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**Determinants of Growth
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Insufficient Investment into Future Growth: The Forgotten Cause of Low Growth in Germany

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1 Introduction and plan of the paper

The nineties were a disappointing decade for Germany. Economic growth decelerated to 1.3%, the lowest growth rate in all of the European Union. Productivity decelerated, unemployment climbed upwards, budget deficits soared and exceeded the maximum allowed for by the Stability and Growth Pact. Macroeconomic growth also decelerated in France and Italy, but not to the same extent. Without these three big continental countries, growth in Europe would have amounted to 2.8% (EU without big 3c), not too far from that of the US (3.2%).

Most studies blame expensive labour, high welfare costs and low market flexibility for the underperformance of Germany. A short and pointed summary of this line of reasoning is provided by *Sinn* (2002A, 2002B, 2003).¹ After describing Germany's loss in GDP versus its EU partners, and the declining share of German exports in the world economy, Sinn enumerates internal and external causes in the following order:

- "The increase in wages and labour-related expenses is the most important factor."
- "The expansion of the welfare state contributed significantly to the rise in labour costs."
- "German unification also explains part of weak economic growth."
- "The intensification of competition following the fall of the Iron Curtain and European Integration."
- "The Euro in particular led...to a dramatic convergence in interest rates....The Euro has robbed German industry of its competitive advantage in the form of lower interest rates."
- "In order to speed up growth again, market forces, especially on the labour market, must be activated...collective bargaining and labour law must be fundamentally reformed."

Insufficient expenditures on research, the slow diffusion of information and communication technology or a comparative disadvantage in new technologies is not included in the list of growth blockers. The closest Sinn comes to mentioning these growth drivers is at the end of the summary, in the form of a hint at the role of education: "Last but not least, education must

* A former version of this paper was published as a European Forum Working Paper 2/2002, Stanford University, December, 2002. The author would like to thank Wolfgang Gerstenberger, Markus Marterbauer, Karl Pichelmann, Gunther Tichy and Ewald Walterskirchen for their comments on an earlier draft. He also acknowledges the research assistance of Dagmar Guttman and Traude Novak.

¹ All citations *Sinn* (2002A), p. 2.

be improved to lay the long term foundation for a new surge in innovation. This is widely accepted, but it will not be enough ... economic growth will continue to lag ... unless the more difficult reforms are implemented, too."

Sinn's analysis is the most precise enumeration of the usual suspects for German problems and the bluntest neglect² of any contribution made by research, innovation, and technology to the medium-term growth rate of Germany. Other studies essentially take the same position, but at least report deficiencies in the innovation system or the technological position.

The *European Commission* (2002) analyses the growth differential of Germany with respect to other countries and the vulnerability of Germany to external shocks (Mexican and Asian crisis and oil shock of 1999/2000). It refers to the long-lasting effects of re-unification, with its artificial exchange rate, the boom and bust of the construction sector and weak consumption demand. Digging deeper into determinants, the Commission specifies the 4% transfer of GDP from the west to the east. This extra burden caused rising taxes and social expenditures and strongly declining cost competitiveness in the first half of the nineties (*European Commission*, 2002); this loss has, "thanks to wage restraint and the weak Euro been largely restored in the West, but not for the Neue Länder. Macroeconomic policy is not responsible, even if Germany has not profited as much as other countries from falling interest rates, the labour market has seen a more subdued development in Germany with rigidities on the labour market standing out as a key factor." The Commission then singles out the following characteristics of the labour market which impede higher employment: (i) wages out of line with productivity...especially for the unskilled segment, (ii) high marginal tax rates in combination with long benefit duration and high benefit rates (for certain groups); (iii) a general lack of flexibility and mobility. Since labour market regulation is not much higher than in other countries – as the report has to acknowledge - the problem lies in the harmful signals sent by the reversals of timid reforms. Furthermore, existing rigidities gained relevance through their interaction with unification related forces. In a following analysis of trade and the current account deficit, the study concludes that although one cannot speak about a competitiveness problem, it does acknowledge the insufficient presence of German exports in dynamic markets and that Germany's "high-technology sector perhaps surprisingly shows a slight and

² Hans Werner Sinn argues in a communication to the author reflecting on an earlier draft, that the enforcement of research and innovation does have its role in a medium term policy and that he has criticized the wrong priorities in the German education policy (as proven by the ranks in the Pisa study), but Sinn maintains that focusing economic policy on R&D would not help in the current situation, inter alia since it is not basic research, but applied research in firms, which is insufficient.

growing comparative disadvantage ... " (*European Commission*, 2002, p. 70 and Figure 3.7). The Commission Report is thus more balanced, as it at least mentions the technology gap. However, there is no connection between this analysis and policy measures, and the technology gap is not mentioned again in the summary. There is a deplorable discrepancy between the interpretation of Germany's growth performance in the past, where investment into research, education and new technologies plays no role at all, and the Lisbon strategy, which sets a 3% goal for growth, and acknowledges the crucial roles of research and education.³

Tab. 1: The anaemic growth performance of Germany (Growth of real GDP per annum)

	1993/2002	2000/2002
Germany	1.3	1.2
France	1.9	2.3
Italy	1.6	1.8
Large 3 continental countries	1.6	1.7
Denmark	2.5	1.9
Finland	3.3	2.6
Sweden	2.9	2.4
Top 3 countries	2.9	2.3
EU	2.1	2.0
EU excl. Large 3 c	2.8	2.4
US	3.2	2.2

Source: WIFO calculations using AMECO.

The OECD Country Report for Germany blames low levels of employment creation as the main reason for slow growth (*OECD*, 2003, p. 27), followed by low productivity and insufficient demand. Reference is made to the education system in light of its high costs, long duration of studies and low Pisa ratings for language and mathematical skills. Telecom is analysed with respect to its potential for decreasing prices, while research is not mentioned at all. The boom and the bust of the construction sector contributed to the deceleration of growth rates between the first and second halves of the nineties. It stresses the influence of German unification, but cannot explain the weak performance of the most recent years. *Wurzel* (2001) stresses the ageing problem as a factor which specifically limits employment creation.

³ The report, which investigates the implementation of the Broad Economic Policy Guidelines (*European Commission* (2003), p. 20), mentions four key policy challenges for Germany: consolidation of public finances, increasing efficiency of active labour market policies, reforming benefit schemes to make work pay, improving the business environment ... especially for small and medium sized firms.

This paper is organised as follows. First we describe German performance in the nineties using a set of macroeconomic indicators regarding growth, stability and fiscal prudence (Section 2). Specifically, we compare Germany with the EU average, but also with France and Italy. We contrast the positions of these countries with the best performing European countries. Then, we compare cost development in Germany with that in the EU, referring to labour costs, as well as to social costs and taxes (Section 3). Section 4 analyses regulation in product and labour markets and regulatory change in Germany relative to other countries. In Section 5, we investigate the dynamics of German investment into "growth drivers", specifically how the German position has changed over the nineties. Finally, we recall studies prior to German unification, which warned about the effects of a high tech gap in a high wage country and discuss why most analyses do not focus on insufficient investment into the long-run determinants of growth as important cause for German problems (Section 6). Section 7 presents our conclusions.

2 Germany at the bottom end of the European performance league

Measuring the performance, welfare or the competitiveness of countries has been the subject of intensive and controversial discussion, culminating in the question whether these notions exist at an aggregate level or for a country. We pragmatically decided to measure economic performance according to the dynamics of GDP, as well as in light of a country's ability to increase productivity and employment and to provide economic stability. The set of indicators includes data on manufacturing; it reports on indicators of growth rates acceleration and starting levels. Employment performance is measured by unemployment and employment rates (levels and changes), stability by the inflation rate and fiscal prudence (deficits, debts, and taxes). The period we chose encompasses the last 10 years up to 2002. The quantitative results for 25 indicators, as well as rankings for Germany and the other big economies are listed in Table 2. Changing the number of indicators, their weights and the timing does influence a few positions, the overall ranking is generally stable.

Germany's average rank over the 25 performance indicators is 10.8; this is the lowest rank of all 14 countries included in the comparison. Germany has the lowest rate of output growth, the lowest level of total factor productivity, and the strongest deceleration in industry growth, potential output and total factor productivity. The best position achieved by Germany is in inflation (4th place), although even here, Germany's performance is surpassed by France, Finland and Sweden. Medium ranks are achieved for productivity growth in manufacturing, per capita GDP and the employment rate (average of the past ten years).

Tab. 2: Ranking the economic performance of Germany for a set of 25 indicators

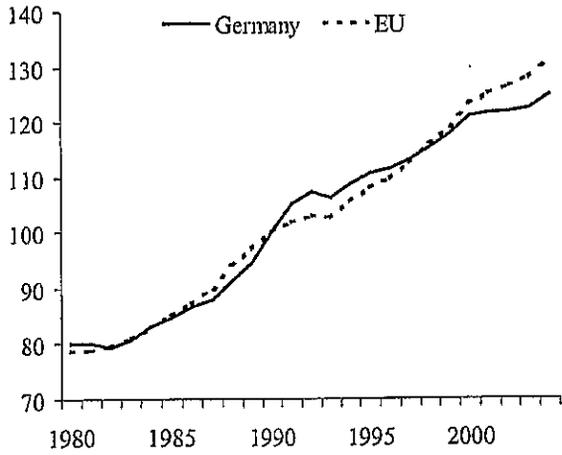
	Germany		France		Italy		Large3		Denmark		Finland		Sweden		Top3	EU
	Rank		Rank		Rank				Rank		Rank		Rank			
1 Real growth of GDP																
Growth 1993/2002	1.3	14	1.9	12	1.6	13	1.6	25	9	3.3	2	2.9	3	2.9	2.1	
Acceleration*	-1.8	14	-0.4	10	-0.7	11	-1.0	0.8	5	1.7	2	1.1	4	1.2	-0.5	
2 Micro productivity growth																
Growth 1993/2002	1.1	13	1.3	11	1.3	10	1.2	1.8	6	2.5	3	2.7	2	2.4	1.4	
Acceleration*	-1.2	13	-0.9	12	-0.4	7	-0.8	0.5	3	-0.1	6	1.0	2	0.5	-0.6	
3 Manufacturing growth																
Growth 1993/2002	1.2	13	1.8	8	1.4	12	1.4	3.2	5	6.1	2	3.8	4	4.4	1.7	
Acceleration*	-1.4	14	0.3	8	-0.9	12	-0.7	0.5	7	4.5	2	1.6	3	2.2	-1.1	
4 Productivity growth in manufacturing																
Growth 1993/2002	3.2	8	0.6	13	-0.2	14	1.2	3.4	6	7.2	2	2.8	10	4.5	2.7	
Acceleration*	0.3	7	-0.9	10	-3.3	14	-1.3	0.8	5	4.7	2	-2.8	13	0.9	0.1	
5 Potential output																
Growth 1993/2002	1.7	13	2.0	12	1.6	14	1.8	2.2	9	2.7	5	2.4	8	2.4	2.2	
Acceleration*	-0.7	14	-0.1	10	-0.6	13	-0.5	0.6	3	0.5	4	0.4	5	0.5	-0.2	
6 Total Factor Productivity																
Growth 1993/2002	0.4	14	0.9	8	0.8	9	0.7	1.6	5	2.7	2	2.4	3	2.2	0.9	
Acceleration*	-1.4	14	-0.4	9	-0.3	7	-0.7	0.6	5	1.3	3	1.4	1	1.1	-0.5	
7 Employment rate																
Average 1993-2002	67.7	7	61.1	9	56.8	12	61.9	76.2	1	63.2	8	73.2	3	70.8	64.4	
Absolute change 1993-2002	0.6	12	3.3	5	1.9	9	2.0	2.9	7	3.1	6	-2.3	14	1.2	3.0	
8 Unemployment rate																
Average 1993-2002	8.4	7	10.7	11	10.8	12	9.9	5.8	4	12.5	13	7.7	6	8.7	9.2	
Absolute change 1993/2002	1.8	13	-1.3	7	0.3	10	0.3	-4.1	3	-2.6	5	-0.7	8	-2.5	-1.0	
9 Inflation rate																
Average 1993-2002	1.9	4	1.5	1	3.1	11	2.2	2.2	7	1.6	2	1.6	3	1.8	2.4	
Absolute change 1993/2002	-2.6	4	-0.5	10	-2.7	3	-1.9	0.3	12	-1.4	8	0.1	11	-0.3	-2.1	
10 Budget deficit in % of GDP																
2002	3.3	13	3.4	14	2.3	11	3.0	-1.8	2	-4.4	1	-0.8	3	-2.3	2.0	
Absolute change 1993/2002	-1.1	13	-1.4	12	-8.6	2	-3.7	-2.4	10	-6.1	5	-6.4	4	-5.0	-3.9	
11 Public debt in % of GDP																
2002	60.8	13	59.5	14	106.7	6	75.7	45.2	4	42.7	8	52.4	5	46.8	62.7	
Absolute change 1993/2002	17.9	13	20.0	14	-1.0	6	12.3	-21.1	4	2.1	8	-10.7	5	-9.9	3.7	
12 Taxes in % of GDP																
2002	45.3	7	50.6	10	45.2	6	47.0	57.1	13	53.7	12	59.1	14	56.6	45.5	
Absolute change 1993/2002	1.4	10	2.3	11	-0.6	9	1.0	-0.8	8	-7.3	2	-5.4	3	-4.5	-0.1	
13 GDP per capita at PPP 2002																
1000 EURO	24.6	7	24.5	9	24.5	8	24.5	27.2	2	24.4	10	24.3	11	25.3	23.9	
Overall average of ranks		10.8		9.8		10.0			5.8		4.7		5.9			
Rank of this average		14		12		13			3		2		4			

* Acceleration: growth p.a. 1993/2002 minus growth p.a. 1983/1992; 14 EU countries (excl. Luxembourg).

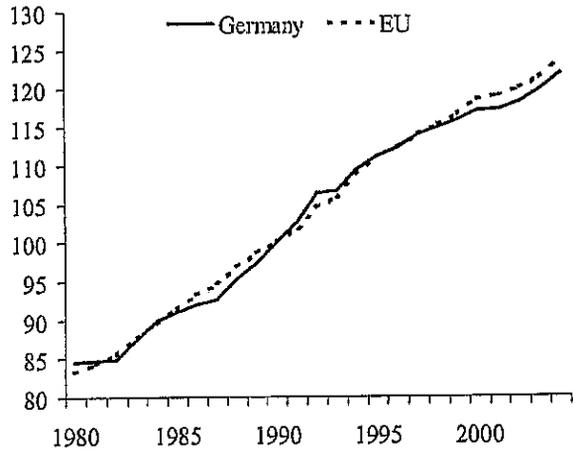
Source: WIFO calculations using AMECO.

Fig. 1: Macroeconomic performance of Germany

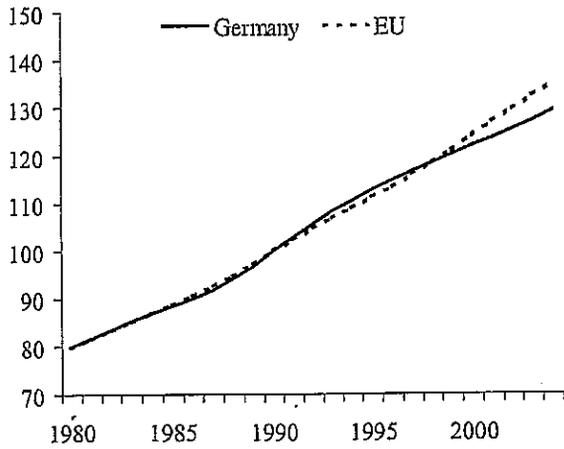
GDP real (1990=100)



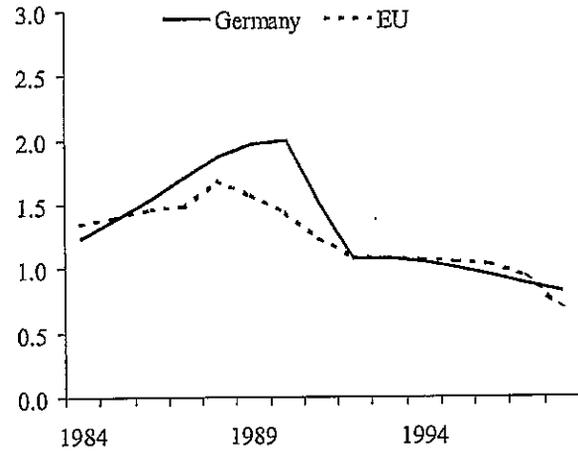
GDP per worker (1990=100)



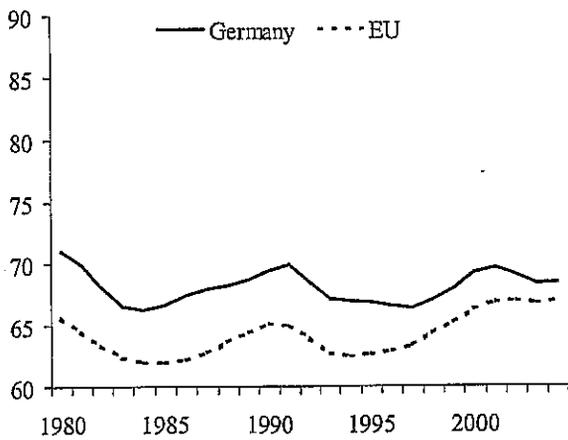
Potential output (1990=100)



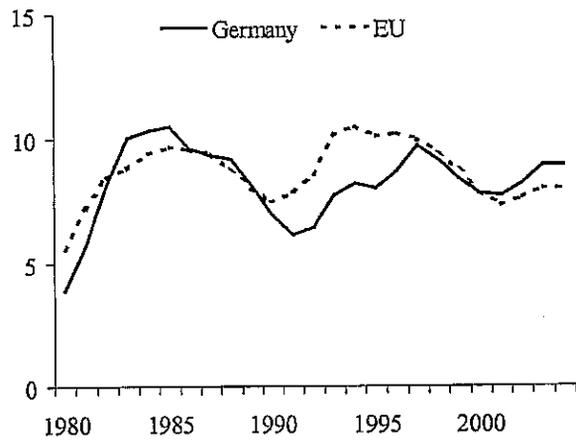
Multi factor productivity growth



Employment rate



Unemployment rate



Source: AMECO.

Within the EU, Italy and France are "neighbours", as far as their weak performances are concerned. Italy places last in productivity and growth in potential output, and also exhibits the strongest deceleration in productivity. In France, the budget deficit has increased strongly, with public debt soaring from 40% to 60% of GDP. Italy excelled only in reducing inflation and its budget deficit. The countries ranked at the top are Ireland, Finland, Denmark and Sweden, of which the latter three will henceforth be called the top 3 countries (following *Aiginger*, 2003). In contrast, Germany, France and Italy are the big 3 countries, or more accurately, the big three continental countries (big 3c). They all had practically the same per capita income at purchasing power parity in 2002.

In summary, over the past ten years, the big 3 continental countries attained an average rate of growth of 1.6%, as compared to 2.9% for the top 3 countries. Within the big 3, Germany lags behind with a growth rate of 1.3%. For manufacturing, growth in the top countries is triple that of the large countries, while Germany's is slightly lower even if compared to the large country group (1.2%). The productivity difference is half a point for the total economy, and one and a half points for manufacturing. In per capita income, the top 3 countries (25,300 EURO) surpass the big 3 countries (24,500 EURO), with Germany exactly in the mean of the big 3c.

3 Cost competitiveness indicators for Germany

In this section we examine indicators of cost competitiveness, which can help us determine the extent to which rising costs could be the cause of German underperformance.

Germany is a high wage country, with the highest per worker and per hour wages in all of European manufacturing. Wages per hour are 25% higher than the European average, 30% higher than in France and 53% higher than in Italy (*Guger*, 2003).

Looking at wage increases over time, we see a steep rise in wages between 1990 and 1995 (see Figure 2, first row). During this period, the German economy achieved a comfortable rate of growth, today labelled the temporary "unification boom". Construction boomed, wages converged between the "Alte" and "Neue Länder", and benefits were extended. The boom, as well as the dynamic rise in wages subdued sometime around 1995, and since then wages and unit labour costs have increased slowly. The wage moderation was so strong that

wages and unit labour costs⁴ for the decade as a whole developed more slowly than the European average.

Taxes in relation to GDP soared between 1990 and 1994; since then, there has been no clear trend. The German tax rate has been close to the European average for a long time; during the eighties, it was a little bit below the EU average, while the largest "advantage" was in 1991 (2.2 points). Although this low tax status was lost after unification, current taxes are still quite near to the European average (see Figure 2, last row). Thus, taxes have contributed to increasing costs. This means a former advantage has been lost, but not to the extent of creating an additional absolute burden in 2000.

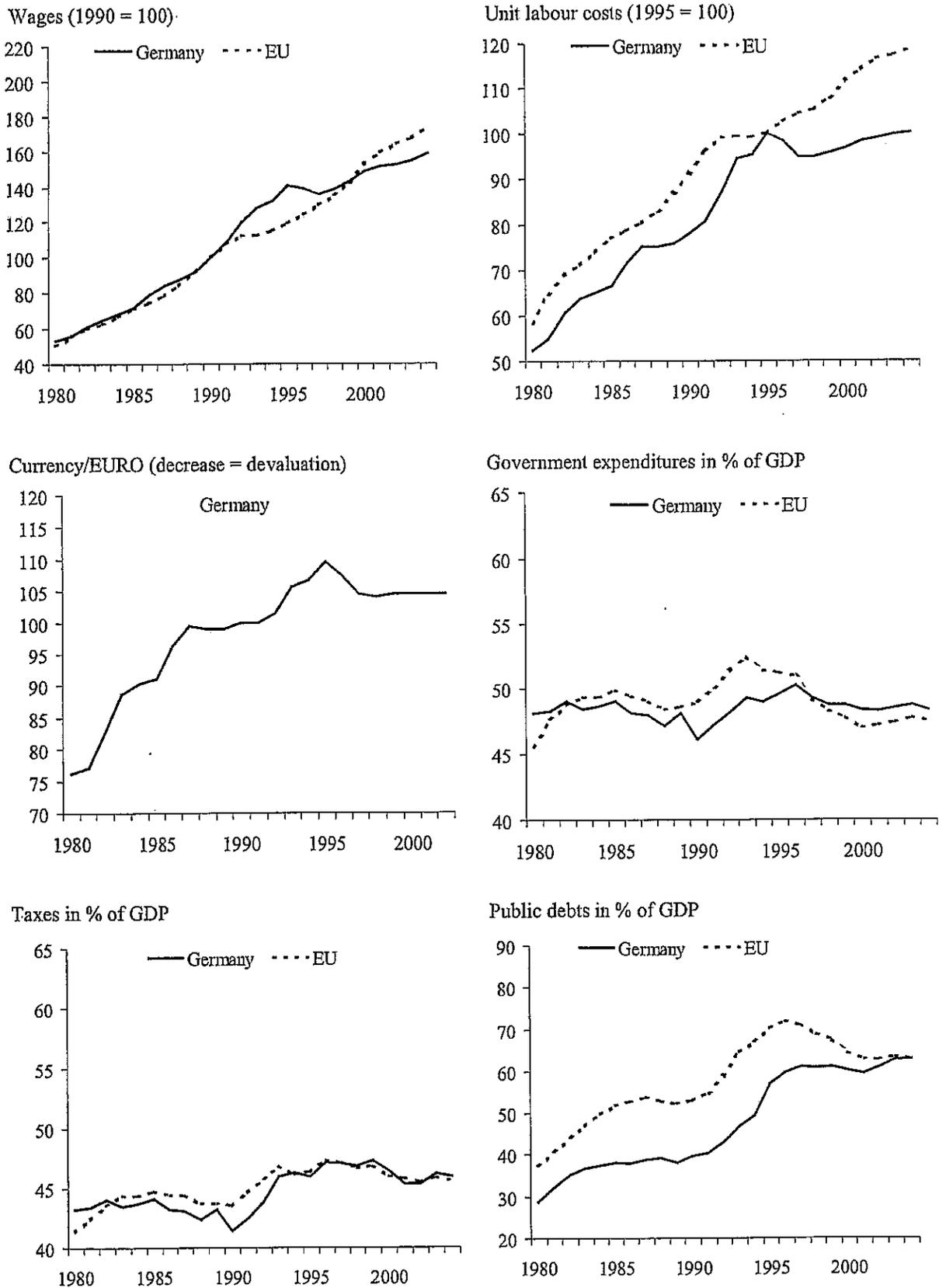
In 1990, social expenditures amounted to 25% of GDP in Germany, as well as in the European Union as a whole (Figure 3); less than in the Scandinavian countries, but higher than in southern countries. The extension of benefits to the "Neue Länder" and high unemployment stepped up the burden to 29%, which is now 3 percentage points more than the European average, but is less than in France (29.5%) and in the top 3 countries (31%). A certain proportion of the higher expenditures may have been compensated by reductions in other expenditures, but the lions share is reflected in the changing budget position. Government expenditures increased from 46% to 50% of GDP, exactly parallel to social expenditures.

In short, labour costs have not increased faster than the European average over the past ten years. They did increase fast in the first half of the nineties, but this was corrected in the second half. Of course, price competitiveness could have been higher in the first half of the nineties and high wage increases may have depressed profits and prevented investment and research. But this does not provide very convincing support for the claim that wage increases have caused slow growth over the course of the entire decade and specifically the last eight years since 1995⁵. Social expenditures increased, but this was reflected only in part by higher taxes: taxes increased somewhat during the first half, thus eliminating the former tax advantage. The greatest share of the unification costs or the increased social expenditures was shifted into the government deficit. This of course has indirect effects on competitiveness, firstly via expectations of further tax burdens and secondly through the crowding out of other expenditure categories.

⁴ Source for wages and unit labour costs AMECO (in common currency, nominal in EURO).

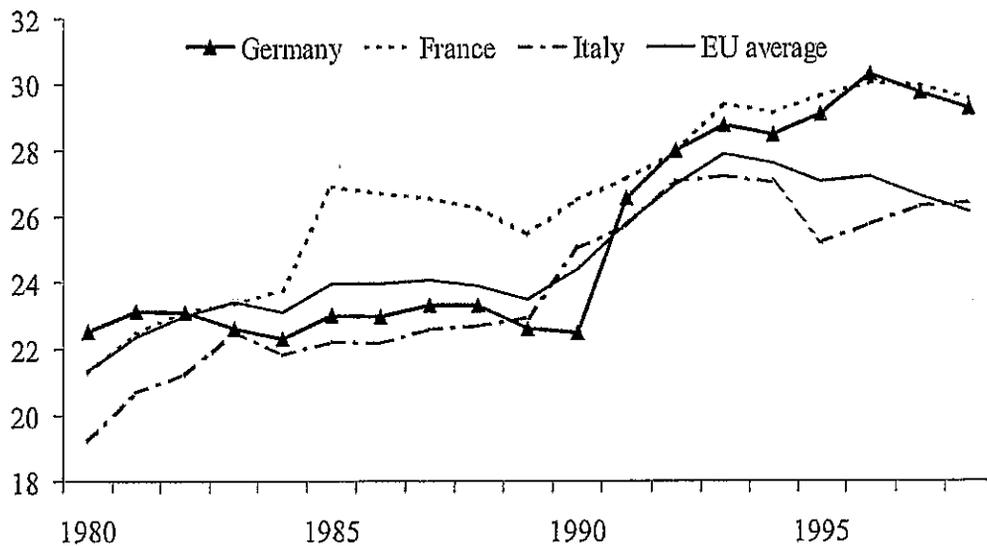
⁵ For a similar evaluation, see *European Commission* (2002, p.2), which reports that price competitiveness was lost in the first half, but regained during the second, due to wage moderation and the weak EURO. This finding is restricted to West Germany, and does not apply to the "Neue Länder".

Fig. 2: Cost competitiveness, taxes, expenditures and debt



Source: AMECO.

Fig. 3: Social expenditures in % of GDP 1980-2000



Source: OECD.

4 Regulation in product and labour markets

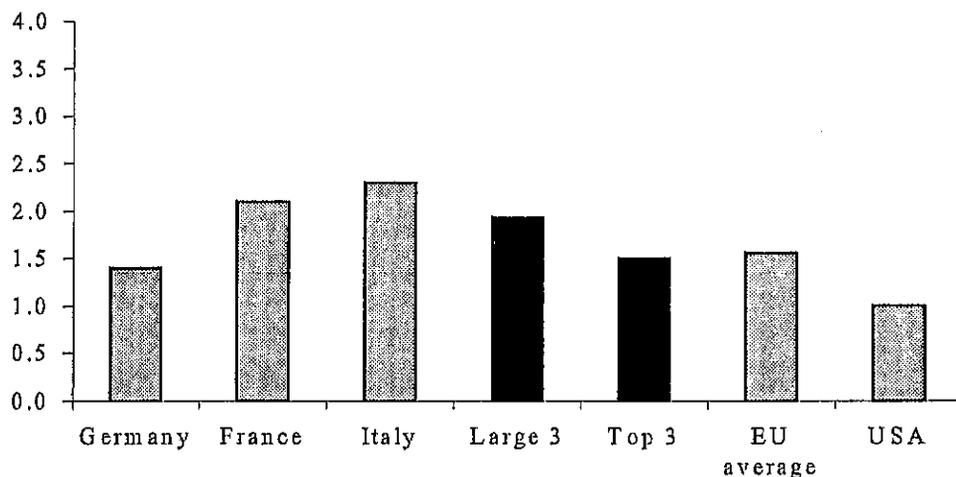
In this section we analyse the extent of regulation and regulatory change for product and labour markets. An international comparison of institutions is extremely difficult. We use a widely known set of indicators provided by the OECD to assess the German situation.

Product markets are definitely less regulated in Germany than in the European Union as a whole; this was the case at the start of the nineties, and since then liberalisation has been stronger than in the European Union.

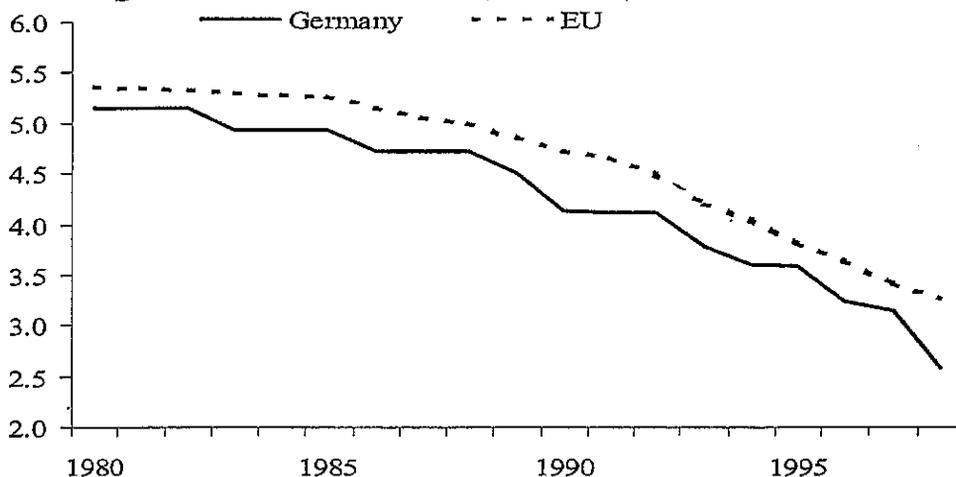
One indicator of product market regulation is available only for 1998; it is therefore called the static indicator (PMRSTAT). Here, Germany ranks 1.4, with lower ranks indicating less regulation. Regulation is definitely lower than in France (2.1) or Italy (2.3), and below the European average, since trade is unrestricted, government ownership is low and competition policy is tough. The other indicator on product market regulation primarily describes liberalisation in network industries and is available over time (PMRDYN). It reveals that in 1990, network industries in Germany were already more liberalised than the EU average (4.13 vs. 4.73), as well as that the further decline was steeper (-37% vs. -31%). Again, the main contrast is vis-à-vis France and Italy. By any measure, Germany is thus among the most liberalised economies with respect to product markets. In the liberalisation of network industries in 1998, Germany shares 3rd place with Finland, preceded only by the United Kingdom and Sweden.

Fig. 4: Regulation and regulatory change

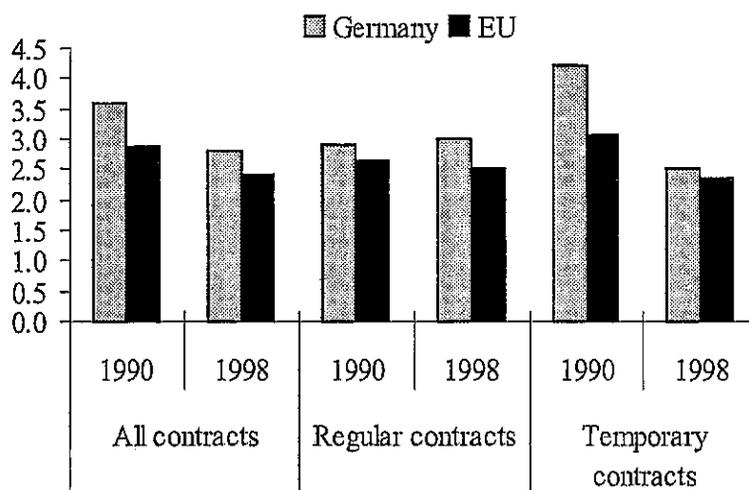
Product market regulation: Static indicator (PMRSTAT)



Product market regulation: Network industries (PMRDYN)



Labour market regulation



Source: OECD Database on Regulatory Indicators.

The opposite is true for labour markets. Labour market regulation was strong in 1990, with a rank of 3.6 for Germany versus 2.9 for the European Union. Deregulation was slightly stronger - the index dropped by 22% for Germany and by 15% for the EU average; in absolute terms the difference to the European Union narrowed from 0.7 to 0.4 percentage points. Labour markets are more regulated in France, Italy, Portugal, Greece and Spain; thus Germany is playing in the "Southern League" as far as labour market regulation is concerned. Germany did not deregulate regular contracts at all (the index reveals a slight increase for Germany, while it decreased for European countries). However Germany did deregulate temporary contracts. These were strongly regulated in 1990 (jointly with Italy and Greece), and the index dropped from 4.4 to 2.6. Temporary contracts are now only slightly more regulated than in the average of other European countries.

Summarising our findings, product markets are deregulated in Germany. Labour markets are more regulated, specifically for regular contracts. Temporary contracts have been deregulated to some extent; this has diminished the difference in overall labour market regulation between Germany and other EU members, while upholding the characterisation of Germany as a labour market with above average regulation. Making labour markets solely responsible for underperformance is not easy, since Germany enjoyed high growth during past decades with a greater extent of "overregulation". It is however likely that rigid labour markets can be a more severe problem in times of turbulence and rapid technological change. Rigidities may also play a larger role in countries with extremely high wages and pressing structural change. We need these arguments of "secondary order" to underline the importance of labour market deregulation.⁶

⁶ This assessment is similar to that of the *EU Commission* (2002), which reports that Germany was not an outlier in labour market regulation. However, it blames Germany for sending the wrong signals by reversing timid reforms. Secondly, the report states that regulation may have a negative impact when it interacts with unification. The amount of change induced by German unification may have needed more flexible institutions.

Tab. 3: Germany's position for 16 growth drivers

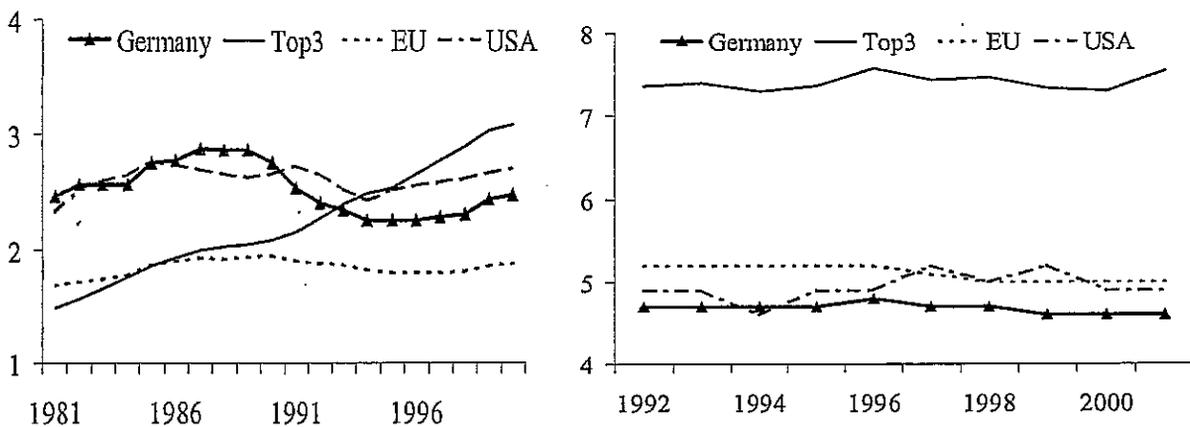
	Germany						EU		Germany vs. EU	
	1990	Rank	2000	Rank	Abs. change 90/00	Rank	1990	2000	1990	2000
Indicators on R&D: input and output										
Total expenditure on R&D in % of GDP	2.75	2	2.44	3	-0.31	10	1.60	1.85	+	+
Business Enterprise Expenditure on R&D (BERD) in % of GDP	1.66	2	1.55	3	-0.11	11	0.99	1.12	+	+
Research intensity in manufacturing	2.52	3	2.52	3	0.00	6	2.25	2.39	+	+
Publications per inhabitant	6.01	8	7.84	9	1.83	10	6.56	8.97	-	-
Patents per resident	4.89	1	5.50	1	0.61	2	2.20	2.28	+	+
Indicators on education system: input and output										
Percentage of the population that has attained at least upper secondary education by age group (1998)	84.00	1	84.00	1	0.00	13	57.86	52.50	+	+
Percentage of the population that has attained at least tertiary education, by age group (1998)	23.00	7	25.00	4	2.00	13	20.36	18.79	+	+
Indicators on ICT: production and use										
ICT expenditure in % of GDP	4.21	5	5.32	12	1.11	13	3.69	6.00	+	-
Information technology (IT) expenditure in % of GDP	2.12	4	2.59	7	0.47	11	1.69	2.57	+	+
Telecommunication (TLC) expenditure in % of GDP	2.09	7	2.73	13	0.64	13	2.00	3.43	+	-
PCs per 1000 inhabitant	1086.8	8	2969.7	8	1882.9	7	975.1	2748.6	+	+
Internet users per 1000 inhabitant	43.2	5	1752.6	8	1709.4	8	49.0	1929.9	-	-
Cellular Mobile Subscribers per 100 capita	1.2	8	28.4	14	27.14	14	2.2	44.4	-	-
Indicators on share of "progressive" industries										
Share of technology driven industries in nominal value added	24.99	2	26.41	4	1.42	11	17.24	19.56	+	+
Share of skill intensive industries in nominal value added	19.63	2	19.22	3	-0.40	9	14.18	14.55	+	+
Share of ICT industries in nominal value added	6.28	7	4.95	10	-1.34	12	6.60	7.25	-	-
Overall average of ranks		4.3		6.6		10.2				
Rank of this average		3		6		14				

Source: WIFO calculations using OECD and EUROSTAT.

5 The dynamics of investment into future growth (growth drivers)

It is well understood that the competitive advantages of countries change with their resources and the relative prices of inputs. High wage countries switch first to capital-intensive production and later to production which is intensive in human capital and research. In low-income countries, economic growth depends on resources; as per capita income increases, physical capital and ultimately research, education and the speed of innovation play increasingly important roles. As the EU-member country with the highest wages, growth theory predicts that Germany will achieve economic growth if it excels in R&D, education and new technologies. We examine the German position first according to a set of 16 indicators of research input and output, educational attainment of the work force, ICT expenditures and use, and finally the share of sophisticated industries. Then, we calculate an indicator of total investment into the future by summing up the shares of R&D, education and ICT expenditures relative to GDP. Our analysis focuses first on the position of Germany versus other countries in levels, then on the change in Germany's position over time.

Fig. 5: Expenditures on R&D (left) and education (right) in % of GDP



Let us start with research. In 1980, Germany had the highest ratio of R&D expenditures relative to GDP in Europe. Its position at the start of the nineties was the 2nd best in Europe (2.8%); it fell to 4th place in the mid nineties (2.3%) and recovered slightly to 2.5% in 2000 (3rd place, see Table 3). Sweden and Finland are now leading, with 3.8% and 3.4% respectively. Of the European countries, only four others had declining ratios.⁷ Other indicators of

⁷ The decline does not seem to be due to the inclusion of East German Länder in the statistics. Research ratios in the Eastern Länder are not much lower than those in West Germany (even if productivity may be lower), and they have been increasing since statistics have been available (*European Commission*, Box 3), *DIW* (2000), p. 283.

research inputs (in manufacturing and the business sector) also reveal high, but stagnant or slightly declining research outlays. With regard to patents per resident, Germany maintained its leading position, for publications it fell back from rank 8 to rank 9.

Expenditures on education in relation to GDP are below the European average and have decreased from 4.8% to 4.6% of GDP. Expenditures on education are far higher and rising slightly in the top 3 countries (from 7.3% to 7.5%). The share of workers with secondary educations is high; that with tertiary education and the share of scientists is rather low. Germany performed weakly in the so called PISA evaluation of mathematical and language skills.

Table 4: "Total investment into future growth" in % of GDP (R&D + education + ICT)

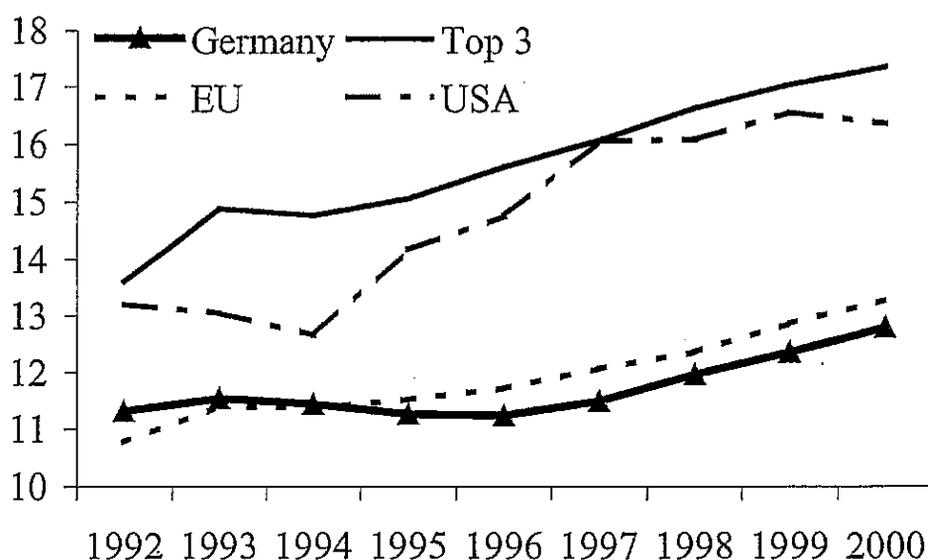
	1992	1993	1994	1995	1996	1997	1998	1999	2000	Rank 2000	Rel. change 2000 / 1992	Rank Rel. change 2000 / 1992
Belgium	10.60	11.06	10.97	10.92	11.33	11.71	12.04	12.87	12.91	9	21.8	8
Denmark	13.62	14.11	14.13	14.49	15.15	15.40	15.88	16.09	16.59	2	21.8	7
Germany	11.32	11.54	11.44	11.26	11.24	11.49	11.97	12.36	12.79	10	13.0	13
Greece	6.01	6.52	7.04	7.09	7.50	7.91	8.93	9.86	10.55	14	75.5	1
Spain	7.98	8.66	8.64	8.90	9.22	10.32	10.92	11.59	12.16	11	52.4	2
France	12.20	12.49	12.45	12.66	12.70	13.04	13.32	13.79	14.17	4	16.1	12
Ireland	10.94	11.83	11.58	11.85	11.94	11.91	11.42	10.79	10.89	13	-0.5	14
Italy	8.42	9.70	9.52	9.89	9.88	9.81	10.35	10.75	11.30	12	34.2	5
Netherlands	11.54	12.15	12.06	12.08	12.46	12.69	12.94	13.38	13.76	5	19.2	10
Austria	11.17	11.55	11.66	11.38	11.47	12.02	12.46	13.17	13.39	8	19.9	9
Portugal	9.20	10.06	10.34	10.35	10.55	11.61	12.44	12.88	13.46	7	46.3	3
Finland	12.68	13.98	13.49	13.87	14.51	14.76	14.92	15.71	15.70	3	23.8	6
Sweden	14.55	16.57	16.69	16.84	17.19	18.06	19.08	19.31	19.75	1	35.7	4
UK	11.54	12.48	12.44	12.68	12.73	12.88	12.78	13.09	13.66	6	18.4	11
EU	10.77	11.40	11.37	11.52	11.72	12.08	12.37	12.86	13.28		23.2	
Japan	10.35	9.74	9.76	10.44	10.86	12.04	12.48	12.63	13.12		26.8	
USA	13.20	13.05	12.66	14.17	14.76	16.06	16.08	16.55	16.35		23.9	
Top 3	13.62	14.89	14.77	15.07	15.62	16.07	16.63	17.04	17.35		27.4	
Large 3	10.65	11.24	11.14	11.27	11.27	11.45	11.88	12.30	12.75		19.8	

Source: WIFO calculations.

ICT expenditures amounted to 5.7% of GDP in 2000, ranking fifth among EU countries. For the other ICT indicators, Germany ranks between 7th (hardware expenditures in the IT sector) and 14th (mobile phone penetration).

Germany's average rank for the set of 16 indicators of future investment was 4.3 in 1990, and 6.6 in 2000. This was the 3rd best position for 1990 and the 6th for 2000. While position 6, may not be a problem for a medium wage economy, it indicates a severe threat when the country involved has the highest wages. It is even worse if we look at the dynamics of the German position over time. Ranking countries according to changes in the sixteen individual indicators between the beginning and the end of the nineties reveals that Germany is in last place, behind France and Italy. This means that for most determinants of long-run growth, investment increased less than in other countries.

Fig. 6: Share of "total investment into the future" (R&D + education + ICT)



Source: WIFO calculations (note that expenditures may overlap between the 3 components of the indicator "total investment into the future").

We arrive at a similar result when we simply sum up the expenditures on research, education and information technologies to an artificial (and partly overlapping) quantitative indicator of "total future investment". For Germany these investments amounted to 11.3% of GDP in 1992 - above the EU average and rank 6. The indicator has risen since then only to 12.8%, which in the year 2000 was rank 10. German total investment into future growth is now half a percentage point below the EU average and 4.6 percentage points below the top 3 countries. Again, the dynamics are more telling: the increase in investment into the future is the second lowest (13th) of all EU member countries.

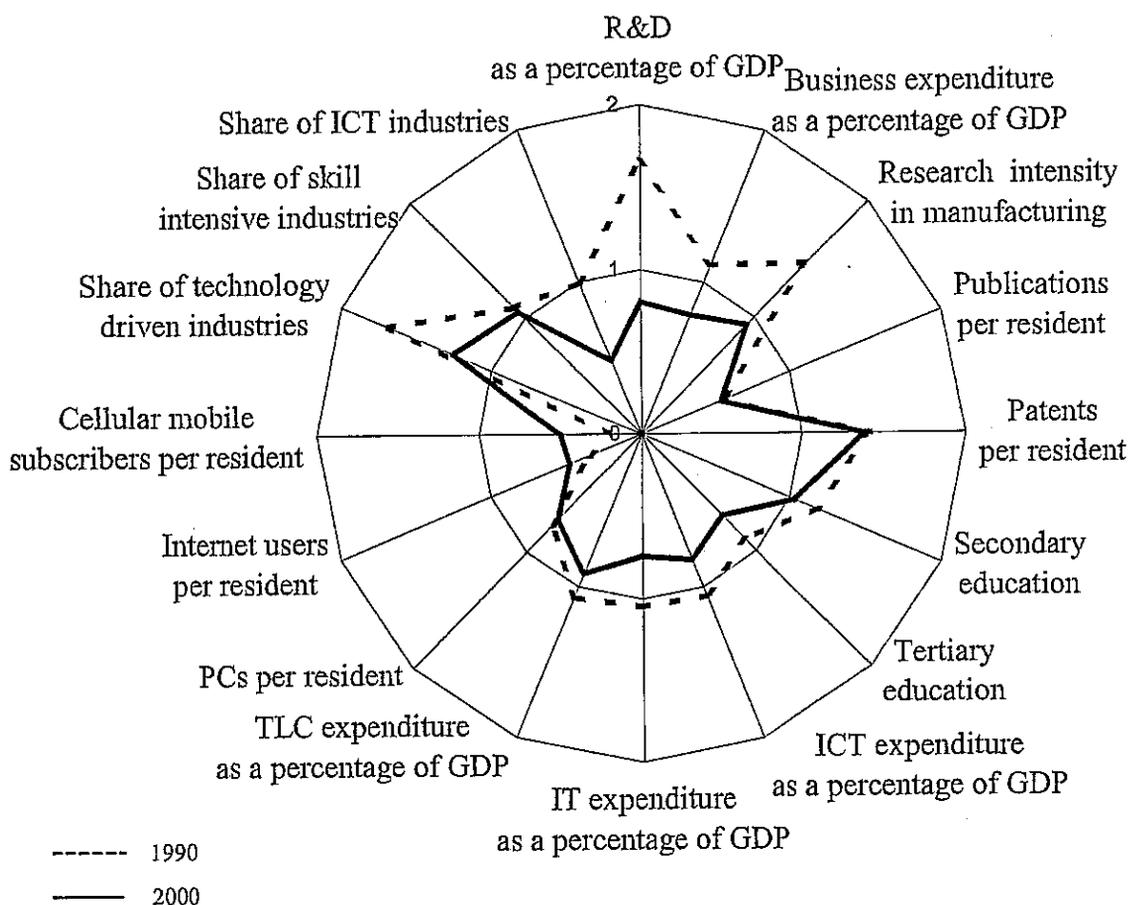
Summing up this section, Germany enjoyed the highest expenditures on research in 1980, which was necessary, given its position as the country with the highest wages. It fell down to rank 3 in research, to rank 6 for a set of 16 indicators of research, education and ICT,

from rank 6 to rank 10 for "total future investment". The deterioration of the relative position is even more dramatic if we focus on changes: in the nineties, Germany had the second lowest increase in "total future investment" (R&D + education + ICT expenditures) and ranked last, if the changes in the set of 16 indicators of future investment are calculated and countries are ranked according to these changes.

6 Low investment dynamics on top of an old, unsolved problem

The unsatisfactory dynamics of investment into growth drivers in the nineties took place on top of a problem already analysed in the eighties.

Fig. 7: Growth Drivers: Germany vs. Top 3



Remark: Each indicator outside the unit circle shows a superior performance by Germany vs. the top 3 (Denmark, Finland, Sweden).

German wages have been the highest of all European Union countries, while the economy has been specialised in medium tech, skill intensive industries. In comparison to the US, as well as to France, the share of high tech industries has been rather low. As is usual with "structural

problems", one never knows at which point in time a problem becomes really binding, since specialisation and excellence in current strengths may overshadow future problems for quite a while (see structural problems in Japan). Germany's gap in high tech industries was, for example, addressed in *Gerstenberger (1990)*, *Porter (1990)*, *Schumacher et al. (1995)*, *Klodt (1990 and 1996)*, *Siebert (1997)*, and even earlier in *Legler (1982)*, *Legler et al. (1992)*, *Schulmeister (1984)*, *Aiginger (1986)* and is repeated in *European Commission (2002)*, which reports that "surprisingly, Germany has a revealed comparative disadvantage in high tech industries".

Tab. 5: Indicators of Germany's high-technology gap

	Technology balance ¹			Share of high-tech exports ²			Share of technology-driven industries in value added ³		
	1991	2000	2000 / 1991	1990	1999	1999 / 1990	1990	2000	2000 / 1990
Germany	-0.96	-2.45	-1.49	13.80	18.50	4.70	23.47	24.82	1.36
France	-0.58	0.07	0.66	16.20	23.90	7.70	22.83	25.17	2.34
Italy	-0.82	-0.65	0.17	10.20	10.60	0.40	16.23	13.66	-2.57
Large 3	-0.79	-1.01	-0.22	13.40	17.67	4.27	20.84	21.22	0.37
Denmark		3.48	3.48	14.80	20.20	5.40	12.54	15.71	3.17
Finland	-2.08	-2.55	-0.47	8.80	24.10	15.30	10.46	24.79	14.33
Sweden	0.40			16.00	27.90	11.90	17.18	27.35	10.18
Top 3	-0.84	0.47	1.50	13.20	24.07	10.87	13.39	22.62	9.23
EU	-0.14	0.06	0.20	14.80	21.50	6.70	20.08	21.36	1.27
USA	2.30	2.39	0.09	32.70	38.30	5.60	26.46	30.27	3.81
Germany vs. EU	-0.82	-2.51	-1.69	-1.00	-3.00	-2.00	3.39	3.47	0.08
Germany vs. Top 3	-0.12	-2.92	-3.00	0.60	-5.57	-6.17	10.07	2.21	-7.87
Germany vs. USA	-3.26	-4.84	-1.58	-18.90	-19.80	-0.90	-2.99	-5.44	-2.45

¹ Receipts minus payments for patents/GDP; Source: *Main Science and Technology Indicators, 2003, p. 53.*

² Source: *OECD, Science, Technology and Industry Scoreboard, 2001, p. 207.*

³ Source: *WIFO calculations using EUROSTAT, SBS.*

The German deficit in the high-tech sector was not closed in the nineties; if anything it became larger, specifically since some of the northern European countries made additional inroads into high tech industries. Table 5 shows that the German deficit in the technology balance (the difference between patent receipts and outlays) increased to 2.45 % of GDP in 2000 from 1% in 1991. France started from a similar deficit in 1990 and today enjoys a small surplus. The same switch from deficit to surplus is reported for the EU as a whole. The countries with the largest surplus today are Denmark and the US.

The share of high tech industries in German exports rose from 13.8% to 18.5%. The export share of high tech sectors is thus still three percentage points lower than the EU average, 5 points less than in France and less than half of that in the US. The increase between 1990 and 1999 was less than 5 points in Germany, as compared to 8 points in France and 12 and 15 points in Sweden and in Finland respectively. The definition of high tech industries used by the OECD includes several industries with information and communication technology.

A typology developed by *Peneder* (2001) is more favourable for Germany insofar as it includes the car industry and parts of the chemical industry under the label of technology driven industries. The share of technology driven industries in German exports increased from 23.5% to 24.8%. This is higher than the EU average, though smaller than in France and in USA. Again, the dynamics are slower in Germany than in the three top European countries, in the US or in France.

As to the reason why neither the high tech gap, which has been acknowledged for decades, nor the inadequate dynamics of investments into future growth have attracted more attention in the German discussion of today, we conjecture that the following considerations are of relevance:

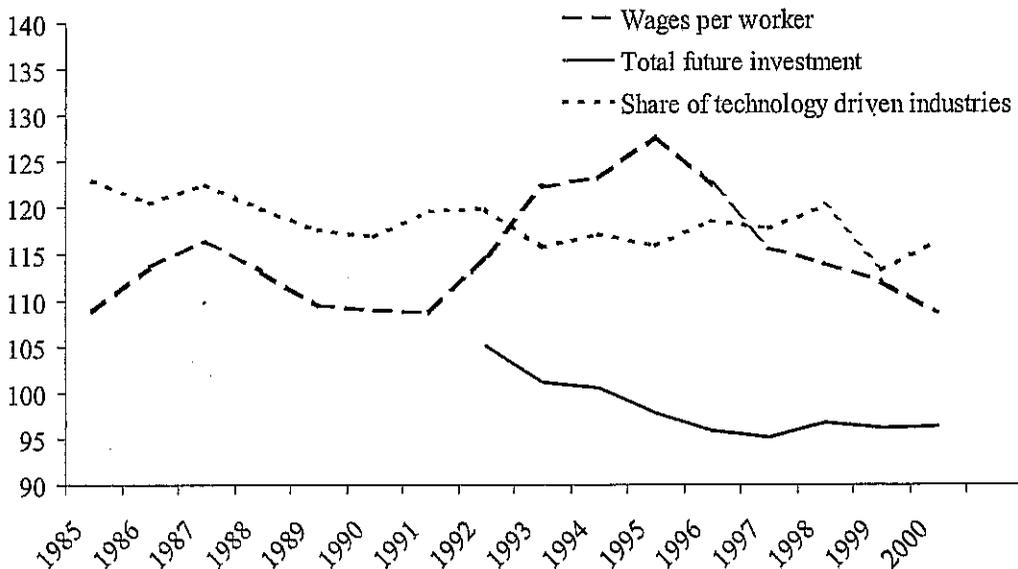
One reason may be that Germany's position with respect to the most popular indicator, namely research in % of GDP, is not really bad. Sliding down from first place to third place does look innocent at first glance, and the position for patents is even better. The problem lies in the dynamics: if research activity is stagnating or declining (relative to GDP), changes from traditional lines to new fields of research and to new technologies is very unlikely. Additionally, the German innovation system⁸ is institutions-based and not demand driven; the distance between basic research at universities and laboratories in the private sector is much greater than in the US. Given such an innovation system and starting with a high-tech gap, the stagnation of research expenditures or a decline relative to GDP is specifically dangerous. Additionally, German unification demanded that many of the best university researchers assist in the strengthening of East German universities (Humboldt University), instead of focussing on internationalisation and firm oriented applications.

⁸ For a characterisation of the German innovation system see *Sostice* (1997), "incremental innovation in high-quality products especially in engineering and chemicals", p. 76 or *Porter* (1990) "as strong as Germany is overall in research, it cannot match the US in inventiveness in new industries", p. 377.

The second reason is that Germany does not rank at the low end, but rather has moderate positions for the majority of other indicators⁹. What is easily overlooked is that the country with the highest wages should be among the top countries for most of the indicators and that each new low cost competitor – specifically endowed with technical skills as are the European accession countries – forces a high-wage country to climb further up the "quality ladder".

Thirdly, while theory does not give clear evidence as to whether the level or the change of investments is important to growth (perhaps it does lean somewhat towards the level or even stocks), the acceleration and deceleration of growth depends on the dynamics of investments. Being positioned in last place for the whole set of indicators and second to last for the quantitative indicator is clearly in line with the declining growth rates and gives a bleak forecast.

Fig. 8: Relative position of Germany in wages and future investment; EU=100



Source: Own calculations.

⁹ As an example for this see the evaluation of Germany by the European Commission in its annual report on the Broad Economic Policy Guidelines, which in their country-specific part on Germany state: "The position of Germany in the knowledge-based economy continues to be relatively strong. R&D expenditures and the number of patent applications are well above the EU average and have both continued their upward trend. Internet access is relatively high as well" *EU Commission* (2003, p. 26). This evaluation definitely compares Germany with the EU average, but not with the leading countries, and it focuses more – albeit not alone – on the position of Germany in a specific year, rather than on the dynamics over time. Consequently, R&D, the high tech gap, and failure to achieve a top position are not seen as a very pressing problems (education is specifically addressed with reference to the PISA ranking).

Table 6: Indicators of the educational gap in Germany

	Secondary education by age group of population ¹			Tertiary education ²	Tertiary education in workforce ³			Expenditures on education ⁴		
	25-34	45-54	25-34 minus 45-54		2001	1991	2001 / 1991	1995	2000	2000 / 1995
Germany	85	83	2	19	21	22	1	5.50	5.30	-0.20
France	78	58	20	25	20	34	14	6.30	6.10	-0.20
Italy	57	39	18	20	45	48	3	4.80	4.90	0.10
Large 3	73	60	13	21	29	35	6	5.53	5.43	-0.10
Denmark	86	80	6	39	27	29	2	6.30	6.70	0.40
Finland	87	70	17	41	33	38	5	6.30	5.60	-0.70
Sweden	91	78	13	30	27	37	10	6.40	6.50	0.10
Top 3	88	76	12	36	29	35	6	6.33	6.27	-0.07
EU	73	56	17	29	20	31	11	5.54	5.39	-0.15
USA	88	89	-1		30	39	9		7.00	
Germany vs. EU	12.00	26.57	-14.57	-9.85	0.82	-9.29	-10.10	-0.04	-0.09	-0.05
Germany vs. Top 3	-3.00	7.00	-10.00	-17.37	-8.00	-12.67	-4.67	-0.83	-0.97	-0.13
Germany vs. USA	-3.00	-6.00	3.00		-9.00	-17.00	-8.00		-1.70	

¹ Source: *Education at a glance 2001*; table A1.2; percentage of the population that has attained at least an upper secondary education.

² Source: *Education at a glance 2001*; table A2.1; ratio of tertiary graduates to the population at the typical age of graduation.

³ Source: *Education at a glance 2001*; table A2.4; percentage of the population of 24 to 34 year olds that has attained a tertiary education. -

⁴ Source: *Education at a glance 2001*; expenditures on educational institutions from public and private sources for all levels of education, by source of funds. For Italy public sector only.)

A fourth reason for distracting attention away from underinvestment into the growth drivers, may be the high quality of German exports, and the high German export surplus in general, specifically in skill intensive industries. What is forgotten is that neither the overall surplus, nor the skill intensity of current exports insures against the consequences of insufficient presence in high tech and high growth sectors for which ICT is a prominent example. The new competitors in central and eastern European countries are specifically well trained in engineering, and efficient in small incremental innovation, using mechanical and increasingly electronic skills. On the policy front, German excellence in medium tech industries has led to a German initiative to shift European attention towards policies in which Germany is specialised ("German industries"), instead of enforcing the EU policy, to make Europe the most

competitive economy of the world. Such a strategy includes, specifically for the country with the highest wages, a rising share of high-tech and high-growth industries.

A final reason might be that the low dynamics of investment in research, education and the diffusion of technology is not seen as the cause of low growth, but as the consequence of low profits and low tax revenues (and the resulting financial strain on private and public sources for these investments). However, independent of the dominant direction of causality – whether from investment to growth or from profits and government revenues to investment - a vicious circle of low investment and low growth now exists and has to be addressed by economic policy, specifically in a high-wage country.

7 Conclusions

(i) Germany's economic performance during the nineties was disappointing. Growth in output and productivity was lower than in the eighties and the lowest in the European Union. Unemployment is high, debt has risen, budget deficits are at or above the level allowed by the Stability and Growth Pact. The trade balance is still positive, but the share of German exports in the world market has fallen by one fifth (from 10% to 8%). German exports recovered in the very last year – mainly as result of low domestic demand and the low value of the Euro in 2002.

(ii) - Analysing the reasons why Germany underperformed, many analysts refer to the triple hypothesis of the costly welfare state, expensive labour and insufficient labour market flexibility. This set of explanations extends to the consequences of German unification and the lost interest advantage due to the common currency. We acknowledge that these factors contributed to Germany's current problems to a certain extent. What these analyses however overlook is that warnings pertaining to the long run sustainability of Germany's economic structure were raised long before German unification. These analyses revealed that the country with the highest wages was underrepresented in high tech industries. We add to this "common knowledge" the information that Germany did not increase its investment into determinants of future competitiveness. For a set of 16 determinants of research input and output, educational attainment, ICT expenditures and ICT use, Germany ranked 3rd in 1990 and 6th in 2000, among all EU members. Ranking the changes in the indicators between 1990 and 2000, Germany places last (next to France and Italy). If, as an alternative, we simply add up expenditures on R&D, education and ICT, we find that Germany ranked 6th in 1992 and

fell down to rank 10 of 14 EU-member countries in 2000. Of all EU-member countries, the increase in "total future investment" is second lowest in Germany.

(iii) Underinvestment into future growth is the missing link in the current analysis of poor growth performance in Germany. The evidence that cost increases are the most important cause of anaemic German growth is not convincing. Labour costs increased in the first half of the nineties, as did taxes. But the wage increase was compensated in the second half, giving Germany a position in wages and in unit costs that was not worse in 2000 than in 1990. Taxes are now exactly as high as the EU average, which of course constitutes a relative loss of a former cost advantage. There might be an additional effect, insofar as the high budget deficit may be seen as a signal of further increases or at least of the impossibility of decreasing the overall tax burden in the future. And there may be structural effects in taxes and expenditures which depress growth. But the high cost story is convincing only in association with the initial high cost position and with the importance of low costs in an economy needing restructuring and lacking technological competitiveness in the high tech sector.

(iv) The same qualifications are relevant to the impact of regulation. Germany's product markets are less regulated, more competitive, and the liberalisation of network industries came faster and earlier than in other countries. Labour markets are more regulated, specifically regular contracts. And some "wrong" signals were sent in the nineties. Temporary contracts, which were heavily regulated at the start of the nineties, are now only slightly more regulated than in other countries. Germany grew with the same institutions faster than the European average over the course of four decades. It is the interaction of regulation with the high necessity for restructuring which makes labour market reforms pressing, and it is the combination of the highest cost position with underinvestment in high tech industries which is depressing growth in Germany.

(v) Germany shares the low growth and the underinvestment into future growth problems with the two other big continental economies. France places 12th in the performance ranking, Italy 13th and Germany 14th. This meagre performance is in line with the ranking for investment into the long-run determinants of growth. For the (level of) investment in growth drivers, Germany, France and Italy rank 6th, 7th and 9th. For changes in the growth drivers between the beginning and end of the nineties, France, Italy and Germany take the last three positions, with Germany "carrying the red lantern." In quantitative expenditures ("total future investment" i.e. R&D, education, ICT), France was 4th, Germany 10th and Italy 12th in 2000, for the relative change between 1990 and 2000 France was 12th and Germany 13th. This is in

striking contrast to the top 3 countries (Sweden, Finland, Denmark), which excelled in economic performance and in the level and dynamics of investment into growth drivers. The relation between the dynamics of growth drivers and actual growth is theoretically expected and the empirical data are in line with this expectation. We do not claim that the similarity of the performance ranking and the ranking for the dynamics of investments is a proof of causality. There is also feedback from investment growth, and the interactions between growth drivers and other determinants of growth (cost side, demand management, regulation) should not be forgotten. Additionally, German unification plays an important role, as does the boom and bust of the construction sector. But the stagnation of investments into the future is the least acknowledged factor.

(vi) It is very surprising that investment into future growth has been neglected in the German discussion as reason for low growth, specifically since the underrepresentation of high tech sectors and the insufficiencies of the German education system (*Bildungsgesellschaft*) have been discussed for decades. Germany's expenditures on research, education and information technologies are decreasing relative to those of leading European countries and even to the EU average. German unification may be responsible for this trend, in part by crowding out these expenditures directly, and partly by indirectly shifting attention to more pressing short run problems. But this should have increased the attention of economists and economic advisors to long-term determinants of growth. Being in the middle of the field is not enough; sliding down the ranking is fatal for an economy in which the highest wages are paid.

(vii) The reason why many analysts focus on labour market reforms, on increasing labour costs and taxes, but pay no attention at all to the long run determinants of growth, is probably linked to the hope that if market inefficiencies are eliminated and costs are reduced, investments into research and new technologies will automatically blossom. But this may take a long time, since increasing flexibility and lowering costs in the short run decreases demand and increases uncertainty. The positive effect on supply will only materialise over the long run. We can hope that this long-run result may come earlier if expectations are very optimistic; a pro-active policy of stimulating research, education and the diffusion of new technologies could bridge this gap.

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Annex 1.1: Recent studies on cross-country differences in economic growth

Author/Institution	Title	Scope	Additional features
Aiginger, K., European Forum at Stanford University, Working Paper 2/2002	The New European Model of the Reformed Welfare State	Analysing performance differences in Europe & determinants	Excellent performance of reformed welfare states with specific innovation policy
Aiginger, K., Landesmann, M., WIFO Working Papers 179/2002	Competitive Economic Performance: The European View	Productivity comparison EU vs. US: determinants on prospect	Impact of differences in industry structure
Ark Van, B., et al., GGCG 2003	ICT Investments and Growth Accounts for the European Union 1980-2000	Contribution of ICT or growth in EU and US	Structural impact in product and labour markets may limit growth
European Commission, 2003	Choosing to grow: Knowledge, innovation and jobs in a cohesive society	Progress of Lisbon Strategy	Role of knowledge, innovation and jobs
European Commission, European Economy 6/2002	The EU Economy 2002 Review	Macroeconomic Development	Convergence of Accession countries
European Commission, European Economy 71/2000	The EU Economy 2000 Review	Is there a new pattern of growth emerging?	Prospects and challenges for Europe
European Commission, 2002	The competitiveness Report 2002	Productivity growth in services	Human capital, environmental performance
European Commission, 2001	The competitiveness Report 2001	Productivity and innovation	Increasing gap to USA; industry study on biotechnology
European Commission, 2000	The competitiveness Report 2000	Competition in quality	Industry study on service inputs, pharmaceuticals
Gordon, R.J., Northwestern University, 2002	Two Centuries of Economic Growth: Europe Chasing the American Frontier	Performance Europe vs. US in the long and short run	Specific differences in per capita and per hour performance
McMorrow, K., Roeger, W., European Commission, Economic papers no 150, 2001	Potential Output: Measurement Methods	New Economy effect on potential growth	Growth scenarios for the EU and the USA
OECD, 2003	The Sources of Economic Growth in OECD Countries	Econometric evidence and growth determinants	Impact of regulation and public sector human capital
OECD, 2001	The New Economy: beyond the hype, Final report on the OECD Growth Project	Explaining differences in growth performance of OECD countries	Policy conclusions
Pichelmann, K., Roeger, W., Review of International Economics 2003 (forthcoming)	The EU Growth Strategy and the Impact of Ageing	Impact of ageing on growth and stability pact	Changes in work incentives needed