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PRODUCTIVITY, HOURS WORKED, AND TAX/BENEFIT SYSTEMS IN EUROPE AND BEYOND

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ABSTRACT: We analyse the development of labour productivity and hours worked by the working-aged population in the EU25 countries and other OECD countries in 1960-2004. We emphasise the possible effects of taxes, benefits and other labour-market variables. First, we describe the trends in productivity and hours worked especially in the EU15 countries relative to the United States. Then we use both cross-section analyses of the 1995-2004 period and pooled least squares panel data analyses of the 1960-2004 period to explain the developments. Taxes and gross replacement rates do not correlate with productivity growth. Instead, productivity growth is influenced positively by investment into fixed assets, R&D and ICT, higher levels of education, and lower product market regulation. According to the results, taxes and gross replacement rates do have a negative effect on the average number of hours worked. Also the ratio between collective bargaining coverage and trade union density as well as higher product market regulation seem to have a negative effect on the number of hours worked.

KEY WORDS: Productivity, growth, hours worked, convergence

JEL CLASSIFICATION: O47, J24, O57, C33

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TIIVISTELMÄ: Tässä tutkimuksessa analysoidaan työvoiman tuottavuuden ja työikäisen väestön keskimäärin tekemien työtuntien määrän kehitystä EU25- ja muissa OECD-maissa vuosina 1960-2004. Tutkimuksessa painotetaan verotuksen, etuisuuksien ja muiden työmarkkinamuuttujien mahdollisia vaikutuksia. Ensin kuvataan tuottavuuden ja tehtyjen työtuntien kehitystä erityisesti EU15-maissa verrattuna Yhdysvaltoihin. Sitten käytämme sekä poikkileikkausanalyysia vuosille 1995-2004 että paneelianalyysia vuosille 1960-2004 havaitun kehityksen selittämiseksi. Verotus ja bruttomääräinen työttömyyskorvausaste eivät selitä tuottavuuden kasvua. Sen sijaan tuottavuuden kasvuun ovat vaikuttaneet positiivisesti kiinteät, t&k- ja ICT-investoinnit sekä korkeampi koulutus ja vähäisempi hyödykemarkkinoiden regulaatio. Tulosten mukaan verot ja bruttomääräinen työttömyyskorvausaste vaikuttavat kuitenkin negatiivisesti keskimääräisiin tehtyihin työtunteihin. Lisäksi työehtosopimusten kattavuuden suhde ay-jäsenyyden laajuuteen sekä korkeampi hyödykemarkkinoiden regulaatio näyttävät vaikuttavan tehtyjä työtunteja vähentävästi.

ASIASANAT: tuottavuus, kasvu, tehdyt työtunnit, konvergoituminen

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1 INTRODUCTION

Europe is said to be suffering from a productivity problem and, indeed, the big picture that has emerged since the mid-1990s is just that. Up until then the EU15 countries were, on average, catching up with the United States in terms of GDP per hour worked, but then the trend was reversed. This has largely been credited to a failure by the Europeans to produce and utilise modern information and communication technology (ICT) in both manufacturing and service sectors. The new trend in productivity growth is worrying, because in the long run incomes depend on how productive we are. However, there are considerable differences between European countries in this respect and the picture is not necessarily as bleak as is often portrayed.

The catching up in terms of productivity before the mid-1990s did not help the EU15 countries to catch up with the USA in terms of GDP per capita, because at the same time Europeans also tended to decrease the average number of hours worked by the working-aged population. The total number of hours worked comprises of a decline in the average number of hours worked by each employed person as well as of a lower participation rate and higher unemployment than in the USA. The first is also affected by, among other things, part-time working and the length of vacations. We will abstract from this decomposition and concentrate on the total number of hours worked divided by the working-aged population.

Working time may be an implicit or explicit choice of the society to work less and have more leisure time which is of course valuable in itself. However, how much work is done may not be just an independent choice but also a function of institutional factors and financial incentives among other things. For example, relatively high tax rates in Europe are sometimes said to cause the lower number of working hours. Labour market institutions and legislation may increase rigidities in the labour market which will limit employment opportunities. For example, it is possible that jobs with lower productivity which produce less value added are left unformed, or women may be discouraged by taxation or other financial or social factors from entering the labour force. These would lower the employment rate and the participation rate.

While Europe has been lagging behind the United States in terms of productivity growth during the past ten years, the decreasing trend in the number of hours worked relative to the USA has on average stopped and even turned slightly around. Despite slower GDP growth and slower population growth, aggregate employment increased faster in the EU15 countries than in the USA between 1997 and 2002. Labour force participation has been rising faster in Europe than in the USA more or less since 1990.

If these new jobs have mostly been formed in sectors with lower-than-average productivity, then average productivity growth has slowed down and the worry about slower European productivity growth may be exaggerated. In the long run there should be no correlation between the level of employment and productivity growth, nor should there be any between the level of unemployment and productivity growth. However, there is a correlation between how many people are employed and how many hours they work on the one hand and GDP per capita on the other hand. As Europe faces a problem with ageing populations, this is important because, potential for higher private consumption aside, it is easier to finance the costs related to ageing (health care, pensions, etc.) from a larger income pool than from a smaller one.

In this study, we will decompose GDP per capita into labour productivity and labour input and systematically use this decomposition to analyse the differences between the

EU25 and other OECD countries[1]–excluding Iceland, Mexico and Turkey.[2] We also distinguish a smaller group of 18 high-productivity countries for which emphasis on innovation is more important than for the countries further back in the catching-up process. The group of high-productivity countries does not include the new EU member countries, Portugal, Greece, South Korea and New Zealand. This division was made on the basis of the level of productivity in 2004.[3] The group of high-productivity countries had at least 70 per cent of the US level of productivity.

In the cross-section analyses of the averages in 1995-2004, productivity is analysed in the light of research and development (R&D), taxation, human capital and ICT investment in particular, while the number of hours worked is analysed in the light of the tax and benefit systems and labour market institutions. We see that the generalisations used to explain the differences between Europe and the USA are often used too loosely. In the pooled least squares panel estimations spanning the whole 1960-2004 period, we emphasise the tax and benefit variables, but also include other control variables.

We will first discuss the general trends in economic size, GDP, population and the labour supply. After this there is an analysis of productivity in Section 3 and an analysis of the development in the number of hours worked in Section 4. Section 5 discusses the possible interaction between productivity and the number of hours worked. Section 6 concludes.

Labour productivity is calculated as purchasing-power adjusted GDP divided by the total number of hours worked in the economy during the year.[4] The data for the number of hours worked are from the website of the Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net, in the autumn of 2005. Data for GDP, population, civilian employment and civilian labour force are from the Eurostat AMECO database unless otherwise stated. Some OECD data have been used in, for example, taxation and labour market institutions. Other sources are credited when the data are used. The data period covered is 1960-2004.

2 CHANGING SOURCES OF THE DIFFERENCE IN GDP PER CAPITA BETWEEN THE EU AND USA

Economic size is important in, for example, trade and other negotiations. Europe's weight in the world has been declining as the share of the EU15 countries in global GDP in purchasing-power terms[5] has been decreasing since the mid-1960s. Neither the enlargement of the EU in 2004 nor any future enlargement will change this develop-

1 A maximum of 33 countries depending on the issue and availability of data.

2 Also see Blanchard (2004) for a like comparison between the EU15 and the USA.

3 As caveats it should first be noted that there are differences between countries in terms of data measurements, which may have a considerable effect on the calculated figures. The use of hedonic indices is one example of this, discussed in the context of the USA by e.g. Baudchon and Brossard (2003). Edquist (2005) discusses price indices in the context of Sweden and argues that in Sweden, where ICT production has been important for total productivity growth, growth has been overestimated because of the value-added price deflators used, and that this may also concern Finland, Ireland and South Korea. Also for example the relative size of public sector employment may affect the data because the measurement of value added in non-market sectors is not straightforward.

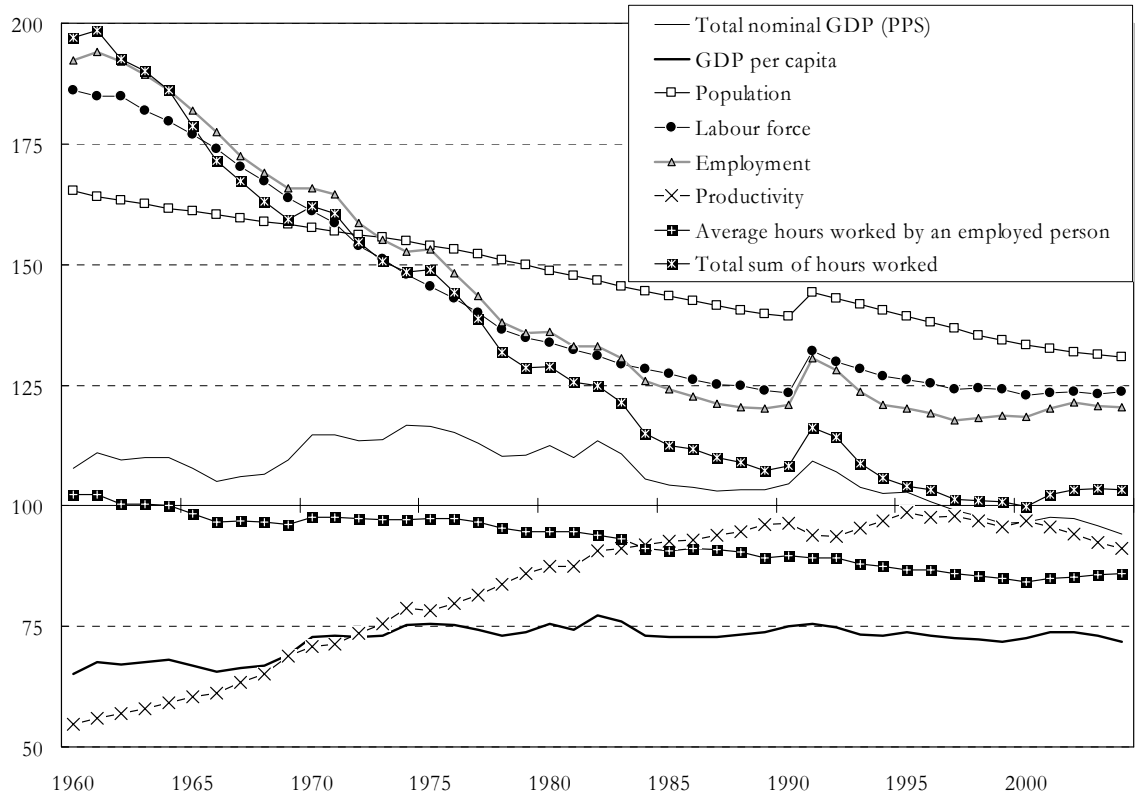
4 The picture that emerges might be different if we were to look at total factor productivity. According to some estimates, the growth rate of total factor productivity has not been that much lower in the EU15 countries compared with the United States as the growth rate of labour productivity in recent years.

5 Data from Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

ment, ceteris paribus. Consequently, Europe will have to do with gradually decreasing importance in global politics and economics.

The share of the United States in global GDP has so far remained unchanged since the mid 1970s. Compared with the USA, Europe's relative decline has been due to lower population growth, people working increasingly less and, since 1995, also slower productivity growth (see Figure 1). The total number of hours worked in the EU15 countries was 263 billion in 1960 and it has stayed around that figure ever since. Meanwhile, the respective figure in the USA has risen from 134 billion in 1960 to 253 billion in 2004.

Figure 1 GDP, population and productivity statistics in the EU15, USA = 100



Note: Unified Germany from 1991 onwards.

Sources: Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

Figure 2 shows the decomposition of GDP per capita in logs in the EU15 countries relative to the United States in the following way:

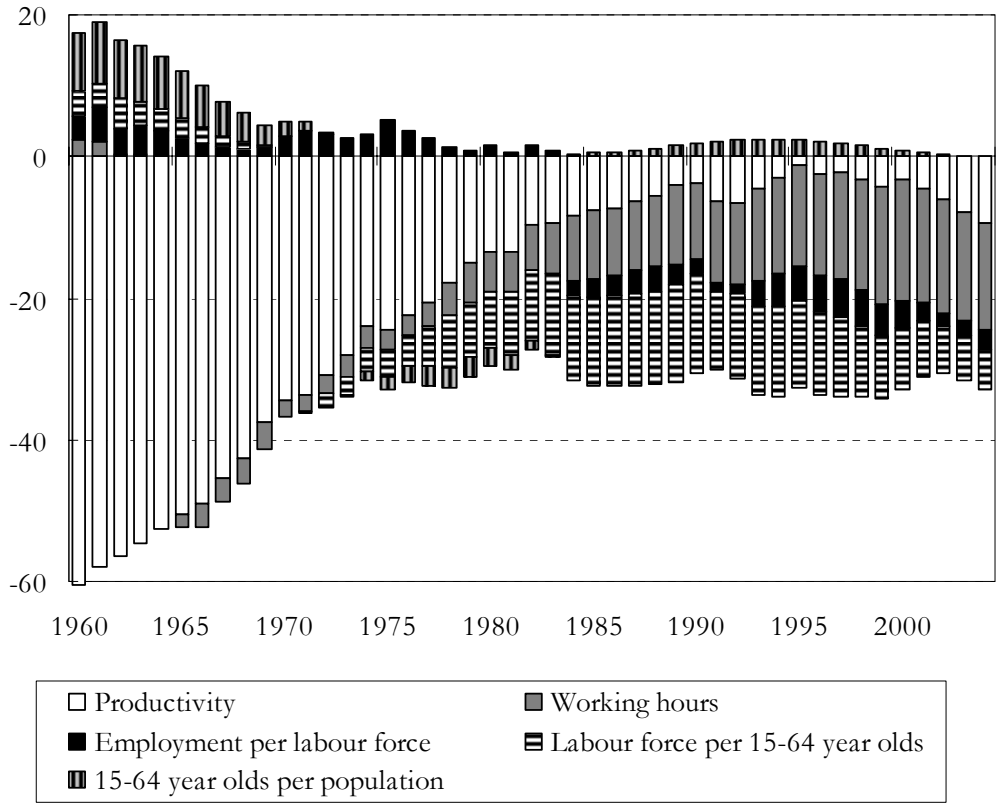
$$\frac{Y}{P} = \frac{Y}{H} \cdot \left[\frac{H}{E} \cdot \frac{E}{L} \cdot \frac{L}{N} \right] \cdot \frac{N}{P}, \qquad (1)$$

where Y is GDP in nominal purchasing power terms, P is population, H is the total number of hours worked in the economy in a year, E is employment, L is the labour force, and N is the working-aged population (15-64 year olds). Consequently, GDP per capita is decomposed into productivity, the three labour market variables (average number of hours worked by each employed person, one less the unemployment rate, and labour force participation), and a demographic ratio that can be considered more or less exogenous. The value in brackets is equal to the average number of hours worked by the working-aged population.

The largest differentiating factor between the EU15 and the USA is the average number of hours worked by each employed person. However, that development has actually

slightly improved from the point of view of Europe in the past few years. Instead, the productivity gap has been widening.

Figure 2 GDP per capita in the EU15, difference in logs to the USA



Sources: Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

The enlargement of the EU in 2004 to include Central and Eastern European countries had no considerable effect on Europe's aggregate GDP. The enlargement raised the total population of the EU considerably, and it raised the average growth rate of productivity and the average number of hours worked in Europe. However, the population growth rate in the new member countries is even lower than in the EU15 countries.

3 THE DEVELOPMENT OF PRODUCTIVITY

In this section we will first discuss how productivity levels have converged in the past. Then we will use cross sections to discuss some factors that may have affected productivity growth after 1995. Finally we will construct a pooled least squares panel data estimation for the 1960-2004 period in order to explain productivity growth.

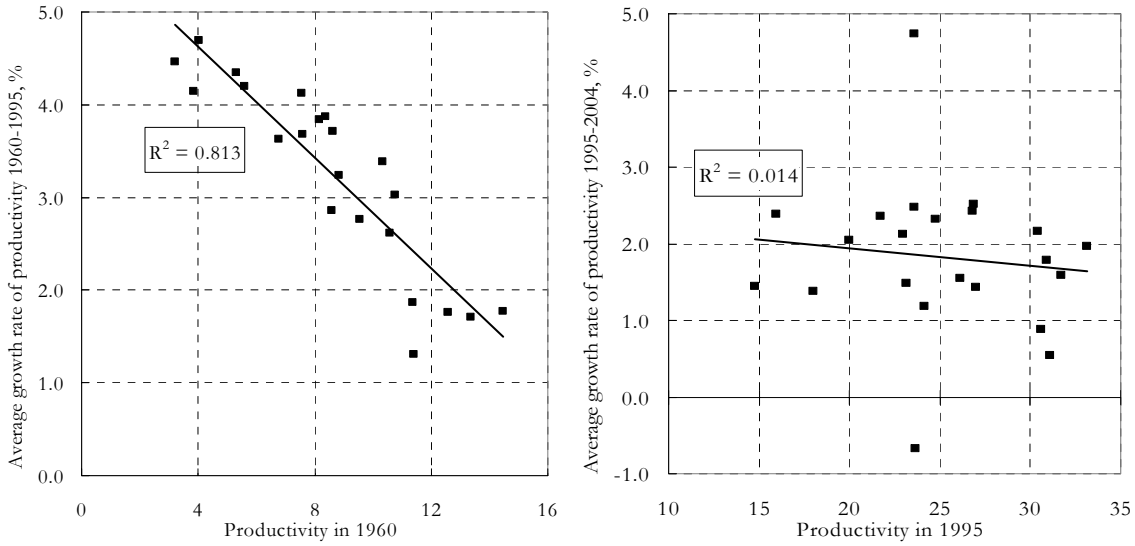
3.1 Convergence of productivity levels

Under free trade and free capital movements, countries (firms) have in principle access to the same technology–notwithstanding patent rights etc.–and are constrained largely only by their ability to use it. Countries with lower initial productivity will normally catch up at least to some extent with countries that have higher initial productivity by taking

into use modern technology, modern business management and public administration, and by practising sound macroeconomic policies, among other things. This explains a lot of the catching up of the EU15 countries with the USA after the second world war and of the new EU member countries' catching up with the EU15 since the early 1990s.

Figure 3 shows the 'old' OECD countries in 1960-1995 and 1995-2004 with their initial levels of productivity and average growth rates during these periods. This separation is due to the convergence of most EU15 countries towards the USA up until 1995 and divergence thereafter. During the first time period, 1960-95, there is a clear tendency for countries with lower initial productivity to catch up with the countries that had higher initial productivity. However, during the shorter ten-year period between 1995 and 2004 there is no such relationship. This ten year period may of course be too short and influenced by the business cycles among other things.

Figure 3 **Productivity in 1960 and 1995 (PPS in 1995 prices) and its real growth rate in 1960-1995 and 1995-2004**



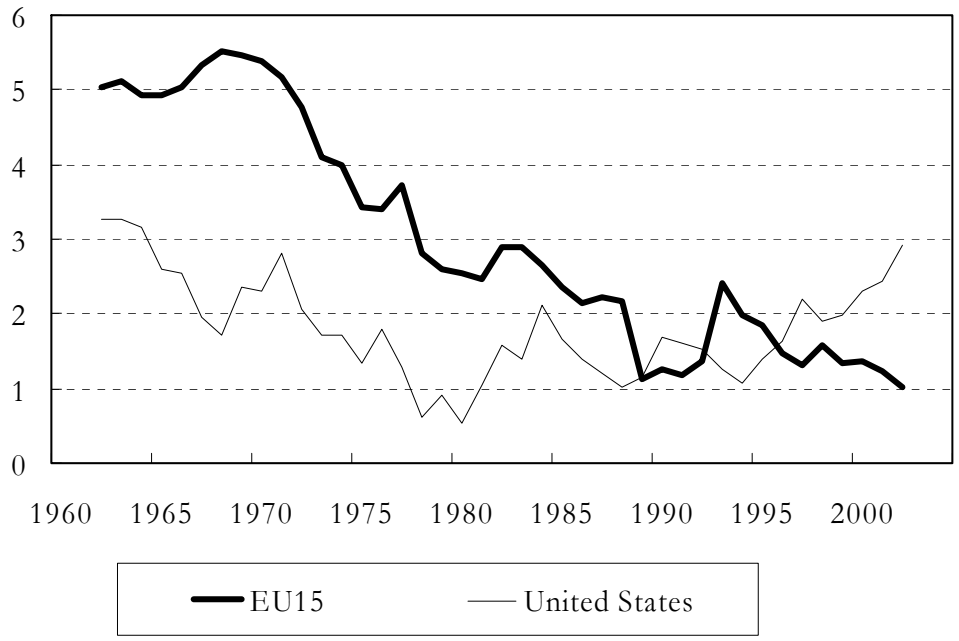
Note: Countries included are Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom, USA, Japan, Canada, Switzerland, Norway, Australia and New Zealand. If we were to include the new member countries in the right-hand side graph, we would again find convergence.

Sources: Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

Figure 4 shows average productivity growth in the EU15 countries and the USA. The reunification of Germany dents the former curve in the beginning of the 1990s. Growth accelerated in the United States after 1995, while average growth in the EU15 countries has been slowing down dramatically in relative terms.

Table 1 shows the average growth rates of productivity in 1995-2004 by countries. The growth rate in the EU15 area was 1.3 per cent, or 1.1 percentage points lower than in the United States. Of the EU15 countries Greece, Luxembourg, Austria, Finland, Sweden and the UK were very close to the US rate and France was not that far. Ireland's growth rate was twice as high as that in the USA. The particularly weak countries in Europe were Spain and Italy, and to a smaller extent the Netherlands. If we were to exclude Italy and Spain, productivity growth in the rest of the EU15 was actually the same as in the USA in 1995-2000, after which it has been a little slower than in the USA.

Figure 4 **Real productivity growth rate, centred 4-year moving averages, %**



Sources: Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

Table 1 **Average productivity growth in real terms in 1995-2004, %**

Region/country	Growth rate	Country	Growth rate	Country	Growth rate
EU15	1.3	**Netherlands**	0.9	**Malta**	1.9
EU10	3.9	**Austria**	2.5	**Poland**	4.9
EU25	1.3	**Portugal**	1.4	**Slovenia**	3.5
Belgium	1.6	**Finland**	2.5	**Slovakia**	4.6
Denmark	1.5	**Sweden**	2.3	**USA**	2.4
Germany	1.4	**United Kingdom**	2.1	**Japan**	2.0
Greece	2.4	**Czech Republic**	3.0	**Canada**	1.5
Spain	-0.7	**Estonia**	7.1	**Switzerland**	1.2
France	1.8	**Cyprus**	2.0	**Norway**	2.2
Ireland	4.7	**Latvia**	6.4	**South Korea**	3.8
Italy	0.5	**Lithuania**	6.4	**Australia**	2.4
Luxembourg	2.0	**Hungary**	2.7	**New Zealand**	1.4

Note: EU10 are the new EU member countries.

Sources: Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

Despite Spain's poor productivity growth record, it has performed well in terms of GDP growth which has averaged 3.3 per cent a year in 1995-2004, the same as the USA. Civilian employment in Spain has increased from 12.5 to 17.9 million, which has had a negative impact on average productivity, but an overall positive impact on GDP and average incomes. Italy's GDP, on the other hand, grew by just 1.5 per cent a year. Still, Italy's total employment increased by over 2 million during 1995-2004. Overall, employment in the EU15 countries increased by almost 12 per cent in 1995-2004, the same as in the USA, despite slower GDP growth. The increase in employment is a good sign for Europe, but it has weighed on productivity growth in the short run. Meanwhile, the upturn in the US economy after 2002 has not increased employment as much as upturns in

the past, and this has supported productivity growth there. Also, the US economy has become quite indebted with an increasingly large current-account deficit, which may require a lengthy period of lower-than-average GDP growth to become more balanced.[6]

Twelve of the EU15 countries are members of the Economic and Monetary Union and, furthermore, Denmark follows closely Euro Area monetary policy and its currency is stable against the euro. EMU was a regime shift in Europe, where many countries have suffered from a destabilising inflation-devaluation spiral in the past. The new regime calls for an adjustment by the labour markets. The development in unit labour costs should now be more uniform across countries and overall more moderate than in the past. This has not really been the case, however. According to the OECD, relative unit labour costs[7] increased by 17 per cent in Italy and Portugal and 16 per cent in the Netherlands between 1998 and 2004, while decreasing by 14 per cent in Ireland and 16 per cent in Austria. A rise in unit labour costs–that is a decline in price competitiveness–has correlated negatively with both productivity growth and GDP growth during this time period. Unit labour costs are of course affected by productivity, but their excessive rise shows that labour costs are increasing too fast. Some countries' labour markets may therefore have failed to adjust to the new regime in EMU.

The differences between the new EU member countries' rates of productivity growth are quite large. Still, there is the trend that the countries with the lowest levels of productivity, namely Poland and the Baltic countries, have enjoyed considerably higher growth rates than the other transition economies that were wealthier in the mid-1990s. Still, if we compare the growth rates in the Czech Republic and Hungary to the best performing EU15 countries, even without taking into account Ireland, the differences are not large even though there is considerable catching up left to do for these transition countries.

Convergence of the new member countries with the EU15 in terms of GDP per capita and productivity is not automatic, however. In order to help this process continue countries still have to emphasise structural and market-oriented reforms as well as sustainable macroeconomic policies. This goes for the EU15 countries as well.

Sound macroeconomic policies are important for the high-productivity countries, but also effective micro-policies and structural reforms should be advanced. The OECD (2005) identifies four policy priorities and micro-policies for enhancing growth and productivity: fostering firm creation and entrepreneurship, seizing the benefits of ICT, exploiting and diffusing science and technology, and enhancing human capital and realising its potential. In Europe, also the working of the internal market should be advanced.

3.2 Estimating productivity growth

Growth accounting analyses of the growth rate of GDP per capita or some productivity measurement as we have here typically take into account the effects of investment, R&D expenditure, human capital, trade openness, etc. We will add to these some tax and benefit variables as well as some labour market institution variables. We will first discuss some results from cross-section analyses for averages in the 1995-2004 period and then the results from a pooled least squares analysis with a longer time perspective.

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[6] Coen and Hickman (2002) argue that the rise in productivity in the US non-farm business sector in the latter half of the 1990s was largely a cyclical phenomenon with the economy catching up to its potential path.

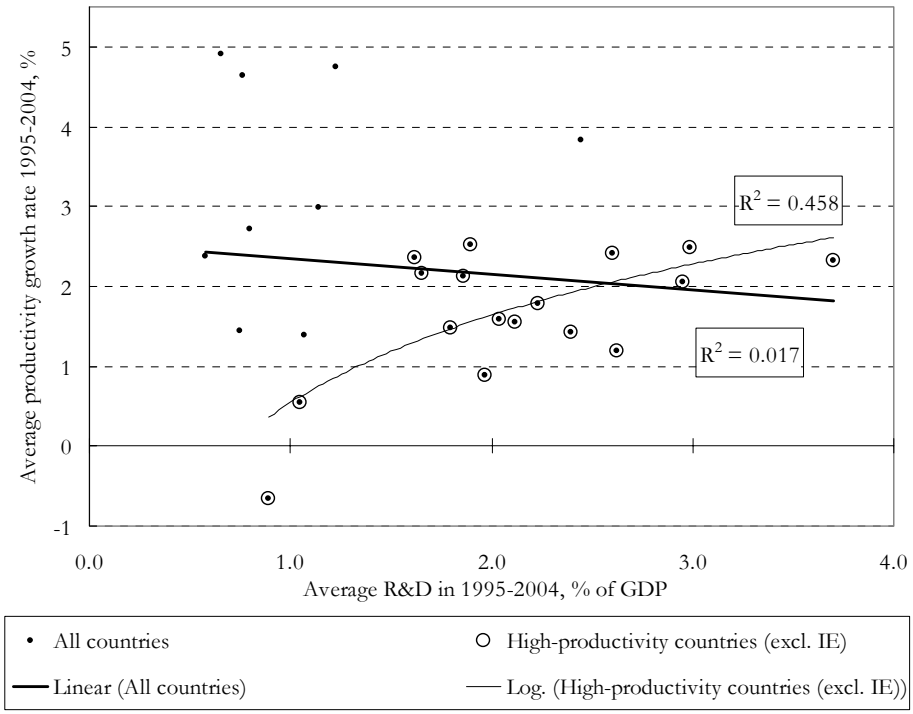
[7] Competitiveness-weighted relative unit labour costs in the manufacturing sector in dollar terms. Competitiveness weights take into account the structure of competition in both export and import markets of the manufacturing sector of 42 countries. An increase in the index indicates a real effective appreciation and a corresponding deterioration of the competitive position.

Productivity growth in 1995-2004 in cross-section analyses

Wealthier countries invest more in **research and development** relative to their GDP than less wealthy ones. Lederman and Saenz (2005) conclude with data for 1960-2000 that innovation may have strong positive effects on countries' long-run development. They use a set of countries that is much more divergent than the countries we analyse in this study. On the other hand, with data for 20 OECD and 10 non-OECD countries for the period 1981–97, Ulku (2004) finds that the R&D stock has had a significant effect on innovation (patent stock) only in large OECD countries with large markets. If this is the case, then it is all the more important for the EU with many small countries to further deepen economic integration in order to benefit more from R&D investment.

If we only take our group of high-productivity countries in a cross section, R&D investment as a percentage of GDP does not correlate with the level of productivity in 2004. Many countries that now have high productivity also have quite low R&D, and the countries with the highest R&D-to-GDP ratios (Sweden, Finland and Japan in this study) have below-average productivity. On the other hand, higher R&D investment has correlated positively with faster productivity growth in 1995-2004 for the high-productivity countries (see Figure 5).

Figure 5 **Average of total R&D in 1995-2004, % of GDP, and average productivity growth in 2000-04, %**



Note: The 'high-productivity countries' are Belgium, Denmark, Germany, Spain, France, Italy, Netherlands, Austria, Finland, Sweden, United Kingdom, USA, Japan, Canada, Switzerland, Norway and Australia. 'All countries' also include the Czech Republic, Greece, Hungary, Ireland, Poland, Portugal, Slovakia, South Korea and New Zealand. See the text for the Irish case.

Sources: STI Scoreboard 2005; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

However, this result requires that we exclude Ireland from the group of high-productivity countries, and this will also be done in some cross-section analyses that follow. Ireland has had very high productivity growth, but it also has low R&D investment, low ICT investment, few patents relative to the size of the population and also, relative

to how high productivity growth has been, a slightly below-average level of at least upper secondary education among 25-34 year olds. Ireland's success is based on several factors, some of which serve as examples to other EU countries, including the large countries. However, we will not discuss Ireland's case further here.

The high-productivity countries have much more **triadic patents** relative to population than countries with lower levels of productivity. However, if we plot the average number of triadic patents per population in 1995-2001 and the average growth rate of productivity in 1995-2004, there is no correlation for either all countries or the high-productivity countries.

One of the principal explanations put forward for the now faster growth rate of productivity in the USA than in Europe is investment in **ICT** in both manufacturing and services. According to van Ark et al. (2003), productivity growth in the USA was faster than in the EU in 1995-2000 because of a larger employment share of the ICT-producing sector and faster productivity growth in service sectors that use ICT intensively. Wholesale and retail trade and the financial securities sectors have accounted for most of the difference in aggregate productivity growth between the EU and the USA.[8] Denis et al. (2005) identify an excessive focus on low and medium-tech industries coupled with a relatively small ICT-production sector, and the EU countries' slowness in reaping the productivity enhancing benefits of ICT in many ICT-using industries as the drivers of the EU countries' productivity problem vis-à-vis the USA.

Van Ark and Piatkowski (2004) compare the performance of the new EU countries and the EU15 countries. They conclude that despite lower GDP per capita in the former, ICT capital has contributed as much to productivity growth as in the EU15. Furthermore, those manufacturing sectors that have invested the most in ICT have been key to the restructuring process. Comparing the EU15 countries with the USA showed that the largest difference in the contribution to the growth in GDP per person employed came from total factor productivity growth and a smaller difference from an increase in ICT capital intensity, both in favour of the USA.[9]

Figure 6 shows ICT and software investment and the average productivity growth rate in 1995-2004. The number of countries that we have data for is rather limited here. For the twelve high-productivity countries we find a slight positive correlation. Also the removal of Spain (with negative productivity growth) from the graph will more or less remove any correlation between the variables. A problem here may be that there is a lot of variation between ICT investment data available from different sources.

We also find a slightly positive correlation between the increase in the share of ICT-intensive sectors in GDP and the average increase in productivity in 1995-2002 implying that in those countries, where ICT-intensive sectors have grown considerably faster than the economy on average, also average productivity growth has been faster.

On the other hand, the average growth rate of productivity has not correlated with the average level of **taxation** in the 1995-2004 period (see Figure 7). There is also no discernible correlation between the **gross replacement rate** in 2001 and average productivity growth rate in 1995-2004 unless we remove Ireland and Spain in which case the negative trend gets an R^2 value of 0.23. Also the results from our pooled least squares analysis conclude that there is no strong evidence that taxation or gross replacement rates have affected productivity growth in the 1960-2004 period.

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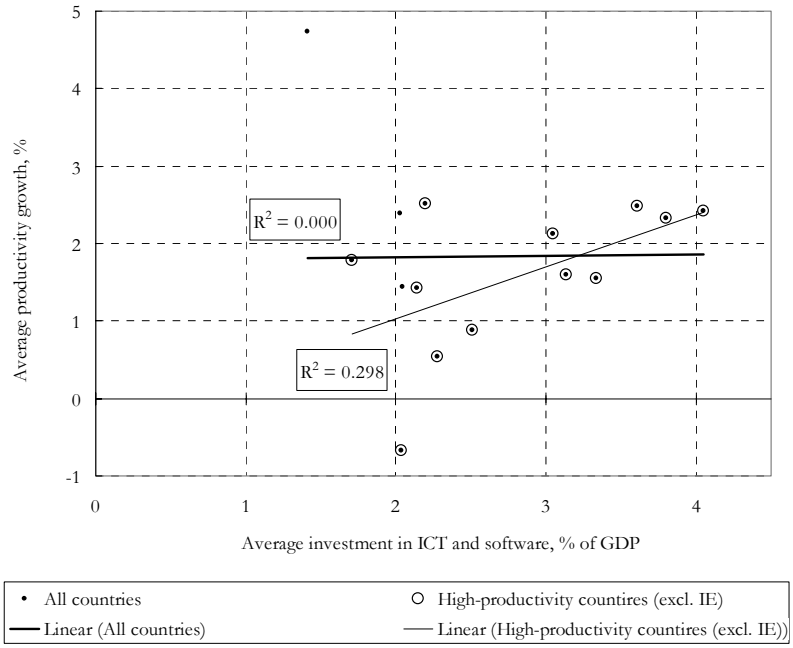
[8] See also O'Mahony and van Ark (2003) and Denis et al. (2004).

[9] See also Daveri (2004).

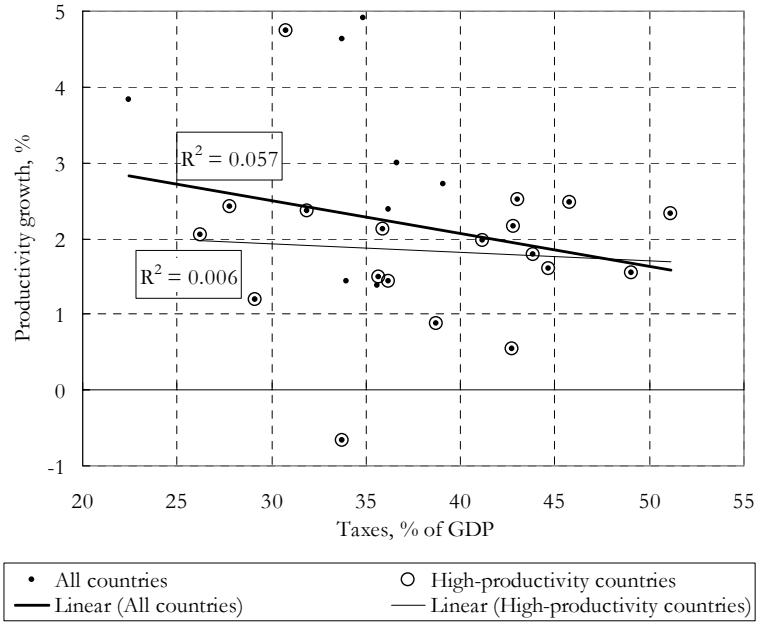
Figure 6 **Average investment into ICT and software, % of GDP, and average productivity growth, %, both in 1995-2004**



Note: The 'high-productivity countries' include Belgium, Denmark, Germany, Spain, France, Italy, Netherlands, Austria, Finland, Sweden, United Kingdom and USA. 'All countries' also include Greece, Ireland and Portugal; see text.

Sources: Timmer et al. (2003); Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database.

Figure 7 **Average taxes and average productivity growth in 1995-2004**



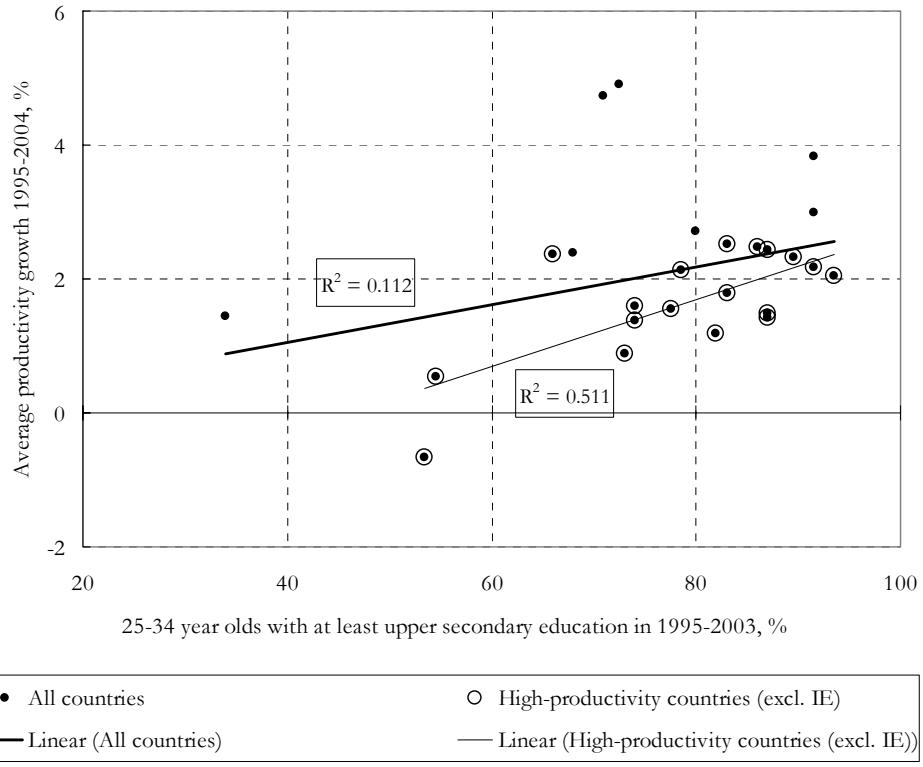
Note: The 'high-productivity countries' include Belgium, Denmark, Germany, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Finland, Sweden, United Kingdom, USA, Japan, Canada, Switzerland, Norway and Australia. 'All countries' also include the Czech Republic, Greece, Hungary, Poland, Portugal, Slovakia, South Korea and New Zealand.

Sources: OECD; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database.

Catching up also requires an increasing absorptive capacity from the part of the labour force. As the country moves closer to the technological frontier, the type and level of education and vocational skills needed change compared with the time when the country was relatively speaking less advanced. Many econometric panel studies that analyse conditional convergence of GDP per capita also take into account **human capital**.[10]

Figure 8 shows the share of young adults aged 25-34 with at least upper secondary education in 1995-2003[11] and average productivity growth rates in 1995-2004. Portugal which has by far the lowest level of education when measured this way has a slightly higher level of productivity than for example the Czech Republic and South Korea that have some of the highest levels of education exceeding 90 per cent.

Figure 8 **Young adults with at least upper secondary education in 1995-2003 and average productivity growth rate in 1995-2004**



Note: Ireland (in point 71, 4.7) has been excluded from the high-productivity countries as an outlier.

Sources: OECD Education at a Glance 2005; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

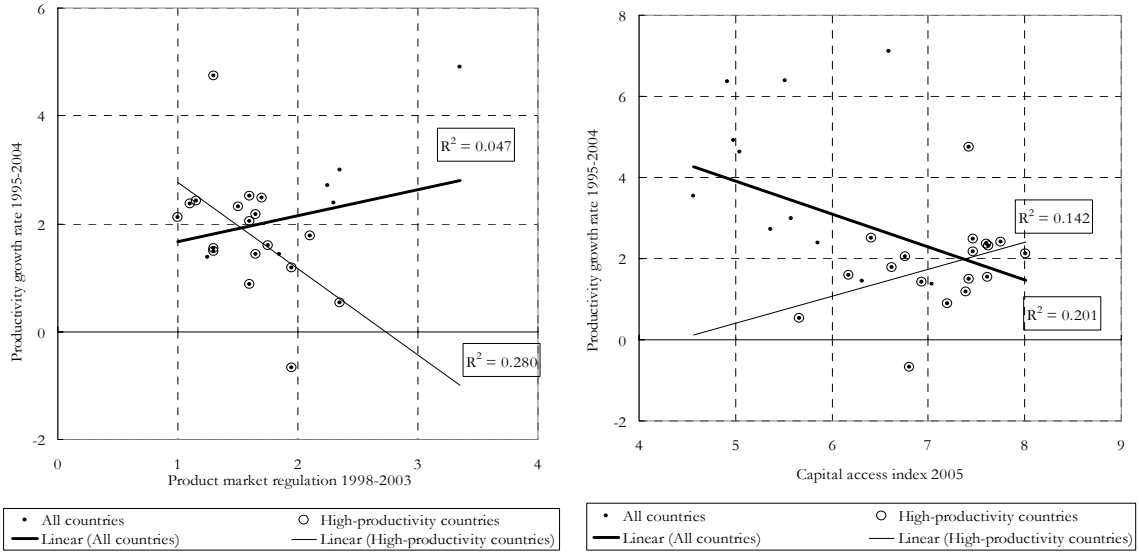
[10] Even though most such studies do conclude that human capital matters for growth in a conditional setting, some studies do not. For example Barro (1991), Mankiw et al. (1992), Bassanini and Scarpetta (2001), and Miller and Upadhyay (2002) conclude that human capital has had a positive impact on growth, but Fölster and Henrekson (2001), Hamilton and Monteagudo (1998) and Benhabib and Spiegel (1994) do not. However, after the latter changed the model so that they used the average level of human capital during the whole analysed period, not its growth rate, they did get the result that human capital affects growth positively. Islam (1995) gets very different results, both positive and negative, as to the significance of human capital depending on the estimation method he uses. Chang et al. (2005) mainly analyse the role of openness in growth, but they also include a human capital variable (secondary enrolment) that is statistically significant. Crucial factors in this regard may be the selection of countries and the way human capital has been measured.

[11] Average of 1995 and 2003. The picture that emerges would be approximately the same if we were to use data for tertiary education enrolment by the World Bank.

For the group of high-productivity countries we find a positive correlation between the level of education of young adults and the productivity growth rate in 1995-2004. However, the correlation no longer exists if we remove Spain, where low productivity growth may be partly due to strong growth in employment, and Italy, which has been suffering from deteriorating competitiveness (see above). Even so, it looks like educational attainment in some EU countries is not compatible with the requirements of a knowledge economy, advocated by the EU Lisbon Agenda.

High-productivity countries with lower **product market regulation** as reported by Conway et al. (2005) and higher **capital market access** according to the Milken Institute Capital Access Index have had faster productivity growth in 1995-2004. The latter correlation is a bit weak, however.

Figure 9 **Product market regulation and capital access against average productivity growth rate in 1995-2004**



Sources: Conway et al. (2005); Milken Institute; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

Lower regulation is likely to increase competition and better access to capital markets is likely to make it easier for start-ups and small companies to acquire capital. According to Conway et al. (2005), overall product market regulation, administrative regulation, and economic regulation have been declining in practically all OECD countries between 1998 and 2003. A simple average shows that the EU15 countries have decreased administrative and economic regulation slightly more than the other OECD countries. Nicoletti et al. (2000) show that product market regulation and employment protection regulation tend to have a strong positive correlation across countries. Griffith et al. (2006) find that product market de-regulation in some OECD countries in the 1990s was associated with an increase in competition, aggregate employment and real wages. They further argue that in countries with higher collective bargaining coverage and/or union density the increase in employment was more pronounced and the increase in real wages less pronounced than otherwise.

In principle, **labour market rigidities** may have a negative impact on the growth rate of productivity if the rigidities slow down structural adjustment. Incumbent firms that operate in mature businesses may be slower to adopt new technology than new firms in new lines of business, which also grow faster. If the incumbent firms do not adjust to the new circumstances by reorganising their operations they will continue to tie down human, financial and other resources more than would be appropriate. Nickell et al.

(2002b) show that the speed of adjustment varies systematically across countries with employment protection, which confirms the importance of labour market policies and institutions in facilitating the reallocation of resources from declining to expanding sectors. Furthermore, reforms may not just improve the performance of labour markets and reduce unemployment but they may also encourage R&D investment and thus support innovation and GDP growth in the longer term.[12]

In the cross-country analyses we further find that the rate of **unionisation** does not correlate with the rate of productivity growth. Countries with the fastest rate of productivity growth after 1995 include both countries with very low trade union power as well as quite high trade union power and a high degree of collective bargaining coverage. Surely, unionisation could also take on extreme forms that might limit productivity growth, but this does not seem to be the case in the countries analysed here.

These cross-section results may be partly due to special reasons. We would like to emphasise the development in Ireland, Spain and Italy as discussed above. These issues should not affect the panel data analysis we turn to next, however.

Productivity growth in 1960-2004 in a pooled least squares panel data analysis

We will now estimate a simple regression equation in order to analyse conditional labour productivity growth in real terms in 21 OECD countries.[13] The data are calculated in non-overlapping five-year averages starting from the 1960-64 period and ending in 2000-04. However, for many variables we have no data for the 1960s in particular.

We will simply take the basic regression for unconditional convergence and add several control variables:

$$\Delta \log y_{it} = a_1 \log y_{i,t-1} + \sum_{j=2}^{m} a_j V_{ijt} + \tau_t + \mu_i + \varepsilon_{it}, \qquad (2)$$

where y is productivity and V represents institutional and policy-related variables, such as taxes, R&D investment, and inflation, etc., while τ_t and μ_i denote the unobserved time and country-specific fixed effects, respectively, and ε_{it} is the regression residual. The time period is denoted with a subscript t and the country with an i. There are also two dummy variables, one for EU/EEA membership[14] and one for Germany in the 1990-94 period when it was reunified causing a negative shock to the country's average productivity growth. The dummies are reported when they are statistically significant, otherwise they have been removed from that particular specification. We also use White heteroskedasticity-consistent covariances for the cross-sections, corrected for degrees of freedom.

There may be some endogeneity problems[15] with this type of analysis. This also concerns the analysis of hours worked in the next section. For example, the country may suffer from an extended period of slow growth that leads to lower employment and higher unemployment (and thus to a lower number of average hours worked by the working-aged population). Then the taxes-to-GDP ratio may rise because higher unemployment raises public expenditure and also because GDP may decline. This would cause a negative correlation between hours worked and the taxes-to-GDP ratio. On the other hand, during a prolonged recession also tax revenue is likely to fall and, further-

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12 See for example Mortensen's (2005) endogenous growth model.

13 The countries are Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, the Netherlands, Austria, Portugal, Finland, Sweden, the United Kingdom, the United States, Japan, Canada, Switzerland, Norway, Australia and New Zealand.

14 EEA (European Economic Area) membership only concerns Norway. On the growth effects of European integration, see e.g. Henrekson et al. (1996), Badinger (2005) and Kaitila (2005).

15 Endogeneity problems are discussed by, for example, Agell et al. (2006) when they criticise the results by Fölster and Henrekson (2001) who found a negative relationship between government size and GDP growth.

more, we will often see an increase in government indebtedness. We do not take deficits or indebtedness into account here. If we think of debt just as postponed taxation, different OECD countries are positioned very differently. For example, there are countries with a low taxes-to-GDP ratio but a high public debt (Japan). Vice versa, in a booming economy employment and the number of hours worked increases and, providing taxes are not raised as fast as GDP grows, the taxes-to-GDP ratio will decline. We seek to tackle these issues at least partly by using country and time-period fixed effects and using five-year averages, which smooth out the business cycles.

Let us now return to our estimations. Table 2 shows the estimation results for productivity growth using different tax and benefit variables and some labour market variables. In Table 3 we include other economic control variables that are often used in growth regressions.

Table 2 Estimation of labour productivity growth (conditional convergence, CC) using tax/benefit and other labour market variable

Variable	CC	CC with taxes	CC with benefits	CC with tax&ben	CC with CBC	CC with CBC + tax&ben	CC with EPI	CC with EPI + tax&ben
Constant	0.149***	0.159***	0.149***	0.164***	0.173***	0.181***	0.137***	0.144***
	(0.010)	(0.012)	(0.010)	(0.013)	(0.027)	(0.027)	(0.014)	(0.013)
Productivity, lagged level	-0.043***	-0.041***	-0.044***	-0.042***	-0.049***	-0.050***	-0.038***	-0.037***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.009)	(0.008)	(0.005)	(0.005)
Taxes-to-GDP ratio		-0.044		-0.068		-0.025		-0.037
		(0.037)		(0.042)		(0.033)		(0.033)
Gross replacement rate			0.008	0.020		0.020		0.012
			(0.012)	(0.012)		(0.013)		(0.010)
Collective bargaining coverage (CBC)					-0.015**	-0.018***		
					(0.006)	(0.005)		
Employment protection index (EPI)							-0.004*	-0.005*
							(0.002)	(0.002)
EU/EEA member					0.009***	0.009***	0.007**	0.007**
					(0.003)	(0.003)	(0.003)	(0.003)
Germany's reunification	-0.015***	-0.016***	-0.015***	-0.016***	-0.017***	-0.017***	-0.017***	-0.018***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
R-squared	0.803	0.806	0.804	0.810	0.834	0.840	0.875	0.877
Adjusted R-squared	0.762	0.764	0.761	0.767	0.783	0.786	0.842	0.842
Log likelihood	578.665	580.103	579.046	581.822	479.773	482.116	522.820	524.060
Durbin-Watson stat	0.871	0.894	0.867	0.903	1.483	1.555	1.358	1.369
F-statistic	19.387	19.005	18.710	18.726	16.403	17.710	26.469	24.808
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Included observations after adjustments	8	8	8	8	8	8	7	7
Cross-sections included	21	21	21	21	19	19	20	20
Total pool (un)balanced observations	168	168	168	168	125	125	140	140

Note: The dependent variable is the log difference in real labour productivity (GDP per hour worked) normalised by the length of the time period (five years). The method used is pooled least squares with White cross-section standard errors and covariance (d.f. corrected). The estimation uses fixed effects for both cross sections and time periods, but these constants are not reported. * = significant at 10 per cent, ** = significant at 5 per cent, *** = significant at 1 per cent. Standard errors are shown in parentheses. All percentage variables are shown as ratios. See the text for more information.

Sources: The taxes-to-GDP ratio and the gross (unemployment benefit) replacement rate are by the OECD. The employment protection index is from Nickell et al. (2002a) and it goes from 0 to 2. Collective bargaining coverage is from the OECD and Nickell et al. (2002a).

The lagged dependent variable is always statistically very significant with a negative sign indicating convergence. Thus countries with lower initial levels of productivity have had faster productivity growth than the countries closer to the technological frontier.

Table 3 Estimation of labour productivity growth (conditional convergence, CC) with tax/benefit variables and other economic control variables

Variable	CC with investment	CC with investment + tax&ben	CC with inflation	CC with inflation + tax&ben	CC with R&D	CC with R&D + tax&ben	CC with openness	CC with openness + tax&ben
Constant	0.104***	0.117***	0.150***	0.176***	0.116***	0.138***	0.149***	0.161***
	(0.010)	(0.012)	(0.010)	(0.011)	(0.019)	(0.025)	(0.011)	(0.014)
Productivity, lagged level	-0.033***	-0.031***	-0.042***	-0.040***	-0.035***	-0.036***	-0.048***	-0.048***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.006)	(0.006)	(0.004)	(0.004)
Taxes-to-GDP ratio		-0.084**		-0.098***		-0.052		-0.056
		(0.034)		(0.035)		(0.032)		(0.039)
Gross replacement rate		0.024*		0.018		-0.001		0.022*
		(0.013)		(0.012)		(0.009)		(0.012)
Ratio of gross fixed capital formation to GDP	0.087***	0.101***						
	(0.032)	(0.034)						
Increase in total number of hours worked p.a.	-0.369***	-0.400***						
	(0.068)	(0.067)						
Consumer price inflation			-0.103***	-0.124***				
			(0.031)	(0.024)				
St. dev. in inflation rate during the 5-year period			0.107	0.079				
			(0.106)	(0.091)				
R&D-to-GDP ratio					0.514***	0.624***		
					(0.143)	(0.152)		
Exports-to-GDP ratio, lagged level							0.050***	0.050***
							(0.010)	(0.008)
Change in the exports-to-GDP ratio							0.055***	0.051**
							(0.020)	(0.021)
EU/EEA member								
Germany's reunification			-0.013***	-0.014***	-0.013***	-0.013***	-0.013***	-0.013***
			(0.001)	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)
R-squared	0.825	0.835	0.820	0.832	0.648	0.659	0.819	0.825
Adjusted R-squared	0.786	0.796	0.779	0.790	0.524	0.525	0.778	0.783
Log likelihood	588.465	593.804	586.223	591.948	391.464	393.039	585.971	588.878
Durbin-Watson stat	0.793	0.838	0.974	1.056	1.295	1.341	0.939	0.966
F-statistic	21.472	21.415	19.969	20.073	5.193	4.931	19.896	19.207
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Included observations after adjustments	8	8	8	8	5	5	8	8
Cross-sections included	21	21	21	21	21	21	21	21
Total pool (un)balanced observations	168	168	168	168	104	104	168	168

Note: Exports are those of both goods and services. * = significant at 10 per cent, ** = significant at 5 per cent, *** = significant at 1 per cent. Standard errors are shown in parentheses.

In most specifications, the taxes-to-GDP ratio and the gross unemployment benefit replacement rate do not have an effect on productivity growth. They only become statistically significant if we include gross investment or inflation. Then the coefficient for

taxation is negative and that of gross replacement rate is positive. An argument could be made for a depressing influence of taxes on the level of innovation activity and thus on the growth rate of productivity. This can be argued against also, however. The higher the gross replacement rate is the less unemployment affects incomes in the short term and this could have a positive effect on unemployment, which could in turn lower the participation rate especially for lower-income workers and thus raise average productivity.

However, based on these estimation results, we are inclined to conclude that the level of taxes and gross replacement rates have not had an effect on labour productivity growth in the OECD countries. In a panel study for the period 1970-95, Fölster and Henrekson (2001) found a negative relationship between government size and economic growth. Agell et al. (2006) argue against these results. However, theirs is a different setup from ours as we decompose economic growth into productivity and labour input.

According to our other specifications, collective bargaining coverage has a negative and statistically significant coefficient. It has to be noted, however, that if we remove the dummy variables from the 'CC with CBC' specification, collective bargaining coverage is no longer statistically significant. Furthermore, trade union density or the CBC-TUD ratio (not reported in the table) are not statistically significant. The employment protection index is also negative and statistically significant. The specifications with collective bargaining coverage and employment protection aside, membership in the EU or EEA has had no effect on the growth rate of productivity. We also tried using a coordination index by Nickell et al. (2002a) but the index was not statistically significant.

Fixed investment has had a positive effect on the growth rate of labour productivity and the increase in the total number of hours worked has had a negative effect, as expected. Inflation has had a negative effect on productivity growth, R&D has had a positive effect, and export openness and its growth have also had a positive effect on the growth rate of productivity. The coefficients imply that a one percentage point higher R&D-to-GDP ratio could raise the productivity growth rate by about one-half of a percentage point. The coefficient of fixed investment is only about one-sixth of this effect.

4 THE DEVELOPMENT OF HOURS WORKED

In this section we will first discuss the different factors that may affect labour input. Then we will use cross sections to analyse if hours worked correlate with the tax and benefit variables and labour market institutions, among other things. In Section 4.4 we will construct a pooled least squares estimation for the 1960-2004 period in order to explain the number of hours worked by the working aged.

4.1 Factors that may affect the number of hours worked

In addition to lower productivity, the other major factor largely to 'blame' for Europe lagging behind the United States in terms of GDP per capita is the number of hours worked by each employed person. Furthermore, a smaller share of the working-aged population takes part in the labour force and the unemployment rate is higher in Europe. Consequently, the average number of hours worked by the working-aged population is considerably higher in the USA than in the EU15. The share of part-time workers in total employment, more common in some countries than others, is also a factor that decreases the average number of hours worked in Europe.

As we saw in Figure 1, Europeans have on average been working increasingly less than Americans for the past three decades. Before that Europeans on average worked as long

or even longer hours than Americans.[16] Cultural reasons are sometimes put forward as the explanation, but culture has hardly changed that fast in some western countries.

Utility can be assumed to be a positive function of consumption and leisure. Ceteris paribus, the former is higher when you work more, but this decreases leisure time so a balance has to be found between the two. Income declines if taxes rise, but of course tax revenue can also pay for better public sector services, such as education, health care and the judicial system that increase utility.

Taxes drive a wedge between the total labour cost faced by the firm and the disposable income the employee takes home. In principle, higher taxes could increase the supply of labour, because people want to guarantee some level of purchasing power for themselves. If taxes rise, people might want to work more in order to keep their purchasing power unchanged. On the other hand, higher taxes that cause net incomes to fall may also raise trade unions' wage demands in order to keep net wages unaffected. Ceteris paribus, this will decrease firms' competitiveness and may lead to labour shedding thus lowering the number of hours worked.

High marginal tax rates may also induce people to appreciate their leisure time more given that they may very well lose more than half of their incremental income as taxes to the government. They may also increase personal activities that are neither taxed nor included in GDP such as household production. Higher taxes may also lead to an increase in grey economy. Thus the profile of the tax regime and of marginal tax rates may have major implications for people's behaviour. Furthermore, higher taxes typically lead to extensive social security and benefit schemes, or vice versa, which are likely to act as a disincentive for some people to seek employment and work longer hours.

Taxes and benefits may affect both people's willingness to join the labour force and, once employed, the number of hours they are willing to work, as well as firms' willingness to employ more people.[17] It is thus reasonable to combine all three channels and analyse the average number of hours worked by the working-aged population as we do here. This figure is also affected by the business cycle, however, especially because of variations in employment and unemployment. Therefore, we use long-term averages.

However, individual people do not typically get to choose the number of hours they work. Rather these are set by legislation[18] and negotiations between employers' and employees' organisations which may or may not represent their members' and non-members' preferences well. In some countries, notably France, trade union membership is considerably lower than the number of employees they represent in wage negotiations.

Prescott (2004) argues that effective marginal tax rates on labour income have strongly affected the number of hours worked by the working-aged population in the G7 countries. According to Alesina et al. (2005), who criticise Prescott's results, labour market

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[16] See historical data presented in, for example, Huberman (2004) and Ngai and Pissarides (2006).

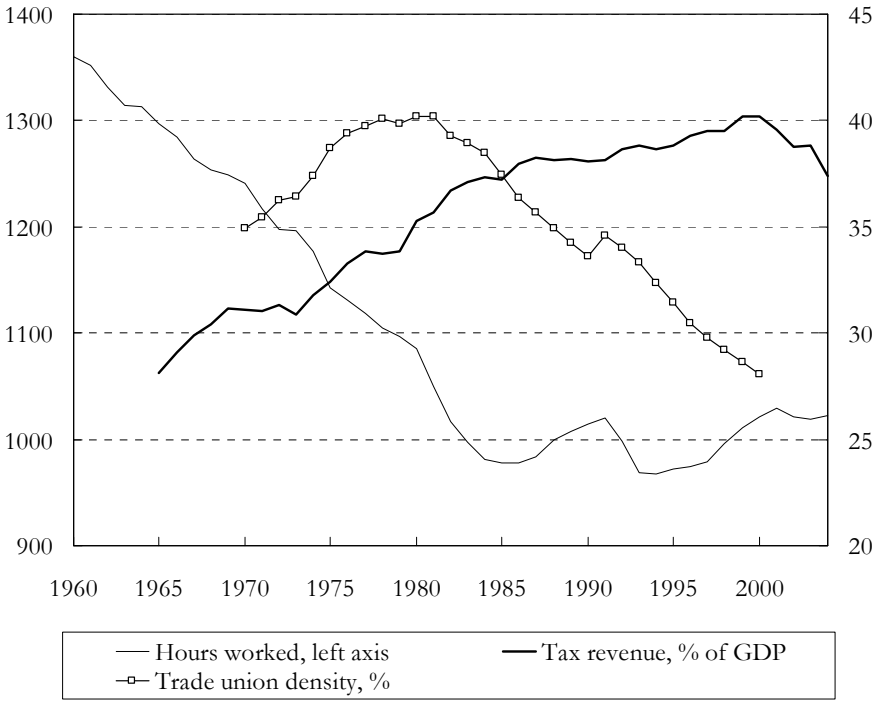
[17] For example, Carone and Salomäki (2001) discuss how the tax and benefit systems may affect employment incentives. Blanchard and Wolfers (2000) discuss the interaction of shocks and institutions in explaining the development of unemployment in Europe. See also Blanchard (2005). Nickell (1997) analyses to what extent the different development of unemployment in Europe and the USA depends on labour market institutions and rigidities. According to Nickell et al. (2005), changes in labour market institutions account for around 55 per cent of the rise in European unemployment from the 1960s to the first half of the 1990s with much of the remainder due to a deep recession in the latter period. According to Daveri and Tabellini (2000), there is a large positive correlation between tax rates on labour income and unemployment in continental Europe, but not in the Anglo-Saxon or Nordic countries. Continental Europe has strong trade unions, but a less centralised wage bargaining system than the Nordic countries.

[18] A recent example of this is the introduction of a 35-hour working week in France. According to GGDC data, the average employed person in France worked 1,537 hours in 1999 but just 1,439 hours in 2004, a decline of 6.4 per cent. Meanwhile, the respective average decline was 1.7 per cent in the other EU15 countries and 3.4 per cent in the USA.

regulation and unionisation correlate strongly with the higher tax and benefit systems in Europe and explain the shorter working time there. Also the sometimes advocated but erroneous 'Work less – Work all' response to higher unemployment combined with demands of higher hourly wages so as to avoid decreasing total incomes as a result of shorter working hours, may have led to lower demand for labour. These policies would then have had a more society-wide influence on leisure patterns because of a social multiplier, where the returns to leisure increase as more people are taking longer vacations. Higher hourly wages also induce firms to substitute labour for capital, which will lead to a lower employment rate and higher average labour productivity.[19] Higher minimum wages in Europe[20] than in the USA are also likely to lead to a lower employment rate as lower-productivity jobs are then less likely to exist.

Alesina et al. (2005) argue that the strength of the trade unions reached a peak in most European countries in the late seventies or early eighties. Trade union density increased during the 1970s and during this time the number of hours worked declined in the EU15 countries (see Figure 10). The former started to decline after 1980, and the number of hours worked continued to decline for a couple of more years. Since then trade union density has continued to decline rapidly, while the number of hours worked has more or less stabilised.

Figure 10 **Average hours worked by the working-aged population, tax revenue and trade union density in the EU15 countries**



Note: We had no data for trade union density in Spain in 1970-79 and Luxembourg in 1996 onwards. Also we had no data for total tax revenue in Denmark in 1965, or Greece and Portugal in 2004. Taxes are weighted by GDP shares, while hours and the trade union density are weighted by employment shares.

Sources: OECD; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database.

[19] See also Daveri and Tabellini (2000) according to whom higher labour taxes have resulted in higher real wages thus leading to substitution of labour with capital.

[20] Not all countries have official minimum wages in Europe. However, trade unions and employers' organisations have then set such wages in practise.

We seem to have a clearer correlation than this between taxes and hours worked. It could of course be argued that when trade union power increased, the unions managed to influence the labour market and the tax and benefit systems so that the number of hours worked decreased. Later, although trade union density has declined, labour market and legislative inertia have caused the number of hours worked to stagnate and not start to rise again.

Trade union density is a slightly problematic variable, however. First, the figures may differ depending on the source. Second, mere extent of membership is not necessarily an indicator of power. Collective bargaining coverage could be a better indicator, but the data there are even poorer.[21] And third, it is the parliament that sets many or most of the rules and legislation that govern the labour market as well as, of course, taxes.

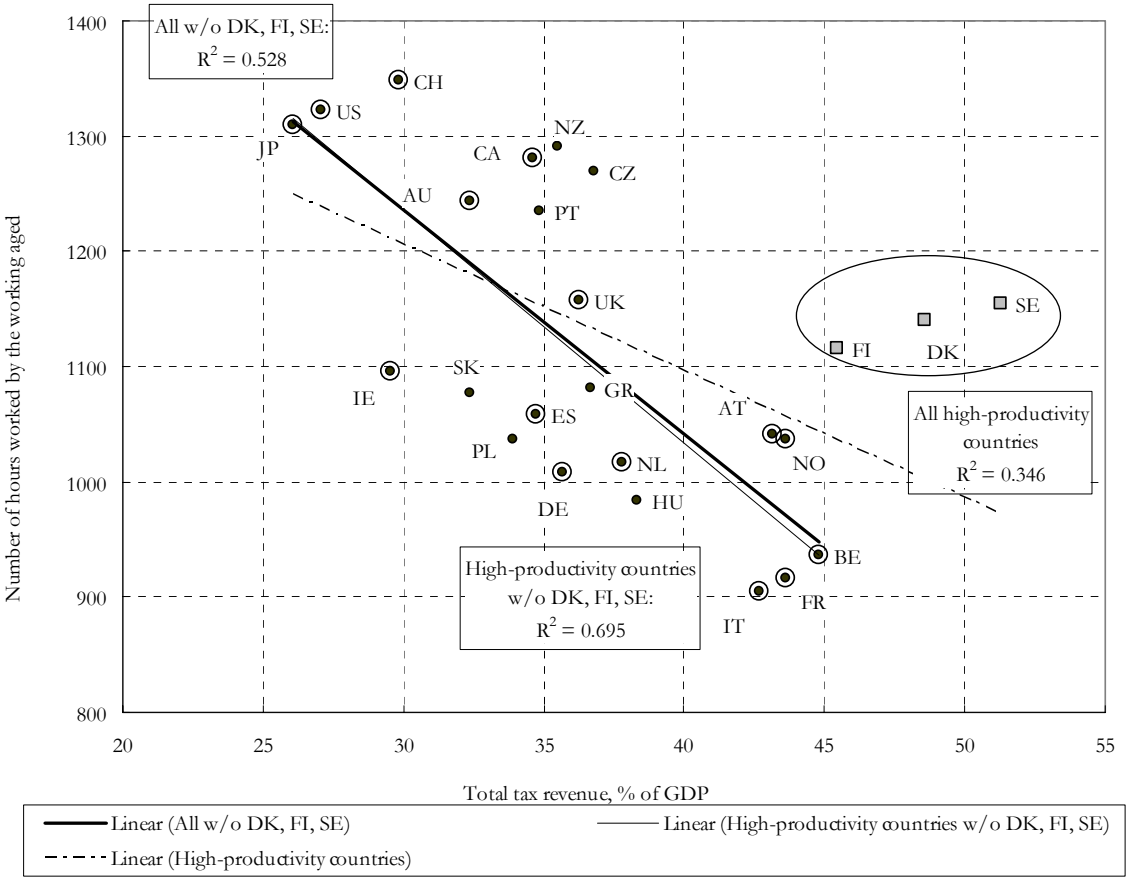
Alesina et al. (2005) argue that European politics is far more friendly towards parties of the left than American politics. They also argue that proportional representation and collective bargaining coverage are linked, but that American federalism, a majority voting system, and the separation of powers (the Senate and the Supreme Court) have all acted to limit the strength of private sector unions. We can find opposing examples, of course, such as the United Kingdom before the 1980s, when unions were quite powerful despite a majority voting system.

4.2 Hours worked and the tax/benefit system

There seems to be a very clear negative correlation between the average number of hours worked by the working-aged population and total **tax revenue** as per cent of GDP in 2000-04 (see Figure 11). However, this requires that the Nordic countries–Denmark, Finland and Sweden–are excluded from the linear trend. These three countries are also excluded from the right-hand side graph of Figure 12, but included in the left-hand side graph, where the development is shown in consecutive five-year averages starting from 1965-69. We see that as average tax rates have risen, the trends have not only moved to the right but also become more vertical indicating higher correlation between the variables. Some of the R^2 values are shown in the graphs.

[21] Collective bargaining coverage was 78 per cent in 1980-85, and then declined smoothly to 68 per cent in 2000. Here we have no data for Greece, Ireland and Luxembourg.

Figure 11 **Total tax revenue, % of GDP, and the average number of hours worked by the working aged, averages in 2000-04**

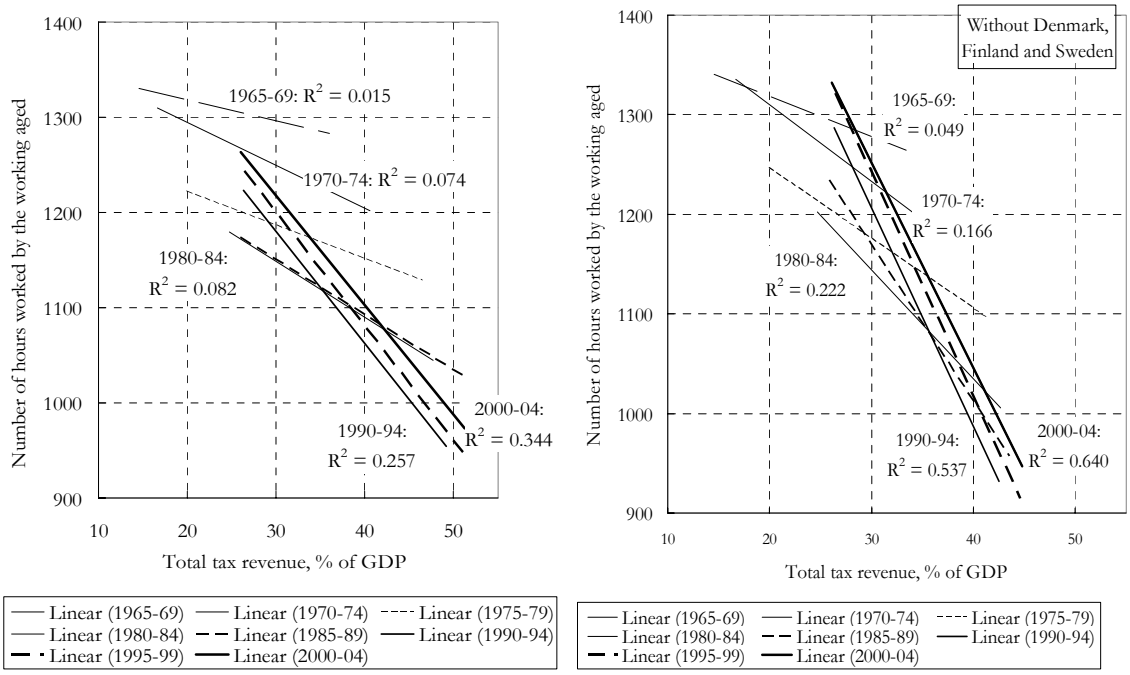


Note: The 'high-productivity countries' are Belgium, Germany, Spain, France, Ireland, Italy, Netherlands, Austria, United Kingdom, USA, Japan, Canada, Switzerland, Norway and Australia. 'All countries' also include the Czech Republic, Greece, Hungary, Poland, Portugal, Slovakia and New Zealand. Denmark, Finland and Sweden are outliers and are not included in the linear trends. See Figure 12 also.

Sources: OECD; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

Some factors that could affect these results are active labour market policies and whether social security benefits, such as unemployment benefits, are taxed. Also a higher share of public sector employment in total employment in the Nordic countries could cause a part of the result seen in Figure 11. Indeed, there is quite a strong correlation between taxes as a percentage of GDP and the share of **government employment** in total employment. On the other hand, we find no real correlation between the average number of hours worked by the working-aged population and the share of government employment in total employment.

Figure 12 **Total tax revenue, % of GDP, and the average number of hours worked by the working aged, averages of five-year periods (the graph on the right is without Denmark, Finland and Sweden)**



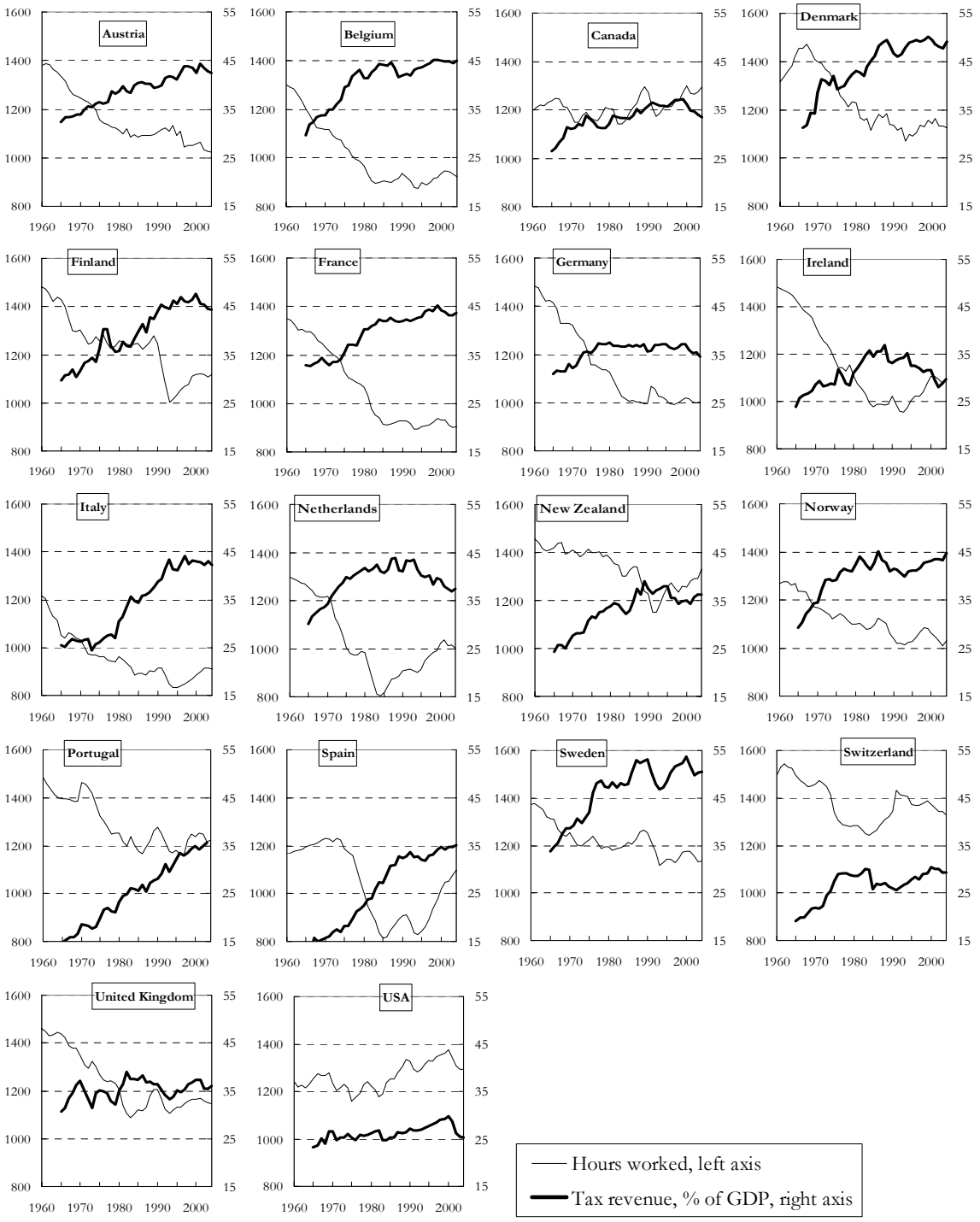
Note: The countries included are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and USA. The correlation coefficient between these two data sets (including the Nordic countries) has risen rather steadily from -0.12 in 1960-64 to -0.46 in 1980-84 and -0.52 in 2000-04. Note that the country set is different from that in Figure 11.

Sources: OECD; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

Figure 13 shows how differently taxes as a percentage of GDP and the average number of hours worked by the working-aged population have developed in eighteen countries. Typically the former have risen and the latter declined. In many cases it also looks as if the stabilisation of taxes at some new level would also result in a stabilisation of the number of hours worked. Consequently, the hours seem to adjust to a new equilibrium level as a response to a change in taxes. This is so especially in many of the European countries.

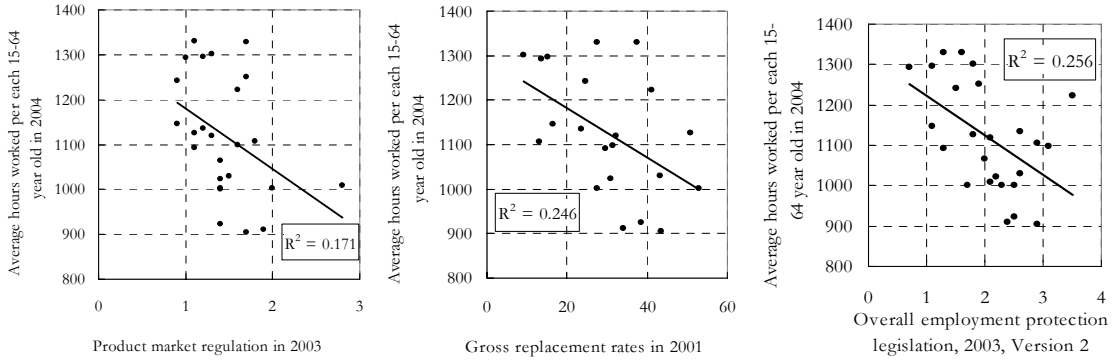
There is also a negative correlation, although not a very strong one, between the average number of hours worked by the working-aged population on the one hand and **product market regulation**, **gross replacement rates** and overall **employment protection legislation** on the other hand. These are presented in cross-sections in Figure 14.

Figure 13 **Total tax revenue, % of GDP, and the average number of hours worked by the working-aged population**



Sources: OECD; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

Figure 14 **Product market regulation, gross replacement rates and employment protection legislation against the average number of hours worked by the working-aged population in OECD countries**



Note: The employment protection legislation data used here are different from those used in the pooled least squares analyses.

Sources: Conway et al. (2005); OECD; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

According to Bell and Freeman (2001), extra work pays off more in the USA due to higher **wage inequality** and a less progressive tax system compared with Germany thus leading to more hours worked. However, de Groot et al. (2004) argue that income redistribution through a social security system does not necessarily lead to lower participation and higher unemployment if countries supplement it with active labour market policies.

Using a cross-section we find no evidence in support of Bell and Freeman (2001). The USA has the highest Gini coefficient among the countries analysed here. However, if we cross-plot the Gini coefficients and the average number of hours worked by the working aged in 28 countries in 2000, there is no correlation between the two.[22] This is so also for the smaller group of high-productivity countries. Income inequality does not therefore seem to explain the differences in the number of hours worked at the macro level.

4.3 Hours worked and labour market institutions

When discussing trade union power, one problem is how to measure it. Some possibilities are trade union density, collective bargaining coverage, and the degree of centralisation of wage setting. Our problem is, however, that we also need long time series, which are often not very satisfactory.

Trade unions' influence in the USA has been declining considerably since, say, the 1960s and it is presently quite low, definitely lower than in continental Europe, for example. However, there are considerable differences within Europe in terms of both trade union influence and membership as well as wage setting systems. According to the OECD, trade union density in 2000 varied from 10 per cent in France, 15 per cent in Spain and 23 per cent in the Netherlands to between 74 and 79 per cent in Denmark, Finland and Sweden, while the USA had a density of 13 per cent.

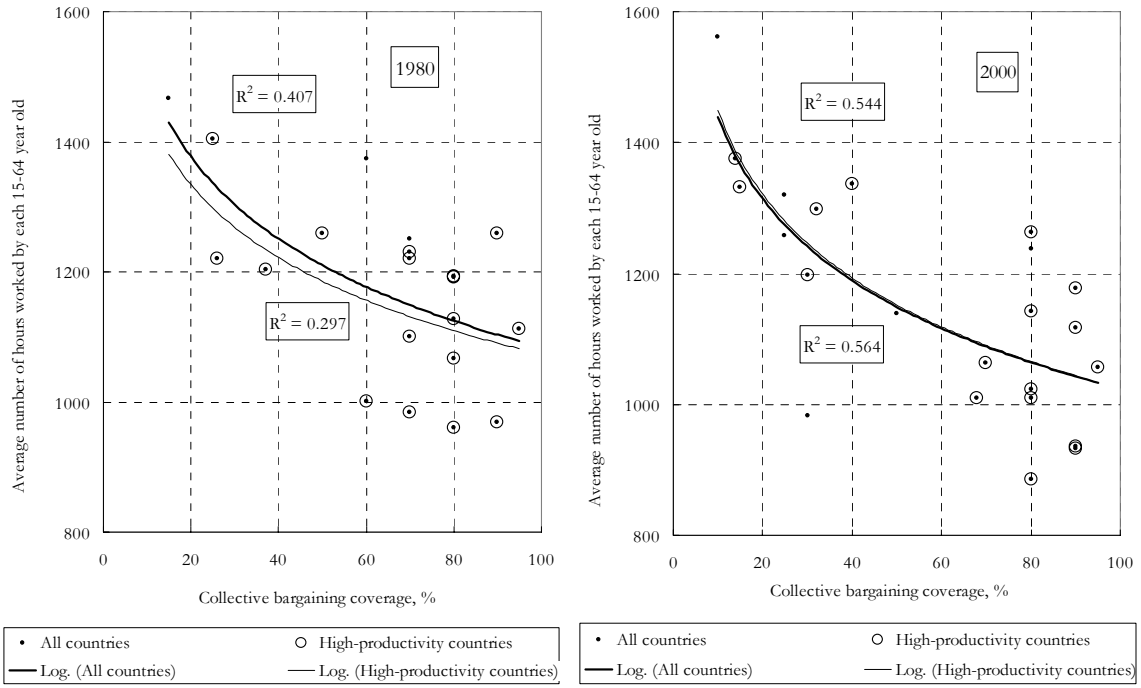
Despite a generally declining number of hours worked in many OECD countries there has also been a decline in trade union density in 1970-2000 also in Europe. An increase has only occurred in Belgium, Denmark, Finland and Sweden. Meanwhile, the average number of hours worked has only increased in Australia, Canada, South Korea, Luxembourg and the USA. In 1980-2000, union density increased only in Finland. In percentage-point terms, declines have been larger in many European countries than in the USA.

[22] With Gini index data from the World Development Indicators by the World Bank for one year in the 1994-2002 period with the year varying from country to country and no data for Japan, Spain and Switzerland.

Plotting **trade union density** against the average number of hours worked by the working-aged in 1970, 1980, 1990 or 2000 does not result in any correlation be it for all OECD countries or the high-productivity countries. Changes in these variables between 1970-1990 or 1980-2000 do not work either. Also, looking at the time series of individual countries, the evidence is quite mixed as to the relationship between the number of hours worked and trade union density.

On the other hand, there is a negative correlation between **collective bargaining coverage** and the average number of hours worked by the working aged. Indeed, this is likely to be a clearer indicator of corporatist power in the labour market than trade union density. It also seems that the correlation has become stronger since 1980 (see Figure 15).

Figure 15 **Collective bargaining coverage (CBC) and the average number of hours worked in 1980 (left-hand side graph) and in 2000**



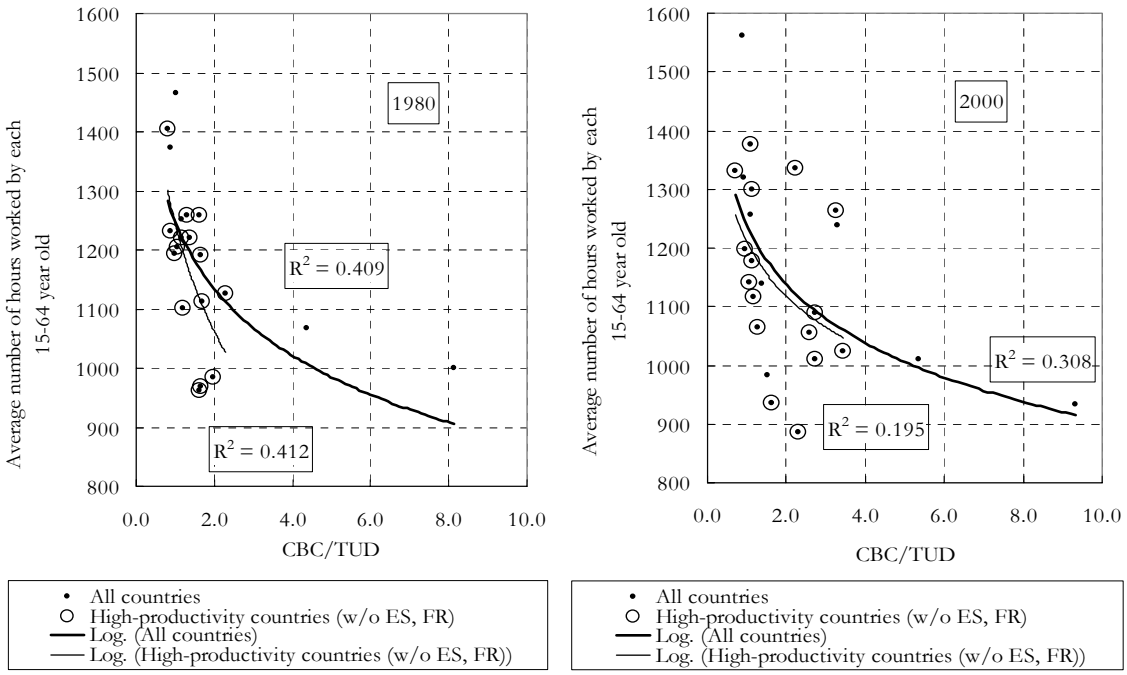
Note: In 1980 'all countries' are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, South Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and USA, in 2000 also the Czech Republic, Hungary, Poland and Slovakia. The 'high-productivity countries' do not include the Czech Republic, Hungary, South Korea, New Zealand, Portugal and Slovakia. There was no CBC data for Ireland. In the right-hand side graph the log-trends are positioned on top of each other.

Sources: OECD; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

We also find a correlation between the **ratio of collective bargaining coverage and trade union density**, on the one hand, and the average number of hours worked, on the other hand. This ratio can be thought of as proxy to how 'democratic' the trade unions are. If the ratio is very high, a relatively small number of trade union members, or rather their representatives, negotiate wages for almost all employed people. This may lead to a radicalisation of trade union policies if there is a selection bias in trade union membership in the sense that those who join unions are more militant than the average labourer. This ratio is particularly high in France and Spain. The correlation worked better in 1980 than in 2000, however (see Figure 16).

We do not claim that any single factor is the cause of the differences between the number of hours worked in the industrialised countries. The differences are likely to be due to several factors, some institutional ones and some that affect incentives. It seems that high taxes, an extensive social security system and rigid labour and product markets go hand in hand with a smaller total work effort. These may be at least partly due to the political power exercised by trade unions, but ultimately national parliaments are the ones that set taxes and other legislation although trade unions do of course exert political pressure on them.

Figure 16 **The ratio of collective bargaining coverage (CBC) and trade union density (TUD) and the average number of hours worked in 1980 and 2000**



Note: In 1980 'all countries' are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, South Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and USA, in 2000 also the Czech Republic, Hungary, Poland and Slovakia. The 'high-productivity countries' do not include the Czech Republic, Greece, Hungary, South Korea, New Zealand, Portugal and Slovakia. Spain and France are not included in the group of 'high-productivity countries' because they are clear outliers. If they were included, the trend for this group of countries would be about the same as for 'all countries'. There was no CBC data for Ireland.

Sources: OECD; Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

4.4 Estimating the number of hours worked

Next we will make a simple estimation in order to explain the average level of working hours in OECD countries in 1960-2004. The specification is:

$$h_{it} = \sum_{k=1}^{n} \beta_k V_{ikt} + \tau_t + \mu_i + \varepsilon_{it}\,, \qquad (3)$$

where h_{it} is the average number of hours worked by the working-aged population in country i in time period t. Otherwise the variables, the time periods and countries are the same as in regression (2). Also the unobserved time and country-specific fixed effects are included in the estimations, but not reported in the tables. White heteroskedasticity-consistent covariances for cross-sections are used here also. The dummies used earlier are not used here, however.

In Table 4 we have the taxes-to-GDP ratio always as an independent variable. This is relaxed in the table that follows. As the only independent variable as well as with any other control variable, the coefficient of taxes is always negative and statistically significant. When taxes are included in the specification, the gross replacement rate, the employment protection index and GDP per capita are not statistically significant. However, collective bargaining coverage and the CBC-TUD ratio are statistically significant. The coefficient for the latter is negative, but interestingly the former is positive.[23] Trade union density (not reported in the table) is not significant.

Table 4 Estimation of the number of hours worked (HW) by the working-aged population with taxes as an independent variable

Variable	HW with taxes	HW with taxes + benefits	HW with taxes + EPI	HW with taxes + CBC	HW with taxes + CBC/ TUD	HW with taxes + GDP per capita	HW with taxes + productivity
Constant	1372.275***	1377.849***	1461.766***	1296.707***	1369.899***	1259.150***	1659.073***
	(65.147)	(66.221)	(31.539)	(56.387)	(73.440)	(57.716)	(66.458)
Taxes-to-GDP ratio	-614.790***	-654.048***	-872.631***	-700.926***	-552.972***	-533.471***	-638.158***
	(190.775)	(204.563)	(110.147)	(205.398)	(206.087)	(172.334)	(125.889)
Gross replacement rate		31.469					
		(33.640)					
Employment protection index (EPI)			4.861				
			(10.574)				
Collective bargaining coverage (CBC)				143.038***			
				(33.784)			
Ratio of CBC and trade union density					-15.066***		
					(2.807)		
GDP per capita						0.006	
						(0.004)	
Labour productivity, level							-13.840***
							(2.219)
R-squared	0.874	0.875	0.880	0.887	0.887	0.876	0.904
Adjusted R-squared	0.849	0.848	0.851	0.856	0.855	0.850	0.883
Log likelihood	-909.640	-909.555	-758.755	-668.273	-660.880	-908.566	-887.433
Durbin-Watson stat	0.692	0.697	0.722	0.714	0.766	0.658	0.764
F-statistic	34.587	33.193	30.471	28.304	27.831	33.642	44.627
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Included observations after adjustments	8	8	7	8	8	8	8
Cross-sections included	21	21	20	19	19	21	21
Total pool (un)balanced observations	168	168	140	125	124	168	168

Note: Pooled least squares analysis with White cross-section standard errors and covariance (d.f. corrected). * = significant at 10 per cent, ** = significant at 5 per cent, *** = significant at 1 per cent. Standard errors are shown in parentheses.

In the specifications shown in Table 5 taxes do not enter as an independent variable. The coefficient for the gross replacement rate now becomes statistically very significant

[23] The correlation coefficient between the taxes-to-GDP ratio and gross replacement rates in 2001 is 0.46 and a cross-plot returns an R^2 value for a linear trend of 0.21. There is a correlation between the two but it is not very strong. The correlation coefficient between collective bargaining coverage and the taxes-to-GDP ratio was higher than this, 0.74.

and negative, but the employment protection index remains statistically insignificant. Collective bargaining coverage remains negative and statistically significant, although much weaker than when taxes are included in the specification. The ratio of collective bargaining coverage and trade union density is very significant and negative. A high ratio is thought to present trade union power which is less democratic and maybe more radical than a low ratio closer to unity (see above). Trade union density is insignificant (not reported in the table). We also tried using the coordination index by Nickell et al. (2002a) but the index was not statistically significant.

GDP per capita now has a positive and statistically significant coefficient. However, higher GDP is of course a result of more work, ceteris paribus. The negative correlation between the level of productivity and the number of hours worked might be due to what we witness in some European countries: average productivity can be higher than in the USA but the number of hours worked is considerably lower.

Table 5 Estimation of the number of hours worked (HW) by the working-aged population without taxes as an independent variable

Variable	HW with benefits	HW with EPI	HW with CBC	HW with CBC/TUD	HW with GDP per capita	HW with productivity
Constant	1204.820***	1222.620***	1131.169***	1182.221***	1078.549***	1486.272***
	(5.308)	(20.162)	(12.857)	(5.010)	(58.856)	(58.473)
Gross replacement rate	-91.757***					
	(22.300)					
Employment protection index (EPI)		-29.878				
		(20.070)				
Collective bargaining coverage (CBC)			34.677*			
			(18.731)			
Ratio of CBC and trade union density				-16.754***		
				(2.519)		
GDP per capita					0.007*	
					(0.004)	
Labour productivity, level						-16.004***
						(3.085)
R-squared	0.850	0.850	0.850	0.853	0.851	0.888
Adjusted R-squared	0.822	0.820	0.812	0.815	0.824	0.868
Log likelihood	-1048.426	-890.724	-744.096	-717.295	-1047.657	-1020.329
Durbin-Watson stat	0.573	0.579	0.578	0.610	0.538	0.660
F-statistic	31.000	27.812	22.392	22.194	31.298	43.632
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000
Included observations after adjustments	9	8	9	9	9	9
Cross-sections included	21	20	19	19	21	21
Total pool (un)balanced observations	189	160	135	131	189	189

Note: * = significant at 10 per cent, ** = significant at 5 per cent, *** = significant at 1 per cent. Standard errors are shown in parentheses.

The use the time and cross-section fixed effects has an effect on the size of the coefficients and of statistical significance. For example in the 'HW with taxes' specification in Table 4, the removal of the fixed effects would result in a common constant of 1493 and a coefficient for the tax ratio of -969. This would bring our results quite closely in line

with Davis and Henrekson's (2004), who find a constant of 1655 and a coefficient of 950 using a smaller sample of 14 OECD countries for the year 1995[24].

Davis and Henrekson (2004) also find that standard errors are large in panel specifications that isolate within-country time variation and argue that the stable relative tax structures explain this. They find that the negative relationship between tax rates and hours worked per person employed is much stronger when the regression specification omits fixed effects. However, we argue that the fixed effects are necessary as controls for country and time-period specific factors.

5 INTERACTION BETWEEN PRODUCTIVITY AND HOURS WORKED

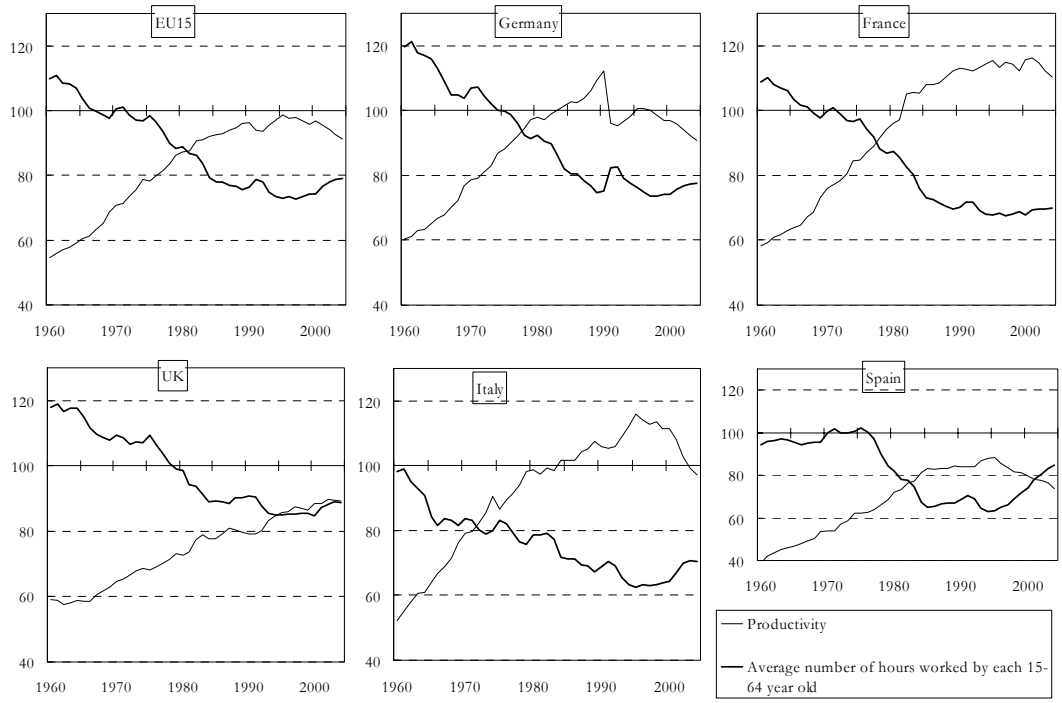
As we have seen, average European productivity and the average number of hours worked by the working-aged population relative to the USA seem to be going hand in hand but in opposing directions. When European countries were catching up with the USA in terms of productivity, the number of hours worked was declining as a result of a smaller number of hours worked by those employed, declining labour force participation and higher unemployment. After Europe's productivity peaked with respect to the USA in 1995, Europe started to catch up again in terms of the number of hours worked. This is not the case for every single EU15 country, but it is so on average and for the large continental member countries, and even for the UK, the past few years notwithstanding.

In a larger group of countries consisting of the EU25 and non-European OECD countries we find that the higher GDP per capita is, the smaller the average number of hours worked by each *employed person* is (see left-hand side graph of Figure 18). The USA is a bit of an outlier here. In the group of high-productivity countries there is no correlation in this respect.

However, if we look at the average number of hours worked by the working-aged population, our principal variable of interest, the correlation does not exist even in the group that includes all the countries (see right-hand side graph of Figure 18). This happens because wealthier countries have lower unemployment and higher participation rates than poorer countries, where the smaller number of people who, according to official statistics, do have jobs work for longer hours.

[24] Note that Davis and Henrekson use tax rates in per-cent form. According to their results for wealthy countries in the mid-1990s, a unit standard deviation difference of 12.8 percentage points in tax rates led to 122 fewer market working hours per adult per year, a drop of 4.9 percentage points in the employment-to-population ratio, and a rise in the shadow economy by 3.8 per cent of GDP. It also led to 10-30 per cent lower employment and value-added shares of retail trade and repairs, of eating, drinking and lodging, and of wholesale, motor trade and repair. Nickell (2004) finds that a 10 percentage-point rise in the tax wedge will reduce overall market labour input by around 2 per cent of the working-aged population.

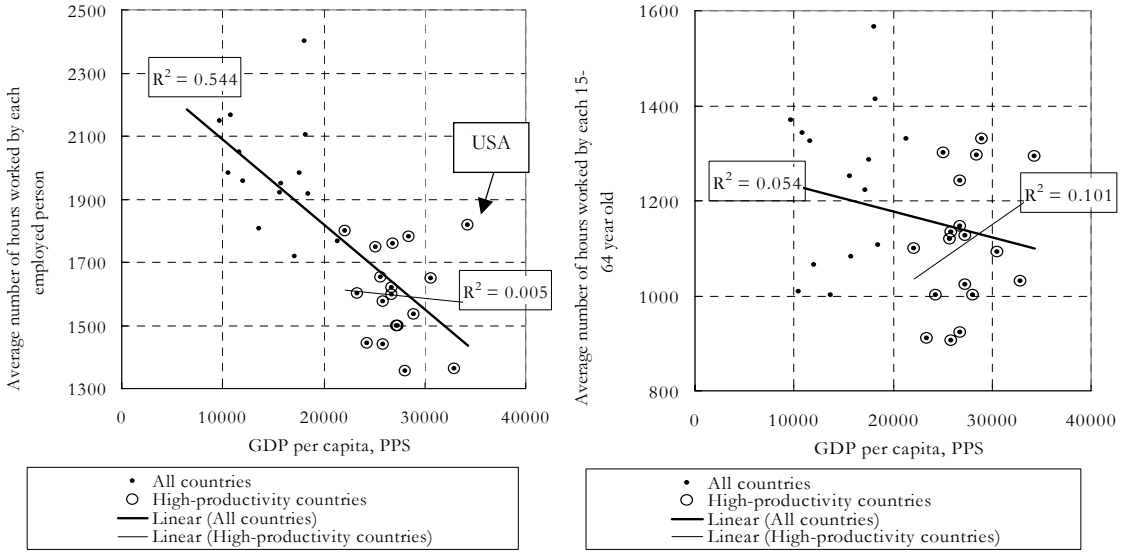
Figure 17 **Productivity and the average number of hours worked by the working-aged population, USA = 100**



Note: Germany's data are affected by the reunification.

Sources: Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

Figure 18 **GDP per capita (nominal PPS) and average hours worked by the employed (left-hand side graph) and the working-aged population (right-hand side graph) in 2004**

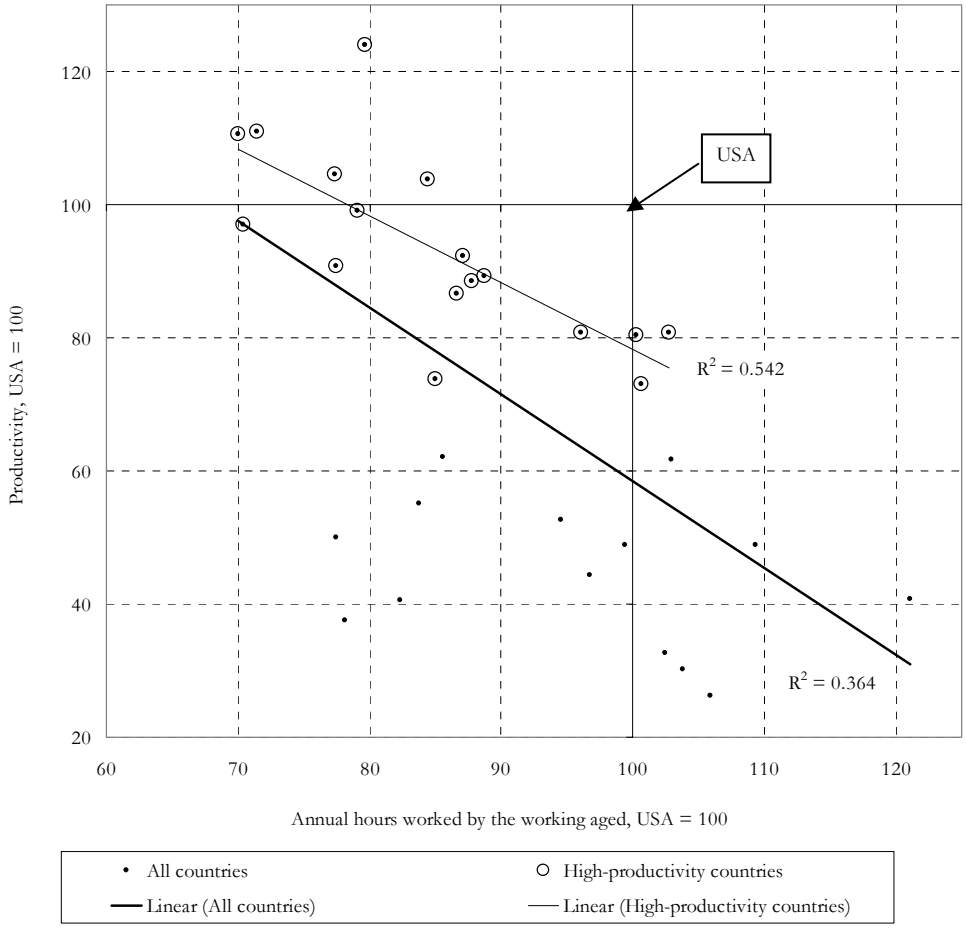


Note: The 'high-productivity countries' are Belgium, Denmark, Germany, Spain, France, Ireland, Italy, Netherlands, Austria, Finland, Sweden, United Kingdom, USA, Japan, Canada, Switzerland, Norway and Australia. 'All countries' also include the Czech Republic, Estonia, Greece, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Portugal, Slovenia, Slovakia, South Korea and New Zealand.

Sources: Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

In Figure 19 we have productivity and average hours worked by the working-aged population relative to the United States in 2004. The higher the productivity, the smaller is the average number of hours worked. As can be seen, the linear curve does not go through the point, where the USA is located.

Figure 19 **Productivity and average hours worked by the working aged in 2004, USA = 100**



Note: The 'high-productivity countries' are Belgium, Denmark, Germany, Spain, France, Ireland, Italy, Netherlands, Austria, Finland, Sweden, United Kingdom, Japan, Canada, Switzerland, Norway and Australia. 'All countries' also include the Czech Republic, Estonia, Greece, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Portugal, Slovenia, Slovakia, South Korea and New Zealand. If we were to use the average number of hours worked by each employed person instead of the working-aged population, the explanatory power would rise to 0.794 for all countries and remain almost unchanged for the high-productivity countries.

Sources: Eurostat; Groningen Growth and Development Centre and The Conference Board, Total Economy Database, http://www.ggdc.net.

Based on the above discussion, there are likely to be several reasons why other industrialised countries have not reached the average US level of productivity with the same number of hours worked, and thus the same higher level of GDP per capita. According to our results, the level of taxation or benefit systems (represented here by the gross replacement rate) and labour market institutions do not affect productivity growth in the industrialised countries. On the other hand, there are other factors such as fixed investment, R&D investment, ICT investment and education that do influence productivity growth. Europe is lagging behind the USA in many of these aspects. Also, there is more market regulation in Europe and thus in many cases less competition which is likely to lead to smaller incentives to increase productivity and competitiveness.

Meanwhile, the number of hours worked by the working-aged population seems to correlate negatively with higher taxes, stricter product market regulation, higher gross replacement rates, higher collective bargaining coverage, a higher ratio between collective bargaining coverage and trade union density, and possibly with stricter employment protection. These are factors that are likely to have influenced the lower number of hours worked in Europe relative to the USA. In this discussion it should of course be kept in mind that leisure time is valuable also. However, Europe's faster ageing means that certain social, healthcare and other costs in the societies will increase in the near future and these would be easier to sustain if incomes (GDP per capita) were higher.

6 SUMMARY AND CONCLUSIONS

We have analysed the relative performance of the EU25 and other OECD countries in 1960-2004 and identified factors that have influenced the growth rate of labour productivity (purchasing-power adjusted real GDP per hour worked) and the average number of hours worked by the working-aged population aged 15-64 years. Relative to the United States, the EU15 countries' total GDP reached a peak in the mid-1970s after which it has been falling behind. Catching up in terms of productivity continued up to 1995, but after that the EU15 countries have on average been losing ground. Meanwhile, the average number of hours worked by the working-aged population was declining in the EU15 countries relative to the USA up until the mid-1990s, but started a recovery shortly thereafter. As a result of the relative development of productivity and hours worked, there has been practically no change in relative GDP per capita between the EU15 and the USA since 1970.

6.1 The development of productivity

While there surely is a problem with productivity growth in the EU15 countries, there are nevertheless some points that need to be taken into account before criticising too harshly the EU countries. First, while slower productivity growth is true on average, there are several EU15 countries with growth rates in 1995-2004 more or less equal to that in the USA. Meanwhile, especially Spain and Italy, and to a lesser extent the Netherlands, have been suffering from low productivity growth. Actually, during the 1995-2000 period the average growth rate of productivity in the EU15, excluding Spain and Italy, was the same as in the USA. While Spain has been suffering from negative productivity growth, employment there has grown very fast and GDP growth has equalled the USA's. Meanwhile, Italy and to a smaller extent the Netherlands have been suffering from a loss of competitiveness due to a too fast rise in unit labour costs.

In cross-section analyses for averages of 1995-2004 in high-productivity countries, where productivity exceeded 70 per cent of the US level in 2004, we find that there is a positive correlation between the growth rate of productivity on the one hand and higher R&D and ICT investment as a percentage of GDP, a higher share of young adults with at least upper secondary education, and lower product market regulation on the other hand. Often this requires that we exclude Ireland, which has had a very high productivity growth rate with little investment in ICT and R&D. No correlation was found between productivity growth, on the one hand, and the taxes-to-GDP ratio or the degree of unionisation, on the other hand.

The results from our pooled least squares regression analysis largely confirm the results from the cross-section data analyses. Here we have 21 OECD countries in 1960-2004 and the data are in the form of non-overlapping five-year averages. We used both

country and time-period fixed effects. The coefficient of the lagged dependent variable of productivity has a negative sign and it is always statistically very significant, which indicates β-convergence. According to the results, the growth rate of labour productivity is affected positively by higher investment, lower inflation, higher R&D investment, and increased exports. In most specifications taxes and gross replacement rates had no statistically significant effect on the productivity growth rate. We found a negative effect from taxes and a positive one from gross replacement rates when they appeared together with fixed investment or inflation. However, with this evidence we conclude that taxes and gross replacement rates have not had an effect on productivity growth.

6.2 The development of the number of hours worked

The average number of hours worked by the working-aged population was the same in the EU15 area and the United States in 1970 but declined thereafter to just 73 per cent of the US level by 1997. After that it has recovered and increased to 79 per cent by 2004. This measurement includes not only the average number of hours worked by each employed person, but it is also affected by labour force participation and unemployment. All three have lower performance in Europe than in the USA. Ceteris paribus, working less means lower GDP per capita, but of course also more leisure time which is of value in itself. The faster ageing of the European population increases healthcare and other costs to the societies. The costs would be easier to finance from a larger GDP, and GDP would be larger if people were to participate in market production more.

In many studies, the lower number of working hours in Europe has been argued to be due to either higher taxes and social benefits and/or a relatively stronger influence of trade unions. According to our cross-section analyses, there was a strong negative correlation in the OECD countries between the average number of hours worked by the working-aged population and the taxes-to-GDP ratio in 2000-04, although this requires the exclusion of Denmark, Finland and Sweden from the analysis. Also, looking at historical time series, the rise and then stabilisation of taxes at some new higher level seems to have often resulted first in a decline in the number of hours worked and then their stabilisation at some new lower level.

In the cross-section data analyses, we further find a negative correlation between the average number of hours worked, on the one hand, and production market regulation, gross replacement rates and the strictness of overall employment protection legislation, on the other hand. However, income inequality does not correlate with differences in the number of hours worked. Trade union density does not correlate with the number of hours worked, but collective bargaining coverage has a negative correlation with it. There is also a negative correlation between the ratio of collective bargaining coverage and trade union density, on the one hand, and the average number of hours worked, on the other hand. This ratio can be thought of as a proxy to how 'democratic' trade unions are. If the ratio is very high, a relatively small number of trade union members, or their representatives, negotiate wages for almost every employed person. At least in principle, it is possible that this leads to a radicalisation of trade union policies.

According to our pooled least squares panel data estimations for the 1960-2004 period, the average number of hours worked by the working-aged population seems to depend negatively on the taxes-to-GDP ratio. Also, as the only independent variable, gross replacement rates have a negative effect, collective bargaining coverage a positive effect, and the ratio of collective bargaining coverage and trade union density has a negative effect on the number of hours worked. On the other hand, trade union density and our measure of employment protection, which is different from the one used in the cross-section analysis, fail to explain the number of working hours.

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