data for a few years only. Data for intervening years have been obtained by logarithmic interpolation. The final year covered by Maddion in 1992. Pilat (1996) presents updates until 1994, using percentage changes from the OECD Employment Outlook. This could be done for a few countries only. We follow Pilat's procedure in order to obtain updates until 1995. Note that the hours data in the Employment Outlook is very different from the Maddison data, as can be seen from comparing the two columns for 1994. This procedure results in time series for annual hours per worker 1975-1994/5. These have been multiplied by total employment series from the OECD's economic Outlook database in order to arrive at time series for total hours worked in the whole economy.

Table A4-1 Annual hours worked per person employed

	1960	1973	1979	1987	1988	1989	1992	1994[a]	1994[b]	1995
Austria	1951	1778	1660	1595	1607	1591	1576	1576	na	na
Belgium	2174	1872	1747	1620	na	na	1581	1581	na	na
Denmark	2127	1742	1721	1669	1654	1654	1638	1638	na	na
Finland	2041	1707	1790	1663	1673	1655	1643	1654	1780	1775
France	1919	1771	1727	1543	na	na	1542	1524	1635	1631
Germany (West)	2081	1804	1719	1620	1623	1607	1563	1529	1575	1559
Italy	na	2059	na	1612	1528	na	1490	1482	na	na
Netherlands	2051	1751	1611	1387	na	na	1338	1321	1395	1397
Norway	na	1997	1559	1721	1486	na	1465	1462	na	na
Sweden	na	1823	1451	1571	1466	na	1515	1563	1532	1544
Switzerland	na	2065	1877	1930	1794	na	1645	1647	na	na
UK	1913	1688	1617	1557	na	1552	1491	1498	1728	1735
USA	1795	1717	1607	1608	1604	1604	1589	1611	1945	1952

Note: na denotes not available.
Sources: 1960-1992: Maddison (1991, 1995); 1979 Netherlands: De Jong and Van Ark (1996).
[a] Pilat (1996).
[b] & 1995: OECD Employment Outlook 1996; b. employment: OECD, Economic Outlook database (on diskette).

Appendix 5 Changes in the structure of employment, 1975-1995

This appendix contains data on the employment structure along the five dimensions distinguished in chapter 3: gender, age, education, part-time/full-time employment, and sector of employment. Before presenting the tables, we first describe the construction of the data.

A5.1 Construction of the data

Gender

For *Employees*, Labor Accounts from Statistics Netherlands (Statistics Netherlands) were used. For *self-employed*, the bi-annual AKT-surveys (Statistics Netherlands) for the period 1973-1985 and the labor accounts (Statistics Netherlands) for the period 1987-1994 were used for the gender distribution for persons. As these two sources did not match, the gender distribution of the self-employed in 1985 was asumed to be the same as in 1987 and changes in the distribution were used to backpolate to 1973. As no sources for the self-employed for 1995 were available, figures for 1994 were used.

The gender distributions for employees and the self-employed were combined using employment-data for these two groups from the National Accounts (I/O-tables). Finally a ratio between the full-time equivalent-factors for self-employed men and women was chosen in such a way that the result matched with the gender-distribution for total employment for the period 1987-1994 from the labor accounts (Statistics Netherlands). This ratio was asumed constant for the whole period 1973-1994

Education

For total employment, the labor accounts (Statistics Netherlands) contain series according to educational level in full-time equivalents for the period 1969-1993. For the extrapolation of the educational level to 1995, the change in the distribution in persons (EBB-surveys, Statistics Netherlands) was used.

The educational levels were further disaggregated according to educational type using distributions in persons from the same EBB-surveys (for the period 1990-1995) and changes in the distributions in persons from Van Opstal and Kuhry (1986, 1987) (for the period 1974-1990), mainly based on AKT-surveys.

Age

The age distribution in full-time equivalents was calculated from micro data (AKTs for 1979 and 1985, EBB for 1991 and 1992). For other years, *changes* in % shares are based on changes in these shares in persons, not full-time equivalents.

Full-time/part-time employment
Employees: Labor Accounts of Statistics Netherlands. Self-employed: assumed equal to employees. Unpublished data from Statistics Netherlands for 1992-95 indicates that we do not make a very large error by making this assumption, at least not for these years.

Sector
Statistics Netherlands, National Accounts. The five broad sectors distinguished in chapter 3 are made up of the following sub-sectors:

Industry:
Agriculture, hunting, forestry and fishing,
Mining and quarrying,
Manufacturing,
Electricity, gas and water

Contruction
Construction

Business services
Wholesale and retail trade, restaurants and hotels,
Transport, storage and communication,
Finance, insurance, real estate and business services
Other commercial services (incl. personal and household services)

Non-business services:
Sanitary and similar services,
Social and related community services,
Recreational and cultural services,

Government
Government

A5.2 Employment shares: data

Table A5-1 presents the percentage distribution of employment in fte's along the five dimensions analyzed in the text: gender, full-time/part-time, age, education and sector.

Table A5-1 Employment shares in fte's: gender, full-time/part-time, age, %

	gender		full-time/part-time		age									
	men	women	full -time	part-time	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1975	76	24	89	11	9	16	15	12	11	10	9	8	6	4
1976	76	24	89	11	8	16	15	13	11	10	9	8	6	4
1977	75	25	89	11	7	16	16	13	11	10	9	8	6	4
1978	75	25	88	12	7	16	15	14	11	10	9	8	6	3
1979	75	25	88	12	7	16	15	15	12	10	9	8	6	3
1980	74	26	88	12	6	16	15	15	12	10	9	8	6	3
1981	73	27	87	13	6	16	15	15	12	10	9	8	6	3
1982	73	27	87	13	6	16	15	15	13	11	9	8	6	3
1983	72	28	85	15	5	16	15	15	14	11	9	8	6	3
1984	72	28	84	16	4	16	15	14	14	11	10	8	6	2
1985	72	28	84	16	4	15	15	14	14	12	10	8	6	2
1986	72	28	83	17	4	15	16	14	14	12	10	7	5	2
1987	72	28	83	17	4	15	16	14	14	13	10	7	5	2
1988	71	29	82	18	4	15	16	14	14	13	10	7	5	2
1989	71	29	81	19	4	14	17	14	14	13	10	7	5	2
1990	70	30	80	20	4	14	17	14	14	14	10	7	5	2
1991	70	30	80	20	3	13	17	15	14	14	11	8	5	1
1992	69	31	79	21	3	13	17	15	13	13	12	8	5	1
1993	69	31	78	22	3	12	16	15	14	13	13	8	5	1
1994	68	32	77	23	2	11	16	15	14	13	13	8	5	1
1995	68	32	77	23	2	11	16	16	14	13	13	9	5	1

Table A5-1 Continued: education

		lower				middle				higher			scientific		
	basic	gene-ral	tech-nical	econo-mic	care	gene-ral	tech-nical	econo-mic	care	tech-nical	econo-mic	care	tech-nical	econo-mic	care
1975	26	12	18	1	4	4	9	8	5	2	2	5	1	1	2
1976	25	11	18	2	4	4	9	8	5	2	2	5	1	1	2
1977	24	11	18	2	4	4	10	9	6	2	2	5	1	1	2
1978	22	10	17	2	4	4	11	9	7	2	2	6	1	1	2
1979	20	10	16	2	4	4	12	10	7	2	2	6	1	1	2
1980	19	9	15	2	4	5	12	11	8	2	2	6	1	1	2
1981	18	9	14	2	4	5	13	11	9	2	2	6	1	1	2
1982	16	8	14	2	4	5	13	12	9	2	2	7	1	1	2
1983	15	8	13	2	4	5	14	12	10	2	2	7	2	1	2
1984	14	8	13	2	4	5	14	12	10	3	3	7	2	1	2
1985	13	8	14	2	4	5	14	12	10	3	3	8	2	1	2
1986	13	7	13	2	4	5	14	12	10	3	3	8	2	1	3
1987	12	7	13	3	4	5	14	12	10	3	3	8	2	1	3
1988	12	7	13	3	4	5	14	12	11	3	3	8	2	1	3
1989	11	7	12	3	4	5	15	12	11	3	3	8	2	1	3
1990	11	7	12	3	4	5	15	12	11	3	3	8	2	1	3
1991	10	7	12	2	4	5	15	13	11	3	3	8	2	2	3
1992	10	7	11	2	4	5	15	12	11	3	4	9	2	2	3
1993	9	7	11	2	4	5	15	13	11	3	4	9	2	2	3
1994	9	7	10	2	4	5	16	13	11	3	4	9	2	2	3
1995	8	7	10	2	4	5	16	12	12	3	4	9	2	2	4

Table A5-1 Continued: sector

	industry	construction	business-services	government	non-business-services
1975	31	10	36	13	10
1976	30	10	36	13	11
1977	29	10	37	13	11
1978	29	10	37	14	11
1979	28	10	38	14	11
1980	27	10	38	14	11
1981	27	9	38	14	12
1982	27	8	38	15	12
1983	27	7	38	15	12
1984	26	7	39	15	12
1985	26	7	39	15	12
1986	26	8	40	15	12
1987	25	8	40	14	12
1988	25	8	41	14	12
1989	25	8	42	14	12
1990	25	7	42	13	12
1991	24	7	43	13	12
1992	24	7	44	13	12
1993	23	7	44	13	13
1994	22	7	45	13	13
1995	22	7	46	12	13

Appendix 6 Wages and productivity: theory

Our methodology for measuring composition effects starts from an aggregate production function linking total value added in the economy to factors of production:

$$Q = f(K,L;A) \qquad \text{A6-1}$$

where
Q = net output
K = capital stock
L = labor input
A = state of technology.

If the price of a factor of production equals its marginal product, and if the production function is characterized by constant returns to scale, then changes in output can partly be attributed to changes in the use of factors of production using the following equation, obtained by totally differentiating equation A6-1:

$$\dot{Q}_t = (\frac{wL}{Q})_{t-1} \cdot \dot{L}_t + (\frac{rK}{Q})_{t-1} \cdot \dot{K}_t + T\dot{F}P_t \qquad \text{A6-2}$$

where a dot above a symbol indicates a relative change over time, w = the wage rate, and r equals the cost of capital. TFP stands for *Total Factor Productivity*. This is a residual term, representing the part of the change in productivity which cannot be attribited to changes in inputs. This is often interpreted as an indicator of technical change. In words equation A6-2 says that changes in output equal a weighted sum of changes in factors of production, using factor shares as weights.

The same method can be used to calculate employment composition effects on labor productivity growth. To illustrate this, we assume that production depends on the use of two types of labor (in the empirical application we distinguish many more types):

$$Q = f(L_1,L_2;A) \qquad \text{A6-3}$$

Assuming constant returns to scale, it follows that output per unit of labor – i.e. labor productivity – is equal to:

$$\frac{Q}{L} = f(\frac{L_1}{L},\frac{L_2}{L};A^{/}) \qquad \text{A6-4}$$

where L = L_1+L_2, the total amount of labor used measured in hours worked. If we again assume that workers receive their marginal product, then totally differentiating equation A6-4 results in the following equation for labor productivity:

$$\dot{q}_t = w_{1,t-1}\cdot\dot{l}_{1,t} + w_{2,t-1}\cdot\dot{l}_{2,t} + \dot{tfp}_t \qquad \text{A6-5}$$

where undercase symbols equal the corresponding uppercase symbol, divided by total labor use L (for example, q=Q/L). Equation A6-5, when translated into plain English, says:

change in labor productivity =
wage rate type 1 labor in base year × change employment share type 1 +
wage rate type 2 labor in base year × change employment share type 2 +
a residual term.

Equation A6-5 forms the basis for calculating the contribution of changes in employment composition to labor productivity. Ideally, we would use separate wage rates and employment shares for the different types of labor, distinguished by age, gender, education, full-time/part-time employment, and sector. However, our data do not allow such a detailed breakdown of employment. We only have data on changes in the employment shares for each of the five dimensions separately. Composition effects can still be calculated if we assume that wages are determined by a linear wage equation:

$$w_{i,t} = \alpha_{0,t} + \alpha_{1,t}\cdot X_{1,i} + \alpha_{2,t}\cdot X_{2,i} + \ldots \qquad \text{A6-6}$$

where the X_i are dummy variables indicating whether individual i has a certain characteristic. Plugging this wage equation into equation A6-5 yields:

$$\dot{q}_t = \alpha_{1,t-1}\cdot\dot{Share}_{1,t} + \alpha_{2,t-1}\cdot\dot{Share}_{2,t} + \ldots \qquad \text{A6-7}$$

Where $Share_1$ indicates the employment share of workers having characteristic 1, e.g. the employment share of women. However, this procedure is restrictive because it excludes the possibility of interaction effects in the wage equation. Empirical evidence indicates that such interaction effects are important. For example, Waaijers (1995) finds that education has a larger impact on wages of older workers than on wages of young workers. Another problem with this derivation is that the literature indicates that a semi-log form is a more appropriate functional form for the wage equation than the linear form assumed here. With a semi-log wage equation, the transition from equation A6-5 to equation A6-7 is no longer possible. Fortunately, Rosenblum et al. (1990) show for the U.S. that one does not make a very large error if one uses a semi-log wage equation and proceeds in the manner indicated in the text. Similarly, Waaijers (1995) shows that for our purposes -measuring composition effects- the ideal procedure and the alternative procedure used here give almost the same results for the period 1991-94.

Appendix 7 Wage equations

Estimation results for the wage equations used in chapter 3 are shown in table A7. We do not report t-values, since nearly all coefficients are highly significant due to the large sample size. Only one sector dummy is insignificant, as indicated in the table. The coefficients in the table have a simple interpretation. When multiplied by 100 each coefficient represents the percentage change in hourly wage between an individual with a certain characteristic and a reference individual without that characteristic, where the reference individual is a male employee working full-time, who is between 15 and 19 years of age, who has received only basic education, and who has a job in industry. For example, women had an expected wage 14% lower than the reference individual in 1994, everything else equal.

The pattern of wage differentials implied by these coefficients looks quite plausible. Women earn less than men, even after accounting for differences in other observed characteristics. Note that this does not necessarily point to discrimination (which is illegal), since it is possible that on average men and women differ in characteristics not included in our data, such as the type of job. Wages are also lower for part-time workers. Wages increase with age and education, and are somewhat lower in services than in other sectors of the economy. The coefficients also imply a decline in the returns to education between 1979 to 1989, and an increase between 1989 and 1992. However, not too much should be made of the increase, since the two datasets (the LSO79 and the AVO93) may not be entirely comparable.

Table A7 Wage equations; dependent variable gross hourly wage rate

		lso79	lso89	avo92
gender	man	-	-	-
	woman	−0.15	−0.18	−0.14
working-time	full-time	-	-	-
	part-time	−0.09	−0.11	−0.12
age	age 15-19	-	-	-
	age 20-24	0.37	0.59	0.53
	age 25-29	0.51	0.85	0.73
	age 30-34	0.61	0.97	0.83
	age 35-39	0.66	1.06	0.89
	age 40-44	0.69	1.11	0.95
	age 45-49	0.71	1.13	1.01
	age 50-54	0.72	1.14	1.04
	age 55-59	0.72	1.18	1.04
	age 60-64	0.67	1.18	1.11
education	basic	-	-	-
	lower general	0.07	0.15	0.12
	lower engineering	0.05	0.07	0.12
	lower economic	0.14	0.19	0.12
	lower care	0.07	0.15	0.12
	middle general	0.25	0.28	0.33
	middle engineering	0.21	0.18	0.33
	middle economic	0.31	0.36	0.33
	middle care	0.32	0.26	0.33
	higher general	0.52	0.41	0.61
	higher engineering	0.53	0.49	0.61
	higher economic	0.45	0.47	0.61
	higher care	0.59	0.50	0.61
	university general	0.81	0.59	0.91
	university engineering	0.87	0.66	0.91
	university economic	0.99	0.84	0.91
	university care	0.80	0.71	0.91
sector	manufacturing + utilities	-	-	-
	construction	0.09	0.00[a]	0.06
	business services	0.01	−0.06	−0.06
	goverment	0.09	0.08	−0.01
	non-business services	0.02	−0.07	−0.02
N		24045	19877	21521
R2		0.65	0.60	0.65

Note: all coefficients highly significant, except
[a] which is not significant at the 5% level

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Abstract

Labor productivity growth slowed down in the Netherlands after the mid-1980s. It is sometimes argued that this is worrying, since advances in material well-being ultimately require productivity growth. Others have argued that the recent slowdown is in part due to the rising employment share of workers with lower levels of productivity, possibly as a consequence of government policies in this area. To the extent that the latter explanation is correct, the productivity slowdown is only temporary.

This report starts off with an empirical overview of productivity growth in the Netherlands. After reviewing problems of measuring and comparing productivity, the empirical evidence on the recent productivity slowdown is presented. It is concluded that The Netherlands still ranks very high in terms of GDP per hour worked. However, the lead of The Netherlands over other countries is diminishing. GDP-growth per hour worked fell sharply in the second half of the 1970s, from more than 5% per year to about 2% per year. Since the mid-1980s there has been a further decline from about 2% to about 1% to 1½% per year.

The report then turns to the role of changes in employment composition in the recent productivity slowdown. It is shown that changes in employment composition along the dimensions age, education, gender, full-time/part-time employment and sector of employment cannot explain the recent slowdown. However, shifts in the wage distribution do indicate a rise in the employment share of workers with lower productivity, at least if one assumes that wage differentials reflect productivity differentials. One reason for a rising employment share of workers with lower productivity is the nominal freeze of the statutory minimum wage during much of the 1980s and 1990s. Simulations with MIMIC, CPBs applied general equilibrium model, indicate that this may indeed have lowered aggregate labor productivity.

Thus, on balance the available evidence indicates that employment composition effects did play a role in the productivity slowdown.