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Differences in Learning and Inequality*

Abstract:
Rapid growth in productivity combined with increasing wage dispersion in some countries, notably Anglo-Saxon, has been the subject of numerous studies. The main hypothesis in the literature is that an increased skill premium provides a link between productivity growth and inequality. If this view is correct it poses some challenges for policies that focus on promoting a learning economy. However, data for many OECD-countries show that increased wage dispersion is not a common feature. Many countries have enjoyed a fairly stable or even declining dispersion of wages. Also in countries where the production and use of ITC-goods are significant, there are hardly any changes in wage dispersion. Thus one must look at a broader set of factors other than skilled biased technical change in order to explain the diverse picture of changes in inequality. This paper points to changes in educational attainment and institutions relating to wage bargaining as possible explanations for the varying experience wrt. wage inequality between OECD-countries in recent decades.

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1. Introduction

It has become commonplace to say that *knowledge* is the most important resource in modern economies. Estimates of national wealth often end up with a share of total wealth due to human capital in the order of two-thirds or three-quarters of total wealth. Knowledge is accumulated through *learning*. In the learning economy the core processes are related to producing, distributing and using knowledge according to OECD (1996a). The knowledge based economy means "..economies which are directly based on the production, distribution and use of knowledge and information. This is reflected in the trend in OECD economies towards growth in high-technology investments, high-technology industries, more highly-skilled labour and associated productivity gains." (OECD (1996a), pp. 229).

This paper addresses the relationship between knowledge and learning and the income distribution in the OECD-countries since 1980. Why do we expect any relationship between learning and income distribution? One simple microeconomic reason could be that people with more skills or knowledge are better paid than the average worker. When there is skill upgrading in a country this may lead to a more unequal distribution. However, this will only be the case if there is increased demand for these skills. If not, the skill premium may fall and the income distribution may in fact become more equal. Another reason is the classical argument put forward by Kuznets (1955). An increase in economic growth is often caused by structural change in the economy with a new sector growing much more rapidly than the economy as a whole. The growth of the ITC sector is a recent example. As a consequence demand for certain skills increases rapidly and so will the wages paid for these skills by the new sector. Initially this increases dispersion of wages. However, as supply of these skills increases and a much larger share of the labour force is employed by the new sector often at the net expense of more traditional sectors, inequality may fall. Thus initially growth goes hand in hand with more inequality while a in more mature stage growth and equality is taking place at the same time. This is one explanation behind the traditional Kuznets curve that depicts an inverted U-shaped curve between the income level and inequality.

As indicated by the quotation from OECD above, OECD-countries (as well as many non-OECD-countries) are characterized by more investments in high-tech goods and software than a few decades ago. This has led many observers to talk about a "new economy". Furthermore, OECD-countries have deregulated both product and labour markets during the last two decades or have been subject to structural reforms. In addition many markets are subject to globalization that has affected factor prices.

Thus skills may become obsolete or at least the market remuneration of these skills may be influenced by more competition in both factor and product markets. So although the growth of high-skilled labour is an important feature of most or all OECD-countries, this growth has taken place a long side a number of other important changes in these countries. Thus the combined effect on the income or wage distribution is far from easy to determine.

The relation between learning and knowledge formally resembles how real investments accumulate into real capital in national accounting. However, learning is socially, geographically and institutionally embedded in more complicated ways than the "physical" accumulation of capital. Knowledge may according to Lam (2002) be seen as either individualized or collective and either as explicit or tacit. Thus learning is not only an individual activity but also an activity that takes place at different institutional levels, within firms, bureaucracies and even at the various societal levels. Knowledge formation as well as knowledge remuneration varies with institutions. In economies such as the US and UK, cf. Whitley (2000) and Lam (2002), the labour market is characterised by high mobility and focus on private ownership of knowledge. Thus collective forms of knowledge focus on codified knowledge also because there is little cooperation between firms. In economies where there is broad-based public education and training and more focus on public private partnership as well as stronger firm linkages and strong unions, tacit knowledge is more common. Finally in economies where the state is more important and labour markets are dominated by large corporations and long-term employment contracts (Japan), knowledge is mobilized again mainly in firm-specific tacit forms. The way knowledge is institutionally embedded and how labour markets are organized in different economies, may thus affect earnings and income equality.

In the following section I present up-dated empirical evidence on changes in the distribution of income and wages in many OECD-countries. Next, a simple model of the labour market is presented and used to organize the discussion of factors that may influence wage dispersion. Then I refer to a number of studies that have presented different interpretation of these empirical features before I conclude.

2. Trends in earnings inequality among OECD-countries

There is by now a vast literature on the distribution of earnings as well as the wider question of income inequality among OECD-countries. cf. Gottshcalk and Smeeding (1997), Förster and Pearson (2002), Atkinson (1999) to mention just a few. The literature on growth theory as well as empirical growth studies are also concerned with the relationship between growth and inequality, cf. Aghion et al. (1999) for a survey. In this section I will draw on these studies and others to present the highly

diverse historical experience of various OECD-countries when it comes to their distribution of income and more narrowly the earnings distribution.

When analysing distribution of income there are many important data issues that need to be taken into account before comparison between countries or even within countries over time can be made with some reliability. Let me briefly address some of these issues. In Förster and Pearson (2002) income is measured as total disposable income mainly by using income statistics for tax purposes at the household level and they also adjust for household size by using equivalence scales. This is useful for some purposes but I argue not necessarily for the purpose of studying the relationship between learning and inequality. Economic and social changes will influence how households are formed and dissolved but these changes vary much between countries and over time and may have little to do with learning, earnings and productivity. The number of children will also affect this measure of distribution. Inequality may increase or decrease due to changes in the tax system (say taxation of capital income) or transfers that are not linked to learning. Inequality may be affected by working hours by adult household members that have to do with factors unrelated to how learning and knowledge is remunerated.

Similarly if one chooses to study earnings inequality a number of data issues are worth considering before making any comparison between countries. Are we to use annual or weekly earning that are affected by working time that may change between countries and over time? If we use annual earnings should we focus only on full time workers in order to avoid too large influence of differences in working hours and how do we make this adjustment consistent between countries? Would it be best to focus on hourly wage rates since these are what workers face as parameters when they decide how much labour to supply? Perhaps there are restrictions or barriers to "pure" labour supply decisions that we should take into account? I shall not try to answer these questions here, but they are forwarded simply to make us aware of some difficult data issues that need to be dealt with in order to make comparisons between countries and over time as I do in this paper.

An alternative to a pure statistical exercise is instead to estimate individual wage equations (Mincer-equations) that explicitly try to measure how education, work experience and other factors closely linked to knowledge are rewarded in the economy. If say the educational premium (How much does the wage rate increase if you spend one more year in formal education?) increases over time, are we then to conclude that knowledge is rewarded more generously than before? What if there is a

simultaneous decline in the experience reward (How much more are you paid if you work another year?) so that on the job training or "learning by doing" is less rewarded?

There is no agreed upon method or best practice available when studying income distribution. The purpose of each study and sometimes simply data availability will to a large extent determine which method that is most relevant or simply available. I will begin discussing changes in the distribution of income in general and not earnings specifically because the distribution of disposable income is perhaps more relevant for discussions of social cohesion than focusing solely on the earnings distribution that more easily can be related to differences in skills and learning.

Household distribution of disposable income

A number of studies have discussed changes in the distribution of income within OECD-countries over time as well as between these countries at any time. There are a number of various measures available as mentioned earlier, but I shall focus on the Gini-coefficient as supplied by the Luxembourg Income Study (LIS) in February 2004. The advantage of using these figures is that they have been compiled and adjusted in order to make them more suitable for comparisons between countries and over time. I focus on the period from around 1980 and as far as recent figures go. It is generally accepted that during the 1970s there were tendencies in most countries for income inequality to decline or at least be stable. Even in a country like the US where inequality has increased in recent decades, inequality decreased or was fairly stable during the 1970s. This seems to have changed in recent decades and many observers relate this change to those factors that the OECD suggests characterize the learning economy.

The main trends are shown in figures 1a, 1b and 1c. The LIS figures are for various years and not continuous and in the figures and I have simply interpolated. As is evident from the figures there are no common trends in inequality between countries over time. Many countries have a rather stable income distribution while in some countries there is increasing inequality. We do not observe a downward trend in inequality for any country.

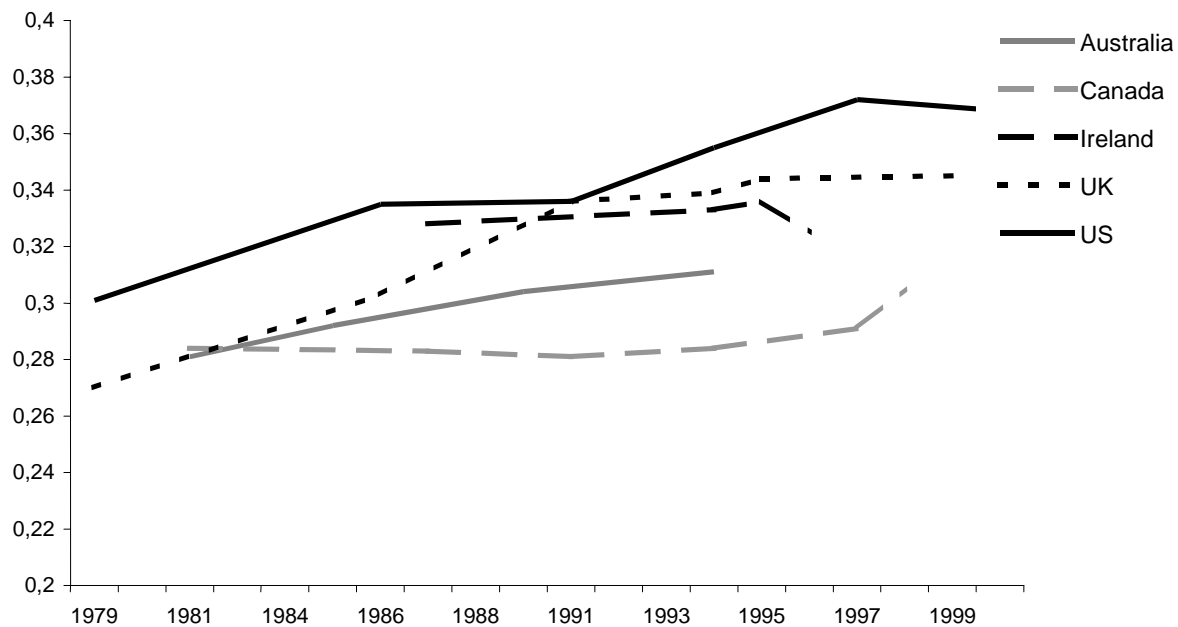**Fig. 1a. Income Inequality. Gini Coefficient**

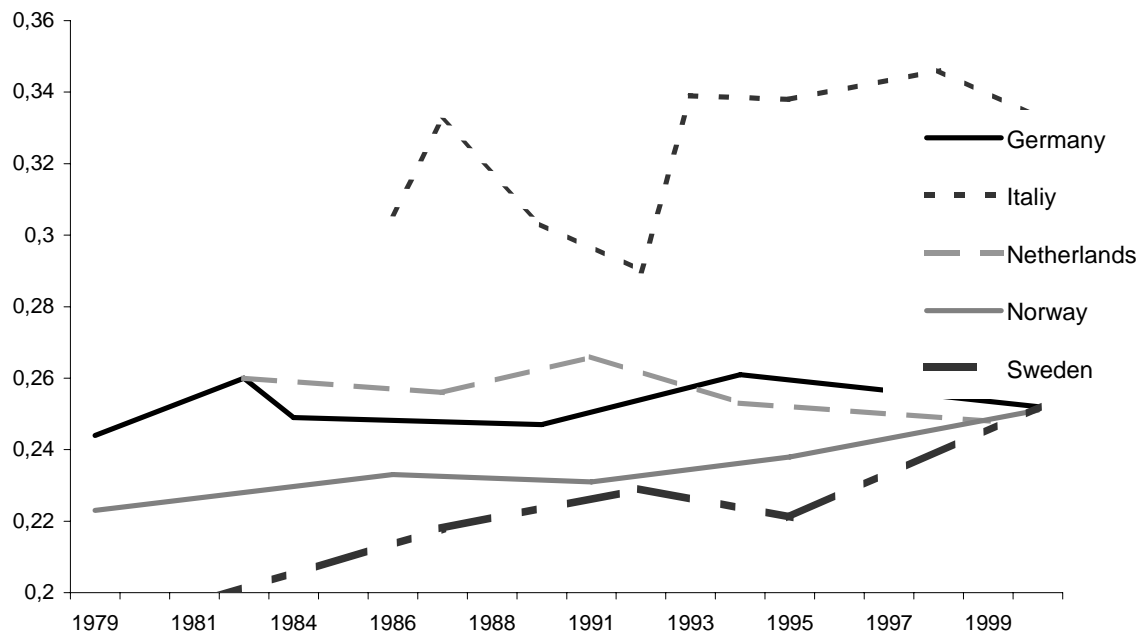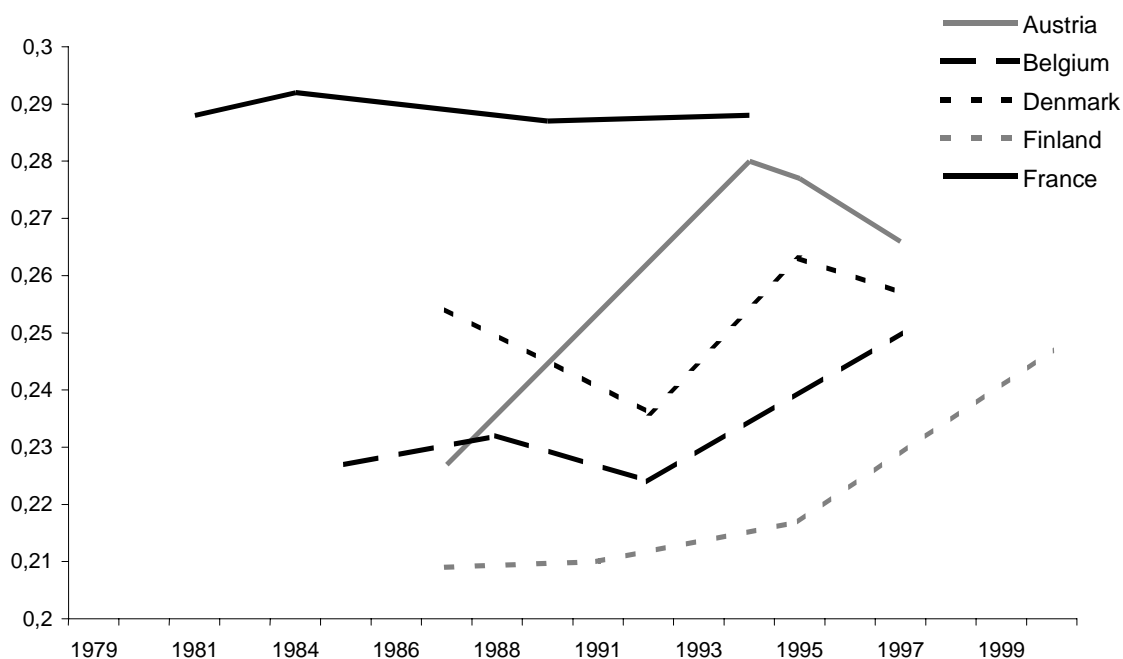**Fig. 1b. Income Inequality. Gini Coefficient**

Fig. 1c. Income Inequality. Gini Coefficient

Let me comment briefly on the development in each country. In *Australia* there is a steady increase in inequality. Percentile ratios (also supplied by LIS but not reported here) show that it is mainly in the lower part of the distribution that has become more unequal. In *Canada* the distribution of income is fairly stable but with a higher degree of inequality during the second half of the 1990s. As for Australia, it is the lower part of the distribution that has changed. In the *United States* increased inequality took place in the first half of the 1980s and during the first half of the 1990s with a large increase at the lower part of the distribution in the early 1980s but with small changes thereafter. In the *United Kingdom* increased inequality took place during the whole of the 1980s but not much change thereafter. There was a large increase in inequality at the lower part of the distribution. For *Austria, Belgium, Denmark, France, Germany, Ireland, Netherlands and Norway* the distribution of income has been quite stable. In *Finland* we observe a fairly stable income distribution but with some sign of increased inequality recently. Finally in *Sweden* there has been an increase in inequality in particular during the latter half of the 1990s.

To sum up, there are quite diverse country experiences when it comes to changes in the distribution of income. Clearly some Anglo-Saxon countries have experienced some marked increases in inequality, while continental Europe has not, or at least the increase in inequality began much later. In most Anglo-Saxon countries the level of inequality is also greater than in most other European countries.

These "facts" are well known to students of income distribution and is reported by Gottschalk and Smeeding (1997). In the OECD-study by Föster and Pearson (2002), also using comparable data from different countries, they conclude that the tendency for a more polarized distribution within each country started in the Anglo-Saxon countries in 1980s and was followed by a similar tendency in many continental European countries in the 1990s.

The empirical studies referred to above also show that market incomes have become more unequally distributed. In spite of the fact that government transfers and taxation contribute more towards equality than before (again as a general trend not as a feature of all OECD-countries) the change in the distribution of market incomes outweighs this phenomenon. The main contributor to this change is more unequal distribution of earnings across households according to Förster and Pearson (2002). They show that one important reason for this is what they call employment polarization; at the household level, total number of hours worked is more unequally distributed than before. There are more households where both adults work full time and fewer where only one adult work and there are also more households where both adults are workless. The high level of unemployment during the 1980s and 1990s has clearly contributed to this polarization. However, we cannot infer that a more unequal distribution of household earnings implies a more unequal remuneration of skills. Let us therefore look at the distribution of wage rates in order better to assess the relationship between learning, wages and distribution.

The distribution of wages
OECD (1996b) presents data on the distribution of earnings for a large number of OECD-countries from around 1980 and until the early or mid 1990s. The data are presented as the ratio of the earnings level of the upper 9th decile (D9) to the median and the ratio between the median and the lower level of the 1st decile (D1). The data are for full time workers and presented for male and female workers separately. In order to simplify, I shall concentrate on the total D9/D1 ratio in this paper. The OECD-figures show a strong trend toward greater inequality of wages in the UK and US, but not in other countries. The increase in earnings dispersion in these two countries applies to both sexes as well as to the upper and lower part of the distribution, so it is pervasive.

The increase in wage inequality in the US has been the subject of a number of studies reviewed by Gottschalk and Smeeding (1997) and others. In order to narrow down possible sources of increased inequality many studies have focused on male earnings for full-time workers. The standard findings in this literature are that there was a large increase in returns to education in the US during the 1980s as well as an increase in returns to experience. Finally there was also an increase in wage inequality

within specific groups even after adjusting for education and experience. All these findings seem to indicate that the remuneration of formal learning and on the job training as well as unobserved personal characteristics have increased and thus contributed to increased dispersion of wages.

According to Gottschalk and Smeeding (1997) only the UK experienced an increase in wage inequality similar to that of the US among OECD-countries. Both Canada and Australia showed a clear tendency toward higher wage inequality but less than in the US and UK while France, Japan, The Netherlands, Sweden and Finland formed a group of countries with quite small increases in inequality that also started a bit later than in the other countries. Only Germany and Italy showed no increase in inequality according to this summary of many studies of wage inequality. Among these countries, only Sweden and the UK showed a clear tendency for the wage distribution to become more unequal due to returns to education. Returns to experience produced more inequality in Australia, Canada, France, The Netherlands and the UK. Finally within group inequality increased in Australia, Canada, Sweden and the UK.

All in all there seemed to be a consensus in the literature based on evidence from the 1980s and early 1990s that wage inequality had increased substantially in Anglo-Saxon countries based on increased wage premium for education and experience as well as within group inequality. For many other OECD countries tendencies were not so clear. But no country shows systematic signs of less wage inequality, as was the case in several countries during the 1970s. In this respect the evidence on wage inequality is quite similar to that on income inequality based on household disposable income as referred to earlier. I shall discuss the possible causes of the increase in wage inequality later.

It is more difficult to establish what has happen to recent developments in wage dispersion because there is no comprehensive single database that is up to date on this issue. What I have done is to up-date the figures in Table 3.1. in OECD (1996b) as far as other sources are available mainly by linking or calibrating more recent data to the OECD data in order to avoid any breaks. The main source of information is an up-dated version of the OECD earnings database that has data until 2001 for some countries. Additional sources are Atkinson (1999), Phelps (2000) and Barrett et al. (2000). As far as these data go, they indicate that the qualitative features found by Gottschalk and Smeeding (1997) are somewhat modified.

According to recent data (the ratio between upper earnings limit of the 9th and 1th decile) shown on figure 2a there is still some increase in wage dispersion going on in the US, but the increase in the

dispersion during the 1990s is much less than during the 1980s. For the UK there is hardly any increase in wage inequality at all during the 1990s. While the wage dispersion in Australia did not change much until the mid 1990s there is an increase in inequality during the latter half of this decade. Wage dispersion is clearly falling in Japan and Canada during the 1990s after having increased somewhat during the 1980s. In South Korea the large decrease in wage inequality during the latter half of the 1980s seems to have come to a halt in the 1990s. So the two East-Asian countries have if anything, enjoyed stable or even a more equal distribution of wages since the early 1980s. The experience of the Anglo-Saxon countries is more varied and it seems difficult to claim they follow similar patterns of development. The US development is in fact an outlier both in terms of the level of inequality and its trend.

Moving to continental Europe cf. Figure 2b, wage dispersion in France is quite stable or has been slightly reduced during the latter half of the 1990s. Also in Germany the wage distribution is quite stable if we do not regard the last observation as indicating a change in development. The same goes for Austria while the Italian development is hard to interpret with a large decrease in wage inequality during the 1980s and a similar but more rapid increase in the early 1990s. The wage dispersion in the Netherlands was quite stable from the mid 1980s to mid 1990s cf. Figure 2c, but there is a jump from 1994 to 1995 that may be due data problems (linking various sources) but could otherwise be interpreted to indicate an increase in wage dispersion during the 1990s.

Developments in some Nordic countries are shown in Figure 2c. Finland is an interesting case from the perspective of the "new economy" because the country is relatively intensive in terms of development and production of ITC-goods. Here if anything, wage inequality has fallen during the 1990s; a decade that most observers regard as the hey-days of globalization and ITC-driven technological change. Norway has hardly experienced any change in wage dispersion during the last two decades. In Sweden on the other hand, there has clearly been a moderate increase in inequality for some time. By international standards dispersion is still very low in all Nordic countries. There are no data for Denmark for the 1990s but wage dispersion during the 1980s was similar to that of Sweden and Norway.

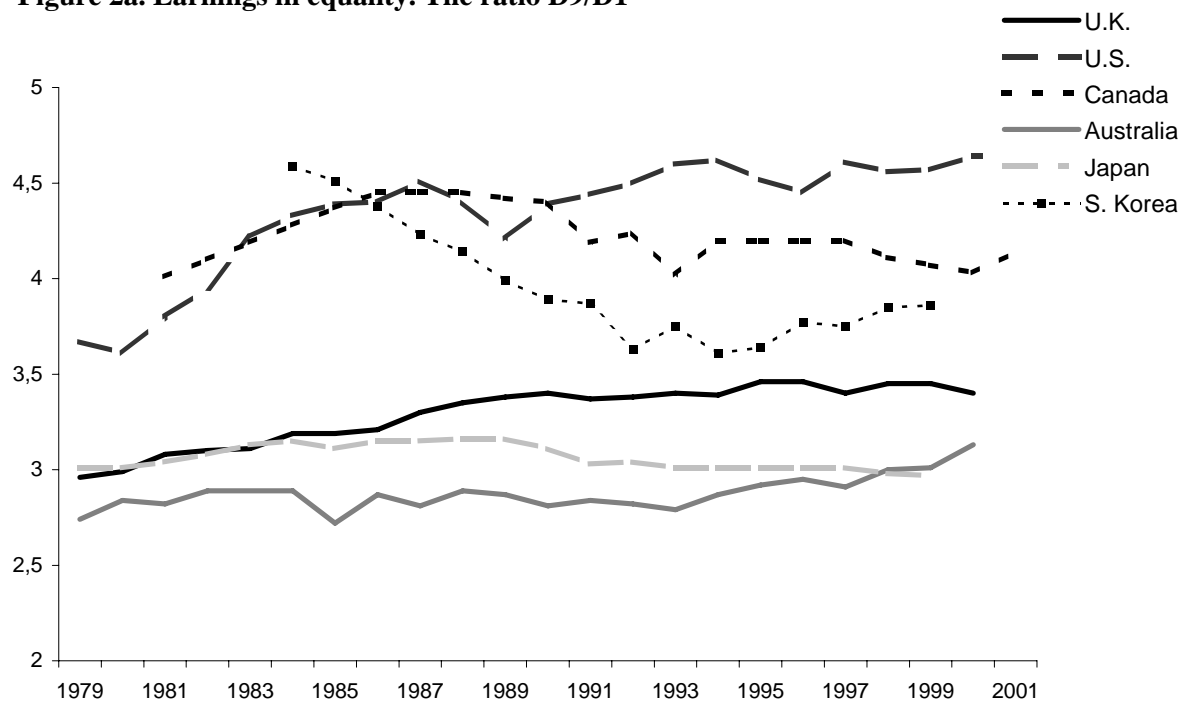**Figure 2a. Earnings in equality. The ratio D9/D1**

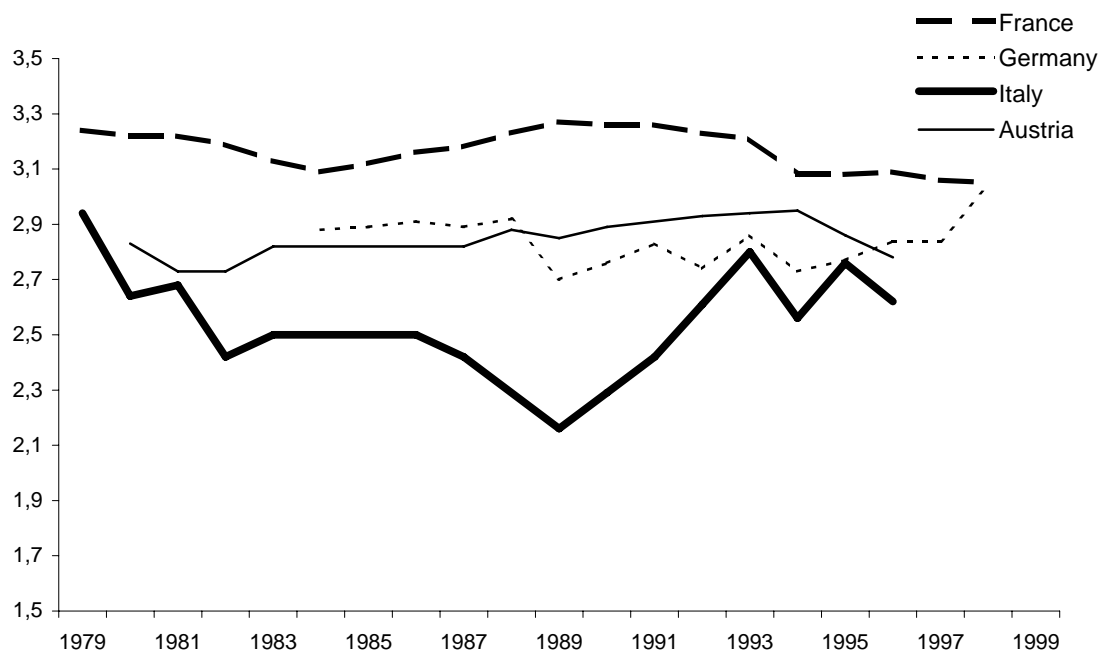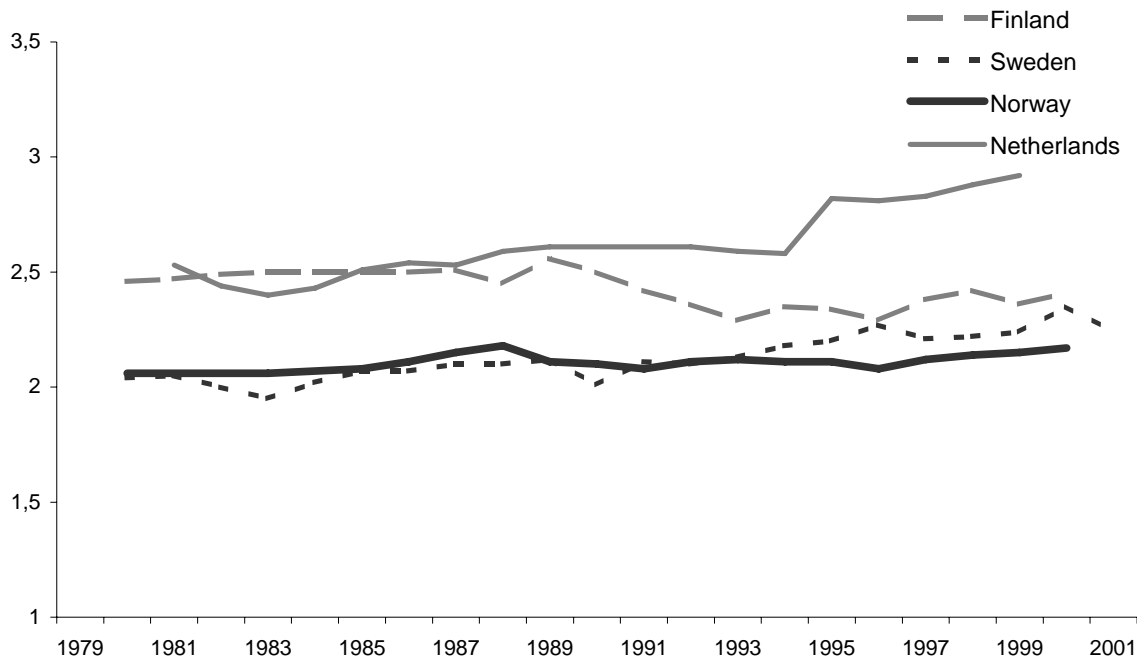**Figure 2b. Earnings in equality. The ratio D9/D1**

Figure 2c. Earnings in equality. The ratio D9/D1

For the US, the UK and Sweden inequality is on the increase both at the top and lower end of the distribution. In Australia there has been a compression of the wage distribution in the low-income end but an increase at the top. This tendency of less inequality at the lower end of the distribution but more inequality at the upper end is apparent in many countries such as Finland, Germany and Japan. For France and Austria the decline in dispersion is mainly due to lower inequality at the lower end of the earnings distribution.

According to the OECD earnings database a more detailed investigation of different parts of the earnings distribution suggests that the experience of various countries is quite varied and no consistent pattern emerges. Thus the impression that emerges from figures 2a-2c of no common trend in the earnings distribution is even more pronounced when looking at the distribution in more detail. I now turn to the question of how to interpret this diverse picture.

3. The skill premium in a model with imperfect labour markets

In this section I present a simple and partial model of the labour market in order to structure my discussion of factors that may explain the changes in wage dispersion presented above.

Assume that demand for skilled labour (N_s) relative to unskilled labour (N_{us}) depends negatively on relative wages for these two groups (W_s/W_{us}) and positively on technical change represented by a shift variable (t)

$$(1) \qquad \frac{N_s}{N_{us}} = f\left(\frac{W_s}{W_{us}}, t\right).$$

By definition employment equals labour supply (S) minus unemployment (U), hence relative employment may be written as

$$(2) \qquad \frac{N_s}{N_{us}} = \frac{1-u_s}{1-u_{us}} \frac{S_s}{S_{us}},$$

where the u's are unemployment rates. Combining equations (1) and (2) and defining s as the share of skilled labour in the total labour force, we have:

$$(3) \qquad \frac{1-u_s}{1-u_{us}} = \left(s^{-1} - 1\right) f\left(\frac{W_s}{W_{us}}, t\right).$$

According to equation (3) a positive shift in t due to technical change that result in more demand for skilled workers at the expense of unskilled (so-called skill biased technical change or SBTC hereafter), the skill premium will have to increase if relative unemployment is to be constant unless there is an increase in the share of skilled persons in the labour force denoted by s in (3). Note that it is relative unemployment rates and not their absolute difference in percent that matters for this result according to the model.

Assume further that wage formation can be described by wage curves, cf. Layard et al. (1991) for each skill category

$$(4) \qquad W_s = P Q g_s(u_s, u), \quad g'_{s1}, g'_{s2} < 0,$$

$$(5) \qquad W_{us} = P Q g_{us}(u_{us}, u), \quad g'_{us1}, g'_{us2} < 0,$$

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where u_s and u_{us} are the skill-specific unemployment rates and where u is the average unemployment rate, P is producer price and Q is average labour productivity by sector. Thus the wage equations state that in the long run the labour share of value added depends negatively on both skill-specific and average unemployment. The wage curve representation encompasses several theories on wage setting[1]. Solving for relative wage rates, and assuming that the effects of the average unemployment rate are the same for both skill-groups, cf. Bjørnstad et al. (2002) yields

$$(6) \qquad \frac{W_s}{W_{us}} = g\left(\frac{u_s}{u_{us}}\right), \quad g' < 0 .$$

According to (6) there is a negative relationship between relative wages and relative unemployment rates for skill-groups. If wages are affected by education-specific unemployment rates, the skill premium adjusts to skill mismatch. However, if there is no such effect, skill mismatch is likely to prevail, at least until supply adjusts accordingly. The exact degree of labour market flexibility depends on the parameters, the substitution possibilities and the price elasticities. Notice also that demand shifts, such as SBTC, affect wage inequality only through skill mismatch in the long run in this model. This assumption is plausible when the labour force is endogenous. Layard et al. (1991, chapter 6) show that only supply-side factors, such as costs of attaining education, affect relative wages and unemployment. In steady state, the skill premium is equal to the cost of attaining that skill.

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[1] Competitive labour market, bargaining between labour unions and firms, and efficiency wages, see Blanchflower and Oswald (1994).

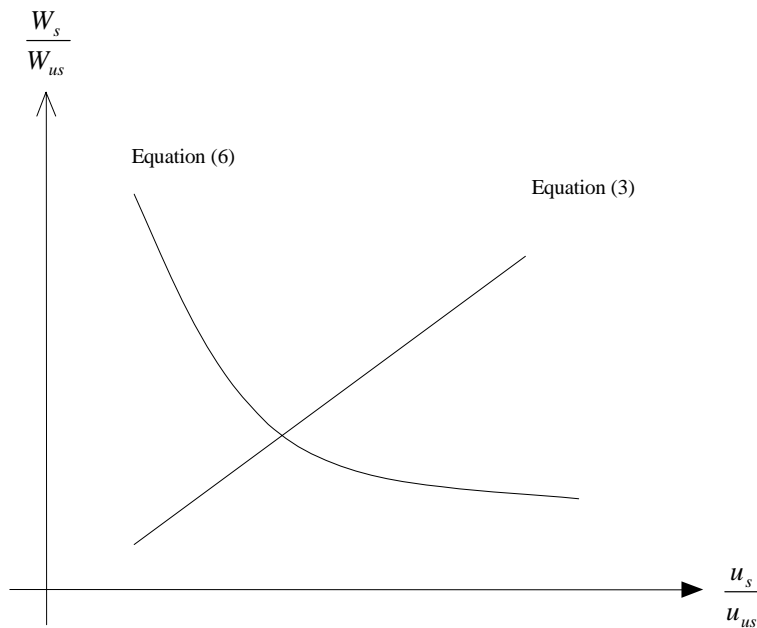**Figure 3: Determination of relative wages and unemployment rates**

Figure 3 illustrates the determination of relative wages and relative unemployment according to equations (3) and (6). Skill biased technical change (SBTC) will shift the demand curve for labour implying an upward shift in the curve marked Equation (3) to a higher skill premium and lower unemployment rate for skilled persons. A relative increase in the share of skilled persons in the labour force (increase in *s* in Equation (3)) results in a downward shift in (3) and leads to lower skill premium and higher relative unemployment for skilled persons. We can also interpret the shift parameter as indicating what happens if there is a change in the structure of demand by skills due to changes in industry structure. If one industry uses relatively more unskilled labour and experience a negative shock of some kind, the relative demand for unskilled will decline even for a given level of relative wages. Through market forces this will change both relative wages and unemployment rates. According to this model, a more skilled labour force will reduce the wage premium for the skilled. Thus learning as such is negatively related to wage inequality. Only when the change in demand for skills due to say technological change is increasing faster than the upgrading of the labour force, will relative wages for skilled workers increase.

According to equations (3) and (6) relative unemployment rates for skilled and unskilled as well as relative wage rates are both determined by the skill composition of the labour force (*s*) and the shift parameter for technological change (*t*). It is fairly straight-forward to show that this shift parameter

also can be interpreted to capture changes in international trade and as such pick up changes in relative product prices due to say increased competition from low income countries. In this case we may think of the unskilled employed mainly in one sector and the skilled in another. The standard interpretation is on the other hand that in the macrosector both types of labour are employed and there is substitution between them. I stick to the technological change interpretation as this is by and large considered to be the most relevant explanation for wage dispersion. This is due to the fact that changes in the skill composition seems to have taken place in nearly all sectors of the economy so it can be interpreted as a common shock to all sectors and not as a sector-specific shock.

If we focus on the technological change explanation as the most relevant one for why wage dispersion has increased in some but not all countries cf. figures 2a-2c, how can the model presented be helpful? First of all, I argue that it is reasonable to regard SBTC as a common shock to all countries studied here. The degree of the shock varies somewhat between countries due to the fact that some countries have a large ITC sector producing capital goods while other countries mainly import and use these goods in production. According to the model presented earlier, only changes in the skill structure of the population may offset the effects of SBTC. Consequently in those countries where a parallel upgrading of skills has taken place alongside changes in technology we should expect to see less inequality. So what do we know about changes in the skill structure in the countries included in the figures earlier?

In Table 1 I show the share of the population between 25-64 years that has attained the highest type of education (tertiary) for some of the countries discussed earlier. For other countries included in figures 2a-2c, no comparable figures were found for a sufficiently long period so they are not included here. The figures in the table show very large differences in educational levels by country with the US ranking highest, but with Norway catching up during the 1990s. Also Canada has a high level and both Australia and the UK rapidly increased their levels of education during the 1990s too. Many EU-countries have fairly low levels of their population between 25-64 years with tertiary education according to the OECD. Both Germany and Belgium (not included in the table because of lack of consistent data) have relatively low levels in 2001, while the Netherlands are similar to Canada.

Table 1. Share of population in percent that has attained tertiary (type A) education

	1981	1989	1994	1998	2001
Australia	missing	10	14	17	19
Canada	12	15	17	18	20
UK	8[1]	9	12	16	18
US	22	24	25	27	28
Austria	missing	6	5	6	7
France	7	7	9	11	12
Italy	missing	6	8	9	10
Finland	8[2]	10	11	13	15
Norway	7	11	17	24[3]	28
Sweden	11	13	13	13	17

[1] 1984. [2] 1982. [3] 1997.

Sources: OECD (2003), OECD (2000), OECD (1997).

According to the model presented earlier, it is the *change* in the education level that is relevant in "explaining" *changes* in the wage distribution. The levels of education will be reflected in the industry structure of countries and are as such part of the comparative advantage created by countries, although it may of course affect both the size of the change and the level of wage dispersion. Let us, therefore, relate changes in education levels to what has happened to changes in wage dispersion taking as our basic starting point SBTC in all countries. In Australia there has been a large increase in the share of the population with high education thus possibly counteracting SBTC. Australia has no large change in wage dispersion. Also Canada has increased its educational level although not by as much as Australia. It is hard to relate changes in wage dispersion in Canada to the upgrading of skill according to Table 1. For the UK the increase in education was moderate during the 1980's and wage dispersion increased while there was less increase in dispersion during the 1990's when educational levels increased more rapidly which fits well with the partial model presented earlier. For the US there was also less increase in share of the population with the highest education during the 1980's than during the 1990s, again in line with how the model would predict a larger increase in dispersion in the 1980's than later given a constant rate of SBTC. For Austria there is little change in dispersion as well as in education, which is not in line with what you would expect in light of SBTC. For France the increase in the educational level is moderate and the decline in dispersion is accordingly unexplained. The increase in dispersion in Italy during the 1990's may partly be explained by the lack of increase in educational level. In Finland there has been a large increase in the level of education although from a fairly low level in line with slightly falling wage dispersion. For Norway there has been a dramatic increase in educational levels and no increase in dispersion. One would nearly have expected a decline

in dispersion given this change in educational levels. For Sweden the increase in dispersion could be explained by a fairly modest increase in higher education. Thus taking all countries together the figures in Table 1 seem to indicate some relevance of the model presented in that countries with substantial upgrading of their educational level, have experienced less increase in wage dispersion and even a decline. But there are deviations from this story so there is obviously a need for refining of our argument.

It has been argued by Krugman (1994) and others that in many European countries the unskilled have been made unemployed by rigid wage bargaining institutions due to skilled bias technical change while in the US this shock has been absorbed by changes in relative factor prices (or wages). Figure 4 shows that there is no such simple relationship present in aggregate data for the countries I study. On the vertical axes the wage dispersion (D9/D1) in the last year available according to figures 2a-2c is shown and on the horizontal axes the ratio u_s/u_{us} in 2001 according to OECD (2003). There is no strong correlation between wage dispersion and relative unemployment rates for skilled and unskilled. If anything there is a tendency for more dispersion in wages in countries with large relative differences in unemployment. Even if we change the figure by using the difference and not the ratio of unemployment rates, the no strong correlation story holds. This is also the case if we use total unemployment; there is simply no strong correlation between dispersion and unemployment between countries.

**Figure 4. Wage dispersion and relative unemployment rates**
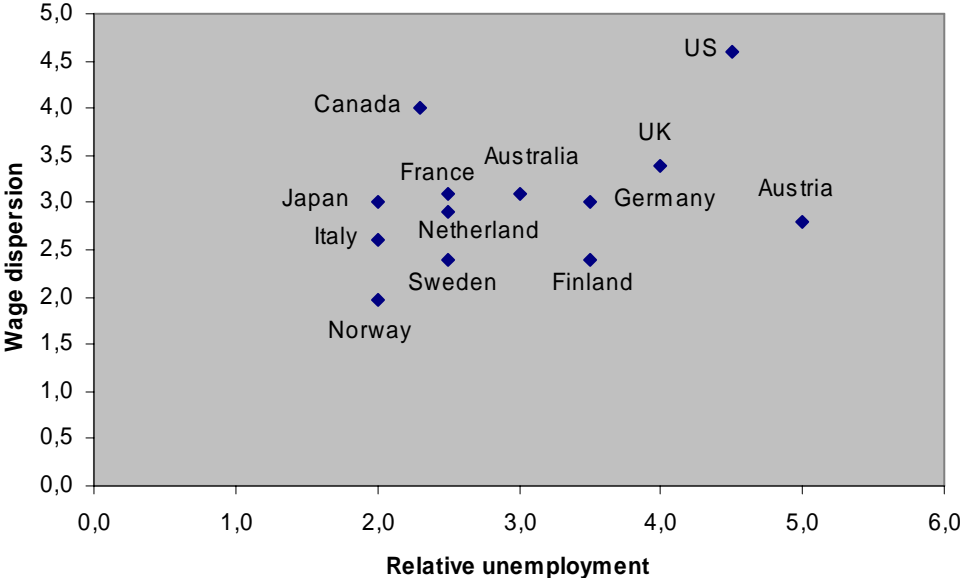
So far I have not referred to changes in institutional factors that may influence the bargaining position of the parties involved in wage negotiations. These variables are in fact suppressed in the wage equations (4) and (5) and affect the location of equation (6) in Figure 3 and thus relative wages. According to the literature on wage determination and wage inequality cf. Blau and Kahn (1996), Nunziata (2001) and Wallerstein (1999) institutional variables that affect the outcome of bargaining are trade union bargaining power and the degree of coordination in wage bargaining. Trade union bargaining power is related to

- the proportion of employees covered by collective agreements and union membership
- labour market regulation and employment protection
- unemployment benefits or the benefit replacement rate that affects "outside options"
- the minimum wage that can act as a floor to wage bargaining

The degree of coordination in wage bargaining is related to a number of institutional factors among which the degree of centralization of wage bargaining is found to be of great significance. Here one distinction is between systems where wages are largely negotiated at the plant level (the US, Canada, the UK) while in many European countries wages are often negotiated at the industry level. The Nordic countries and the Netherlands (since the 1982 Wassenaar agreement) have traditionally had significant additional national coordination and periodically direct governmental interference at the macrolevel, cf. Wallerstein (1999). Interestingly EU-countries with a relatively high degree of coordination in wage bargaining also belong to the group of countries with a relatively high share of so-called learning organizations, cf. the chapter by Lorenz and Valeyre in this volume. Several estimates of wage bargaining coordination exist in the literature and it not obvious how one best should measure an institutional factor. I have chosen a measure of coordination developed by Wallerstein (1999) that applies to most countries in my sample. If we relate this qualitative variable to wage dispersion in the same way as in Figure 4, we get a picture of a possible link between coordination and dispersion as in Figure 5 below. From this figure we clearly see a negative relation between wage dispersion and the degree of coordination in wage bargaining. The US and Canada have hardly any coordination in wage bargaining and large wage dispersion while in the Scandinavian countries on the other hand there is much more coordination and less dispersion.

Figure 5. Wage dispersion and bargaining coordination
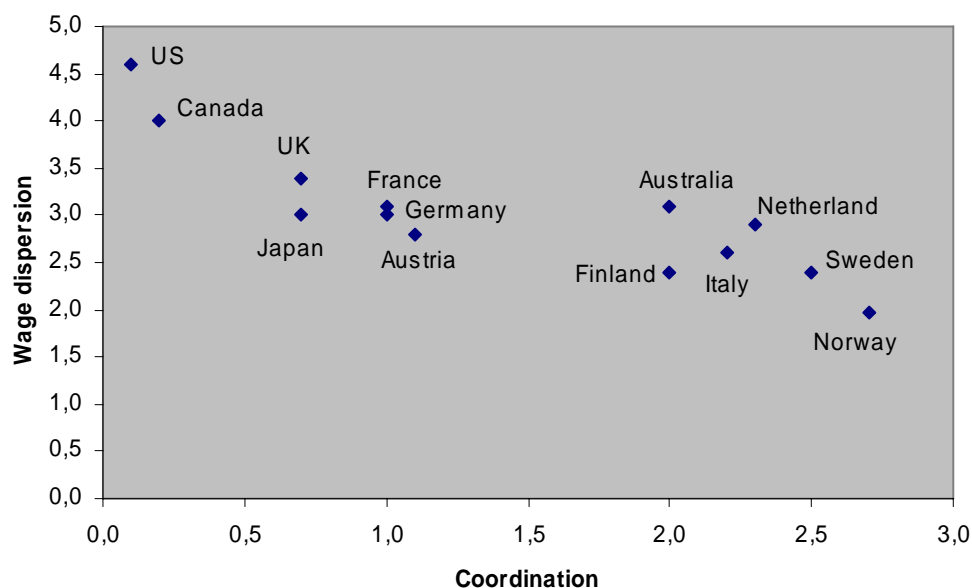
Let me now try to explain *changes* in dispersion using *changes* in those institutional factors affecting wage bargaining that I listed above and data supplied in Nunziata (2001). For the US there has been little changes in coordination. However, the unemployment benefits replacement rate (BRR) was reduced somewhat during the 1980s (but not the 1990s) and union density (UD) declined during the 1980s but stabilized later. Also the minimum wage declined markedly during the 1980s; a fact we shall return to in the next section. Thus there are some changes in institutions that may explain the increase in dispersion during the 1980s for the US. Noticeably, these factors changed much less during the 1990s when also dispersion was more stable. A similar story can really be told for the UK where also wage coordination measured by the proportion of employees covered by collective agreements declined during 1980s. Thus here there are strong reasons to believe that institutional changes have lead to increased dispersion in the UK. For Australia the degree of coordination was reduced during the first half of the 1990s. That fits well with the moderate increase in dispersion that we observe in Figure 2a from 1993 and onwards. For Canada there are few changes in institutions except for the minimum wage that relative to average earnings has developed just inversely to dispersion; falling markedly from the late 1970s until 1986 and increasing thereafter. This is very much the opposite of what to expect when looking at the earnings inequality according to Figure 2a. For Japan there are hardly any changes in the institutional factors and inequality.

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For France the institutional variables show a diverse picture. The benefit replacement rate (BRR) has declined along with union density (UD) but coordination has increased somewhat. From Figure 2b we see that dispersion has not changed much. For Germany BRR was reduced recently along with UD. This should lead to more inequality and that is what we observe during the second half of the 1990s, but changes are small. For Austria there are in general small changes. For Italy the institutional indicators point in different directions. According to Wallerstein (1999) coordination has been reduced recently and this may explain the large increase in dispersion during the early 1990s.

In Finland both BRR and UD has increased and this may explain the slight reduction in dispersion according to Figure 2c. For Norway institutional factors have been quite stable and there is hardly any change in dispersion. In Sweden wage coordination has been reduced and this might explain the increase in dispersion. UD has on the other hand increased while BRR shows an inverted U-shape. For the Netherlands coordination has been stable, BRR has increased somewhat but here there is a strong decline in the minimum wage that may explain the upward trend in inequality.

My summary of the country evidence is that changes in institutional variables seem to fit well with the observed changes in wage dispersion across countries. Thus it is a more likely candidate for explaining the diverse experience of the OECD countries when it comes to changes in wage dispersion than a common technological shock like skill biased technical change. In addition also changes in educational attainment help explain why some countries have been more successful in mitigating the effect of SBTC on wage dispersion.

4. A closer look at some country studies

Let me now refer to some recent published country studies that can add to our knowledge on wage dispersion and skills. Let me start with a recent study on the US where the debate on wage dispersion and the causes for its increase over time has been vivid for many years. Card and DiNardo (2003) argue against the current dominating view that skill-biased technological change (SBTC) is the most important factor that can explain the rising wage inequality in the US (and elsewhere). Using several sources of information and arguing for the use of hourly wage rates for all and not annual earnings for full time male workers, Card and DiNardo conclude that in the US it was only during the 1980s that wage dispersion increased and in particular in the early part of the 1980s. Looking at men and women separately, there is some tendency for wage dispersion to increase for women. Note that these data are not the same as those in the OECD earnings database that show a moderate increase in dispersion also

during the 1990s, cf. Figure 2a. So which wage measure to use, matters. This should of course make us more careful when concluding because it is far from obvious what to choose.

Card and DiNardo (2003) also show that the education premium as measured by the college-high school wage ratio, has been quite stable during the 1990s. In particular for men there is hardly any change in the ratio while there was a large increase (more than 10 percentage points) during the 1980s and again mostly during the early stage of the decade. For women there was an increase during the 1980s similar to that for men, but also an increase in the ratio during the 1990s, although only half of the absolute increase of the 1980s. The reason for the large increase in the education ratio for both men and women was that younger cohort of college educated persons increased their relative wages compared to others. During the 1990s there has been more stability in the dispersion also controlling for age. The education premium increased much during the 1980s in particular for younger people and this indicates that formal skills or knowledge was relatively better remunerated than before. However, this feature did not continue at least not at the same pace during the 1990s. Finally, looking at the residual in Mincer-type wage equations, i.e. after taking into account education, age (or experience) gender and race, the same pattern of changes in wage dispersion occurs, an increase in dispersion during the 1980s and little change thereafter.

Having established these empirical features of the wage dispersion in the US (in addition to a number of other facts that we shall not consider here), Card and DiNardo (2003) argue quite convincingly that in order to explain the increase in dispersion in the 1980s but stability in the 1990s, it is in particular relevant to look at which of those factors that have been suggested as explanatory candidates survive when taking the features of both decades into account. They argue that SBTC is much less convincing as the main explanatory factor in the US because productivity change due to increased production and use of computers cannot have been slower during the 1990s than during the 1980s. In fact when looking at aggregate productivity figures for the US economy, there is no increase in productivity growth in the 1980s compared to the 1970s. However, such an increase in productivity growth took place during the 1990s, but then no widening wage dispersion occurred. Thus the timing of SBTC and aggregate productivity growth does not match and neither does the timing of SBTC and change in wage dispersion.

What is then a reasonable explanation? According to Card and DiNardo (2003) reduced minimum wages is the "culprit" in particular because the timing fits well. Real minimum wages fell during most the 1980s and quite dramatically from 1979 to 1984 (by 33 %) but the fall continued during the whole

decade, while it changed little during the 1990s. A simple regression of the 90/10 wage-gap on the log of real minimum wages explains most of the changes in this dispersion from 1973 to 2000 according to the authors. There are other studies concluding in a similar vein, in particular DiNardo, Fortin and Lemieux (1996), Blau and Kahn (1996), Lee (1999) and recently also Teulings (2003).

So while much of the early literature on what explained the increasing wage dispersion had concluded that this was mainly due to SBTC, more recent evidence but also simply the passage of time seem to question this conclusion. Instead a larger role for institutional factors and changes in these factors may be called for. The main problem with the hypothesis that large reductions in minimum wages caused the increased dispersion in the US is that although it may well explain increasing wage dispersion in the bottom end of the wage distribution, it is unclear why falling minimum wages affects the upper tail of the distribution (i.e. the 90/50 gap).

A recent study for the UK by Gosling (2003) is based on data much in line with those in Figure 2a. The growth in high incomes (the 90th percentile) has been larger than growth in low incomes (the 10th percentile) but with an interesting difference between men and women. Income growth for low-income (unskilled) women has been much larger than for men with low earnings. Also when controlling for education, Gosling finds that the educational premium for men has been increasing but not for women, in fact it seems like the male education premium is converging towards the female premium. This can explain why wage inequality among men has been increasing as more men have acquired more skills through more human capital or education while this has not been the case for women in the UK. However, when comparing with the US, a different picture emerges. In the US it is among the well-educated women that wages have been increasing most. This leads Gosling to conclude that there must be institutional differences in the labour market between the two countries in order to explain the different outcomes.

Let us now move to Norway a Nordic country where there is generally more equal distribution of incomes as well as earnings. A recent study by Hægeland and Kirkebøen (2005) shows that very moderate changes in the wage dispersion have taken place in Norway since 1980. A compression of the wage structure took place during the 1970s but really no clear trend during the 1980s. However, during the 1990s and in particular during the boom in the latter half of the decade, inequality increased somewhat. This increase took place only at the upper half of the distribution, i.e. full time workers in top deciles have become relatively richer than before. During the first (and second) half of the 1980s the compression of the wage structure continued in the lower part of the distribution while inequality

increased in the upper part. These changes can be decomposed into changes in skill premiums (due to education and experience), changes in the distribution of these characteristics and unobserved characteristics and premiums. An interesting result in the study by Hægeland and Kirkebøen (2005) in our context is that they find no systematic change in skill premiums from 1980 to 2000. This can explain why there has been a moderate increase in wage inequality in Norway. There is more systematic evidence indicating that given existing skill premiums, education and experience have changed in order to produce moderately more inequality. In addition, unobserved skills and prices have contributed to more inequality. This result is also found in earlier studies for the US and Sweden. Increased within group inequality (i.e. after adjusting for gender, education, experience, sector and region) may indicate that wage determination have become more market oriented and less centralized or influenced by unions than earlier. An obvious reason for this - at least in the private sector - is that sectors of the Norwegian economy where unions traditionally have not been very strong have been expanding more than sectors that are traditionally union strongholds. Thus the very modest increase in wage inequality in Norway during the last 20 years is probably not much related to increased premiums for skills or by learning.

To sum up these three country-studies they all show fairly stable educational wage premiums with the premium for UK men as the obvious outlier. Thus at least recent evidence point to the possibility that increased formal learning can take place without increased wage inequality. One reason may of course be that the supply of more educated people have increased sufficiently to match the increase in demand. In my view the argument in Card and DiNardo (2003) that technological change during the 1990s cannot have been less than during the early 1980s, is very convincing. In the US labour productivity increased twice as fast during the 1990s compared to the 1980s. This was even more so in Norway, while in the UK productivity growth was higher during the 1980s than later. In fact, it is quite difficult to find any stable or systematic relationship between economic growth (which is mainly driven by productivity growth) and inequality cf. Banerjee and Duflo (2003) for a recent study. Comparing the change in earnings distribution according to figures 2a-2c with the change in labour productivity growth according to table 1.A1.1 in OECD (2002) between the 1980s and 1990s simply leaves you confused. By further comparing these changes using the data for 1970s when income inequality in general was on the decline in the OECD area and productivity growth generally higher than during the 1980s, simply adds to this confusion.

5. Summary and discussion

From the mid 1990s (labour) productivity growth in the US increased markedly compared to previous decades when productivity growth was slow. In the Euro area the picture is quite the opposite with dismal growth more recently but rapid growth during the 1980s and early 1990s. Much of the increase in US growth is due to the production and use of ITC. The rapid growth of the ITC sector in the US is partly due to new ways of measuring output of industries producing new capital goods of higher quality.[2] Freeman (2004) suggests that microelectronics is the key factor behind a new long wave in the world economy, while others are skeptical as to the effect that the ITC-revolution has on the overall economy, cf. Gordon (2000). Even if there is no general agreement on the size of the impact of ITC on the economy, there is hardly any disagreement that it has changed and is changing production at the firm level as well as household consumption. It makes earlier knowledge obsolete and creates the need for acquiring new knowledge and learning. The change in the structure of the economy with uneven growth in productivity between sectors also affect labour markets and may change institutions and systems of wage bargaining, cf. Acemoglu et al. (2001). Thus there are reasons to believe that the economic effects of the ITC revolution may potentially be far-reaching and widespread including effects on the distribution of earnings.

The main empirical findings of this paper are the following.

- There are no systematic changes in income distribution or wage dispersion among OECD-countries during the last two decades. Some countries have experience increasing inequality while this is not the case for many others in particular when it comes to earnings inequality. There is a tendency for inequality to increase less during the 1990s than during 1980s. In some countries there is even falling wage inequality more recently.

- The evidence on inequality suggests that technological change and skill-biased technological change in particular is only one of many factors contributing to more inequality. Institutional changes and differences may be more important in studying the relation between inequality and skills than technological change. It is difficult to find any systematic link between changes in inequality and productivity-growth among OECD-countries.

- There is no correlation between wage inequality and unemployment differences across countries. The claim that high rates of unemployment of unskilled is caused by rigid relative wages needs to be modified to say the least. There is strong evidence both within and between

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[2] A seminal contribution to the methodological change in output measurement is Gordon (1990).

countries, that those institutional factors that influence wage bargaining - both at the national and firm level - also have effects on wage inequality.

- Wage dispersion has increased less or is even absent in countries where an increasing proportion of the population has attained tertiary education. In many EU-countries the level of education is relatively low compared to most OECD-countries. Both in order to promote growth and avoid increasing inequalities, these countries should focus more on stimulating education. In this sense more learning is good both for growth, equality and social cohesion.

If we relate these observations on earnings inequality to institutional differences between countries we may perhaps shed new light on our findings. In most Anglo-Saxon countries (US, UK, Australia, but not Canada) earnings inequality has increased. This phenomenon has been studied extensively and the standard view is that this change in distribution is mainly due to specific changes in technology. But in addition labour markets have been deregulated in these countries and are also characterized by high mobility and focus is on private ownership of knowledge. Expenditures on higher education are high and increasing and so is productivity. The results of this productivity growth have been individually appropriated and inequality has increased.

In some Asian countries (Japan and South Korea) there has not been much increase in wage dispersion (rather the opposite). Labour markets in these countries are much influenced by large corporations and knowledge is more collective in nature. Thus productivity improvements are distributed to many and inequality has not increased.

In many continental EU-countries labour markets have not been much deregulated although some structural reforms have been carried out. In these countries there is more focus on private-public partnership and strong firm linkages and strong unions where tacit knowledge are harder to remunerate individually. Thus there is less increase in inequality in spite of a rapid growth in labour productivity during the 1980s and first half of the 1990s. According to the chapter by Lorenz and Valeyre in this volume many of these countries also have a high share of learning organizations.

Finally in most Nordic countries labour markets are still quite regulated and bargaining coordinated (but with some deregulation in Sweden) and there is less change in inequality (again with Sweden as the exception) in spite of high productivity growth.

So even if countries should face similar productivity shocks, their institutions vary both at the firm level as well as at the industry and macro-level. These institutional differences are probably important for explaining why the changes in productivity have been distributed so differently between countries during the last decades with large inequality as a result in some countries but not in others.

References

Acemoglu, D., P. Aghion and G.L. Violante (2001): Deunionization, Technical Change, and Inequality. *Carnegie-Rochester Conference Series on Public Policy* **55**, 29-64.

Aghion, P., E. Caroly and C. Garcia-Peñalosa (1999): Inequality and Economic Growth: The Perspective of the New Growth Theories. *Journal of Economic Literature* **37**, 1615-1660.

Atkinson, A. (1999): Is Rising Income Inequality Inevitable? A Critique of the Transatlantic Consensus, 1999 WIDER Annual Lecture, Oslo, Mimeo.

Banerjee, A.V. and E. Duflo (2003): Inequality and Growth: What Can the Data Say? *Journal of Economic Growt,* **8**, 267-299.

Barrett, A.M., J. Fitzgerald and B. Nolan (2000): Earning Inequality, Returns to Education and Immigration into Ireland, CEPR Disc. Pap No.2493.

Bjørnstad, R., Å. Cappelen, I. Holm and T. Skjerpen (2002): *Past and Future Changes in the Structure of Wages and Skills,* Documents 2002/4, Statistics Norway.

Blanchflower, D.G. and A. Oswald (1994): *The Wage Curve,* The MIT Press, Cambridge.

Blau, F.D. and L.M. Kahn (1996): International Differences in Male Wage Inequality: Institutions versus Market Forces. *Journal of Political Economy* **104**, 791-837.

Card, D. and J.E. DiNardo (2003): Skill-Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles. *Journal of Labor Economics* **20**, 733-783.

DiNardo, J.E., N. Fortin and T. Lemieux (1996): Labor Market Institutions and the Distribution of Wages, 1973-1992: A Semi-parametric Approach. *Econometrica* **64**, 1001-44.

Freeman, C. (2004): "Income inequality in changing techno-economic paradigms", in E.S. Reinert (ed.): *Globalization, Economic Development and Inequality*, Edward Elgar, UK, pp. 243-258.

Förster, M. and M. Pearson (2002): Income Distribution and Poverty in the OECD Area: Trends and Driving Forces, *OECD Economic Studies* **34***, 7-40.

Gordon, R.J. (1990): *The Measurement of Durable Good Prices*, University of Chicago Press, Chicago.

Gordon, R.J. (2000): Does the "New Economy" Measure Up to the Great Inventions of the Past? *Journal of Economic Perspectives* **14**, 49-74.

Gosling, A. (2003): The Changing Distribution of Male and Female Wages, 1978-2000: Can the Simple Skills Story Be Rejected? CPER Disc. Paper No. 4045.

Gottschalk, P. and T. M. Smeeding (1997): Cross-National Comparisons of Earning and Income Inequality. *Journal of Economic Literature* **35,** 633-687.

Hægeland, T. and L. Kirkebøen (2005): Education, earnings and industry. (In Norwegian). Reports xx/2005, Statistisk sentralbyrå, Oslo.

Krugman, P. (1994): Past and Prospective Causes of High Unemployment. *Economic Review* **79**, 23-43.

Kuznets, S. (1955): Economic Growth and Income Inequality. *American Economic Review* **45,** 1-28.

Lam, A. (2002): Alternative Societal Models of Learning and Innovation in the Knowledge Economy. *International Social Science Journal* **171,** 67-82.

Layard, R., S. Nickell and R. Jackman (1991): *Unemployment, Macroeconomic Performance and the Labour Market,* Oxford University Press, Oxford, UK.

Lee, D.S. (1999): Wage Inequality during the 1980s: Rising Dispersion or Falling Minimum Wages? *Quarterly Journal of Economics* **114**, 977-1023.

Luxembourg Income Study (2004): http://www.lisproject.org/keyfigures/ineqtable.htm

Nunziata, L. (2001): *Institutions and Wage Determination: a Multi-Country Approach.* Mimeo, Nuffield College, Oxford.

OECD (1996a): *The Knowledge-based Economy,* OECD, Paris.

OECD (1996b), *Employment Outlook*, OECD, Paris.

OECD (1997): *Employment Outlook*, OECD, Paris.

OECD (2000): *Education at a Glance,* OECD, Paris.

OECD (2002): *Economic Outlook*, No.72, June 2002, OECD, Paris.

OECD (2003): *Education at a Glance,* OECD, Paris.

Phelps, E.S. (2000): The Importance of Inclusion and the Power of Job Subsidies to Increase It. *OECD Economic Studies* **30**, 85-109.

Teulings, C.N. (2003): The Contribution of Minimum Wages to Increasing Wage Inequality. *Economic Journal* **113**, 801-833.

Wallerstein, M. (1999): Wage-Setting Institutions and Pay Inequality in Advanced Industrial Societies. *American Journal of Political Science* **43**, 649-680.

Whitley, R.D. (2000): The Institutional Structuring of Innovation Strategies: Business Systems, Firm Types and Patterns of Technical Change in Different Market Economies. *Organization Studies* **21,** 855-886.

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