# Inequality, Employment and Skills in OECD Countries: An International Comparative Analysis

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In loving memory of my mother
Ljiljana

*Your belief in me has made this journey possible.*

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# 1. Introduction

A rise of economic inequality across OECD countries since the early 1980s has increased interest and fostered a comprehensive discussion about the causes of rising economic inequality and its consequences. In addition, the role of public policy in fighting inequality has been reexamined since the 1980s, which leads to an increased importance of inequality as a research topic among economists (see Piketty, 2014; Atkinson, 2015; Stiglitz, 2015a; Milanovic, 2016; Boushey *et al.*, 2017). This development pushed economic inequality to the forefront of public debate, and offered more diverse insights on the topic. However, economists still seem to have very diverging opinions related to the main drivers of inequality, its consequences, relationship to growth and employment, necessity of policy intervention, and the right public policy mix aimed at its reduction.

Not only is a universal view of the problem lacking, but the debate also goes from one extreme view claiming that inequality is beneficial for employment and growth to the other extreme claiming that inequality is detrimental for growth, employment, and progress in general. The new classical school of thought does not see rising inequality in the economy as a vital problem that economists and policymakers should deal with. The marginality of the topic of inequality at the beginning of this century can be seen best in the address of Robert Lucas, a Nobel Prize winning economist who said the following about inequality: "Of the tendencies that are harmful to sound economics, the most seductive, and in my opinion the most poisonous, is to focus on questions of distribution" (Lucas, 2004). Inequality has risen, but this is not necessarily negative for a society; it can even be seen as a positive development (see Welch, 1999). On the other hand, another Nobel Prize economist described the current situation of rising inequality as "a stark picture of a world gone wrong" (Stiglitz, 2015b), and insists on active policies to correct for high inequality in society. Keynes also stressed high income/wealth inequality (in addition to unemployment) as one of the biggest failures of our system: "The outstanding faults of the economic society in which we live are its failure to provide full employment and its arbitrary and inequitable distribution of income and wealth" (Keynes, 1936:372).

This academic debate did not remain in the academic world, rather, it vastly influenced policymaking around the world. The OECD's Jobs Study (1994) and the IMF's World

Economic Outlook (2003) also recommended labor market reforms and deregulation of labor market institutions (in line with the new classical school) as the best way to achieve higher growth and employment and ignore questions of distribution. However, with new research emerging that is critical of inequality, both IMF (2017) and the OECD (2015a) have recently changed their views and put high inequality at the center of the policy debate, even questioning its effect on growth and employment. Not only do they emphasize the negative consequences of high inequality, they even call for corrective redistributive measures and active fiscal policy to tackle inequality (in stark contrast to their previous policy recommendations).

The fact that two views differ significantly and offer contradicting views is problematic for policymakers. Given the importance and significance of these issues (especially in the world of rising inequality), it is tremendously important to provide correct answers to these and some other questions and to offer possible solutions. The best way to deal with these contradictions is to empirically test theoretical hypotheses, assumptions, and conclusions empirically, and this is precisely what this thesis seeks to do. By thorough empirical examination, this thesis seeks to shed light on some controversial and fervently debated (but extremely important) inequality matters – such as the relationship between inequality, institutions and employment, contribution of skill inequality to wage inequality, and issues related to educational inequalities. This thesis also discusses policy recommendations that follow from the presented results. The results presented in this thesis will offer some clarity to the issue and propose adequate policy solutions accordingly. Comparing different countries might be very useful in this kind of work, especially because different countries have different levels of inequality, different degrees of coordination, and different policymaking procedures. However, in order to keep the set of countries homogeneous in this study (and due to data limitations), I focus on the highly developed OECD countries only. Furthermore, there are different aspects of inequality[1] that can be examined; this thesis is mainly focused on wage inequality, skill inequality, and intergenerational educational mobility[2], along with the

[1] There are different aspects of inequality in a society. The economists mainly focus on wealth/income/wage inequality within one country or between different countries, which shows how unevenly wealth/income/wage is distributed among group of individuals/or countries. In the recent period, topics related to inequality in health, skills, education, consumption etc. are gaining significance as well. Global inequality that examines inequality in the world as a whole is becoming more important as well (see Milanovic, 2016).

[2] In the second chapter other measures of income inequality are used as well

relationships between them and employment, and a discussion of the relevant policy implications.

I start by examining the "big tradeoff". Tradeoff between high efficiency and equality (Okun, 1975) and the idea that countries cannot achieve both simultaneously has been guiding policymaking for years. In line with this theory, the response to high unemployment rates has included recommendations for institutional reform, deregulation of labor market institutions, and austerity measures (OECD, 1994; IMF, 2003), although such measures might lead to higher inequality. In essence, higher inequality was the price to be paid for higher efficiency. Belief in this neoclassical view was so strong that macroeconomics and Keynesian economic policy recommendations almost completely vanished from political discussion. In Chapter 2, "Does Inequality Promote Employment? An International Comparison" (co-authored with Ronald Schettkat), we empirically analyze the big tradeoff. An earlier version of this paper was published as Schumpeter Discussion Paper (Jovicic and Schettkat, 2013). Based on the panel data of 21 core OECD countries during the period 1980-2010, we examine the relationship between inequality and labor market performance in order to investigate whether the mainstream theoretical claim that permitting high inequality leads to higher employment can be proved empirically.

There have already been some earlier studies that investigated the relationship between labor market institutions and unemployment rates (input variables), but they could not confirm the hypothesized link between the two, which contradicts the mainstream view as well (for a summary of these studies see Baker *et al*., 2002). In addition to these studies, we go a step further and also regress labor market performance on various inequality measures (output variables). However, we cannot confirm the postulated tradeoff either. Whereas inequality measures seem to correlate negatively with the strength of the institutions (union densities, bargaining level and coverage, employment protection measures), contrary to the theory, they seem not to be related to labor market performance (e-pops, unemployment rates, hours worked). Variation in institutions across countries affects their inequality levels, but not their success in labor markets.

These results have enormous policy implications. If nothing else, they cast serious doubts on the validity of the current policy recommendations and call for their revision (e.g., austerity measures in Europe). Grounding an entire policy on theoretical models that cannot be confirmed empirically needs a rigorous reassessment. Rather than dismantling institutions that have a positive effect on equality (apart from other benefits), governments should focus on increasing employment through alternative policy measures. Also, rather than continuing to insist on austerity measures (that had disastrous consequences on the well-being of South Europe and did not improve employment significantly), Keynesian economics, which offers solutions in terms of expansionary macroeconomic policies and fosters aggregate demand, needs to be reconsidered. It is necessary for this discussion to be returned to the political agenda. Although the European Union (EU) still does not seem very open to this kind of debate, IMF and the OECD (who used to be the biggest promoters of deregulation policies) are somewhat changing their views and calling for more investment and expansionary fiscal policies in order to fight unemployment. This move is in line with the findings in this paper and the opinions of other economists (Solow, 2008; Carlin and Soskice, 2008; Schettkat and Sun, 2009).

As discussed above, wage structure and compressed wage dispersion were the main culprits of high unemployment in general, but especially so for unemployment in the low-skilled sectors (Siebert, 1997; Heckman and Jacobs, 2010). The wage compression hypothesis states that labor market institutions like minimum wages, unions, etc. increase wages for the low-skilled above their productivity levels, and, consequently, cut them out of employment. In order to achieve higher employment in the low-skill sector, it is necessary to allow for more dispersed distributions and lower wages. Chapter 3, "Wage Inequality, Skill Inequality, and Employment: Evidence and Policy Lessons from PIAAC" tests empirically whether wage compression hypothesis hold true. This paper was published in the IZA Journal of European Labor Studies (Jovicic, 2016). In addition to Chapter 2, where we explored the relationship between inequality and labor market performance, a new dataset is used that allows us to look at this relationship for various skill levels. This analysis is based on the Programme for the International Assessment of Adult Competencies PIAAC dataset, which is a survey of adult skills that was conducted by the OECD in 2011. Apart from demographic information, hourly earnings, and other background information, the numeracy test scores of adults (that are central to good performance in the labor market) are available for 16 core OECD countries.

A general problem with the wage compression hypothesis and the big tradeoff is that their conclusions are derived from rigid theoretical assumptions that often fail to be confirmed empirically, such as perfect market model, marginal productivity theory of wages, etc. Chapter 3 discusses and tests empirically both the wage compression hypothesis and some of its core assumptions. First, I investigate the skill compression hypothesis. According to neoclassical view, wage inequality is related to skill inequality, higher skill premium, and increased demand for high-skill workers (due to globalization and skill-biased technological change). If this claim is true, then wage inequality can be seen as a main driver of increased incentive to invest in acquiring better skills. Higher skill levels and human capital have a positive influence on countries' potential to produce higher output and growth rates; this is why high wage inequality is not perceived as a negative outcome. However, this view is wrong. Cross-country empirical analysis in this chapter shows that some countries have compressed wages, even accounting for skills. Furthermore, the fact that wage inequality seems to be concentrated in the top half of the wage distribution while skill inequality seems to be higher in the bottom half of the skill distribution calls for explanations beyond market forces and skill inequality in order to more fully explain wage inequality. Additionally, data shows that dispersion at each skill level is higher than the dispersion between skill levels, which contradicts marginal productivity theory. This result is in line with Agell (1999), who concluded that high wage dispersion within the same education levels is rather a disincentive for acquiring additional schooling - contrary to the mainstream view.

Finally, wage compression hypothesis cannot be confirmed either. This might not come as a surprise, given the problematic rigid (and unrealistic) assumptions on which this hypothesis is based. However, it is contradictory to the traditional economic view. I find no evidence that countries that have high wage inequality tend to have better employment performance (neither overall nor in the bottom half of the distribution). Countries that have high employment among low-skilled workers have high employment levels in general, independent from their wage inequality levels. Again, I come to conclusion that there must be other reasons that have more potential to explain cross-country differences in employment. It is more likely that macroeconomic policymaking plays a more significant role in explaining these differences. As Krugman (2009) and Wolf (2014) suggested, demand deficiency might offer a possible explanation for cross-country divergence in employment trends. Although this kind of conclusion would go beyond the scope of this paper, not being able to find evidence for the

skill and wage compression hypotheses at least calls for reconsideration of alternative explanations. Whereas it has been proven previously that high inequality is related to many negative outcomes such as health and social problems (e.g., mental illness, crime, infant mortality; Wilkinson and Pickett, 2009), this paper shows that wage inequality does not affect labor market outcomes in terms of employment. Austerity measures and decline in public services in the EU needs to be revisited.

Though there is a discussion for whether existing inequality of outcomes has a negative impact on economies, the majority of economists agree about the importance of attaining equality of opportunities (Putnam, 2015; Haskins and Sawhill, 2009; Roemer, 1998; Sen, 1999). Each individual should have equal chances to unfold their full potential and succeed in life. Even liberals such as Milton Friedman (who was, in general, against any government intervention with a purpose of correcting unequal outcomes) insists on equal opportunities for all citizens (Friedman and Friedman, 1970). Also, although Okun (1975) asserted the existence of a tradeoff between efficiency and equality, in the same work he claims that the tradeoff might reverse itself if unequal outcomes come from unequal opportunities. According to him, not only are these economic inequalities more "intolerable", but also they are more "remediable" and can be "corrected with the present institutional structure". He calls for public policies that lead to equalizing opportunities, such as narrowing the educational financing gap and increasing access to education. Chapter 4 of this dissertation "Literacy Skills, Equality of Educational Opportunities and Educational Outcomes: an International Comparison" broadens a previous discussion that was mainly related to unequal outcomes (in this chapter measured by skill inequality) with an analysis of equality of opportunities as well. An earlier version of this paper was published as an INEQ Working Paper (Jovicic, 2018). There are different ways to measure and define equality of opportunity. Equality of opportunity can be reflected in intergenerational mobility, a movement in the socio-economic status from one generation to the next. This chapter explores intergenerational educational mobility, which examines the strength of the relationship between fathers' educational levels and their children's skills (measured by literacy test scores) across OECD countries. In addition to the PIAAC dataset (also used in the previous chapter), another survey conducted in the mid-1990s (IALS – International Adult Literacy Survey) is used as well to additionally investigate the change over time.

First, in line with previous chapters, this chapter cannot find evidence for a big tradeoff, in this case between educational efficiency and equality; on the contrary, countries that have high efficiency/average performance (measured by average literacy test scores) have simultaneously, both high equality of skills and high equality of opportunity (intergenerational educational mobility). Moreover, increasing the average literacy scores (especially by improving scores of the low-skilled) is related to an increase in equality. The two are correlated and go hand-in-hand, which is certainly the good news. Improving average skill levels will lead to less inequality. This is a result that can please both Keynesian and neoclassical schools of thought, although policy recommendations to achieve these would probably vary between them. In order to shed light on this issue, in the next step, I try to identify the main drivers of the changes in literacy scores across countries (at least to the extent that the data allows). The data uncovers a big puzzle, however. Although there has been a substantial expansion in education in all countries, only a few have managed to improve their average test scores, and this result is less encouraging. Moreover, by decomposing score differences between the mid-1990s and 2011, it turns out that literacy scores for each educational-age group were on the decline in all countries, which might imply that there was a decrease in educational efficiency.

These results have straightforward policy recommendations. Both schools of thought suggest that better skills and education should be important policy goals and a way to achieve higher equality (although the manner in which they are achieved would lead to different measures). Whereas increasing educational levels is definitely an important goal, it seems very important to simultaneously ensure that the quality of schooling does not deteriorate. Educational reform that would lead to higher educational efficiency must be on the policy agenda as well. On the other hand, the role of education as an equalizer should not be overestimated; the active role of the state, family policies, etc. might be necessary in order to confront inequalities. Furman (2016) called for policies to reduce inequality of opportunity by increasing investments in education, health, and well-being of poor children, as well as providing safety nets, reforming the criminal justice system, and limiting economic rents. Putnam (2015) stresses the role of disparities in schooling systems, family structures, child development and parenting, and communities in producing existing inequalities of opportunities. However, by designing the right policies to tackle these disparities, existing inequalities could be reduced.

This thesis proceed as follows. Chapter 2 focuses on the hypothesized big tradeoff between efficiency and equality. Chapter 3 empirically examines both skill compression and wage compression hypotheses. Finally, Chapter 4 broadens the discussion on inequality by including an analysis on the equality of opportunity (in addition to equality of outcome), and the associated role of education and skills.

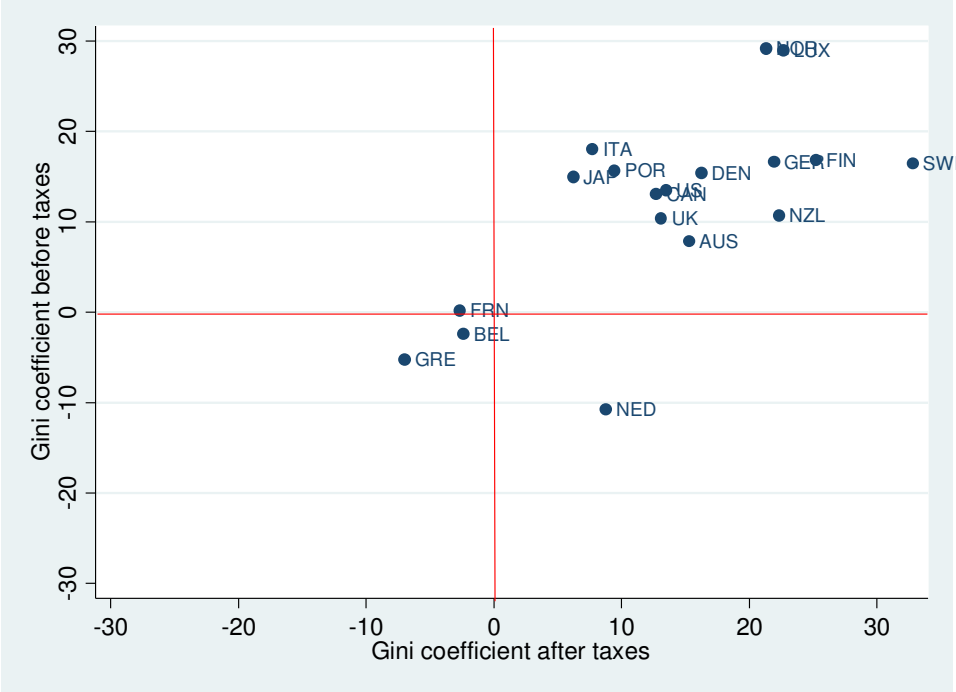
# 2. Does Inequality Promote Employment? An International Comparison[3]

## 2.1 Introduction: The big trade-off

The (almost) universal rise in inequality (see Figure 1 and 2) is often interpreted as the market response to changing economic conditions, to skill-specific changes in labor demand and supply. Skill-biased technological progress and globalization have shifted labor demand away from lower to higher skills, requiring a wider wage distribution – or so the argument goes. Higher inequality reflects new equilibrium, where some entities gain because their marginal productivity rises and others lose because their relative contribution to production falls. Marginal productivity determines wages; therefore, higher inequality reflects a new Pareto optimum, which cannot be changed without substantial losses in efficiency, representing the so-called "big tradeoff." Countries either adapt to the market requirements and change their institutional frameworks to allow for more inequality, or they will suffer from high and persistent unemployment or low employment (the two-sides-of-the-coin view). Consequently, institutional reform became and still is regarded as the major road to competiveness and efficiency. The "new menu of choice" for economic policy became "inequality or unemployment"; macroeconomics seems to have disappeared from the agenda (critically e.g., Solow, 2008; Carlin and Soskice, 2008; Schettkat and Sun, 2009).

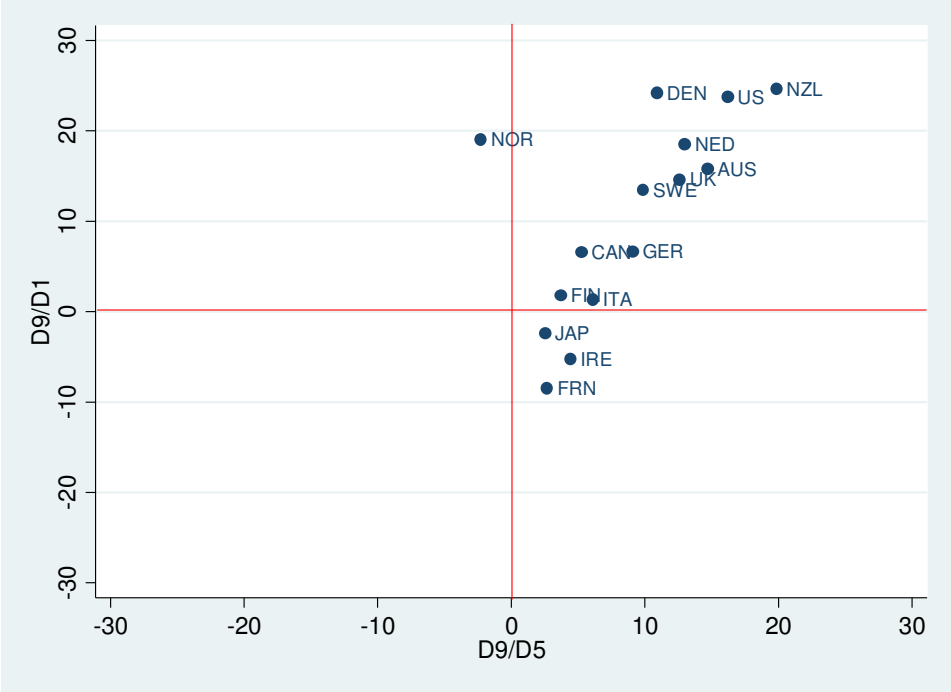
[3] Parts of this paper are based on "Inequality and Employment", presented at the 2012 INET conference (Institute for New Economic Thinking) in Berlin (see Schettkat, 2012)

**Figure 1: Inequality trends, change in Gini coefficients of household income before and after taxation 2000s-1980s, [% change]**




*Source:* OECD database, for details see (Jovicic, 2015).

**Figure 2: Inequality trends, change in D9/D1 and D9/D5 2000s-1980s, [% change]**




*Source:* OECD database, for details see (Jovicic, 2015).

But higher inequality may actually reflect market failure rather than a Pareto optimal distribution. Allowing for market imperfections in the analysis instead of assuming smoothly functioning perfect markets may produce very different conclusions. Within imperfect labor markets, firms may exercise wage-setting power. With imperfect capital markets, inequality will reproduce inequality, thus creating a class structure that may become structural with increasing polarization of the income distribution. However, even the fiercest advocates of inequality argue that society's self-interest should not allow for extreme poverty among sections of the population, because crime, violence, and riots may result. Aside from such extremes, inequality is beneficial (Welch, 1999). However, less extreme outcomes may be costly for society: overall beneficial policies may be blocked in overly unequal societies either at the high end (e.g., securing privileges) or the low end as a result of fear of insecurity (e.g. resistance to technological change). Inequality may also cause inefficient investment in human resources. Krueger (2003) emphasized access to political elites and stronger influence on the formulation of policy. Finally, people care about their relative income position, according to Keynes's (1936) major explanation for resistance to nominal wage reductions.

It has been argued that low income is transitory; i.e., that today's low paid workers will move up the income ladder, or that workers have other undeclared incomes and live in households with several other incomes (e.g., Feldstein, 1999; critical Schettkat, 2014). High and rising income inequality is even presented as an opportunity: higher individual returns to education may positively influence the individual's decision to invest in human capital, as argued by Welch in his Ely lecture "In Defense of Inequality" (Welch, 1999). He interprets the simultaneous occurrence of rising wage dispersion and increasing enrollment in higher education in the US as evidence in favor of his hypothesis.[4] What a misperception of reality! Aside from the fact that schooling decisions are certainly driven by factors other than pure economic variables – although these are important – the equation "rising inequality equals rising educational attainment" ignores high wage dispersion within educational classes which is a risk and thus a disincentive for educational investments (Agell, 1999). Furthermore, the Welch view is based on an overly idealized world of equal opportunity without capital constraints. Actually opportunity is strongly depending on the households' income position. If ability is equally distributed, equality of opportunity implies a low elasticity in the socio-economic status of consecutive generations, but actual capital markets are imperfect, and the

[4] High wage dispersion within educational groups raises ex ante the risk to human capital investment; i.e. it may be a disincentive (Agell, 1999).

social status of the family (parents) strongly influences the academic achievements of students, as shown by longitudinal study by Fox, Connolly, and Snyder (2005). Sorting students by their math performance in the 8th grade into 3 groups (low, medium, high), the researchers observed a positive relation to the share of completed bachelor degrees within each income group. But, most shockingly, the proportion of students from low-income families who scored high in math in the 8th grade – the very able poor – is the same as that of low-scoring students from high-income families – the less able rich. Money beats ability. Inequality reproduces inequality and puts a long shadow on societies; it is long living rather than a transitory phenomenon affecting many aspects of life (e.g., health, mortality, and obesity; see Wilkinson and Pickett, 2009).

Naturally, in all countries, the influence of parents on their children's educational achievements is strong, but the strength of the relation varies and seems to be substantially affected by public policy. In a strictly privately financed educational system, the link between the parents' income position and educational attainment of their children will be strong. Countries with higher income inequality seem to have higher intergenerational income elasticity; i.e., lower intergenerational income mobility (OECD, 2010a). Thus, the much vaunted great mobility in countries with higher inequality does not show up in the data. On the contrary, the US appears to have not only high inequality but also high intergenerational income elasticity, whereas the countries with the lowest inequality have much lower intergenerational income elasticity (i.e., higher mobility). Thus, it may be concluded that inequality reproduces inequality – not a result that would please the advocates of greater inequality as an incentive for skill formation.

The "big tradeoff" (Okun, 1975) between equality and efficiency was established on the grounds that taxing high incomes creates a disincentive to work at the upper end of the pay-scale, while transfers have a similar effect at the lower end. In addition, administering tax collection and the payment of transfers is like a hole in a bucket (the leaky bucket). Labor market behavior deduced from perfect market assumptions produced a strong prior against any measure that might lead to wage compression, especially at the lower end of the wage scale.[5] The less skilled, so the argument goes, were excluded from jobs, being priced out of

[5] Consequently the most celebrated hypothetical cause of unemployment in Germany was an overly compressed wage structure at the low-wage end. Prasad (2004) claimed in an IMF paper that Germany's major problem was

the market by excessively high minimum wages; i.e., by compression of wage distribution from below. Therefore, the "menu of choice" for governments is between higher inequality or higher unemployment.

Taxes may discourage labor supply,[6] but public spending can enable (more) equal access to education and more equality of opportunities, which seems to affect participation in labor markets positively. Furthermore, in a dynamic economy, educational services may be especially important, because proper functioning in a complex society requires a minimum level of education. Moreover, better education may enhance technological advancement and facilitate adaptation to rapidly changing environments. Education may create positive spillovers; i.e., individuals' investment in human resources may be sub-optimal, especially if households face credit constraints – as they of course frequently do. Overcoming these impediments is not only socially but also economically beneficial. Moreover, individual productivity derived from education will depend on the overall educational level of society. Broad access to public education would probably benefit society most if preschool education were enhanced (Carneiro and Heckman, 2003). Moreover, public spending affects the growth path of an economy as the public sector invests directly of finances basic research, the most risky research, providing the basis for new technological developments (Mazzucato, 2013).

In this paper, we investigate the "big tradeoff" hypothesis with respect to labor market outcomes. The next section discusses "natural rate theory" and its relation to institutional features and investigates the relationship between institutional patterns and empirical income distributions. We apply different classification schemes of capitalist economies (the Hall and Soskice (2001) classification of varieties of capitalism) and relate them to variables of labor market institutions, demonstrating a clear pattern between institutional arrangements and inequality. In the fourth section, we describe our cross-country longitudinal data set followed by our empirical analysis of the relation between inequality, redistribution, and labor market outcomes in highly industrialized (OECD) countries. We use several indicators for labor

its compressed wage structure, although inequality had in fact been rising since the mid-1990s (Schettkat, 2006; Dustmann *et al.,* 2009). Microeconometric comparison between the lower end of the US and German wage structures showed higher dispersion of the D5/D1 (the median wage divided by the wage of the first decile) measure in Germany than in the US (Möller, 2008). But the widening wage distribution in Germany since the 1990s remained unnoticed or was ignored.

[6] The neoclassical labor supply model-immanent conclusion is that rising non-work incomes reduce labor supply.

market performance (unemployment rates, employment to population rates, and hours worked per head of population) and inequality (decile ratios, Gini coefficients, and the income share of top 1% of the income scale). Section 6 concludes with our main findings.

The contribution of our paper to the research is that, in contrast to the rest of the literature, rather than using only institutional variables (input indicators) in our panel data model, we use inequality measures (output indicators) as well, which helps to add a new perspective on the issue. Furthermore, variables are updated and include more recent data (2000s), compared to the majority of previous studies. In addition to answering our research question regarding the relation between efficiency and equality, we also explore relations between institutions and inequality, where our data shows a clear pattern. Our paper provides evidence that the postulated trade-off between equality and efficiency does not exist. Different labor market institutions can produce very similar labor market outcomes with very different degrees of equality.

## 2.2 Institutional diversity and "natural rate theory"

"Natural rate theory" – the hypothesis that national institutional frameworks generate a unique equilibrium unemployment rate resulting from utility maximization of economic agents – dominated economic policy for decades. Although never universally accepted[7] (see e.g. Tobin, 1972; Solow, 2008), "natural rate theory" interpreted unemployment no longer as a waste of (human) resources, an unused potential production, but rather as the result of an optimization process within a given institutional setting; i.e., as a structural problem. Within this framework, expansionary macroeconomic policy could only create a short-term or in the Lucas rational expectation version no reaction of the real economy[8]; in this theoretical framework, the only lasting effect will be inflation. Equating wages with individual marginal productivity (i.e., with the individual's contribution to the economy) often leads proponents of natural rate theory to interpret rising incomes of top earners to be Pareto efficient. High paid individuals only get what they deserve and what they contribute, whereas low wages imply small contributions. High-wage workers' incomes do not adversely affect the income of low-wage workers, because high wages represent the individual's contribution to production

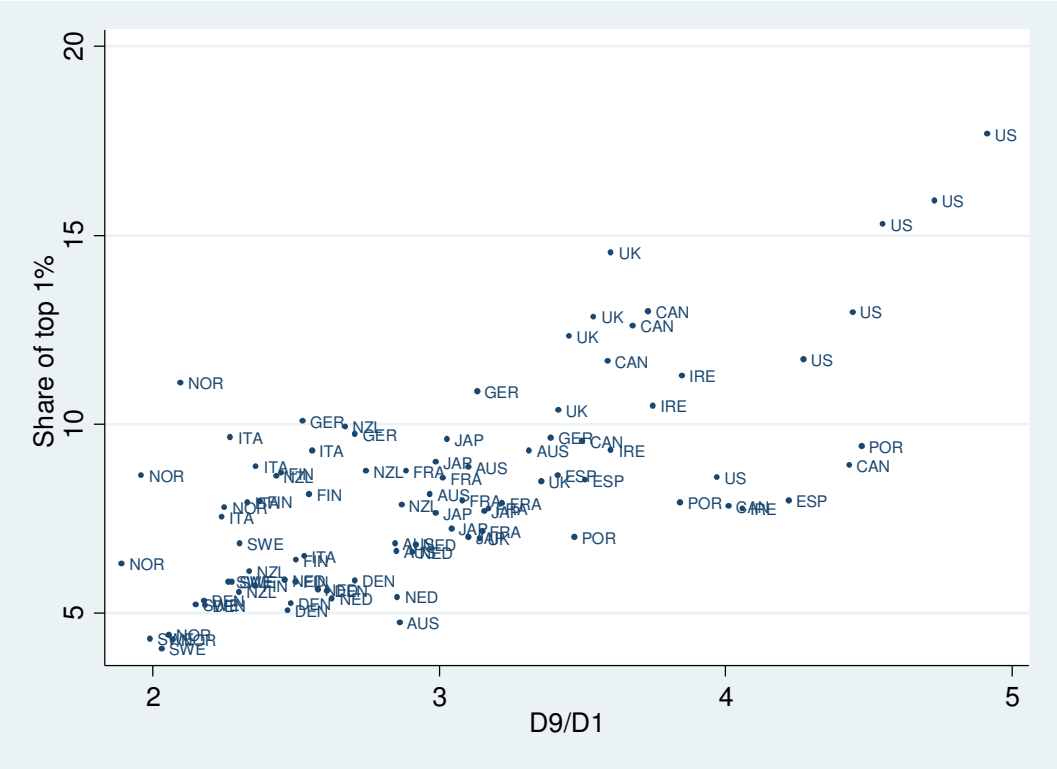
[7] Post-Keynesians have criticized NAIRU as well; see (Stockhammer and Klaer, 2011).
[8] Learning is a key ingredient in the Lucas model (Lucas and Sargent, 1978) but taking learning serious leads to conclusions fundamentally different from that of Lucas (Schettkat and Jovicic, 2017).

(marginal product theory).[9] Consequently, as claimed by Feldstein (1999) and others,[10] an increase of income at the top of the pay scale, even with constant wages at the lower end, should be seen as Pareto efficient. Why not improve the situation of some if others do not have to suffer? On the other hand, if wages reflect marginal productivity, a compressed wage structure deviating from the distribution of productivity is, in this view, costly, as it will exclude workers with lower productivity from employment. Reducing high incomes – directly or through taxes – will frustrate efforts at the top, the pie will shrink, and nobody will benefit. Let the market determine wages, and there will be "full employment" – meaning that actual unemployment is at the "natural rate".

The assumption that wages are determined by marginal productivity loses plausibility if the rise in income is concentrated among the "super stars." The very top of the income ladder has captured a rising share of total pre-tax income. For the United States, Saez's data (2012, webpage) reveals that, in the 2009-2010 recovery, the top 1% received a real income increase of 11.6%, but the income of the bottom 99% stagnated.[11] In general, the top 1% increased its share everywhere, as The World Top Income Database reveals. Figure 3 presents a positive correlation between the top 1% income share and D9/D1 ratio. Although the top 1% share does not necessarily influence D9/D1 ratios, high shares of the top 1% occur in countries that have a wider income distribution mainly. It seems implausible, however, that these incomes and their increases reflect marginal productivity. Dew-Becker and Gordon (2005, 2008) argue that too much emphasis was placed on demand and supply issues to explain the widening wage dispersion in the United States. The increasing wage pressure at the lower end was probably due to declining unionization and shrinking (real) minimum wages, whereas at the upper end of the distribution, peer-group behavior raised the incomes of CEOs and financial managers. Thus, the most important questions is whether wage and income dispersion are actually essential for superior labor market performance.

[9] Stiglitz (2013), said that he wishes the assumptions were true because that would prevent bankers from receiving high bonuses.
[10] Becker and Murphy, 2007; Welch, 1999.
[11] For similar trends in Germany see Bach *et al.,* 2007.

**Figure 3: Relationship between top 1% share in overall income and D9/D1, 1980-2010 [means of 5 year periods]**




*Note:* D9/D1 corresponds to the ratio of 9th decile earnings to 1st decile earnings

*Source:* top 1% income share from The World Top Income Database, D9/D1 OECD data.

Upon comparison of unemployment (employment) trends in Europe (identified as rigid welfare states) and the US (identified as an unregulated market economy), many institutional arrangements ranging from collective bargaining to unemployment benefits came under suspicion of causing unemployment and consequently labor market flexibility and deregulation became the number one recipe for economic policy. Amable (2003) criticizes the practice of insisting on flexible labor markets as one solution for all economies (due to good economic performance of the US), since this ignores the diversity among them and overlooks the disadvantages of this system. However, policy recommendation remained the same. Countries may keep narrow wage dispersion, but they would have to face higher unemployment – the "big trade-off" between equality and efficiency or the "two sides of the coin." In an IMF-paper (Prasad, 2004) Germany's narrow wage structure was identified as the main reason for economic stagnation, and the IMF's World Economic Outlook (2003) predicted huge gains in growth and substantial reductions in unemployment from labor market reforms. The OECD's Jobs Study (1994) was designed according to "natural rate

theory" emphasizing wage and working time flexibility, reducing employment protection, reforming unemployment benefit system etc.[12] Assuming labor supply (or effort) to be highly elastic, the deregulation of European welfare state institutions was claimed to be the springboard for a Great European Job Machine.[13]

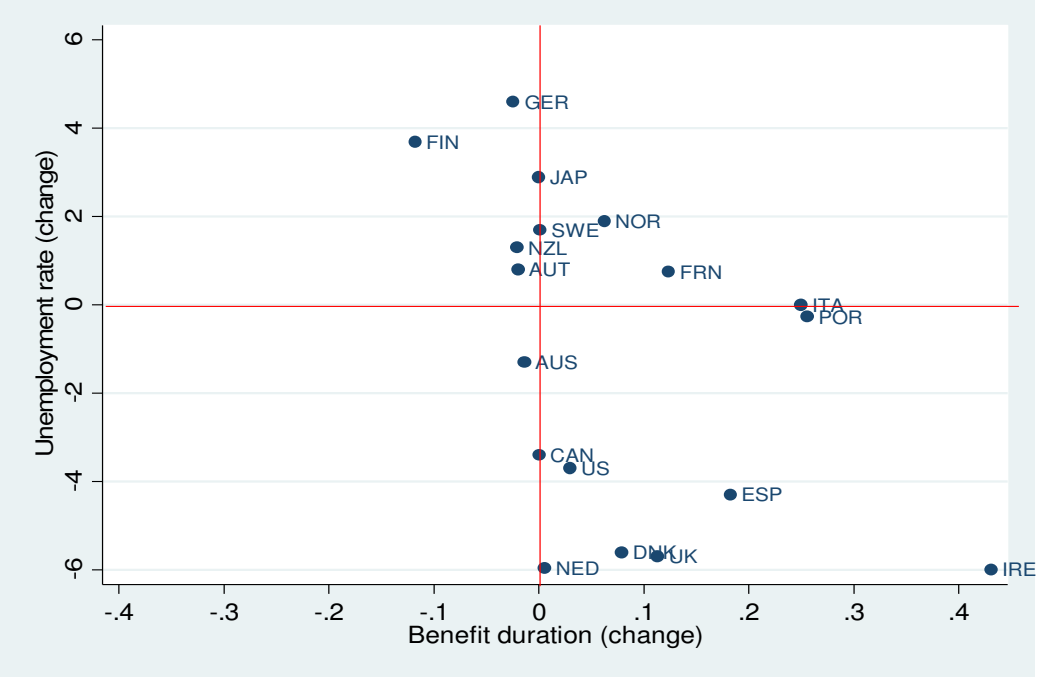
It was claimed that lower tax rates for high-income earners would generate social benefits, because the income elite would raise their efforts, which would result in higher growth, this way also benefiting the lower end of the wage distribution – put money at the top and it will eventually trickle down. Consequently, top marginal income-tax rates fell by about 20 percentage points in the OECD average from 1980 to the mid-2000s (OECD, 2012). In other words, measures mainly based on theoretical deductions from an idealized model became general guidelines for economic policy. "Natural rate theory" and rational expectations were the yardsticks used to evaluate economic policy. Markets were assumed always to perform optimally, if not disturbed by public policy interactions, which should therefore be restricted to a minimum. Also, today, labor market reforms and austerity programs are major ingredients in the recipe for competiveness in EU countries suffering as a result of the banking crisis; i.e. austerity programs, lower wages, and rising inequality.[14]

Although cross-country data comparing the US (where the unemployment rate fluctuated about 6% starting from the 1970s) and many European countries (where unemployment rate rose with every recession without returning to pre-recession levels) was for many years in line with the deductions of natural rate theory; i.e., rising European unemployment remaining at higher levels after every recession and not returning to pre-recession levels is only consistent with the natural rate theory if the higher unemployment rates are interpreted as new equilibria, or in other words, if natural rates of unemployment jumped. How can that be? One possibility is that changes in institutions made unemployment more attractive or hiring less attractive; i.e., through higher benefits, longer durations, and less strict eligibility criteria.[15] Studies could not confirm a positive effect of unemployment replacement rates on unemployment

[12] The Jobs Study also mentions macroeconomic policy, which should be sustainable, i.e., non-inflationary (reform recommendation 1), OECD Jobs Study 1994.
[13] Freeman (2005) showed that the magnitude of this IMF claim was totally implausible.
[14] Austerity programs and cuts in public services have severe consequences if not only monetary incomes but also indirect incomes and in-kind services are taken into account. Lower income households are more affected than higher income households by a reduction in public services (see OECD, 2011).
[15] A Dutch-German comparison showed that the Netherlands were more generous in almost all aspects of unemployment benefits but had substantially lower unemployment rates in the 1990s (Schettkat, 2005).

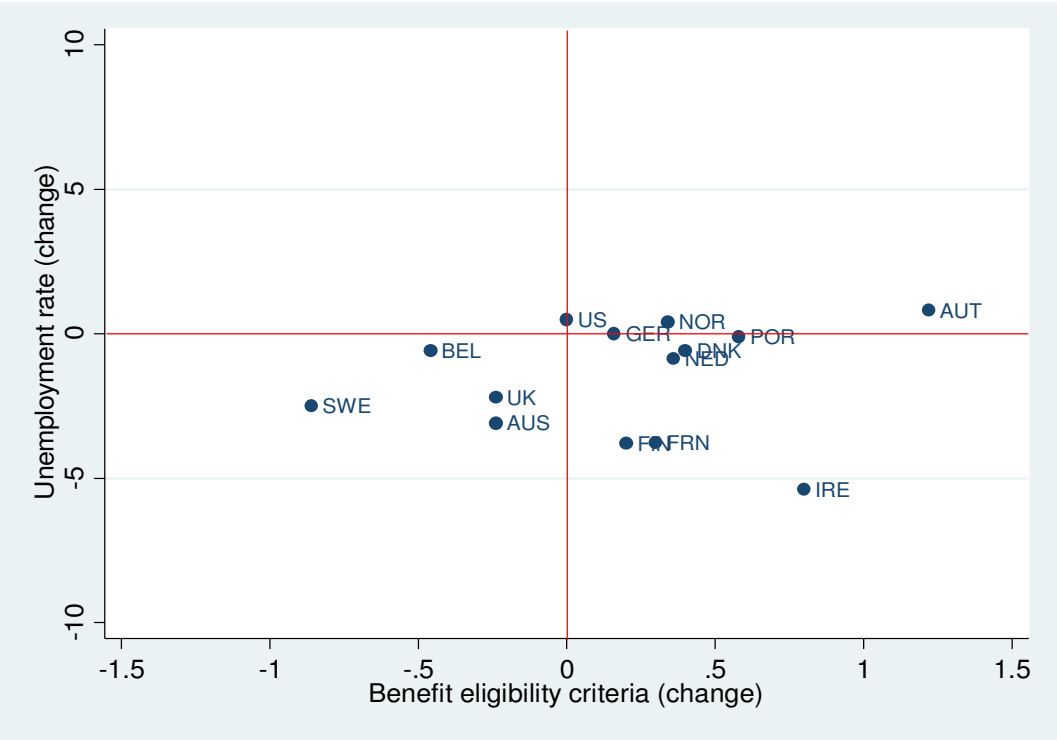
rates. Longer benefit durations seem to affect unemployment rate positively; i.e., raising unemployment rates. Figure 4 displays changes in the unemployment benefits schemes for 21 OECD countries from the mid-1980s to the mid-2000s. According to OECD (Bassanini and Duval, 2006) data, only in Ireland did unemployment benefit duration increase substantially in the 1990s, but during this period, unemployment fell in Ireland. Unemployment support became mostly stricter. Figure 5 shows that unemployment benefit eligibility criteria became stricter in almost all OECD countries in the time period of 1997-2004, which is only consistent with the "natural rate" hypothesis if "natural rate" can jump. Nevertheless, the natural rate hypothesis was accepted without a qualm (Solow, 1998). Macroeconomic causes for persistent unemployment like overly strict monetary policy focusing on inflation in Europe (especially in Germany) preventing labor markets from recovering were almost entirely neglected (see Schettkat and Sun, 2009), although in combination with hysteresis phenomena (Ball, 2009) they can be a powerful explanation for diverging unemployment trends in the US and Europe.

**Figure 4: Changes in unemployment benefit duration and change in unemployment rates (1981-2003)**




*Source:* Benefit duration from Bassanini and Duval, 2006; unemployment rates from OECD

**Figure 5: Changes in strictness of benefit eligibility criteria and change in unemployment rates (1997-2004)**




*Source:* Danish Ministry of Finance; unemployment rates from OECD

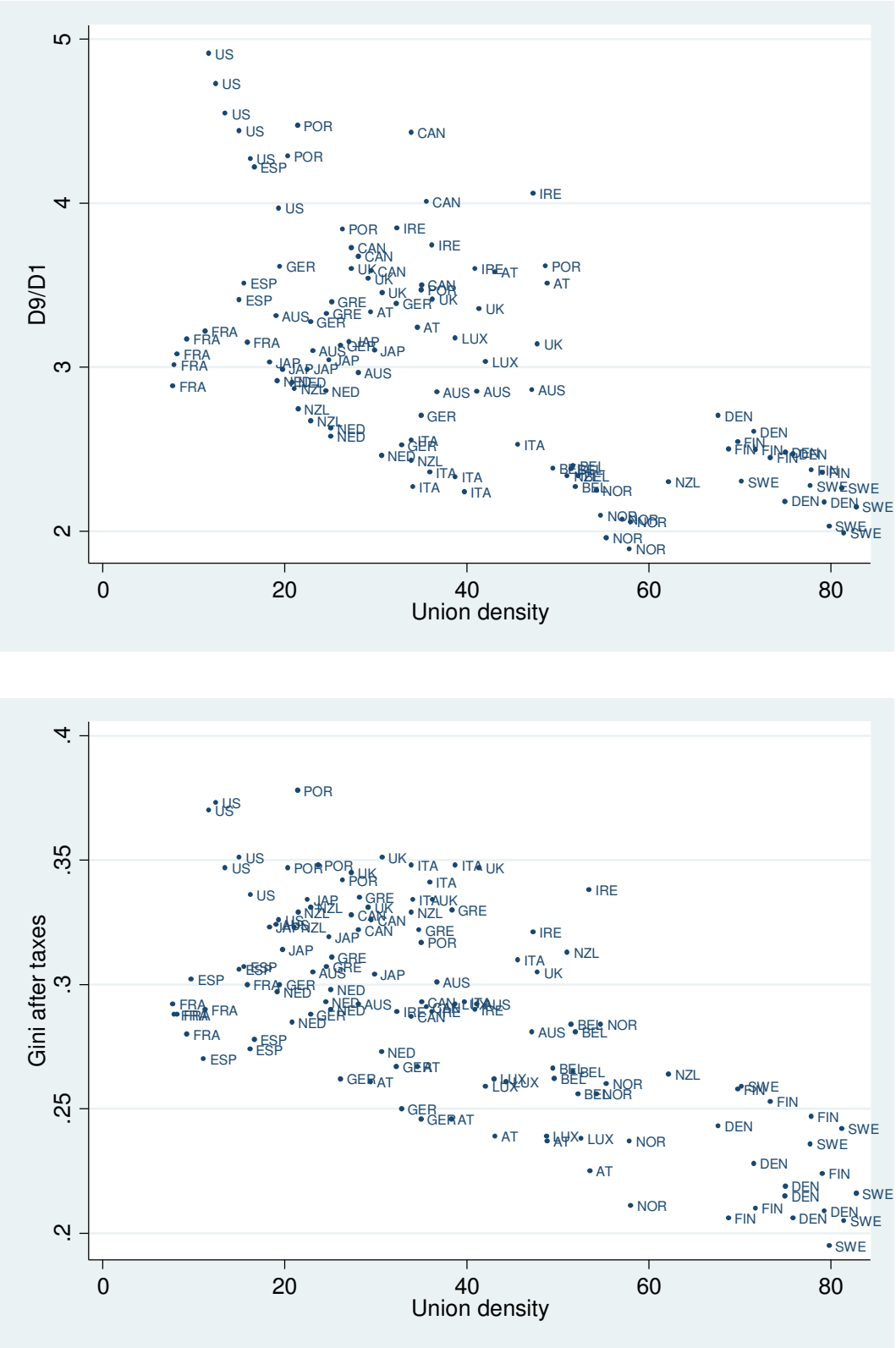
## 2.3 Inequality and Institutional Frameworks

The widely cited paper by Calmfors and Driffill (1988) related unemployment rates to the centralization of wage bargaining.[16] Faced with the fact that, in the 1980s, the US (regarded as decentralized in wage bargaining) and also Scandinavian countries (regarded as centralized in wage bargaining) both achieved comparatively low unemployment rates, Calmfors and Drifill (1988) argued in line with Olson's theory (1982) that decentralized wage bargaining systems achieve a low unemployment equilibrium but that also very centralized bargaining systems can achieve a similarly low unemployment rate. These researchers argue that, in a decentralized bargaining system, unions will not have much power to push up wages whereas they are powerful in a centralized bargaining system, but here, negative macroeconomic effects resulting from overly aggressive wage setting will hit their own constituency (through rising taxes, inflation, and/or unemployment). Therefore, these macroeconomic outcomes are endogenous to the decision making of the centralized union. In a way, a centralized bargaining system simulates the decentralized bargaining system. In the middle of the spectrum, however, unions are powerful but do not endogenize negative macro effects; i.e., here unemployment is high. The result was an inverse u-shape unemployment function, which, however, turned out to be specific for certain periods (Appelbaum and Schettkat, 1996; Freeman, 2005).

However, decentralized and centralized bargaining systems produce substantially different wage distributions. Whatever indicator for the wage bargaining system is used, be it union density, bargaining coverage, or bargaining level, there is a clear negative relationship with inequality. Figure 6 displays negative correlations between union density and two measures of inequality (D9/D1 ratio and Gini coefficient) in the period from 1980-2010.

[16] Earlier, Bruno and Sachs (1985), using a corporatist index of Crouch (1985), argued that corporatist economies responded in a more efficient way to the oil price shocks in the 1970s.

**Figure 6: Relationship between union density and D9/D1, the Gini coefficient after taxes, 1980-2010**




*Source:* OECD database and Data Base on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts, 1960-2011 (ICTWSS) by Jelle Visser, for more details see Jovicic, 2015.

Rather than regarding institutional arrangements as such to cause high European unemployment, Blanchard and Wolfers (1999) argued that adjustments after external shocks (total factor productivity shocks, real interest rates, and labor demand shifts) were slowed by welfare state institutions – such as unemployment compensation, employment protection legislation, tax wedge, bargaining coverage, bargaining level, and union density – prevented Europe's unemployment rates from returning to its pre-recession levels. Although much more plausible than the pure natural rate theory-story, they applied (due to the lack of better information) "fixed institutions." However, institutions changed substantially from the 1980s to the 2000s to less regulation. As Carlin and Soskice observe, institutional change in Germany, for example, fails to explain the rise in unemployment from the mid-1980s to the mid-2000s. Reforming institutions should have lowered rather than increased unemployment in Germany during that period (Carlin and Soskice, 2008).

The varieties of capitalism literature (Hall and Soskice, 2001) go beyond labor market institutions[17] and classify advanced economies into liberal market economies (LME),[18] where coordination is substantially based on market mechanisms and coordinated market economies (CME),[19] which rely to a greater extent on other coordination mechanisms. There is an intense debate about the alternative classifications (Amable, 2000; Kenworthy, 2005), but, taking the mean of institutional variables in the 1980s, 1990s, and the 2000s, Table 1 reveals that LMEs are indeed substantially different from CMEs along the listed institutional dimensions. LMEs are less regulated and labor market institutions are – as expected – more in line with an unregulated market than CMEs. Coverage by collective bargaining is almost twice as high in CMEs; union density, bargaining levels, and consequently the comprehensiveness index show substantially higher values in CMEs. Employment protection and redistribution are less strong in LMEs than in CMEs, but redistribution exists. Union density was in decline everywhere, but the decline was much stronger in LMEs than in CMEs, increasing the distance between the two types. Similarly, the coverage and the level of bargaining fell, especially in LMEs, thus increasing the difference between the two types. Where regulation was reduced, the

[17] The Hall and Soskice approach has been criticized (Amable and Palombarini, 2009) as overly firm based and insufficiently including the political sphere.
[18] LME countries include Australia, Canada, Ireland, New Zealand, the UK, and the US
[19] CME countries include Austria, Belgium, Denmark, Finland, Germany, Japan, Netherlands, Norway, and Sweden. In addition, France, Italy, Greece, Portugal, and Spain are classified as mixed market economies (MME).

LMEs dismantled the institutions more than CMEs, leaving the difference between them to remain or even to grow.

**Table 1: Institutional characteristics of LMEs, CMEs, and MMEs, 1980s, 1990s, 2000s, levels and differences to LMEs**

| Period | Variety of capitalism classfication | Employment protection legislation | Redistribution measure | Union density | Bargaining coverage | Bargaining level | Comprehensiveness index |
|---|---|---|---|---|---|---|---|
| **Means** | | | | | | | |
| **1980s** | **LME** | 0.96 | 1.31 | 41.45 | 53.65 | 2.48 | 161.09 |
| | **CME** | 2.44 | 1.57 | 52.92 | 78.11 | 3.61 | 289.64 |
| | **MME** | 3.33 | 1.31 | 32.69 | 79.83 | 3.12 | 244.74 |
| **1990s** | **LME** | 1.03 | 1.32 | 30.78 | 38.14 | 1.93 | 57.12 |
| | **CME** | 2.38 | 1.52 | 51.37 | 78.47 | 3.34 | 272.78 |
| | **MME** | 3.07 | 1.37 | 27.08 | 80.41 | 3.10 | 246.13 |
| **2000s** | **LME** | 1.11 | 1.12 | 24.07 | 31.21 | 1.70 | 38.54 |
| | **CME** | 2.31 | 1.47 | 45.95 | 77.90 | 3.26 | 263.89 |
| | **MME** | 2.96 | 1.38 | 23.85 | 78.41 | 3.08 | 236.66 |
| **Difference CME, MME minus LME** | | | | | | | |
| **1980s** | **CME** | 1.48 | 0.26 | 11.47 | 24.46 | 1.13 | 128.55 |
| | **MME** | 2.37 | 0.00 | -8.76 | 26.18 | 0.64 | 83.65 |
| **1990s** | **CME** | 1.35 | 0.20 | 20.59 | 40.33 | 1.41 | 215.66 |
| | **MME** | 2.04 | 0.05 | -3.7 | 42.27 | 1.17 | 189.01 |
| **2000s** | **CME** | 1.2 | 0.35 | 21.88 | 46.69 | 1.56 | 225.35 |
| | **MME** | 1.85 | 0.26 | -0.22 | 47.2 | 1.38 | 198.12 |

*Source:* computations are based on various sources; for details see Jovicic, 2015.

LMEs and CMEs also generate substantially different incomes and wage distributions. Inequality is significantly higher in LMEs than in CMEs, as Table 2 reveals. Whatever the observed period is, be it 1980s, 1990s, or 2000s, all inequality measures (Gini coefficients before and after taxation as well as decile ratios and the income share of the top 1%) are substantially higher in LMEs than in CMEs. The difference in the share of the top 1% income between LMEs and CMEs was higher in the 2000s than in the 1980s and 1990s because the share grew mildly in the CMEs but much stronger in the LMEs (Table 2 last column). The difference in LMEs and CMEs for Gini coefficients suggests that CMEs use the tax system to

achieve a higher degree of income equality. It is important to note, that inequality in CMEs is also lower in pretax income. This holds not only for the Gini coefficients (which are based on household income) but also for the decile ratios of wages. The difference between CMEs and LMEs as measured by the D9/D1 ratio remained roughly constant (lower part of Table 2) but both became more unequal since the 1980s.

**Table 2: Inequality indicators of LMEs, CME and MME economies, 1980s, 1990s, 2000s, level, and difference to LME**

| Period | Variety of capitalism classification | Gini coefficient before taxes | Gini coefficient after taxes | D9/D1 | D9/D5 | D5/D1 | Top 1% share |
|---|---|---|---|---|---|---|---|
| **Means** | | | | | | | |
| **1980s** | **LME** | 0.40 | 0.30 | 3.35 | 1.78 | 1.87 | 7.37 |
| | **CME** | 0.36 | 0.23 | 2.43 | 1.62 | 1.48 | 6.14 |
| | **MME** | 0.40 | 0.28 | 3.04 | 1.88 | 1.62 | 7.53 |
| **1990s** | **LME** | 0.43 | 0.32 | 3.46 | 1.86 | 1.84 | 10.24 |
| | **CME** | 0.39 | 0.26 | 2.54 | 1.67 | 1.51 | 6.87 |
| | **MME** | 0.42 | 0.31 | 2.74 | 1.75 | 1.56 | 8.19 |
| **2000s** | **LME** | 0.44 | 0.33 | 3.65 | 1.98 | 1.83 | 11.93 |
| | **CME** | 0.40 | 0.27 | 2.74 | 1.73 | 1.57 | 7.66 |
| | **MME** | 0.43 | 0.31 | 3.28 | 2.05 | 1.59 | 8.91 |
| **Difference CME, MME minus LME** | | | | | | | |
| **1980s** | **CME** | -0.04 | -0.07 | -0.92 | -0.16 | -0.39 | -1.23 |
| | **MME** | 0.00 | -0.02 | -0.31 | 0.10 | -0.25 | 0.16 |
| **1990s** | **CME** | -0.04 | -0.06 | -0.92 | -0.19 | -0.33 | -3.37 |
| | **MME** | -0.01 | -0.01 | -0.72 | -0.11 | -0.28 | -2.05 |
| **2000s** | **CME** | -0.04 | -0.06 | -0.91 | -0.25 | -0.26 | -4.27 |
| | **MME** | -0.01 | -0.02 | -0.37 | 0.07 | -0.24 | -3.02 |

*Source:* computations are based on the OECD, Schumpeter School International Comparative Institutional Data Base (Jovicic, 2015).

The equality-efficiency trade-off hypothesis suggests that countries restricting wage dispersion and redistributing income should achieve lower growth rates. If one accepts growth rates in GDP per capita as an efficiency measure, CMEs should under the trade-off hypothesis show lower growth rates than LMEs. However, in LMEs as in CMEs, the average growth rate

of GDP per capita (computed as the first difference of logs of GDP per head of population) is around 10% and seems to be insensitive to the institutional setting. In a regression of GDP growth rates including a dummy for CMEs, the coefficient of the CME-dummy is insignificant. Institutions seem to affect equality but their impact on efficiency is insignificant.

In general, institutions seem to produce substantially different wage and income distributions. Table 3 displays correlation coefficients between various institutional variables and inequality measures for 21 OECD countries in the time period from 1980-2010. There is a clear significantly negative correlation between all institutional variables and the displayed inequality measures; institutional variables thus have a severe impact on the distribution. The redistribution measure is also negatively correlated with inequality measures; i.e. a high degree of redistribution leads to lower inequality (not only with the Gini coefficients of after tax income but also with pre-tax income). Countries that have stronger labor market institutions show higher redistribution and a lower level of income (Gini coefficients) and wage inequality (decile ratios). However, reducing labor market institutions remained the main policy recommendation, although this was expected to have a negative impact on distribution. These data confirm what has been observed before (Schettkat, 2003; Freeman, 2007), that unionization and coverage by collective bargaining and comprehensiveness of bargaining correlate negatively with measures of inequality.

**Table 3: Correlation matrix for institutional and inequality indicators, 1980-2010**

| Indicator | Employment protection regulation | Redistribution measure | Union density | Bargaining coverage | Bargaining level | Comprehen-siveness index |
|---|---|---|---|---|---|---|
| **Gini coefficient before taxes** | -0.077 | -0.323*** | -0.495*** | -0.163 | -0.264*** | -0.222 |
| **Gini coefficient after taxes** | -0.235 | -0.572*** | -0.705*** | -0.560*** | -0.550*** | -0.598*** |
| **D5/D1** | -0.456*** | -0.495*** | -0.546*** | -0.581*** | -0.538*** | -0.631*** |
| **D9/D1** | -0.264*** | -0.514*** | -0.635*** | -0.535*** | -0.479*** | -0.569*** |
| **D9/D5** | 0.054 | -0.383*** | -0.571*** | -0.319*** | -0.284*** | -0.342*** |
| **Top 1%share** | -0.476*** | -0.442*** | -0.538*** | -0.631*** | -0.568*** | -0.634*** |

*Notes:* *** = significant at 1%

*Source:* computations are based on various sources, for details see (Jovicic 2015)

The redistribution measure correlates negatively with all distribution measures; i.e. a higher degree of redistribution occur where inequality is lower from the beginning. If redistribution were used to correct the most unequal labor market outcomes, a positive correlation between the redistribution measure and inequality variables should occur. Instead, we find generally negative correlation coefficients of the redistribution measure with all inequality variables, indicating that economies that are already more equal also emphasize redistribution.

Past empirical research often failed to identify the responsibility of labor market institutions for major differences in transatlantic employment trends (e.g., Glyn et al., 2006; Howell et al., 2007; Freeman, 2007; Howell and Huebler, 2001; Schettkat, 2005 and 2008)[20]. Baker *et al.* (2002) summarize several cross-country studies investigating the impact of institutions on unemployment often based on the Bassanini and Duval (2006) or Nickell and Bell (1996) data. The studies present a mixed picture and show a wide variation of coefficients. It was impossible to find evidence for a correlation between labor market institutions and unemployment, and there were no obvious links in patterns of deregulation and unemployment-rate trends. The studies, however, do not investigate the impact of inequality and wage distribution on labor market performance. Several studies, however, investigated the impact of wage distributions on employment. As the OECD (2004) states, micro-econometric studies focusing on wage compression in Europe (the main factor used to explain high European unemployment) failed to establish evidence that wage compression had caused labor market problems (the OECD cites Nickell and Bell 1996; Card *et al.,* 1996; Krueger and Pischke, 1997; Freeman and Schettkat, 2001). But the same OECD study concluded that, nevertheless, rising wage inequality in the US was the market response to demand shifting away from less skilled labor and that this would also be an effective cure for Europe. In Europe, minimum wages (statutory, negotiated, or implied by social assistance and unemployment benefits) and generous unemployment benefits had prevented wage inequality from rising, but the result was high and increasing unemployment. Rather than casting doubt on the "natural rate theory", however, this led to the neglect of differences in macro-economic policies and corresponding institutions.[21] Flow and duration analysis of unemployment and vacancies in the US and Germany showed great mobility, suggesting that Germany was

[20] Heckman *et al*., (2006) fiercely criticize the revised OECD view, arguing that the analysis of aggregate data is flawed and that the unemployment rate is not the right measure, because corporatist countries hide unemployment in active labor market programs, early retirement, etc.
[21] (Solow, 2008; Schettkat and Sun, 2009)

suffering from aggregate demand deficiency rather than labor market rigidity (Schettkat, 1992; Hein and Truger, 2005). But labor market reforms and austerity measures became the guiding principle in European policies in response to the "great recession".

There seems to be a clear pattern between institutional characteristics and inequality. The major question thus is what the relationship is between inequality and efficiency; i.e., labor market performance. According to natural rate theory, one expects a low degree of inequality – especially if redistribution is high – to negatively affect labor market performance indicators.

## 2.4 Data

Naturally, country studies rely on few observations, and aggregate analysis using countries as units may hide other substantial differences than the one included in the analysis. The wage or income distribution may be narrower in one country than in another, because the dispersion of skills is lower. For example, Sweden is known for its comparatively narrow wage distribution, but Sweden also has a very narrow skill distribution (Devroye and Freeman, 2001). Therefore, a narrower wage and income distribution in Sweden is hardly unexpected. The longitudinal aspect in panel data can help with such issues. If, e.g., the Swedish skill distribution remains roughly constant, the impact of a narrow skill distribution on the wage and income distribution can be captured in country-fixed effects. To control for the effect of unobserved variables, the following analysis exploits a panel data set derived mainly from OECD data but also from other sources (see Jovicic, 2015 for details). The panel consists of 21 highly industrialized OECD[22] countries during the period 1980-2010.[23] Thus, we exploit the cross-sectional as well as the longitudinal information in the data. Only some data is available on an annual basis. Information on equality and some institutional characteristics, for example, is less frequently available. Moreover, information on institutional characteristics is likely to demonstrate little annual change. Therefore, following other researchers (e.g., Baker et al., 2002; Bertola et al 2001; Blachard and Wolfers, 1999; Nickell, 1997) we gathered means over 5-year periods, which resulted in six different time periods (1981-1985, 1986-1990, 1991-

[22] OECD countries included are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Germany, Italy, Ireland, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, the United Kingdom and the United States.

[23] Because not all data were available for every country and year

1995, 1996-2000, 2001-2005, and 2006-2010). In addition, using the means of 5-year periods reduces autocorrelation problems occurring in annual data.[24] Since not all data were available for all countries at all times, the panel is unbalanced.

Unemployment rates, although the most widely used labor market indicator, are influenced by many institutional variables such as replacement rates, eligibility durations, pension systems and others more, which limit the comparability between countries and periods. In addition, changes in the definition of unemployment –usually undertaken to improve the unemployment rate- affect national rates strongly. The OECD data, however, is based on so-called internationally comparative unemployment rates based on survey data –rather than administrative data more strongly affected by national definitions- applying the ILO-definition.[25] To achieve a more comprehensive picture of the labor market situation less sensitive to national idiosyncrasies, we used as dependent variables (aside from unemployment rates[26]) employment-population rates and hours worked per head of population (18-65). Similarly, we used several indicators representing institutions and inequality as independent variables. Data on institutional characteristics is limited especially for longer time periods. To represent institutions, we relied on the variables listed in section 3: employment protection legislation, union density, coverage by collective bargaining, the level of collective bargaining as well as the comprehensiveness index calculated as the product of the last two variables (see Schettkat, 2003). We also constructed a measure for the strength of redistribution in a country calculated as the ratio of the Gini coefficient before taxes divided by the Gini coefficient after taxes. Values of this redistribution measure above 1 indicate less inequality after taxation, values below 1 indicate more inequality after taxation. According to conventional reasoning, a high degree of redistribution should discourage high wage labor supply because some income is taxed away, and low wage labor supply because transfers are

[24] In almost all cases in which annual data were available for inequality measures, the error terms displayed high autocorrelation when labor market variables (see below) were regressed on inequality. The Durbin-Watson d deviated substantially from 2 as expected under the H0 for no autocorrelation. The table with regressions is available from the authors on request.

[25] Unemployment rate is calculated as the percentage of unemployed persons in the total labor force. The unemployed comprise all persons of working age who were: a) without work during the reference period, i.e. were not in paid employment or self-employment; b) currently available for work, i.e. were available for paid employment or self-employment during the reference period; and c) seeking work, i.e. had taken specific steps in a specified recent period to seek paid employment or self-employment. The ILO defines all persons of working age who report working for at least one hour in the survey week or day as employed (paid employment or self-employment).

[26] ILO has also adopted different changes to the definition in unemployment more times since 1981. For more details on the relevant resolutions and guidelines adopted by the International Conference of Labour Statisticians, and the changes to the definitions and labor statistics, see ILO (2013)

available with little or no work. Thus, the redistribution measure may capture "the big tradeoff."

For inequality, we used Gini coefficients before and after taxes as well as decile ratios (D9/D1, D9/D5, D5/D1). The Gini coefficients were computed on the basis of household incomes weighted with equivalence scales and are thus influenced by the household size, its structure and labor market participation respectively. For example, if a higher share of women is working, it may reduce the Gini coefficient based on household income, but this may not reflect a more equal distribution of wages but rather the labor supply effect. The Netherlands, for example, experienced a decline in pre-tax inequality, measured by the Gini coefficients of household incomes despite rising wage dispersion (D9/D1), suggesting that the decline in pre-tax inequality measured by the Gini coefficient of household income is related to rising female labor force participation in the Netherlands (Schettkat and Yocarini, 2003). Therefore, the more direct measure for inequality that potentially affects labor market outcomes is the decile ratio of wages.

Table 4 displays the correlation matrix of inequality measures for levels as well as for first differences. For levels the Gini coefficients before and after taxes correlate highly with each other but much less with the decile ratios of wages, indicating the distinction between inequality among household incomes and wages mentioned above. The decile wage ratios of the lower (D5/D1) and upper (D9/D5) end of the wage scale both correlate mildly with each other, i.e. countries with a wide dispersion at the lower end of the wage scale (D5/D1) do not necessarily show a wide dispersion at the upper end (D9/D5). Since the correlation of both measures is high with the overall decile ratio D9/D1, overall dispersion seems to be either concentrated at the lower or the upper end of the wage distribution. Indeed, Table 2 (lower panel) reveals a larger difference between LMEs and CMEs in the D5/D1 ratio (i.e. the lower end of the wage distribution) than in the D9/D5 ratio (i.e. the upper end of the wage distribution). Intuitively one may expect the correlation between the D9/D5 ratio and the share of the top 1% to correlate highly but actually the income concentration of the very top-earners is hiding behind the D9/D5 ratio. The income concentration within the top decile was only discovered when Atkinson, Picketty and Saez analyzed the within distribution among the top earner. The correlations of the level data (top part of Table 4) are significant for all pairs,

but the first differences show a more diverse pattern. The coefficient of correlation for changes in the Ginis before and after taxes are significant, as are the pairs of the decile ratios.

**Table 4: Correlation matrix of inequality measures (levels and first difference of logs)**

| Variable | Gini coefficient before taxes | Gini coefficient after taxes | D9/D1 | D9/D5 | D5/D1 | Top 1% |
|---|---|---|---|---|---|---|
| **Levels** | | | | | | |
| **Gini coefficient before taxes** | 1 | 0.708*** | 0.428*** | 0.462*** | 0.281*** | 0.558*** |
| **Gini coefficient after taxes** | 0.708*** | 1 | 0.606*** | 0.552*** | 0.497*** | 0.645*** |
| **D9/D1** | 0.428*** | 0.606*** | 1 | 0.849*** | 0.867*** | 0.690*** |
| **D9/D5** | 0.462*** | 0.552*** | 0.849*** | 1 | 0.480*** | 0.543*** |
| **D5/D1** | 0.281*** | 0.497*** | 0.868*** | 0.480*** | 1 | 0.640*** |
| **Top 1%** | 0.558*** | 0.645*** | 0.690*** | 0.543*** | 0.641*** | 1 |
| **First differences** | | | | | | |
| **Gini before taxes** | **1** | 0.572* | 0.082 | 0.076 | 0.040 | 0.167 |
| **Gini after taxes** | 0.572*** | **1** | 0.261 | 0.266 | 0.170 | 0.189 |
| **D9/D1** | 0.082 | 0.261** | **1** | 0.910*** | 0.325*** | -0.092 |
| **D9/D5** | 0.076 | 0.266** | 0.910*** | **1** | 0.675*** | -0.016 |
| **D5/D1** | 0.040 | 0.170 | 0.325*** | 0.675*** | **1** | 0.070 |
| **Top 1%** | 0.167 | 0.189 | -0.092 | -0.016 | 0.070 | **1** |

*Notes:* *** = significant at 1%, ** = significant at 5% , * significant at 10%

*Source:* computations based on OECD data, for details see Jovicic 2015.

## 2.5 Econometric specification

Earlier studies[27] investigating the impact of institutional variables on labor market performance usually regressed unemployment rates on institutional measures, sometimes

[27] Nickell, 1997; Elmeskov et al., 1998; Nickel et al., 2005; Blanchard and Wolfers, 1999; Bassanini and Duval, 2006; Howel et al., 2007, etc.

using interactions of institutions and macroeconomic trends. These studies are usually based on level data; i.e., the unemployment rate was regressed on the indicators approximating country-specific institutions (often the Bassanini and Duval, 2006; Nickell and Bell, 1997 data). The periods covered the range from the 1960s up the mid and late 1990s. The regressions of labor market performance (measured by unemployment rates or employment to population rates) in earlier studies have the following principle form:

$$(1)\ labor\ market\ indicator_{it} = \alpha 0 + \Sigma \alpha 2_{i.t}\, institution_{i.t} + \Sigma \alpha 3_t\, dt + \Sigma \alpha 4_i\, dc_i + u_{it}$$

Where labor market indicator = unemployment, employment population rates, hours worked per head of population, institution = institutional characteristics, dt = dummies for the periods, dc = dummies for countries. i = country index. t = time index.

We replicated earlier studies; i.e., we estimated the level of unemployment as a function of institutional characteristics, country and period controls (Equation 1). We also performed regression including growth rates of GDP and inequality measures (Equation 2):

$$(2)\ labor\ market\ indicator_{it} = \alpha 0 + \alpha 1_{i,t} \Delta ln\ GDP_{it} + \Sigma \alpha 2_{i.t}\, (institutions_{i.t}) + \alpha 3_{i.t}\, (inequality_{i,t}) + \Sigma \alpha 4_t\, dt + \Sigma \alpha 5_i\, dc_i + u_{it}$$

Where labor market indicator = unemployment, employment population rates, hours worked per head of population, GDP = gross domestic product per head of population, inequal = inequality measure = Gini coefficients before and after taxation, decile ratios of wages (D9/D5, D9/D5, D5/D1), the share of the top 1% in overall income, institution = redistribution measure, employment protection legislation, union density, bargaining coverage, bargaining level and comprehensiveness index, dt = dummies for the periods, dc = dummies for countries. i = country index. t = time index. Δ=first difference (here between averages of 5 year periods).

Labor market performance (measured by unemployment rates, employment population rates, hours worked per head of population) may differ between countries for various reasons in addition to the potential effects of institutions and inequality. If a causal relationship between institutional and inequality variables on the one side and labor market performance on the other side actually exists, changes in institutions and inequality are expected to cause changes in labor market performance. With a difference-in-difference approach, where country-

specific differences in labor market performance are regressed on country-specific differences in the relevant institutional and inequality measures, identification of the effects requires other potential influences on labor market performance to remain unchanged; we use country dummies to control for (fixed) unobserved effects. The overall trend in labor market performance is controlled for by year dummies; i.e. the assumption is that period-effects affect all countries similarly.

$$(3)\ \Delta(\text{labor market indicator}_{it}) = \alpha 0 + \alpha 1 \Delta \ln GDP + \alpha 2_{i.t}\ \Sigma\Delta(\text{instituions}_{i.t}) + \alpha 3_{i.t}\ \Delta(\text{inequality}_{i.t}) + \Sigma\, \alpha 4_t\, dt + \Sigma\, \alpha 5_i\, dc_i + u_{it}$$

Where labor market indicator = unemployment, employment population rates, hours worked per head of population, GDP = gross domestic product per head of population, inequal = inequality measure, Gini coefficients before and after taxation, decile ratios of wages (D9/D5, D9/D5, D5/D1), the share of the top 1% in overall income, institution = redistribution measure, employment protection legislation, union density, bargaining coverage, bargaining level and comprehensiveness index, dt = dummies for the periods, dc = dummies for countries. i = country index. t = time index. Δ=first difference (here between averages of 5 year periods).

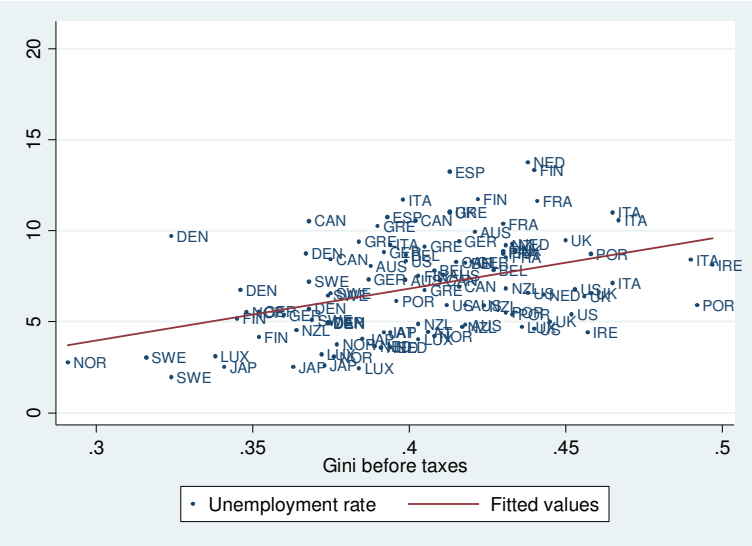
## 2.6 Institutions, inequality, and labor market performance

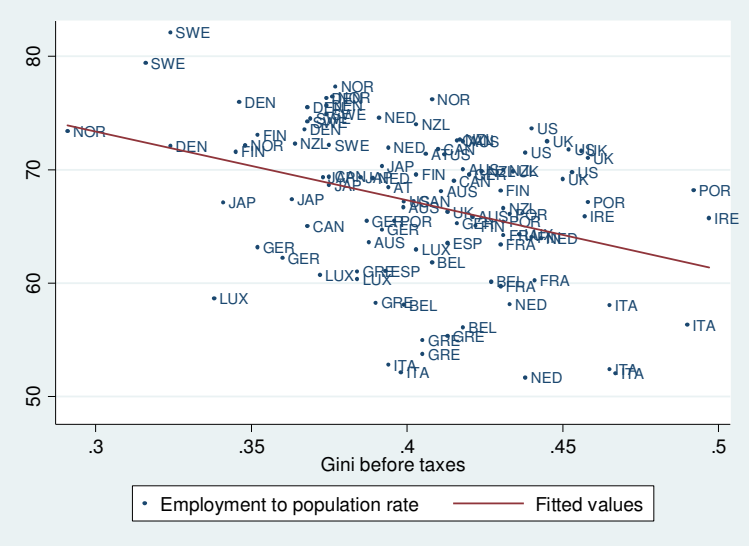
### 2.6.1 Levels of unemployment rates, employment-to-population rates, and hours worked per head of population

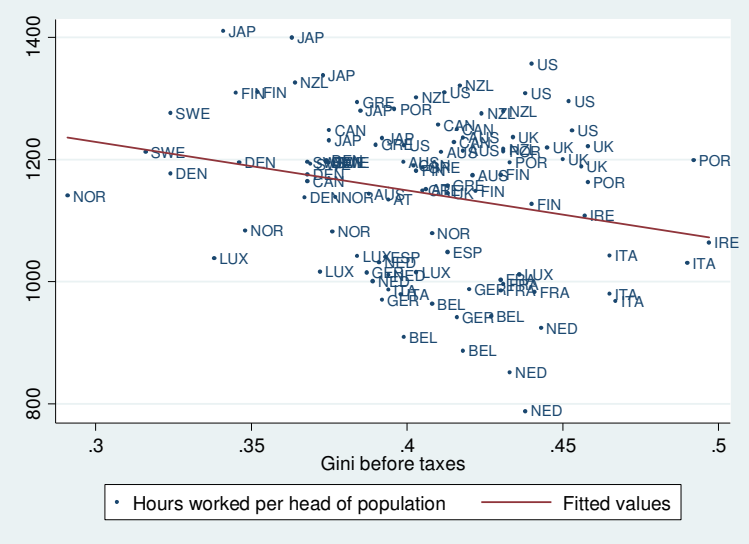
Figure 7 shows scatter diagrams for unemployment rates, employment-to-population rates, hours worked per head of population, and inequality measured by the Gini coefficient before taxes from the 1980s to 2010. At first glance, these diagrams seem to contradict the big tradeoff view: unemployment rates are higher where inequality is higher, employment-to-population rates and hours worked per head of population are lower where inequality is higher. Rather, the data suggest that a higher degree of inequality is promoting employment-to-population rates, hours worked, and reduce unemployment rates. However, first glances may be misleading, and we analyze the relationship more carefully using regression analysis of levels and also of first differences. If a relationship between two variables is causal, changes in the independent variables are expected to cause change in the dependent variables. The advantage of longitudinal or panel data is that changes in institutions within one country

can be analyzed and/or other variables can be explicitly or implicitly controlled for. One such variable in our context may be GDP trends, whereas other variables (such as culture) we assume to be constant; i.e. captured by the fixed-country effects.

**Figure 7: Unemployment rates, employment-to-population rates, hours worked per head of population and inequality (Gini coefficients before taxation)**




*Source:* OECD database

Unemployment rates show much higher volatility than either employment-to-population rates or hours worked per head of population. The standard deviation of the relative changes in unemployment rates (the first difference of the logs) in our sample is 0.30, whereas it is 0.04 for employment-to-population rates and for hours worked per head of population, similarly for the maximum changes, which are 8 (employment-to-population rates) to 9 (hours worked) times higher than for unemployment rates. Changes in the unemployment rates of 50% or more are not common, but they happen. Such unemployment shocks are hardly caused by institutional features, which can change labor markets over a certain period but not in shock waves. In Finland, unemployment rates more than doubled between the means of five-year periods from 1986-1990 to 1991-1995. This was related to the breakdown of demand from the Soviet Union in Finland. Germany exhibited a data problem in the same time period due to the unification. Exclusion of these two extreme data points leads to the results presented in Tables 5 and 6.

Table 5 and 6 provide an overview of models estimated for unemployment rates, employment to population rates, and hours worked per head of population. The columns labeled 1 to 6 in Table 5 show our replications of earlier estimates; i.e., labor market indicators are regressed on institutional characteristics as well as country and time controls (in line with the model in Equation 1). The positive sign of the redistribution measure loses its significance if GDP growth rates are included (Columns 3 and 4), although GDP growth seems not to affect unemployment rates significantly. Employment protection legislation is significant in some cases but with the "wrong" sign; i.e., lowering unemployment rates rather than raising them. At the 5% level, none of the other institutional variables – union density, bargaining coverage, bargaining level as well as comprehensiveness index substituting bargaining coverage and bargaining level in columns 2 and 4 – significantly affects unemployment rates. Regressing employment-to-population rates and hours worked per head of population shows partly reducing effects of union density, but the significant negative effect of redistribution disappears when growth rates of GDP are included in the models (Columns 2 & 4-10 of Table 5).

Institutions seem not to affect labor market performance systematically, which is in line with the conclusion by Baker et al. (2002), who summarized the results of several former studies.

The coefficients of the institutional variables remain insignificant if GDP growth rates (models in Columns 3 and 4 of Table 5) are included.

When including inequality measures, the institutional variables affect unemployment rates in surprising ways: employment protection legislation occurs with lower unemployment rates across the models in Table 5. This is rely unexpected for theories explaining Europe's unemployment as a hiring problem (e.g., Flanagan, 1988).

The inequality measures – Gini coefficient before taxes, Gini coefficient after taxes as well as the top-1-income share – are occurring in higher rather than lower unemployment rates. However, as mentioned above, the Gini coefficients refer to (weighted) household income; i.e., reverse causation may be important in this case. If unemployed workers find jobs, this will lift the income of their households and may reduce inequality, which would be consistent with the positive coefficient. Using hours worked per head of the population as an independent variable again shows significantly positive effects; i.e., more strict employment protection legislation seems to promote rather than discourage hours per head of population, which is the product of participation in employment (employment-to-population rates) and their actual hours worked. For employment population rates, the regressions show compatible coefficients: higher GDP growth rates occur where employment population rates are significantly higher, and bargaining levels seem to reduce unemployment rates and raise employment-to-population rates. The amount of redistribution (the redistribution measure) is significant in some regressions but not in others. The decile ratios (D9/D1, D9/D5, D5/D1), which may better relate to labor markets than the Gini coefficients (see discussion above) turn out to be insignificant in all regression models displayed in Table 5.

In summary, the replication of the cross-country analysis of unemployment rates confirm the general findings of former studies: differences in institutions hardly explain the cross-country differences in unemployment rates, employment-population rates, and hours worked. On the contrary, employment protection legislation seems not to have the destructive employment effects as is often claimed. Employment protection legislation occurs with higher employment and lower unemployment rates, just the reverse of proposals suggesting deregulation of

markets. Also higher inequality, as measured with the Gini coefficient before and after taxation, occurs with lower employment and higher unemployment rates.

### 2.6.2 First differences, changes

Table 6 displays the results of regressions of first differences of unemployment rates, employment to population rates, and hours worked per head of population on first differences in institutional variables and inequality measures including controls (country and period effects). If institutions and inequality cause unemployment rates, employment-to-population rates and hours worked per head of population to change, first differences between the 5-year periods seem to provide better proof of the effects than the regression on levels of the labor market indicators discussed above in Section 2.6.1.

The most important variable affecting changes in unemployment (employment measures respectively) is GDP growth. One may argue that aggregate economic activity (measured by growth rates of GDP) is endogenous to the institutional setup and the distribution in an economy. The empirical evidence, however, shows substantial variation in growth rates across institutional characteristics, and the insignificant differences of growth rates between LMEs and CMEs (see Section 2.3) suggests that growth rates do vary systematically with the institutional setup. We therefore use growth in GDP as an independent variable in the analysis. The distribution measure, which seems to affect the independent variable significantly, is the top 1% income share. Here, however, the sign is positive for unemployment rates; i.e., the reverse of the two-sides-of-the-coin metaphor, according to which one should observe either rising inequality or rising unemployment. The inequality measures – Gini coefficients before taxes and Gini coefficients after taxes – are occurring with higher rather than lower unemployment rates; however, this result is insignificant. The D5/D1 ratio seems to affect hours worked, albeit only with low significance. All the other decile ratios are insignificant in all specifications.

**Table 5: Results of regression analysis: unemployment rates, employment-to-population rates, hours worked regressed on institutions, inequality and GDP per capita growth rates, 1980-2010.**

| VARIABLES | Unemployment rate | | | | | | | | | | Employment to population | | | | | | | | | | Hours worked per head of population | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10 |
| GDP per capita growth rate | | | - | - | - | - | - | - | - | - | | | + | + | + | + | + | + | + | + | | | + ** | + ** | + * | + * | + * | + * | + * | + |
| Redistribution measure | + ** | + *** | + | | + | + *** | + | + | + | + | - * | - * | + | - | + | - | - | - | - | - | - *** | - *** | - | - | - | - * | - | - | - | - |
| Employment protection legislation | - ** | - * | - *** | - ** | - ** | - ** | - ** | - ** | - *** | - ** | + | + * | + * | + * | + | + | + * | + * | + * | + | + *** | + *** | + *** | + *** | + *** | + *** | + *** | + *** | + *** | + *** |
| Union density | + | + * | + * | + | + ** | + ** | + | + | + | + * | - * | - ** | - | - | - ** | - ** | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Bargaining coverage | - | | - | | | | | | | | + | | + | | | | | | | | + | | + ** | | | | | | | |
| Bargaining level | - | | - | | | | | | | | + ** | | + | | | | | | | | + * | | + | | | | | | | |
| Comprehensiveness index | | - * | | - * | - ** | - ** | - | - * | - | - * | | + * | | + | + ** | + * | + | + | + | + | | + | | + | + * | + * | + | + | + | + |
| Gini coefficient before taxes | | | | | + *** | | | | | | | | | | - *** | | | | | | | | | | - *** | | | | | |
| Gini coefficient after taxes | | | | | | + *** | | | | | | | | | | - *** | | | | | | | | | | - *** | | | | |
| D9/D1 | | | | | | | + | | | | | | | | | | + | | | | | | | | | | + | | | |
| D9/D5 | | | | | | | | - | | | | | | | | | | + | | | | | | | | | | + | | |
| D5/D1 | | | | | | | | | + | | | | | | | | | | + | | | | | | | | | | + | |
| Income share of top% | | | | | | | | | | + | | | | | | | | | | - | | | | | | | | | | - * |
| Country dummies | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Time dummies | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Observations | 90 | 90 | 77 | 77 | 77 | 77 | 76 | 76 | 76 | 67 | 90 | 90 | 77 | 77 | 77 | 77 | 76 | 76 | 76 | 76 | 88 | 88 | 76 | 76 | 76 | 76 | 76 | 76 | 75 | 66 |
| R-squared | 0.6 | 0.6 | 0.7 | 0.7 | 0.8 | 0.8 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |

*Notes:* *** p<0.01, ** p<0.05, * p<0.1.

*Notes:* GDP per capita growth rates were computed as the first differences of logs of GDP per head of population.

*Source:* computations based on various sources, for details see (Jovicic 2015).

**Table 6: Results of regression analysis: first differences in unemployment rates, employment-to-population rates, hours worked regressed on first differences in institutions, inequality, and GDP per capita growth rates, 1980-2010.**

| VARIABLES | Unemployment rate | | | | | | | | | | Employment to population | | | | | | | | | | Hours worked per head of population | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| GDP per capita growth rate | | | -*** | -*** | -*** | -*** | -*** | -*** | -*** | -*** | | | +*** | +*** | +*** | +*** | +*** | +*** | +*** | +*** | | | +*** | +*** | +*** | +*** | +*** | +*** | +** | +*** |
| Redistribution measure | + | + | + | + | + | + | + | + | + | + | - | - | + | - | + | - | - | + | + | + | - | - | - | - | - | - | - | - | - | - |
| Employment protection legislation | + | + | + | - | - | - | - | - | - | + | - | - | - | + | + | + | + | + | + | - | - | - | + | + | + | + | + | + | + | - |
| Union density | - | + | - | + | + | + | + | + | - | + | + | - | + | - | - | - | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| Bargaining coverage | + | | + | | | | | | | | - | | -* | | | | | | | | -* | | -** | | | | | | | |
| Bargaining level | -** | | -** | | | | | | | | + | | + | | | | | | | | + | | + | | | | | | | |
| Comprehensiveness index | | -** | | -** | -** | -** | -** | -** | -** | -** | | + | | + | + | + | + | + | + | + | | + | | + | + | + | + | + | + | + |
| Gini coefficient before taxes | | | | | + | | | | | | | | | | - | | | | | | | | | | - | | | | | |
| Gini coefficient after taxes | | | | | | + | | | | | | | | | | - | | | | | | | | | | - | | | | |
| D9/D1 | | | | | | | - | | | | | | | | | | + | | | | | | | | | | + | | | |
| D9/D5 | | | | | | | | + | | | | | | | | | | - | | | | | | | | | | + | | |
| D5/D1 | | | | | | | | | - | | | | | | | | | | + | | | | | | | | | | +* | |
| Income share of top% | | | | | | | | | | +*** | | | | | | | | | | - | | | | | | | | | | - |
| Country dummies | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Time dummies | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Observations | 67 | 67 | 67 | 67 | 67 | 67 | 66 | 66 | 66 | 61 | 67 | 67 | 67 | 67 | 67 | 67 | 66 | 66 | 66 | 61 | 66 | 66 | 66 | 66 | 66 | 66 | 65 | 65 | 65 | 60 |
| R-squared | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.6 | 0.6 | 0.5 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.6 | 0.6 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 |

*Notes:* *** p<0.01, ** p<0.05, * p<0.1

*Notes:* GDP per capita growth rates were computed as the first differences of logs of GDP per head of population.

*Source:* computations based on various sources, for details see (Jovicic 2015).

## 2.7 Conclusions

Two metaphors, the "big tradeoff" and "two sides of the coin", both based on the marginal productivity theory of wages, have influenced the views on the distributional effects on labor market outcomes. Rising unemployment may be caused by an overly narrow wage and income distribution (mainly due to strong institutions), or it may be prevented by allowing for higher inequality. The present analysis, based on data for 21 countries during the period 1980 to 2010, does not find evidence supporting the big tradeoff. Just as several other studies using indicators for institutions (an input variable) affecting labor market performance failed to find such evidence, so this study (in addition using output indicators) cannot support the two-sides-of-the-coin tradeoff either. Unemployment rates – but also employment to population rates and hours worked per head of population – seem not to vary systematically with measures of inequality.

One may criticize that aggregate data cannot detect the subtle effects of distributional variables in labor markets and that micro data is preferable (Freeman, 2007). True, micro data facilitates control for many variables potentially affecting labor markets (such as education and age), but as the OECD (2004) observed, summarizing several of such micro econometric studies, microanalysis does not support the conventional wisdom that greater inequality promotes employment. Indeed, it appears that the majority of international studies using micro data to test whether the relative employment performance of low-skilled workers was worse in countries where the wage premium for skill was more rigid have not verified this thesis (see above). At that time, however, the OECD preferred to stick to the conventional wisdom; subsequently, it seems to have corrected former views.

However, micro studies also have limitations – not the least the enormous manpower needed to analyze micro data carefully. Surely, the diversity of micro data sets and their complexity prevents the comparative analysis of 20 or so countries but only at the country level can a sufficient variation in the institutions be observed. True, aggregate analysis seems to be sensitive to the particular time periods and countries included, but so is analysis based on micro data. Analysis based on aggregate data may miss subtle effects, but if wage and income distribution (or redistribution) has the dominant negative effects on employment that are claimed for it, one would expect to see this relation emerge.

Regressing labor market indicators on measures of distribution and redistribution, we cannot detect the hypothesized labor-market-improving effects. Unemployment rates do not decline where inequality increases, and employment-to-population rates, as well as hours worked per head of population, do not improve significantly with rising inequality. Inequality measures may be regarded as output variables, as the result of institutional features, and our analysis then confirms the results of studies using indicators for institutions – e.g. Howell et al., 2007 – which may be regarded as input variables. Freeman (2005) concluded that institutions affect distribution but that labor market performance is hardly affected, which is totally consistent with the findings presented in this paper.

# 3. Wage Inequality, Skill Inequality and Employment: Evidence and Policy Lessons from PIAAC

## 3.1 Introduction

The variation in wage inequality across developed countries has puzzled economists for many years, and different theoretical explanations and empirical evidence have been presented on this issue. Some economists argue that these differences can be explained by supply and demand factors, whereas others emphasize the influence of wage-setting institutions on the wage structure. Consistent with the first theory, the variations in wage inequality across different countries can be explained by variations in skill inequalities. Countries that have more compressed (dispersed) wage structures simultaneously have more compressed (dispersed) skill structures as well (Nickell and Bell, 1996[28]; Leuven *et al.*, 2004). According to neoclassical theory, supply and demand factors, skill-biased technical change (SBTC), and globalization are responsible for the increase in wage inequality in the past decades (Katz and Murphy, 1992; Juhn et al 1993; Katz and Autor, 1999; Goldin and Katz, 2008; Acemoglu and Autor, 2012), and market forces play a more significant role in explaining cross-national differences in wage inequality and return to skill than institutional factors (Gottschalk and Joyce, 1998). Since the Anglo-Saxon countries had simultaneously higher wage and skill inequalities compared to continental and Nordic Europe, this was taken as proof of the theory. The reasoning behind this theory is that higher wage inequality is a consequence of higher return to skills. High skill premium goes along with increased motivation to invest in skill formation (Heckman *et al.,* 1998; Welch, 1999), and consequently, greater supply of highly-skilled labor. This explanation, however, fails to explain high educational attainment in Nordic countries, which exhibit among the lowest rates of wage inequality when compared to other developed countries. Alternative explanation for variation in wage dispersion is based on the variation in wage-setting institutions. Economists who are in favor of this hypothesis stress the importance of decreasing real minimum wages and union membership in order to explain the widening wage gap (Freeman, 1991; Freeman and Katz, 1994; Blau and Khan, 1996; Bach *et al.,* 2007; Machin, 2016). A similar conclusion comes from Dew-Becker and Gordon (2005, 2008), who, in addition to these explanations, identify peer-group behavior as responsible for increasing wage dispersion at the top of the distribution in the US. Card and DiNardo (2002) reach similar conclusions and also criticize the skill-biased technical change

[28] In his paper, however, skills are measured by years of schooling and not by competency test scores

argument as being unable to account for gender and racial wage inequalities and differences in return to education.

Variation in wage inequality in the bottom half of the wage distribution is also often linked to variation in employment in the low-skill sector. According to neoclassical theory, differences in wage dispersion are often credited as an important explanation for differences in unemployment rates. Whereas dispersed wage structure can contribute to employment creation, wage compression in the bottom half of the wage distribution (usually assumed by labor market institutions) can cause unemployment in the low-skill sector (Siebert, 1997; Heckman and Jacobs, 2010). Due to the skill-biased technical change, relative demand for low-skilled workers in developed countries exhibited a decline; their relative marginal productivity deteriorated (relative marginal productivity of skilled workers rose). However, wage compression and excessively high wages (higher than marginal productivity) at the low end of the wage distribution cut low-skilled workers out of employment. Consequently, countries should allow for higher wage dispersion in the bottom half of the wage distribution and lower wages for the low-skilled (institutional reform) which should push their employment levels up. This is in line with a trade-off between efficiency and equality (Okun, 1975), according to which it is impossible to achieve high employment and low inequality at the same time. In order to achieve high employment, countries must accept high wage dispersion. By comparing the distribution of wages and employment in Germany and the US, Siebert (1997) concludes that the relevant policy recommendation to increase employment in Germany at the low end is to allow for dispersed wage structure (higher wage inequality).

High and increasing wage inequality as well as high unemployment in some OECD countries shifted the focus of policymakers to differences in wage dispersion. This paper discusses theoretical and empirical backgrounds of wage compression hypothesis. Wage compression hypothesis is based on the perfect market model and its rigid assumptions. However, many of these assumptions are flawed – as the empirical analysis of this paper shows. Cross-country differences in wage dispersion cannot be explained by cross-country differences in skill dispersion; educational attainment does not seem to be higher in countries where return to schooling is high; and there is wage dispersion within skill levels, which is in stark contrast with marginal productivity theory. These arguments are in contrast with theoretical foundations of wage compression hypothesis. Finally, unemployment/e-pops/average hours

worked are not correlated with compressed wages. Thus, this paper shows that the wage compression hypothesis is not supported by empirical evidence, and therefore challenges the theoretical assumptions it is derived from. The results of this study (although descriptive) have some important consequences for policy-making. Recommended policies for eliminating wage compression, and allowing for higher wage dispersion are deregulation of labor market institutions (collective bargaining, unemployment benefits, unions, minimum wages etc.) and reduction of public welfare policies. However, since wage compression is not correlated with labor market performance in the low-skilled sector (contrary to the theory), these policy recommendations need to be revised. Moreover, higher wage dispersion is related to major social and health problems, as well as the higher share of low-paid jobs. This study shows that countries that have good labor market performance in the low-skill sector have good labor market performance in general, and this is likely due to macroeconomic policies. Consequently, the role of expansionary macroeconomic policies in fostering employment needs to be revisited.

The analysis presented in this paper extends the existing literature by examining these issues. This paper shares the most similarities with the work of Freeman and Schettkat (2001), Devroye and Freeman (2001). Freeman and Schettkat (2001) examine the wage compression hypothesis based on differences between the US and Germany in relation to employment. They find that skill compression can only partly explain wage compression. However, the wage compression hypothesis cannot explain the US-German difference in employment. Devroye and Freeman (2001) study the relationship between distribution of earnings and distribution of skills and find that skill inequality explains only 7% of wage inequality. Within-skill-group inequality plays a larger role than inequality between skill groups; this contradicts the theory. In contrast to the first two studies that were based on the international literacy survey in the 1990s (International Adult Literacy Survey - IALS), in this paper a more recent data set is used, with a larger number of countries and larger sample sizes. It is important to check whether the results based on the IALS survey can be confirmed by using the Program for International Assessment of Adult Competencies (PIAAC).

This paper is organized as follows. In section two, the data set and data adjustments are presented in more detail. This section is followed by the empirical analysis in sections three, and four. Firstly, international differences in skill levels, wage inequality, and the relationship

between skill inequality and wage inequality is examined. In section five, dispersion of wages within skill levels is investigated. Section six analyses the wage compression hypothesis and its effect on employment. Finally, section seven concludes.

## 3.2 Data Description

This analysis is based on the PIAAC data set that was collected between 2011 and 2012 and initiated by the OECD. PIAAC is a unique data set that provides numerous opportunities for research, because it comprises various individual level indicators of skill competencies, earnings, demographic, and socio-economic characteristics, and other internationally comparable information across OECD countries. Since countries' sample sizes are bigger than in previous similar data sets (around 5,000 observations per country), such a sample facilitates more comprehensive analysis and better investigation of different subgroups. People were questioned on the basis of 1.5-2 hours interview, which was performed by a specially trained interviewer (tests were done either on computer or on paper). The adult competency skills are measured by literacy, numeracy, and problem-solving in technology-rich environments[29] that are central for good performance in the labor market. That is why the skills tested in the survey should be a good proxy for the skills needed in the workplace. According to the test score results, six different proficiency levels are defined. The pooled dataset used in this paper contains national representative samples of around 120,000 observations based on working age populations (16-65) from 16 different highly developed core OECD countries. Countries included in the dataset are Austria, Belgium[30] (Flanders), Canada, Denmark, Finland, France, Germany[31], Ireland, Italy, Japan, Netherlands, Norway, Spain, Sweden, Great Britain (England and Northern Ireland), and the United States[32].

The definition of the PIAAC literacy test is as follows, "understanding, evaluating, using, and engaging with written text to participate in society, to achieve one's goals, and to develop one's knowledge and potential." Numeracy assessment is defined as the ability to access, use,

[29] Problem solving is not measured in France, Italy, and Spain.
[30] Belgium is represented by its subunit Flanders. It is the most developed part of the country, with the lowest unemployment rate, and it cannot be considered as a representative for the whole country. It is important to keep this in mind when interpreting the study results.
[31] For Germany, the United States, and Austria we obtained a Scientific-use file from their national centers (GESIS - Leibniz Institute for the Social Sciences, American Institutes for Research, and Statistics Austria, respectively). For Canada, and Sweden information about continuous earnings is not available.
[32] National samples are weighted to population in relevant time period

interpret, and communicate mathematical information and ideas and to engage in and manage mathematical demands of a range of situations in adult life. Finally, problem solving accounts for "using digital technology, communication tools, and networks to acquire and evaluate information, communicate with others, and perform practical tasks" (OECD, 2013a:59).

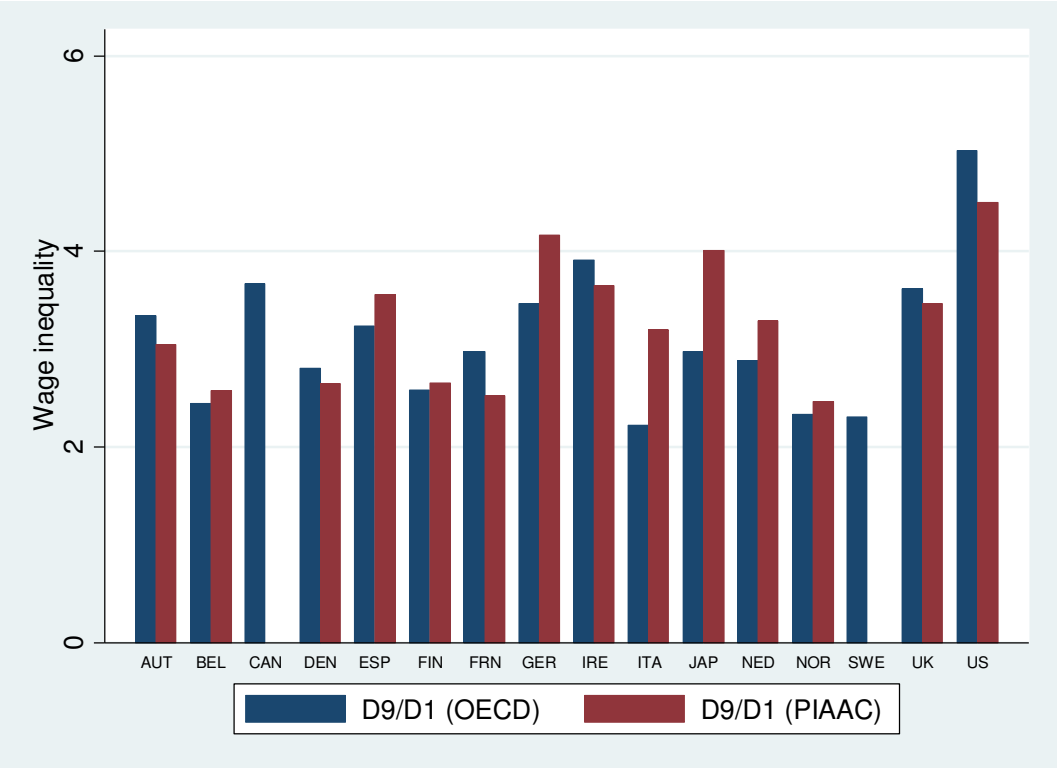
The correlation coefficient between different test results is slightly lower than in previous test surveys (ALL or IALS) but is still highly positive. The correlation coefficient between numeracy and literacy scores is the highest and equal to 0.89, followed by the correlation coefficient between literacy scores and problem-solving skills (0.79). The smallest correlation coefficient is found between numeracy scores and problem-solving scores in technology-rich environments (0.75). In this analysis, numeracy test scores are used as a measure of skill test results[33], which is standard in this literature, but further analysis actually showed that the same results are confirmed when literacy test scores are used.[34] For further analysis, it is vital to compare the wage data from the micro data set – the PIAAC survey with the macro data from the OECD database. Figure 8 displays wage inequality taken from both databases and apart from a couple of outliers (Japan, Italy, and Germany have higher wage inequality; France and the US have lower wage inequality in the PIAAC survey comparative to the OECD database[35]), micro data seems to correspond well to the aggregate macro data. According to both data sources, ranking of the countries in terms of inequality is almost unaffected. If D9/D5 and D5/D1 are observed, deviations between the datasets are even smaller.

[33] The PIAAC sample design requires using plausible values of scores technique which is used through the whole analysis

[34] These are available on request.

[35] OECD Earnings Database collects data on gross earnings of full-time dependent employees which are usually taken from household surveys.

**Figure 8: Wage inequality (D9/D1) for OECD countries, only employed persons**




*Source:* OECD Earnings database and PIAAC.

## 3.3 Skills and Wages across OECD countries

### 3.3.1 Skill Dispersion

According to the OECD database, in the past 30 years, wage inequality has been on the rise in almost all of the OECD countries (see OECD, 2011; Jovicic and Schettkat, 2013). On one hand, the increase in inequality has been criticized by many economists; on the other hand, many others have justified this development as a result of the rise in skill inequality (see introduction). In order to get a better insight on wage inequality and skill inequality, a deeper look into the data set and some descriptive statistics is necessary. Table 7 presents the mean, median, standard deviation, and coefficient of variation of numeracy scores in core OECD countries. If all people are included, independent of their employment status, Anglo-Saxon countries together with France and Spain have the highest dispersion of skills, whereas Japan has the lowest inequality of numeracy skills. In terms of employed persons, the countries with the highest skill inequality among employed workers are the United States, France, and Italy (followed by Canada, the United Kingdom, and Ireland). Japan, Finland, and the Netherlands

(followed by Denmark, and Belgium) have the lowest coefficient of variation of numeracy test results. Coefficients of variation of numeracy scores are higher for all persons than for employed persons in all countries, which implies that the unemployed are likely to be lower skilled than the employed. Another very important conclusion can be drawn from this table. Countries with higher skill inequality exhibit lower average skill scores, whereas the countries with lower skill inequality perform better in terms of average skill scores (mean). If the median is observed instead of the mean, the conclusion is the same. In every country, the median is only slightly higher than the mean; the difference between the two measures ranges between a maximum five points and a minimum two points (the distribution of skills is just slightly skewed to the left). This leaves the ranking of the countries according to their average results unaffected if the median is used (instead of the mean).

**Table 7: Mean, median, standard deviation, and coefficient of variation of numeracy scores for all and employed persons**

| | All persons | | | | Employed | | | |
|---|---|---|---|---|---|---|---|---|
| Country | mean | median | st dev. | var.coef | mean | median | st dev. | var.coef. |
| Canada | 265.2 | 269.6 | 55.60 | 0.21 | 271.6 | 275.0 | 52.77 | 0.19 |
| Denmark | 278.2 | 282.0 | 51.23 | 0.18 | 285.7 | 288.9 | 47.63 | 0.17 |
| Finland | 282.2 | 285.8 | 52.21 | 0.18 | 291.3 | 293.2 | 47.63 | 0.16 |
| France | 254.1 | 259.1 | 56.17 | 0.22 | 260.9 | 265.1 | 54.42 | 0.21 |
| Germany | 271.7 | 275.9 | 53.07 | 0.20 | 277.5 | 280.4 | 49.71 | 0.18 |
| Ireland | 255.5 | 259.5 | 53.66 | 0.21 | 264.5 | 267.0 | 49.91 | 0.19 |
| Italy | 247.1 | 249.2 | 49.99 | 0.20 | 255.1 | 258.0 | 49.9 | 0.20 |
| Japan | 288.1 | 290.8 | 43.98 | 0.15 | 292.5 | 294.7 | 43.44 | 0.15 |
| Austria | 275.0 | 278.2 | 49.29 | 0.18 | 279.7 | 282.8 | 47.53 | 0.17 |
| Netherlands | 280.3 | 285.8 | 51.07 | 0.18 | 287.4 | 291.7 | 46.99 | 0.16 |
| Flanders (Belgium) | 280.3 | 284.4 | 50.59 | 0.18 | 286.6 | 290.2 | 48.42 | 0.17 |
| Norway | 278.3 | 283.5 | 54.21 | 0.19 | 285.8 | 289.9 | 50.55 | 0.18 |
| Spain | 245.8 | 250.3 | 51.32 | 0.21 | 257.5 | 261.3 | 47.58 | 0.18 |
| Sweden | 279.0 | 284.0 | 54.87 | 0.20 | 287.2 | 290.4 | 50.26 | 0.17 |
| England/N. Ireland (UK) | 261.7 | 264.9 | 54.88 | 0.21 | 270.9 | 273.3 | 51.6 | 0.19 |
| United States | 252.8 | 256.0 | 57.03 | 0.23 | 260.0 | 264.0 | 55.95 | 0.23 |

*Source:* Calculations based on PIAAC.

In order to develop a better understanding of the cause of the difference in average numeracy score results, one must examine the share of people within different skill levels. Skill levels are defined according to test scores and divided into six different groups. People with the highest scores are assigned to group levels 5 and 4, whereas levels 0 and 1 are the groups with

lowest numeracy scores.[36] Table 8 shows that the countries with the lowest numeracy test scores (and the highest skill inequalities) have the highest proportion of workers in the lowest skill group (below level 1 and at level 1) – Italy, the United States, France, and Spain. Japan, the Netherlands, and Finland (followed by Denmark and Belgium) have the lowest percentage of least-skilled workers. These countries, however, also have slightly higher percentage of people in the highest skill group[37]. According to the PIAAC survey evidence, countries with the highest numeracy test performance simply have more high-skilled workers and fewer low-skilled workers.

**Table 8: Share of population in 6 different skill levels, employed persons**

| | Level 0+1 | Level 2 | Level 3 | Level 4+5 |
|---|---|---|---|---|
| Country | % | % | % | % |
| Canada | 18.76 | 32.00 | 34.84 | 14.39 |
| Denmark | 10.12 | 28.67 | 42.11 | 19.11 |
| Finland | 8.18 | 27.28 | 41.46 | 23.08 |
| France | 24.31 | 33.57 | 31.73 | 10.4 |
| Germany | 14.93 | 31.59 | 37.51 | 15.98 |
| Ireland | 20 | 37.63 | 32.66 | 9.71 |
| Italy | 26.55 | 37.59 | 29.61 | 6.24 |
| Japan | 6.84 | 26.03 | 45.35 | 21.78 |
| Austria | 12.11 | 32.20 | 40.11 | 15.57 |
| Netherlands | 9.63 | 27.26 | 43.34 | 19.77 |
| Flanders (Belgium) | 10.62 | 27.57 | 41.36 | 20.45 |
| Norway | 11.03 | 27.41 | 40.93 | 20.63 |
| Spain | 23.07 | 39.75 | 31.40 | 5.77 |
| Sweden | 10.84 | 26.97 | 40.34 | 21.86 |
| England/N. Ireland (UK) | 18.79 | 33.41 | 33.82 | 13.99 |
| United States | 25.41 | 33.43 | 30.47 | 10.69 |

*Source:* Calculations based on PIAAC.

Next we examine differences in performance between different subgroups. Table 9 shows average numeracy test scores according to gender, immigration status, and age groups. The difference between men and women is not large; it varies roughly between 8 points and 12 points. On average, men have slightly higher numeracy test scores than women, and this is true for every country. However, since women often demonstrate poorer scores in the quantitative tests, comparing additionally the literacy test results shows that there is almost no difference in the test performance (both men and women have average literacy scores of

[36] Skill levels are defined according to numeracy score results in the following way: L0<176; L1= 176-226; L2=226-276; L3=276-326; L4=326-376; L5>376 points.
[37] Share of population in skill groups L0 and L5 is very low and not representative; that is why they are observed together with groups L1 and L4.

around 277 points). On the other hand, immigrants[38] have much lower results than non-immigrants – around 35 points less on average. The biggest reason for this is the fact that the test was done in the countries' national languages; immigrants are disadvantaged comparatively to the non-immigrants and often experience difficulty with the foreign language. This may suggest underestimation of their proficiency skills. The only two countries where the difference is moderately small are Ireland and to some extent Canada. Canada is a large immigration country where immigration and integration policies probably play a big role and contribute to higher language proficiency of immigrants. When age subgroups are compared, the difference is only marginal in almost all groups, aside from the oldest age group. People in the older age subgroups have lower results on average, probably due to the fact that older people tend to forget and experience decline in skills after age forty-five, but especially after the age of fifty, according to Table 9. This is in line with various other studies that dealt with literacy and numeracy skill surveys; however this might not hold for other skills. In general wages increase with age, as well as the experience and some experience-related skills. In most countries, the lowest age group also tends to have slightly lower proficiency scores than the age groups from 25-45. What stands out is that, in Denmark, Italy, and the US, these age subgroups have similar results to the oldest age subgroups, which is particularly alarming (especially in the US and Italy, since they also have very low scores). One reason for this (and comparatively lower young age subgroup results in general) could be that the education systems alone do not produce relevant work-related skills and that the quality of schooling and the standard of education system are deteriorating.

[38] Immigrants include first generation immigrants. Quick tabulation shows that around 76% of the immigrants are not native speakers. Being a native speaker is highly correlated with higher scores in every country. On average native speakers have 40 points higher scores than non-native speakers.

**Table 9: Mean of numeracy scores in different gender, immigrant and age groups, employed persons**

| Country | Men | Women | Non-immigrant | Immigrant | Age (16-24) | Age (25-34) | Age (35-44) | Age (45-54) | Age (55-65) | All |
|---|---|---|---|---|---|---|---|---|---|---|
| Canada | 277.32 | 265.33 | 275.95 | 262.5 | 271.71 | 281.94 | 277.63 | 266.11 | 258.61 | 271.6 |
| Denmark | 289.96 | 281.55 | 289.43 | 254.26 | 276.87 | 290.96 | 295.59 | 283.4 | 275.58 | 285.7 |
| Finland | 297.04 | 285.93 | 293.95 | 235.79 | 289.11 | 306.47 | 296.51 | 288.9 | 270.07 | 291.3 |
| France | 265 | 256.85 | 267.24 | 226.17 | 260.97 | 276.59 | 268.15 | 251.24 | 237.58 | 260.9 |
| Germany | 283.59 | 270.89 | 282.62 | 255.51 | 277.74 | 284.96 | 286.12 | 271.59 | 264.14 | 277.5 |
| Ireland | 270.05 | 259.66 | 265.4 | 261.01 | 262.43 | 271.13 | 270.8 | 257.91 | 243.34 | 264.5 |
| Italy | 255.82 | 254.19 | 258.65 | 222.72 | 232.03 | 265.66 | 257.54 | 252.8 | 240.83 | 255.1 |
| Japan | 298.07 | 285.35 | 292.56 | 266.98 | 282.61 | 301.13 | 299.47 | 295.66 | 275.15 | 292.5 |
| Austria | 285.77 | 273.26 | 285.14 | 254.9 | 274.1 | 285.03 | 285 | 277.38 | 269.32 | 279.7 |
| Netherl. | 294.13 | 280.31 | 291.8 | 255.46 | 287.44 | 298.73 | 292.58 | 282.48 | 268.82 | 287.4 |
| Flanders | 292.75 | 280.17 | 290.08 | 247.65 | 278.4 | 298.8 | 290.91 | 282.82 | 268.42 | 286.6 |
| Norway | 292.16 | 279.36 | 291.67 | 246.83 | 277.99 | 289.73 | 295.24 | 286.3 | 272.43 | 285.8 |
| Spain | 263.63 | 250.8 | 261.33 | 230.15 | 258.98 | 262.94 | 264.37 | 253.4 | 234.01 | 257.5 |
| Sweden | 292.2 | 281.69 | 294.12 | 255.36 | 286.57 | 297.08 | 293.2 | 282.35 | 276.34 | 287.2 |
| UK | 276.96 | 264.64 | 275.51 | 249.84 | 263.29 | 279.51 | 278.94 | 264.14 | 261.01 | 270.9 |
| US | 265.71 | 253.79 | 265.64 | 235.46 | 249.81 | 260.34 | 257.48 | 250.39 | 247.07 | 260.0 |

*Source:* Calculations based on PIAAC.

Table 9 reveals some differences between various subgroups, thus it is reasonable to see whether compositional differences have an effect on average numeracy test scores and dispersion of numeracy test scores. Population subgroups characterized by lower average numeracy test scores were immigrants, followed by the oldest age group and women. Whereas the share of women[39] is comparable across countries, there is considerable variation in the share of immigrants across countries, and this probably affects the average numeracy score results and their dispersion[40]. Some of the countries with a high share of immigrants in the sample are found to have lower average numeracy test scores. Lower average numeracy test scores in Canada, Ireland, the US, and the UK may be partly explained by higher shares of immigrants whose skills are underestimated due to language difficulties. When immigrants are excluded from the sample, the average numeracy test scores increase in these countries, and the coefficient of variation is slightly reduced as well. This is true for every country, but the reduction is the highest in the US. The United States has the highest dispersion of skills, but this phenomenon can be partly explained by the lower score of immigrants, and suggests that immigration status should be controlled for in the regression analysis. There is also a moderate variation in the share of the oldest age group in the employed population across

[39] The share of women in employed population varies between 46-49% in all countries, apart from Italy and Japan where the share of women in employed population is relatively small - around 40%.
[40] Share of immigrants varies between less than1% in Japan and 32% in Canada

countries, but this does not appear to affect average scores nor dispersion of scores considerably.[41]

### 3.3.2 Wage Dispersion and Skill Dispersion

In addition to the individual skill scores, the PIAAC data set provides information on hourly wages[42] of employed persons. Table 10 shows dispersion of numeracy test score results, wages, and years of schooling[43] measured by the coefficient of variation. This data already shows that there is no clear empirical relationship across countries between wage dispersion and numeracy skill dispersion. Countries with the highest dispersions of numeracy test scores are the United States, France, Canada, and the United Kingdom, whereas the countries with the lowest dispersions are Japan, the Netherlands, and Finland. In terms of wage inequality, countries with the highest wage dispersion are Japan, the United States, and the UK, and the countries with the lowest wage dispersions are Belgium, Norway, Denmark, and Finland. If there was a strong link between skill dispersion and wage dispersion, the data would be expected to show that the countries with the highest skill dispersions exhibit the highest wage dispersion and vice versa; this is not always the case here. Additional analysis also shows that the same conclusions hold when wage inequality between different population subgroups is observed. In all the population subgroups examined (men, women, immigrants, non-immigrants, different age cohorts), the countries with the highest wage dispersions are still Japan, and the US, and the countries with the lowest wage dispersions are Belgium and Scandinavian countries (ranking of the countries remains intact).[44]

In order to develop a more comprehensive view of the relationship between skill dispersion and wage dispersion, in addition to measuring skills by proficiency score results, years of

[41] Japan, Finland, and Sweden have the highest share of the oldest age group (more than 20%), but in these countries the oldest age groups have relatively high scores. On the other hand, Austria, Ireland, Italy, and France have small shares of the oldest age groups, but these countries do not have high average scores.

[42] Wage and salary earners could choose among reporting their earnings per hour, day, week, two weeks, month or year, or by piece rate. There was also an option for respondents to report their earnings in broad categories which was especially attractive for those who knew only roughly how much they earn. These novelties improved the data quality and willingness to report earnings (for more details, see OECD, 2013a).

[43] Certainly the most widely used measure of skill in human capital literature is years of schooling. Years of schooling are easy to measure, and they are easily available for researchers. For a long time, this was probably the only measure of skills, since international comparative surveys of skills were first done in the '90s.

[44] In the pooled sample, coefficient of variation does not seem to vary between men, women, immigrants, and non-immigrants. However, wage dispersion is the highest in the youngest and oldest age cohort, and it is decreasing with the decrease of the age in the rest of the groups. The same is true for D9/D5 and D5/D1. Additionally, D5/D1 is slightly higher for men and immigrants than for women and non-immigrants.

schooling are also included in the analysis. However, when years of schooling is used in the analysis, this must be based on the assumption that one year of schooling has the same effect on human capital formation in every country, which is difficult to confirm. International skill proficiency surveys are thus becoming more and more popular, since their comparability is likely to be more reliable. According to the estimates, there is a positive but weak correlation between numeracy test scores and years of schooling – correlation coefficient for the entire PIAAC sample is 0.44 (correlation coefficient varies between 0.36 and 0.60 for individual countries). The fact that years of schooling and numeracy skills are positively correlated is expected, since longer schooling produces higher levels of skills and, at the same time, higher-skilled individuals acquire more schooling. However, the rather small size of the correlation is somewhat surprising[45]. One potential explanation is that schooling is related to unmeasured competencies and unobserved non-cognitive skill (or some dimension of cognitive skills other than numeracy skills). Table 10 shows that dispersion of years of schooling is slightly higher than the dispersion of test scores in most countries. The only three countries that have relatively high dispersion in years of schooling are Italy, France, and Spain; countries with the lowest skill dispersion measured by schooling are the UK, Norway, and Germany.

In addition to the distribution of numeracy test scores, years of schooling, and wages, Table 10 reports correlation coefficients between these variables. The correlation coefficient between wages and numeracy scores is positive but ranges between 0.14 and 0.37 only. This could be additional proof that cross-country variation in numeracy scores is not strongly associated with cross-country variation in wages. Although the variable of years of schooling performs a bit better (its correlation to wages is higher and ranges between 0.24 and 0.51), it can hardly confirm the skill compression hypothesis. Possible explanations for why there is a stronger link between years of schooling and wages (than between numeracy test scores and wages) could be that either unmeasured competencies are related to years of schooling or years of schooling is positively associated with wages through signaling effect – employer assumes that more schooling is positively correlated with having advanced abilities. It could be that years of schooling has a large effect on wages, without having a large effect on skills measured by numeracy test scores.

[45] Additional analysis shows that there is no difference in the correlation coefficient between gender, age, and (non-) immigrant cohorts. The correlation coefficient in all the subgroups varies between 0.41 and 0.48 in the pooled sample.

**Table 10: Coefficient of variation of average numeracy scores, hourly wages and years of schooling, and their correlation coefficient, employed persons**

| | Coefficient of variation | | | Correlation coefficient | | |
|---|---|---|---|---|---|---|
| Country | Scores | Wages | Schooling | Scores-Wages | Scores-Schooling | Wages-Schooling |
| Canada | 0.19 | | 0.21 | | 0.42 | |
| Denmark | 0.17 | 0.38 | 0.20 | 0.31 | 0.39 | 0.46 |
| Finland | 0.16 | 0.38 | 0.22 | 0.31 | 0.43 | 0.46 |
| France | 0.21 | 0.43 | 0.29 | 0.33 | 0.60 | 0.37 |
| Germany | 0.18 | 0.52 | 0.18 | 0.33 | 0.46 | 0.51 |
| Ireland | 0.19 | 0.55 | 0.19 | 0.33 | 0.47 | 0.36 |
| Italy | 0.20 | 0.53 | 0.33 | 0.23 | 0.41 | 0.34 |
| Japan | 0.15 | 0.69 | 0.18 | 0.26 | 0.46 | 0.29 |
| Austria | 0.17 | 0.58 | 0.22 | 0.27 | 0.43 | 0.38 |
| Netherlands | 0.16 | 0.46 | 0.19 | 0.27 | 0.40 | 0.45 |
| Belgium | 0.17 | 0.37 | 0.20 | 0.32 | 0.49 | 0.39 |
| Norway | 0.18 | 0.37 | 0.17 | 0.31 | 0.37 | 0.42 |
| Spain | 0.18 | 0.53 | 0.28 | 0.34 | 0.51 | 0.46 |
| Sweden | 0.17 | | 0.21 | | 0.39 | |
| United Kingdom | 0.19 | 0.61 | 0.17 | 0.36 | 0.36 | 0.36 |
| United States | 0.23 | 0.67 | 0.23 | 0.37 | 0.55 | 0.47 |

*Source:* Calculations based on PIAAC.

In order to conclude the discussion on skill and wage dispersion and get a more comprehensive description of their relationship, in addition to coefficient of variation, other measures of inequality are examined. Table 11 shows decile ratios (D9/D1, D9/D5, D5/D1[46]) of skill and wage dispersion. Decile ratios reveal additional evidence against skill compression hypothesis. Since wage inequality in the top half of the distribution is higher and varies most across countries (D9/D5 is higher than D5/D1), it was expected that the same would be true for skill inequality. However, Table 11 shows that the opposite is the case. The highest skill inequality and the highest variability in skill inequality is observed for measures of skill inequality in the bottom half of the skill distribution. In every country, skill inequality at the bottom of the distribution is higher than at the top, whereas the opposite holds for wage inequality (the only exceptions are Denmark, Germany, and to some extent the Netherlands where wage inequality in the bottom half of the skill distribution is higher than in the top half of the distribution. These patterns contradict skill compression hypothesis, and this conclusion is further confirmed by looking at the last column of Table 11. If the top wage decile is excluded (instead of D9/D5 we look at D8/D5), wage inequality drops significantly in every country. It leads to the conclusion that the primary contributors of high wage inequalities are excessively high wages at the top. These high wages are most likely a consequence of

[46] Decile is any of the nine values that divide the sorted data into ten equal parts, so that each part represents 1/10 of the sample or population. The decile ratio is an indicator of dispersion; it is calculated by dividing the ratio of the 9th/5th decile by the 5th/1st decile of skill scores and hourly earnings of an employed person.

"celebrity" and "managerial" wages, usually caused by peer behavior and rent seeking. This observation contradicts the view that higher wage inequality will do much to improve outcomes of the people at the bottom; as is promoted by the economists who support wage compression hypothesis. On other hand, this exercise shows that wages are indeed more compressed in the bottom half of the distribution than in the top half of the wage distribution in all countries (despite more dispersed skills at the bottom). This is a starting point that could offer support for a wage compression hypothesis. In order to investigate if the wage compression hypothesis is correct, and whether compressed wages are related to unemployment, an examination of employment differences between countries is necessary (see Section 3.6).

**Table 11: Distribution of Individual Average Literacy Test Scores and Wages, by Country**

| Decile ratios | Literacy Scores | | | Hourly Earnings | | | |
|---|---|---|---|---|---|---|---|
| Country | D9/D1 | D9/D5 | D5/D1 | D9/D1 | D9/D5 | D5/D1 | D8/D5 |
| Canada | 1.71 | 1.23 | 1.39 | | | | |
| Denmark | 1.59 | 1.20 | 1.32 | 2.65 | 1.56 | 1.70 | 1.30 |
| Finland | 1.59 | 1.21 | 1.31 | 2.65 | 1.75 | 1.51 | 1.44 |
| France | 1.79 | 1.24 | 1.44 | 2.52 | 1.77 | 1.43 | 1.43 |
| Germany | 1.66 | 1.21 | 1.37 | 4.16 | 1.91 | 2.18 | 1.52 |
| Ireland | 1.68 | 1.23 | 1.37 | 3.65 | 2.11 | 1.73 | 1.65 |
| Italy | 1.69 | 1.24 | 1.36 | 3.20 | 1.88 | 1.70 | 1.47 |
| Japan | 1.48 | 1.17 | 1.26 | 4.01 | 2.34 | 1.71 | 1.74 |
| Austria | 1.57 | 1.20 | 1.31 | 3.05 | 1.81 | 1.69 | 1.43 |
| Netherlands | 1.58 | 1.19 | 1.33 | 3.29 | 1.79 | 1.84 | 1.47 |
| Belgium | 1.60 | 1.20 | 1.33 | 2.58 | 1.67 | 1.54 | 1.38 |
| Norway | 1.63 | 1.20 | 1.35 | 2.47 | 1.60 | 1.54 | 1.30 |
| Spain | 1.73 | 1.23 | 1.41 | 3.56 | 2.08 | 1.71 | 1.61 |
| Sweden | 1.63 | 1.21 | 1.35 | | | | |
| United Kingdom | 1.72 | 1.24 | 1.38 | 3.47 | 2.08 | 1.67 | 1.59 |
| United States | 1.81 | 1.26 | 1.44 | 4.5 | 2.2 | 2.00 | 1.78 |

*Source:* Calculations based on PIAAC.

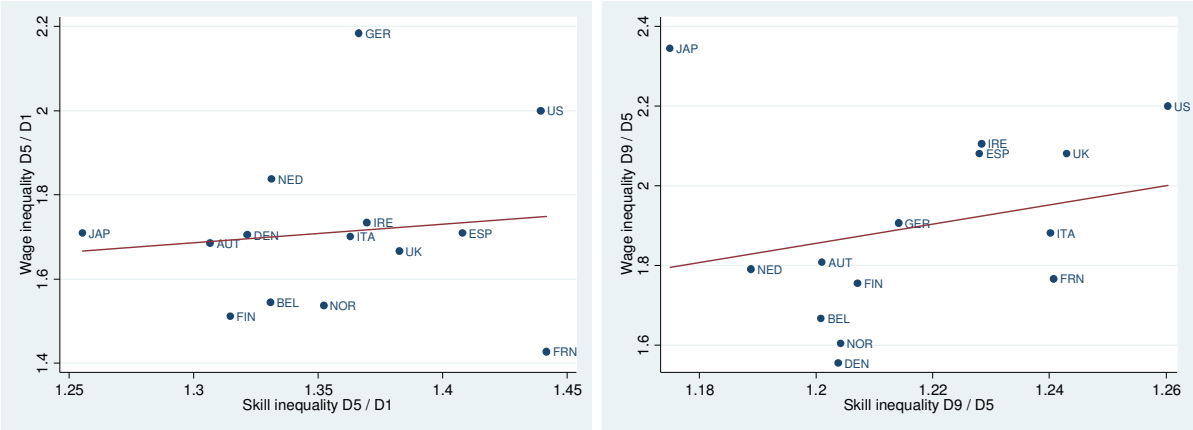
Regardless of whether the relationship between skill inequality and wage inequality is measured by decile ratios or coefficient of variation – the relationship is not statistically significant (see Figure 9). Correlation coefficients[47] are 0.11, 0.24, and 0.19, respectively. Inequality in numeracy test scores is not correlated with wage inequality, and this is why variation in numeracy skill inequality cannot explain variation in wage inequality across core OECD countries. The same is true if years of schooling are used as a measure of skill. The

[47] Wage and skill inequality measured by D9/D1, Gini coefficient, and Theil index also show that there is no strong relation. Their correlation coefficients are 0.09, 0.05, and 0.02, respectively.

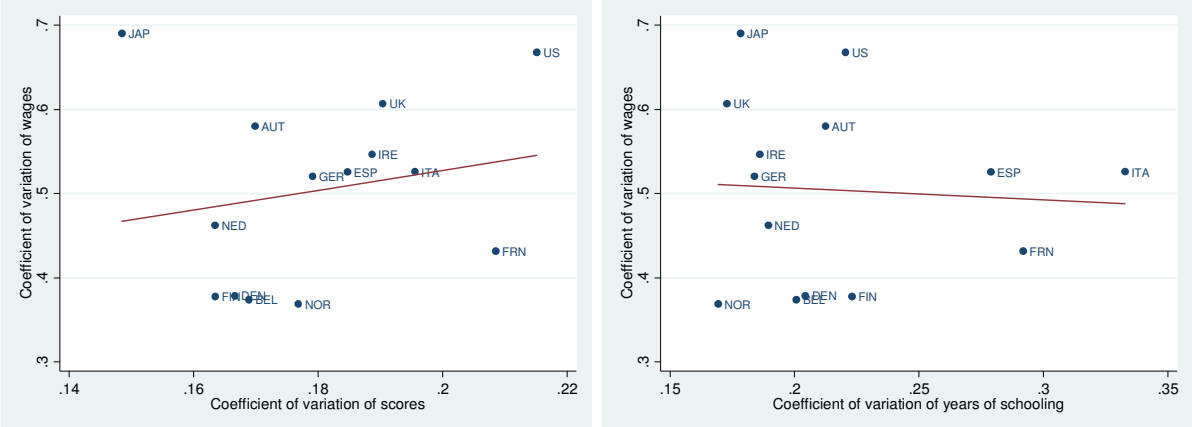
relationship between the coefficient of variation of wages and years of schooling is flat – there is no significant relationship between the two; the correlation coefficient is low: -0.06. It does not hold that countries with higher skill dispersion (either measured by numeracy test scores or years of schooling) have higher wage dispersion and vice versa, as the lower panel of Figure 9 suggests. Countries with similar skill inequality differ significantly in terms of wage inequality. The skill compression hypothesis cannot be confirmed based on the cross-country analysis presented here.

**Figure 9: Relationship between skill inequality and wage inequality, employed persons**

**A: D5/D1, and D9/D5 ratios of wages and numeracy test scores, employed persons**




**B: Coefficient of variation of wages, skills, and schooling, employed persons**




*Source:* Calculations based on PIAAC.

Although there is some criticism (see Broecke *et al*, 2016), these rather descriptive results are in line with other wage and skill distribution analysis conducted previously with the PIAAC dataset (and this is why deeper analysis is not necessary). Paccagnella (2015) investigated the relationship between skill inequality and wage inequality based on PIAAC data and 22 OECD

countries. He finds no strong relationship between the two. Based on his decomposition exercise, he concludes that the wage structure effect (differences in the rates of returns to observable characteristics) seems to be more important in explaining cross-country differences in wage dispersion than composition effect (differences in observable characteristics). Pena (2016) also uses the decomposition method similar to Juhn *et al* (1993) and finds that unobservable factors (such as labor and product market institutions) play a major role in explaining cross-country differences in wage dispersion; the effect of skills is rather small. Thus, both papers suggest that institutions are potentially likely to explain a larger share of cross-country differences in wage dispersion.

## 3.4 Wage Dispersion and Return to Skills

The wage compression hypothesis is based on the perfect market theory, according to which, wages correspond to marginal productivity. Empirically, wage regression analysis should be able to explain variation in wages. In this body of literature, Jacob Mincer (1958; 1974) was the pioneer in defining earnings as a function of schooling and experience in the log-linear form. The Mincer earnings equation proved to be a big empirical success in labor market economics, and the model is still a good specification for estimating the relationships between schooling, experience, and earnings relatively accurately (see Lemieux, 2006). The empirical model that is to be estimated in this paper is based on the Mincer earnings equation and has the following principal form:

$$(4)\ ln(w) = a + bS + cX + dG + eI + u \quad (1)$$

Where ln (w) is the natural logarithm of the hourly wage, *S* corresponds to qualification level (numeracy test scores or years of schooling, or both), *X* is experience (defined as years of labor market experience), *G* is a gender indicator, *I* denotes immigration status, *u* is a residual, and a, b, c, d, e are parameters to be estimated

Table 12 reports the results from OLS regressions of log wage on numeracy test scores and years of schooling in models which includes controls for gender, experience, experience squared, and immigrant status (see Equation 4). Model 1 results show considerable variation across countries. In some countries, an increase in numeracy test scores is associated with

higher wages than in other countries. An increase of 100 numeracy score points is associated with a 30 percent increase in the average wage in the pooled sample across countries. The highest coefficients are in the US, the UK, Germany, and Spain, and the lowest are in Norway, Italy and Denmark. If one interpreted these results by saying that skills affect wages significantly in the US (coefficient=0.48), one needs to be able to explain why the coefficient is only 0.21 in the case of Norway. Differences in dispersion of numeracy skills explain the differences in dispersion of earnings only partly. Model 2 shows that the coefficient of years of schooling on wages is the highest in the US (11 percent), Germany (10 percent) and the UK, and the Netherlands (9 percent), whereas the lowest is in Italy, France, and Scandinavia (6 percent). On average, one extra year of schooling is associated with 7 percent higher earnings. Once we add both numeracy scores and years of schooling to the model, both coefficients are significant, although the size of the score coefficient drops significantly (from 0.30 to 0.15 in the pooled regression). This is due to the fact that numeracy skills and schooling are correlated (0.45 on average). However, big variation across countries is evident here as well; whereas in most of the countries the skill coefficient drops by around half, in the UK, Ireland, and Norway, it drops less. In this model, the coefficient of years of schooling remains stable at 7 percent on average. The 1 percent fall is observed in all countries, except for the UK and the US, where the drop is equal to 2 percent. These findings are similar to those of Hanushek *et al.* (2014)[48].

Once controlled for all factors, why does return to skills vary so much across countries? Although the fact that the coefficients are highest in the first model could lead to the conclusion that the skill compression hypothesis holds, this notion is rejected. Especially in the model where both skills and years of schooling are included, the coefficient for skills drops by half. It might be that schooling affects wages independently from numeracy skills (possibly through the signaling effect). However, it all leads to the conclusion that there must be something else (in addition to numeracy scores and years of schooling) that affects wage structure significantly and affects wage inequality as well[49]. As mentioned above, if perfect market theory was correct, wages should be explained by the wage regression and residual

[48] Hanushek et al. (2014) examined return to skills based on the PIAAC data set and find significant heterogeneity between the countries. Returns to skills (associated with a one-standard-deviation increase in measured numeracy test scores) vary between 12-15 percent in Nordic countries and 28 percent in the United States. Furthermore, returns to skill are lower in countries with higher union density, stricter employment protection, and a larger public sector.

[49] It could also be that schooling reflects wider range of skills, but this analysis is limited to numeracy skills only

should be equal to one. However, Mincer Equations explain only 30% of variation of wages; this either disproves perfect market hypothesis or increases relevance of immeasurable skills (Schettkat 2008).

**Table 12 Regression of log wages on numeracy test scores and years of schooling, employed persons[50]**

| Model | Model 1 | | Model 2 | | Model 3 | | |
|---|---|---|---|---|---|---|---|
| Country | Scores | $R^2$ | Schooling | $R^2$ | Scores | Schooling | $R^2$ |
| Denmark | 0.22 (0.01) | 0.34 | 0.06 (0.00) | 0.44 | 0.09(0.01) | 0.06(0.00) | 0.45 |
| Finland | 0.24 (0.01) | 0.25 | 0.06 (0.00) | 0.38 | 0.11(0.01) | 0.06(0.00) | 0.40 |
| France | 0.30 (0.01) | 0.23 | 0.06 (0.00) | 0.32 | 0.14(0.01) | 0.05(0.00) | 0.34 |
| Germany | 0.39 (0.02) | 0.28 | 0.10 (0.00) | 0.37 | 0.18(0.02) | 0.09(0.00) | 0.39 |
| Ireland | 0.34 (0.02) | 0.23 | 0.08 (0.00) | 0.29 | 0.20(0.02) | 0.07(0.00) | 0.32 |
| Italy | 0.22 (0.02) | 0.14 | 0.06 (0.00) | 0.26 | 0.08(0.02) | 0.05(0.00) | 0.27 |
| Japan | 0.34 (0.02) | 0.29 | 0.07 (0.01) | 0.31 | 0.22(0.02) | 0.06(0.01) | 0.33 |
| Netherlands | 0.30 (0.02) | 0.34 | 0.09 (0.00) | 0.47 | 0.13(0.02) | 0.08(0.00) | 0.48 |
| Flanders (Belgium) | 0.28 (0.01) | 0.25 | 0.07 (0.00) | 0.34 | 0.14(0.01) | 0.06(0.00) | 0.36 |
| Norway | 0.21 (0.01) | 0.31 | 0.06 (0.00) | 0.39 | 0.11(0.01) | 0.05(0.00) | 0.41 |
| Spain | 0.35 (0.03) | 0.18 | 0.08 (0.00) | 0.33 | 0.15(0.03) | 0.07(0.00) | 0.34 |
| England/N. Ireland | 0.40 (0.02) | 0.29 | 0.09 (0.00) | 0.29 | 0.30(0.02) | 0.07(0.00) | 0.36 |
| United States | 0.48(0.02) | 0.28 | 0.11(0.00) | 0.39 | 0.22(0.02) | 0.09(0.00) | 0.42 |
| **Pooled** | **0.30 (0.01)** | **0.25** | **0.07 (0.00)** | **0.34** | **0.15(0.01)** | **0.07(0.00)** | **0.36** |

*Source:* Calculations based on PIAAC

*Note:* Controls: experience, experience$^2$, gender and immigration status. Tables are available upon request.

## 3.5 Dispersion within Skill Level

While it is often argued that high wage inequality fosters investment in human capital, Agell (1999) claimed that that could be true, but only if the wage dispersion is between education levels. However, if there is high wage dispersion within the same education level, wage dispersion serves as a discouragement for educational attainment. Based on similar logic, as among the most convincing evidence that the skill hypothesis does not hold, Devroye and Freeman (2001) used the tables that show that dispersion of wages is much higher within skill levels than between skill levels. If skill determines wages, people at the same skill level should earn similar wages - the highest dispersion should be between different skill levels; within skill levels there should barely be any significant dispersion. In their analysis based on the IALS data set and four OECD countries, Freeman and Devroye find that this was not the case. We perform the same calculations based on the PIAAC data set. Table 13 records the coefficient of the variation of log wages by six defined numeracy test score levels. The

[50] For purpose of easier interpretation, numeracy test scores are divided by 100

conclusion is the same – wage dispersion within skill levels differs significantly across countries. The highest dispersions of earnings are in Germany, Ireland, Spain, and the United States for every score level. The smallest dispersions are in Japan, Denmark, and Norway. Countries that have the highest wage dispersion in the lowest skill levels have on average comparatively higher wage dispersions for all skill levels and vice versa. In the second part of Table 13, the same exercise is performed for five narrow-defined score groups (score range varies only between 250-350 test points for all five groups). Narrow score groups tell the same story, which is an even stronger evidence against skill compression hypothesis. The biggest variation is within different skill levels and not between them, and it is astonishing how this pattern is repeated in every country and on every skill level. Thus, variation in numeracy skills cannot fully explain the variation in wages. Some other factor (other than numeracy skills) in these countries and their institutional settings must create these differences.

**Table 13: Coefficient of variation of log wages by score, employed persons**

| | SKILL LEVELS | | | | NARROW SCORE GROUPS | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Country | L0+1 | L2 | L3 | L4+5 | 251-270 | 271-290 | 291-310 | 311-330 | 331-350 |
| Canada | | | | | | | | | |
| Denmark | 0.08 | 0.08 | 0.08 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| Finland | 0.15 | 0.1 | 0.12 | 0.12 | 0.12 | 0.12 | 0.13 | 0.12 | 0.12 |
| France | 0.14 | 0.14 | 0.14 | 0.15 | 0.14 | 0.14 | 0.15 | 0.14 | 0.16 |
| Germany | 0.23 | 0.23 | 0.21 | 0.2 | 0.20 | 0.20 | 0.21 | 0.19 | 0.21 |
| Ireland | 0.26 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.17 | 0.16 |
| Italy | 0.18 | 0.2 | 0.17 | 0.17 | 0.18 | 0.16 | 0.16 | 0.17 | 0.18 |
| Japan | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| Austria | 0.19 | 0.19 | 0.19 | 0.17 | 0.17 | 0.16 | 0.16 | 0.16 | 0.16 |
| Netherlands | 0.15 | 0.16 | 0.17 | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.17 |
| Belgium | 0.13 | 0.12 | 0.12 | 0.12 | 0.11 | 0.12 | 0.11 | 0.11 | 0.11 |
| Norway | 0.06 | 0.07 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| Spain | 0.21 | 0.21 | 0.21 | 0.19 | 0.21 | 0.20 | 0.19 | 0.18 | 0.21 |
| Sweden | | | | | | | | | |
| UK | 0.17 | 0.18 | 0.19 | 0.19 | 0.19 | 0.19 | 0.20 | 0.18 | 0.19 |
| US | 0.18 | 0.18 | 0.19 | 0.19 | 0.20 | 0.20 | 0.22 | 0.22 | 0.21 |

*Source:* Calculations based on PIAAC.

High wage dispersion within skill levels is in stark contrast with marginal productivity theory. Based on the theoretical perfect market model, marginal productivity theory claims that everybody is paid according to their contribution – to their marginal productivity. Empirical implication of this theory shows that there is the same wage for the same work. Since productivity is difficult to measure, it is necessary to find different proxies that could account

for it. The most obvious ones are skills. Stiglitz (2013) commented that he wishes bankers were paid according to their marginal productivity during crisis. Proponents of marginal productivity theory and perfect markets try to defend their theory by claiming that people with the same measurable skills might differ in their immeasurable skills and this is why their wages are different; yet explanations based on monopsonistic labor market seem more plausible (see Manning, 2003).

## 3.6 Wage Compression and Unemployment

Since the variation in wage dispersion across countries cannot be fully explained by variation in skill dispersion and its theoretical foundations seem to be flawed, another set of explanations needs to be considered. Some economists stress the importance of variation in wage setting institutions across countries, for example minimum wages and unions (Freeman, 1991; Freeman and Katz, 1994; Blau and Khan, 1996), as the most plausible explanation for cross-country variation in wage dispersion. Before the link between wage dispersion and unemployment is explored, the relationship between wage setting institutions and wage dispersion is examined. Table 14 shows a clear pattern – there is a significant negative correlation between various wage bargaining institutions and wage inequality. Countries with higher union density and union membership, stronger and more coordinated wage bargaining institutions, and higher minimum wages have lower wage inequality and vice versa[51]. This is in line with other studies based on panel data analysis (Schettkat, 2003; Freeman, 2007; Salverda and Checchi, 2014). It is interesting to observe that the correlation coefficient between wage dispersion and various institutions is much higher than the correlation coefficient between wages and skills (see section 3). Regrettably, the PIAAC data set does not provide information on union membership of the employees, so more thorough analysis is not possible. However, this data set offers information on employment status which allows us to examine wage compression hypothesis.

[51] Detailed tables are available on request.

**Table 14: Relationship between wage inequality and wage setting institutions, employed persons, 2011**

| Institutions/ Inequality | Minimum wage | Union density | Union membership | Bargaining coordination | Comprehensi-veness index[52] |
|---|---|---|---|---|---|
| COV | -0.65* | -0.78* | -0.63* | -0.84* | -0.78* |
| D9/D1 | -0.70* | -0.85* | -0.61* | -0.71* | -0.62* |
| D9/D5 | -0.72* | -0.71* | -0.61* | -0.86* | -0.76* |
| D5/D1 | -0.43* | -0.67* | -0.38* | -0.37* | -0.32* |
| Gini | -0.66* | -0.87* | -0.69* | -0.78* | -0.72* |

*Source:* Institutions from Schumpeter School International Comparative Institutions Database, for details see (Jovicic, 2015). Wage Inequality from PIAAC.

*Note:* * represents 1% significance level

As seen in the previous table, minimum wages and wage setting institutions are negatively correlated with wage inequality. This is exactly why some economists (neoclassical school of thought) claim that strong institutions cause wage compression, which in turn causes high unemployment among the low skilled (Siebert, 1997; Heckman and Jacobs, 2010). Due to skill-biased technical change, the relative demand for low-skilled workers declined in the past three decades. In countries with flexible labor markets (and weaker institutions), workers' wages dropped, but they remained employed. In countries with rigid markets, institutions prevented the wages of low-skilled workers from falling, and therefore these workers lost their jobs. In the first group of countries, an increase in wage inequality contributed to comparatively higher employment. If the wage compression hypothesis was true and differences in wage inequalities across countries can explain differences in employment, we expect to find a positive relationship between wage inequality in the bottom half of the wage distribution and employment among low-skilled workers. This explanation is based on marginal productivity hypothesis, according to which, wages always correspond to the marginal product of labor. If there is no institutional intervention, the free market leads to solutions in which people earn what they contribute. Setting a wage through various forms of labor market institutions, will lead to a higher wage than marginal productivity, and higher unemployment subsequently.

In order to get a complete measure of labor market performance, employment to population rates (e-pops), the unemployment rate, and average weekly hours worked per head were calculated from the PIAAC survey or were already available (weekly hours worked). Table 15

[52] Comprehensiveness index corresponds to product of bargaining level and bargaining coverage (see Schettkat, 2003)

shows the correlation matrix for various measures of labor market performance and wage inequality (for all employed persons and all skill levels). The majority of correlation signs are statistically insignificant. No matter which measure of labor market performance is being used, the relationship between labor market performance and wage inequality is insignificant and flat. If we look at the whole sample (regardless of skill level), there seems to be no significant relationship between these measures. In the case of e-pops[53] and unemployment rates, the correlation sign actually contradicts the wage compression hypothesis, although it is insignificant. If additionally skill levels are accounted for, most of the correlations still remain insignificant at 10% significance level[54]. E-pops, average hours worked and unemployment rates are not related to wage inequality, either at the top or at the bottom. According to Table 15, and analysis based on the core OECD countries, there is no evidence for wage compression hypothesis.

**Table 15: Relationship between wage inequality and labor market performance, employed persons**

| Employment/Wage inequality | D9/D1 | D9/D5 | D5/D1 |
|---|---|---|---|
| E-pop | -0.0049 | -0.2587 | 0.2418 |
| Hours worked | 0.3083 | 0.5045* | -0.0382 |
| Unemployment rate | 0.2307 | 0.3357 | 0.0454 |
| E-pop, skill level 0+1 | 0.2674 | 0.1685 | 0.2407 |
| E-pop, skill level 2 | 0.1263 | -0.1451 | 0.3423 |
| E-pop, skill level 3 | 0.1304 | -0.2086 | 0.4092 |
| E-pop, skill level 4+5 | 0.0877 | -0.2269 | 0.3358 |
| Hours worked, skill level 0+1 | 0.0772 | 0.3087 | -0.2154 |
| Hours worked, skill level 2 | 0.2545 | 0.4557 | -0.0646 |
| Hours worked, skill level 3 | 0.2903 | 0.5052* | -0.0700 |
| Hours worked, skill level 4+5 | 0.4029 | 0.5713* | 0.0411 |
| Unemployment rate, skill level 0+1 | 0.2302 | 0.2940 | 0.1030 |
| Unemployment rate, skill level 2 | 0.2364 | 0.3165 | 0.0699 |
| Unemployment rate, skill level 3 | 0.1473 | 0.2802 | -0.0268 |
| Unemployment rate, skill level 4+5 | -0.3019 | -0.0389 | -0.4536 |

*Source:* Calculations based on PIAAC.

*Note:* * represents 10% significance level

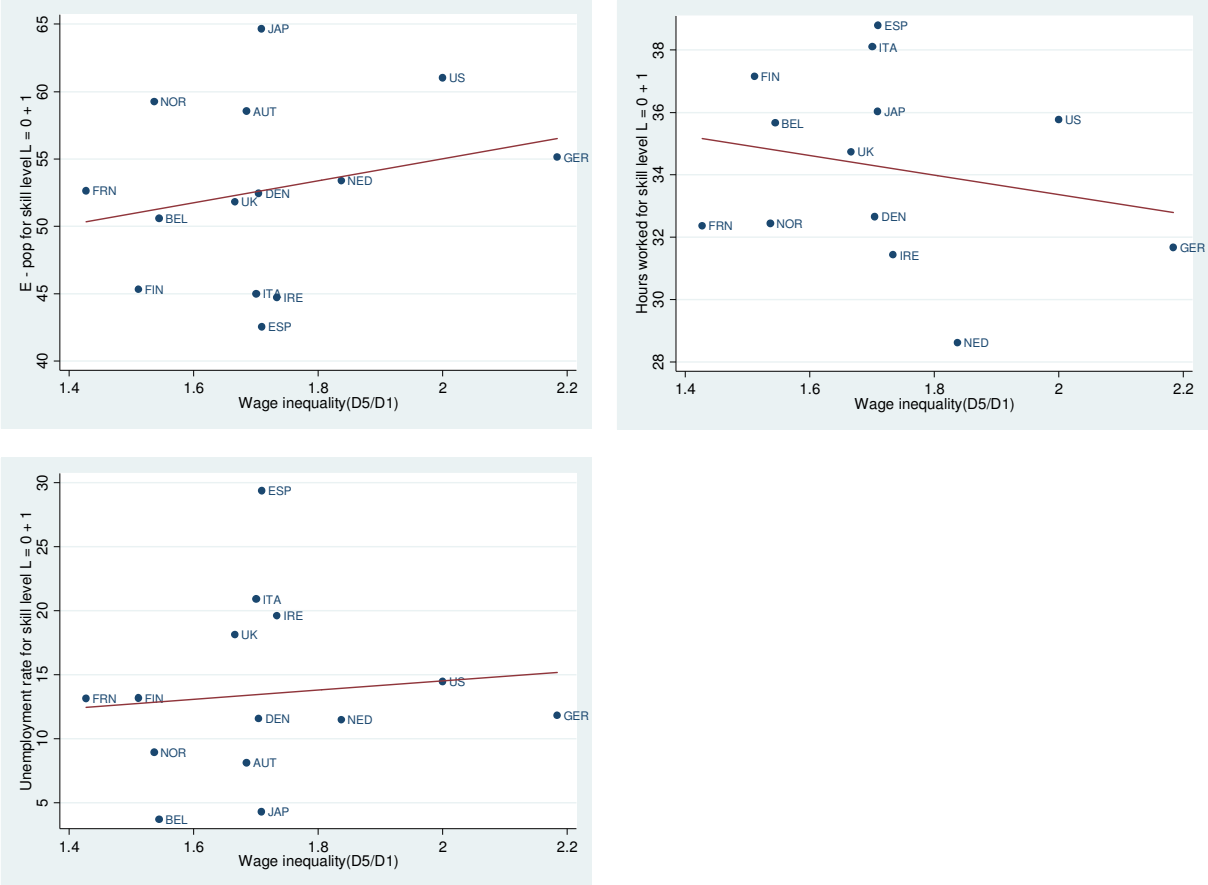
Furthermore, Figure 10 focuses only on the relationships between wage inequality (D5/D1) and employment for the low-skilled workers, and allows additionally observing individual

[53] The employment to population rate refers to the percentage share of employed persons in the total working age population.

[54] The only correlation that is of week significance (at only a 10% significance level) is the one between hours worked per head and wage inequality at the upper part of distribution. More hours worked are related to higher wage inequalities at the top.

countries. The first diagram in the upper left corner shows a slightly positive (although insignificant) relationship between D5/D1 wage ratio and e-pops in the lowest skill level. The US is the country with high wage inequality (D5/D1) that simultaneously has a good performance in terms of employment. However, all three diagrams find no support for wage compression hypothesis – countries' labor market performance in the low-skill sector does not show relation to wage inequality at the bottom half of the wage distribution; pattern is rather mixed.

**Figure 10: Wage inequality (D5/D1) and employment for the low-skilled workers**

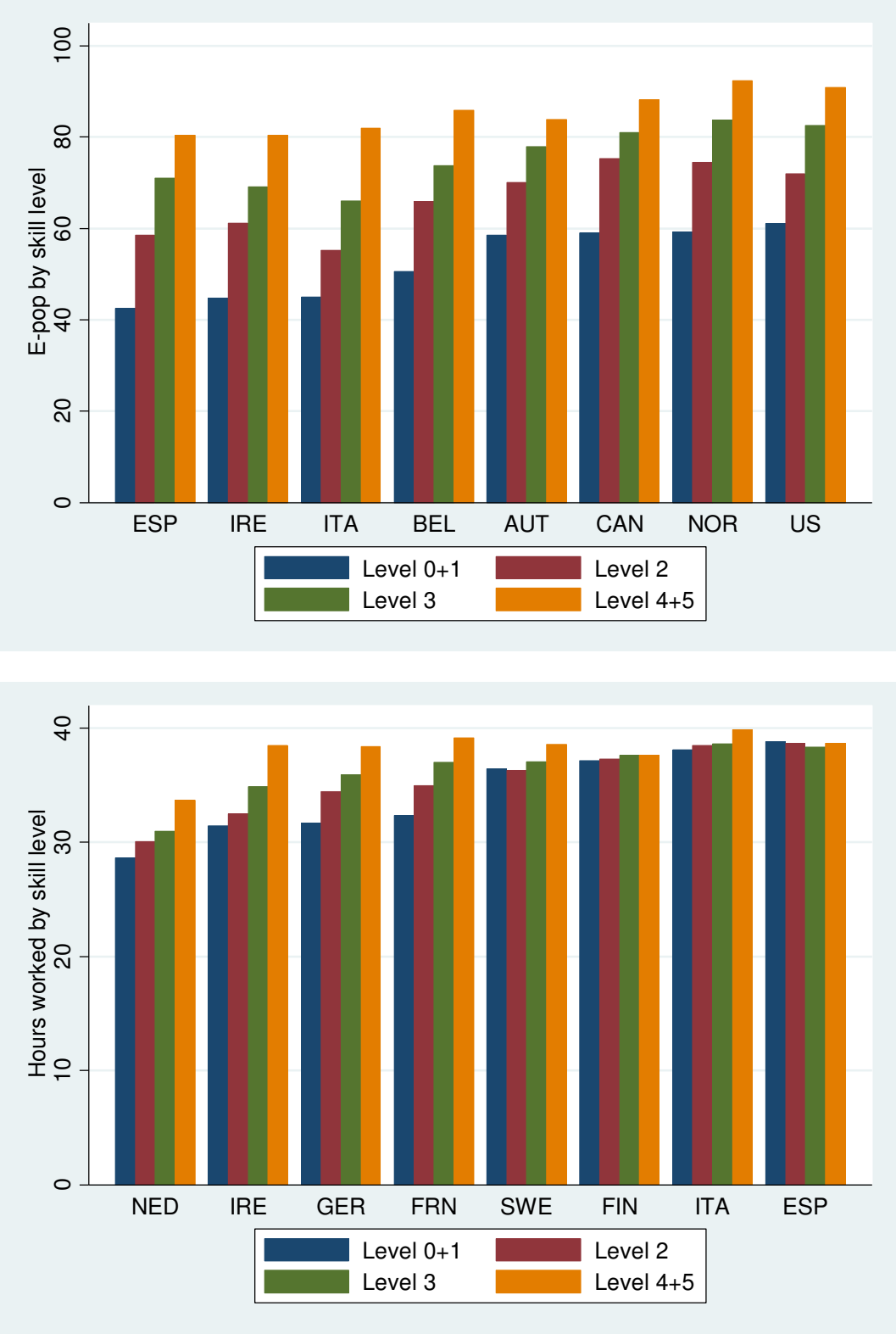


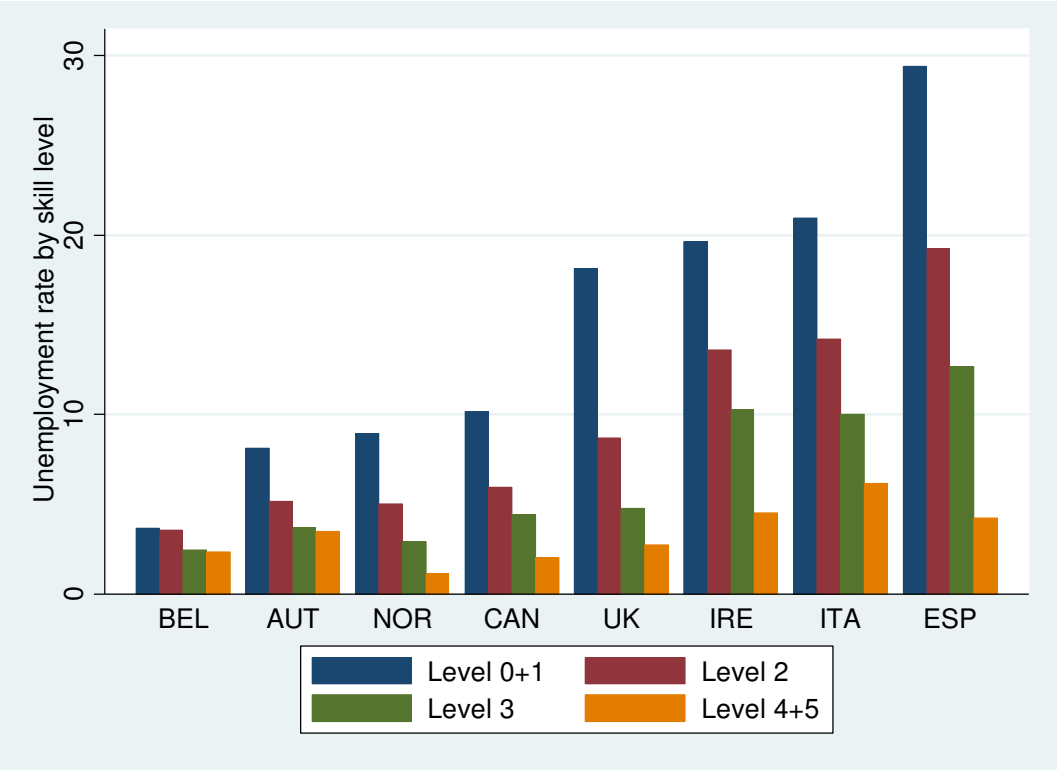

*Source:* Calculations based on PIAAC.

Why do some countries do so well in terms of low-skill employment, whereas others are much less successful in job creation? Can this cross-country variation in employment be explained by cross-country variation in wage inequality? Figure 11 presents e-pops/hours worked per head/unemployment rate for four different skill levels for eight selected countries. Countries are selected according to the lowest (highest) proportion of employed persons in the

low-skill group. The diagram displays a very clear pattern. Employment to population rates are highest in high skill level groups, as expected. Countries that have comparatively higher employment among low-skilled workers (the US, Norway, and Canada) also demonstrate higher employment in the other skill groups. Countries with the lowest employment among low-skilled workers (Spain, Ireland, and Italy) also have the lowest employment in other skill groups. When wage inequality among these countries is observed, the picture becomes mixed, and there is no clear pattern. It rather seems more plausible that some countries are in general more successful in employment creation than others. It is not the low-skill sector and excessively high wages at the bottom of the wage distribution that make the whole difference in the employment performance of the countries, but rather something else; e.g. economic policy making. The only country that does not follow this general pattern is Japan. It has one of the highest e-pops in the lowest skill groups L0 and L1, whereas e-pops in other skill groups are significantly lower. The same story is true for unemployment rates. Only at the highest skill levels is unemployment low everywhere with no pattern across countries – high-skilled workers have low unemployment rates in all countries (under 6%). However, all other countries exhibit either high or low unemployment, regardless of the skill level. Average hours worked per head do not seem to vary much at different skill levels in Spain, Italy, Finland and Sweden. In other countries, higher skills are related to higher number of hours worked, and they are especially high for the highest skill workers. Even in countries with flexible wages in the bottom half of the wage distribution, average hours worked for low-skilled workers are lower than hours worked for high-skilled workers and well paid. Germany, the Netherlands, and Ireland have at the same time the highest wage dispersion in the bottom half of the wage distribution and the lowest average hours worked in the low-skill sector; which is not in line with theory. It is actually in Finland (low inequality country) in which there is no difference in the average weekly hours worked across skill groups.

**Figure 11: Employment to population rate for four different skill levels, by country**






*Source:* Calculations based on PIAAC.

Finally, in order to perform an additional check, the mean and median score results between the employed and unemployed across countries are compared. If the wage compression hypothesis was true, it would be expected that, in the countries with rigid labor markets and low inequality, the pool of unemployed consists mainly of low-skilled workers. At the same time, countries with flexible labor markets are expected to have much higher employment in the low-skilled sector[55] (and low-skilled should not be unemployed)[56]. Table 16 shows the mean, median, and standard deviation of numeracy skill scores by labor force status. Employed persons in the US, the UK, Spain, and Italy have lower average scores than the unemployed in Japan, Belgium, Finland, Denmark, and the Netherlands. Since the latter countries (apart from Japan) have at the same time more compressed wage structure, low-skilled people in these countries should be unemployed (on the basis that their wage is too high). Indeed, some of these less unequal countries do demonstrate low employment at the bottom. But these workers are not unskilled; their average score results are too high, as the data suggests. The data actually shows that the unemployed in these countries have higher

[55] Analysis shows that there is no correlation between the relative deviation of scores between the employed and the unemployed and the wage dispersion in the low-skilled sector (D5/D1), which is not in line with wage compression hypothesis.
[56] Surely, there will always be some frictional unemployment, but it exists in all skill groups

average scores than the employed in some other countries. On the other hand, in the first group of countries, where wage flexibility is higher, the employment of low-skilled workers should be higher. However, the unemployed do have very low average skill scores, which is contradictory to the wage compression hypothesis. Furthermore, in Japan there is almost no difference in the average score results between the employed and unemployed, which is again evidence against wage compression hypothesis. The average score results of people out of the labor force are comparable to those of the unemployed people with a minor variation in the number of score points in both directions.

**Table 16 : Mean and standard deviation of numeracy skill scores by labor force status**

| | Employed | | | Unemployed | | | Out-of-labor force | | |
|---|---|---|---|---|---|---|---|---|---|
| Country | mean | median | sd | mean | median | sd | mean | median | sd |
| Canada | 271.66 | 275.03 | 52.77 | 249.22 | 253.41 | 54.96 | 244.41 | 249.26 | 60.18 |
| Denmark | 285.54 | 288.93 | 48.64 | 265.43 | 268.74 | 50.13 | 256.54 | 258.59 | 53.32 |
| Finland | 289.70 | 291.94 | 48.45 | 271.21 | 275.33 | 56.99 | 263.58 | 268.26 | 56.19 |
| France | 261.14 | 265.48 | 54.22 | 244.86 | 248.02 | 53.51 | 241.27 | 247.33 | 58.27 |
| Germany | 278.43 | 282.07 | 49.97 | 248.43 | 248.90 | 49.07 | 251.74 | 255.49 | 58.35 |
| Ireland | 264.35 | 266.99 | 50.17 | 246.98 | 250.29 | 50.12 | 240.18 | 246.60 | 57.65 |
| Italy | 255.00 | 257.20 | 49.31 | 236.38 | 241.41 | 50.62 | 237.33 | 239.22 | 48.62 |
| Japan | 291.03 | 293.52 | 43.99 | 285.69 | 285.76 | 43.80 | 280.17 | 283.01 | 43.01 |
| Austria | 279.78 | 282.81 | 47.53 | 265.33 | 269.37 | 51.86 | 261.41 | 264.63 | 51.58 |
| Netherlands | 286.86 | 291.30 | 47.38 | 264.84 | 270.00 | 56.89 | 258.45 | 264.04 | 56.41 |
| Belgium (Flanders) | 287.18 | 290.62 | 48.64 | 278.17 | 277.92 | 49.09 | 263.51 | 268.61 | 51.53 |
| Norway | 285.05 | 289.47 | 51.31 | 256.80 | 262.47 | 55.71 | 252.44 | 258.59 | 57.47 |
| Spain | 256.24 | 259.84 | 47.77 | 234.72 | 238.83 | 50.43 | 229.33 | 236.39 | 53.53 |
| Sweden | 287.22 | 290.41 | 50.26 | 255.12 | 263.08 | 59.44 | 256.62 | 264.86 | 60.57 |
| England/N. Ireland (UK) | 269.80 | 272.30 | 51.69 | 236.61 | 238.70 | 55.69 | 244.25 | 246.64 | 57.51 |
| United States | 260.04 | 264.03 | 55.95 | 235.63 | 236.30 | 46.89 | 232.21 | 235.90 | 58.14 |

*Source:* Calculations based on PIAAC.

But then again, who are the employed, unemployed, and out-of-labor force? Are the subgroups of these three pools of people somehow different, and can they reveal important insights? Data shows[57] that on average there is no significant difference between men and women – they are equally represented in both pools of the employed and unemployed. However, on average, people out-of-labor force are more likely to be women (60%), compared to only 40% men in this group. This share is even higher in Japan, Italy, the

[57] All tables and graphs are available upon request.

Netherlands, the US, and the UK, where women's participation in the labor market is lower than men's, possibly while they engage more in the household activities and parenthood and due to social norms. Only in the Scandinavian countries does there seem to be almost no gender difference in this regard. When it comes to immigration status, immigrants are only slightly more present in the pool of the unemployed compared to the pool of the employed and the out-of-labor force, relative to the non-immigrants. The main conclusion about the age cohorts is that unemployment is gradually decreasing with age across all countries. The pool of people out of the labor force is mainly represented by the lowest and highest age cohorts (age groups 1 and 5), and these two groups together account for around 60% of those out-of-labor force on average.

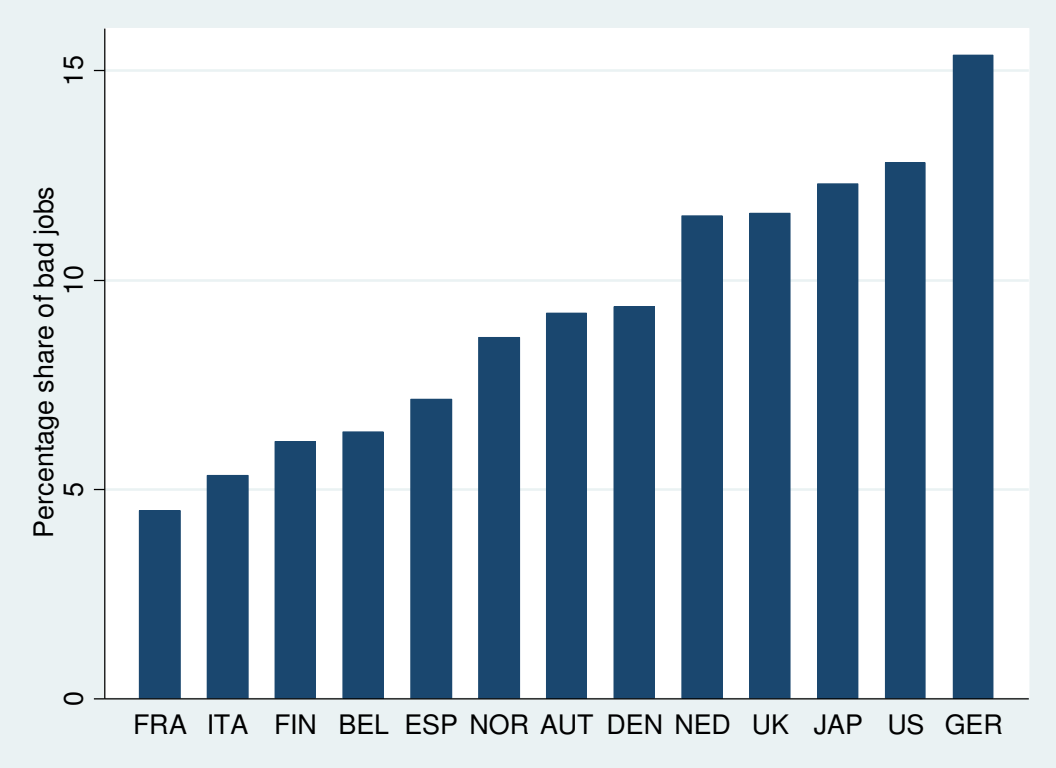
Challenges to the validity of the wage compression hypothesis has been made in earlier cross-country empirical work (Glyn *et al.*, 2006; Howell *et al.*, 2007, Jovicic and Schettkat, 2013), which found no evidence of a relation between wage compression (strong institutions) and unemployment. There are also a number of studies based on micro data that could not explain the high European unemployment rates with institutional rigidity (Card *et al.*, 1996; Krueger, and Pischke, 1997). At the same time, some other economists were insisting on exploring the aggregate demand deficiency and macroeconomic policies as a potential explanation for employment differences across countries (see Solow, 2008; Krugman, 2009; Schettkat and Sun, 2009; Wolf, 2014). However, this evidence appears to have been ignored, and the deregulation of welfare-state institutions remained the main policy recommendations even today in Europe.

### 3.6.1 Share of Low-paid Jobs

It is doubtful that countries with rigid labor market institutions and rigid wages at the bottom of the distribution have low employment among the low skilled workforce, as the previous analysis showed. What are the consequences of compressed wage structures? Figure 12 shows the share of low-paid jobs; where low pay is defined as 2/3 of the median wage in OECD countries. Countries with the highest share of low-paid jobs are Germany, the US, Japan, and the UK. Not surprisingly, these are the countries where the dispersion of the wages in the bottom half of the wage distribution is relatively high. (Alternatively, the United States has relatively high employment among low-skilled workers, but this is certainly not the case for the rest of the countries.) The high share of low-paid jobs was not enough to produce

high employment in the low-skill sector in Japan, the UK, and Ireland. On the other hand, Norway managed to maintain well-paid jobs and high employment at the same time. The only certain result of wage flexibility hypothesis is that there is a higher share of low-paid jobs. Proponents of low pay policy claim that this is still better than unemployment. This paper, however, finds no evidence for wage compression hypothesis.

**Figure 12: Share of low-paid jobs measured as 2/3 of median wage, employed persons**




*Source:* Calculations based on PIAAC.

## 3.7 Conclusion

Based on the PIAAC adult skill survey, this paper examined international differences in wage inequality, skills, and whether a compressed wage distribution is associated with high unemployment across core OECD countries. Although both skill compression and wage compression hypotheses have strong theoretical backgrounds, none of them could be empirically verified based on this cross-country study. Firstly, there is a large variation in wage dispersion across countries, but its correlation to variation in skill dispersion is rather weak. Even accounted for skills, some countries have more compressed wage structure.

Instead, it seems plausible that the other set of explanations in terms of institutions have more power in explaining these differences. According to this analysis, the correlation between various measures of institutions and wage inequality is significantly higher than the correlation between skill inequality and wage inequality. However, in order to confirm this finding, a more detailed analysis is required. Secondly, relative employment performance of low-skilled workers is not worse in countries where the wage premium for skill is more rigid (lower wage inequality). Countries that do well in this sector in terms of employment perform well in general (in all the other groups as well), which is independent from the level of wage inequality. On average, countries that have higher e-pops, higher hours worked and lower unemployment rate do not have high wage inequality, neither at the top nor at the bottom of the wage distribution. The only certain result of wage flexibility is that there is a higher share of low-paid jobs, (but this high share of low-paid jobs does not appear to be related to high employment).

These results (although descriptive) have some important implications for policy-making. Based on the perfect market model, marginal productivity theory, skill compression and wage compression hypotheses etc., institutional reform (that should lead to higher wage dispersion) was considered as the appropriate policy measure to increase competitiveness, output, and employment (see OECD, 1994; IMF, 2004). When not distressed by regulation and public policy, markets should lead to wages that correspond to marginal productivity, and full employment should follow. Compressed wages are seen as likely causes of high unemployment, especially in the low-skill sector; consequently permitting higher wage dispersion should stimulate employment. The same thinking grounded on the equity-efficiency tradeoff is guiding austerity measures and reduction in public services in the EU today. This study challenges both hypotheses and the theoretical assumptions they are derived from; it calls for revision of the current policies. Instead of insisting on deregulation of labor market institutions as the main policy recommendations to achieve higher employment (and higher wage inequality), policymakers should reconsider demand deficiency and macroeconomic policies as a potential explanation for the employment differences across countries (see Solow, 2008; Krugman, 2009; Schettkat and Sun, 2009; Wolf, 2014). Consistent with this view, expansionary macroeconomic policies –stimulative demand policies- might be necessary in order to achieve high employment and low unemployment. Moreover, high inequality is correlated to major health and social problems e.g. crime, violence, anxiety, mental illness, obesity, infant mortality, imprisonment rates (see Wilkinson

and Pickett, 2009). Not only that high wage dispersion have negative consequences on societies, but this study also shows that wage dispersion is not vital for better labor market performance.

This study builds on the previous work of Devroye and Freeman (2001) and Freeman and Schettkat (2001), who performed similar analysis based on the IALS literacy survey from 1998 and two (four) countries. These findings, based on the more recent literacy survey (PIAAC) and core OECD countries, are in line with their findings and confirm their results. However, one must acknowledge that literacy surveys have their limitations; they capture narrow measure of skills. Furthermore, evidence presented here is rather descriptive. Yet, if the skill compression and the wage compression hypotheses were true, even descriptive cross-country analysis would be expected to show that there are correlations and patterns between the variables of interest. Evidence presented here illustrates that this is certainly not the case.

# 4. Literacy skills, equality of educational opportunities and educational outcomes: an international comparison

## 4.1 Introduction

This paper assesses the role of literacy skills as an equalizer in both educational outcomes and educational opportunities. There is substantial cross-country variation in the average skill levels and skill dispersion of the adult population. From a policy perspective, it is critical to understand whether these cross-country differences in in performance (average skill levels) are associated with cross-country differences in skill equality and intergenerational educational mobility[58], and this is the topic this paper strives to explore. Achieving better skills and higher educational levels is vital, particularly because higher educational performance may lead to higher productivity (Woessmann, 2004; Card, 1999) and enhanced earnings, social prosperity, employment, and economic growth (OECD, 2010b, 2012a, 2012b). These potential benefits are the reason why most economists agree that investing in human capital and increasing educational attainment should be important aspects of every political agenda. Although it is still under debate regarding whether equal outcomes are necessarily desirable, economists primarily agree on the importance of ensuring equal opportunity to succeed in life and fulfill one's potential (Roemer, 1998, Stiglitz, 2015; Atkinson, 2015; Putnam, 2015).[59] Each person's success should depend on his talents, motivation, and sacrifices of time and effort, and should not depend on the socioeconomic status of his parents.

This paper seeks to answer the following question: Is performance (measured by average literacy test scores) across countries related to within-country skill inequality (dispersion in literacy test scores) and intergenerational educational mobility (measured by the estimated coefficient of parents' educational levels on their children's test scores)? Furthermore, this paper explores the possible drivers of cross-country differences in average literacy scores and their changes. By comparing differences between developed countries, there is an opportunity to understand the extent of the differences between countries, as well as the reasons that might

[58] One aspect of equality of opportunity

[59] Even well-known libertarians such as Milton Friedman (who is an opponent of policy intervention with a goal of achieving equal outcomes) insist on providing equality of opportunity as an essential component of liberty (Friedman and Friedman, 1980).

underlie the differences and the changes. This analysis may in turn shed light on what can be done in order to make improvements.

This empirical analysis builds on earlier work, and shares the most similarities with Freeman *et al.* (2011). Based on the PISA mathematics tests (waves 2000 and 2009), these authors examine the relationship between inequality of student scores, average score levels, and family background. Although they reject the equality-efficiency tradeoff, they find no relationship between the family background effects and dispersion of scores. Woessmann (2004) analyzes the effects of family background characteristics on student math scores across 18 countries using TIMSS tests conducted in 1995 (the target population is 13-years-olds). He finds no relationship between equality of opportunity and the mean performance of countries. Based on the PIAAC survey, Solga (2014) finds an association between mean literacy scores and economic inequality and stresses the necessity of investing in children's education and in more equal family conditions, and the significance of an active welfare state in order to achieve higher economic equality. This paper strives to replicate the analysis of Freeman *et al.* (2011), but based on literacy skills and adult working-age population to determine whether the results that hold for 15-year-olds can be confirmed among the representative adult working-age population. Additionally, this analysis explores cross-country differences in average literacy scores and, more importantly, links the two surveys to allow for the exploration of changes over time.

This paper is organized as follows. Section 4.2 describes the data set and data adjustments and also conveys descriptive statistics. The following section analyzes the tradeoff between equality and efficiency. Section 4.4 explores the effects of family background and its relationship to average skill levels and skill equality. Section 4.5 seeks to shed light on cross-country differences in literacy test scores and their changes. Finally, last section concludes.

## 4.2 Data description and statistics

This analysis is focused on adult skills measured by literacy test scores and their changes using two skill surveys: the Survey of Adult Skills (PIAAC) and the International Adult Literacy Survey (IALS). Both surveys were initiated by the OECD and were conducted in 2011-2012 (PIAAC) and 1994-1998 (IALS). These data sets comprise the survey data on

various indicators of adult competencies, demographics, socioeconomic status, and other information internationally comparable across OECD countries. The number of countries that took part in the surveys is higher in the PIAAC survey when compared with the IALS survey. This analysis is thus limited to 11 highly developed OECD countries that took part in both surveys: the United States, the United Kingdom, Ireland, Denmark, Finland, Norway, Sweden, Belgium, Germany, Italy, and the Netherlands.[60] Countries' sample sizes are larger in the PIAAC (around 5,000 observations per country) than in the IALS (2,000-3,000 observations). In both data sets, national weighted[61] samples based on a representative civilian non-institutional working-age population (16-65) were generated, which makes them both representative and comparable. Both surveys were conducted through interviews with similar background questionnaires and competency tests. Existing differences in the background questionnaire were accounted for by creating new derived variables that allowed for stronger compatibility between the two surveys. This analysis is based on the comparable linking variables in both surveys, which are marked as "trend" variables in the two data sets.

In the PIAAC, adult skills are measured by literacy, numeracy, and problem-solving skills in technology-rich environments that are central to both strong performance in the labor market and successful participation in society. However, only literacy skills are comparable between the two surveys. The definition of numeracy skills varies between the surveys, and the problem-solving domain was not tested at all in the IALS survey. Numeracy tests in the PIAAC are much broader and involve wider variations in tasks than the quantitative literacy tests in the IALS, which are exclusively comprised of computational tasks. Since tasks vary considerably, these two competency domains are not comparable. Although literacy test scores in their original form were not directly comparable between the two surveys, the OECD undertook technical adjustments and rescaled literacy scores in the IALS so that they match literacy scores in the PIAAC.[62] In the IALS, prose literacy and document literacy were tested separately. Consequently, the OECD was required to rescale them in order to combine them into one literacy test score scale. These two parts were also included as a component of the literacy domain in the PIAAC, which makes them directly comparable between the two surveys. Additionally, literacy skills in the PIAAC are more broadly defined, and they involve a reading component as well. However, 18/24 items were linking items in the paper-based

[60]Canada is excluded from the analysis, due to the missing information on age (both surveys) and educational levels (IALS).
[61]Weighted to population in relevant time periods.
[62]For more information on the procedure, see Technical Report of the Survey of Adult Skills (2013a).

assessments, and 29/52 were linking items in the computer-based version (see OECD, 2013b, for a comparison of the surveys).[63] This is another important difference between the surveys. Whereas the IALS tests were paper-based, in the PIAAC, adults had an opportunity to choose between paper and computer-based tests. According to the OECD, this did not affect adult scores.[64] The definition of the PIAAC literacy test is as follows: "understanding, evaluating, using, and engaging with written text to participate in society, to achieve one's goals, and to develop one's knowledge and potential" (OECD, 2013a:59). In order to determine the relationship between adult competencies and parental background, data on parents' highest obtained educational levels is necessary. Adults' (and their parents') educational levels are measured according to standardized ISCED levels (0-9), which are comparable across countries. Based on this classification, three different levels were created: low (upper secondary schooling), middle (secondary and post-secondary, non-tertiary education), and high (tertiary education or higher). Furthermore, this analysis is restricted to the age group spanning ages 25-65, since the youngest adults (16-24) could still be enrolled in the educational system.

Using literacy test scores as the measure of skills has many important advantages over other more traditional measures. It is challenging to obtain the right measure of human capital and skills, and different measures have been employed to assess the level of human capital in the literature. The most traditional among these measures are years of schooling and level of education. The correlation coefficient between years of schooling and literacy test scores in this sample is positive but lower than expected (0.54 in the IALS, and 0.50 in the PIAAC). By using years of schooling as a measure of skill, the required assumption is that one year of schooling produces the same level of skills in all countries, which is fairly unrealistic. Previous research has demonstrated that there is a high dispersion of adult skills within the same educational level/years of schooling; educational degree does not produce a precise skill level either (see Jovicic, 2016; Devroye and Freeman, 2001). Additionally, skills change over the life cycle, but these changes are not captured by the educational degree either, which once earned remains throughout one's entire life. Furthermore, adult literacy surveys demonstrate stronger international comparability, since identical tests were taken in every country,

[63]In these kinds of surveys there will always be a tradeoff between administering the same items (which maximizes comparability over time) and adding new items (skills/tasks that are more relevant at the time the survey is taken).

[64]For this purpose, the OECD conducted a field test in 2010 that confirms no significant difference in scores regarding two different delivery modes (see OECD, 2013b).

whereas years of schooling and educational levels do not produce the same skills across countries. Tyler *et al.* (1999) offer further evidence in favor of using cognitive scores as a superior measure of skill by demonstrating that even among those with the lowest educational attainment (high school dropouts), there are substantial earning returns to basic cognitive skills, as measured by GED test scores. Thus, it can be argued that whereas years of schooling and education levels measure educational quantity, test scores capture the aspect of educational quality.

Table 17 reports the mean, median and standard deviations of literacy test scores in the IALS and the PIAAC, as well as changes. In the IALS, countries with the highest average literacy scores (median higher than 287 points) were Scandinavian countries (Norway, Sweden, Denmark and Finland), whereas countries with the lowest average literacy scores were Italy, Ireland, and the UK (average literacy scores (median) in Italy were only 243 points). Around 15[65] years later, rankings of the countries had not changed considerably, yet within-country changes were noteworthy. Countries that experienced the highest decline in the average scores were Denmark, Norway, Sweden, and Germany. As mentioned above, these were the countries that had relatively high average literacy scores in the IALS. Despite this decrease of 10 points or more, Sweden and Norway remain in the group with the highest average literacy scores. Only Finland and the Netherlands remain countries with relatively high average literacy scores, primarily by maintaining stable average scores in comparison to the IALS (average literacy scores did not change significantly). On the other hand, three countries experienced improvements in their average literacy scores of at least 4 points: Italy, the UK, and Ireland. As shown previously, Italy and Ireland had the lowest score level to begin, and this positive change still leaves them in last place in the new survey. They are followed by Germany and the US, whose average scores are also relatively low. To summarize, Norway and Sweden are the countries with the highest literacy scores despite suffering major losses in the number of average test points between the two surveys. Ireland and Italy represent the opposite story: they had the lowest results in both surveys, despite achieving significant improvements in average scores. The UK and the US did not do particularly well in any of the surveys. Examining the mean instead of the median scores reveals a similar story. Differences in scores are only marginal in most of the countries. However, the median score was noticeably higher than the mean in Italy, the UK, and the US in the mid-1990s.[66]

[65] 13-17 years, since depending on the country IALS was taken between 1994 and 1998.
[66] This is due to the number of people with very low test scores in the IALS.

**Table 17: Summary statistics of literacy scores, IALS, PIAAC, and changes (25-65)**

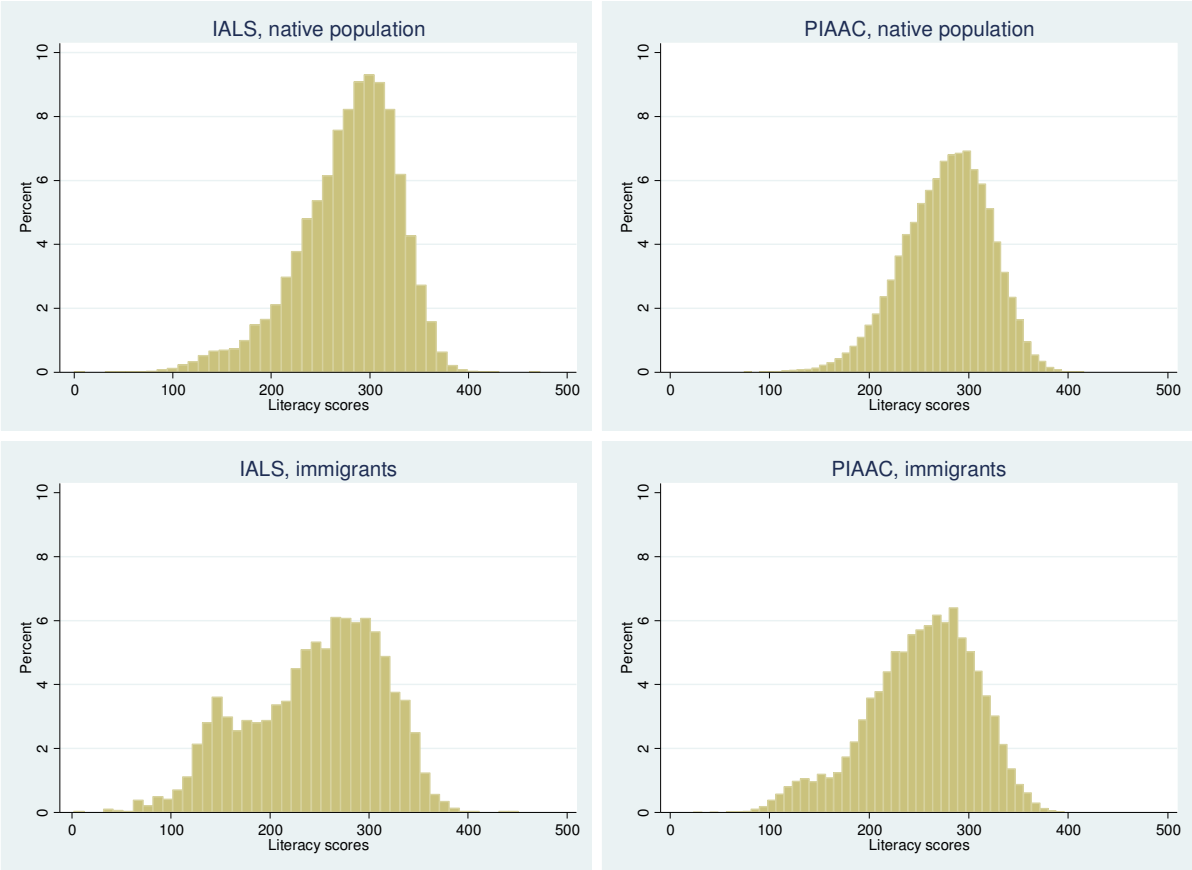
| Survey | IALS (1996) | | | PIAAC (2011) | | | Change | |
|---|---|---|---|---|---|---|---|---|
| Country | Mean | Median | St.Dev. | Mean | Median | St.Dev. | Mean | Median |
| BEL | 272.12 | 280.00 | 52.02 | 273.73 | 278.49 | 47.82 | 1.61 | -1.51 |
| DEN | 286.81 | 290.75 | 41.81 | 269.69 | 275.28 | 48.80 | -17.12 | -15.47 |
| FIN | 282.25 | 287.67 | 48.47 | 285.67 | 289.93 | 51.87 | 3.42 | 2.26 |
| GER | 280.52 | 281.75 | 43.97 | 268.08 | 271.10 | 47.73 | -12.44 | -10.65 |
| IRE | 259.91 | 265.89 | 57.01 | 265.69 | 269.91 | 48.35 | 5.78 | 4.02 |
| ITA | 236.46 | 243.77 | 57.88 | 248.74 | 250.63 | 44.67 | 12.28 | 6.86 |
| NED | 277.44 | 283.54 | 47.63 | 281.83 | 287.23 | 49.44 | 4.39 | 3.69 |
| NOR | 291.70 | 297.65 | 45.63 | 279.19 | 284.59 | 47.76 | -12.51 | -13.06 |
| SWE | 290.12 | 295.85 | 55.03 | 278.43 | 284.06 | 51.56 | -11.69 | -11.79 |
| UK | 264.54 | 272.18 | 60.92 | 273.92 | 277.11 | 49.34 | 9.38 | 4.93 |
| US | 274.77 | 283.27 | 59.71 | 269.42 | 273.40 | 50.51 | -5.35 | -9.87 |
| Pooled | 277.77 | 285.25 | 50.59 | 277.27 | 280.65 | 43.62 | -0.5 | -4.6 |

*Source:* Calculations are based on the IALS and the PIAAC.

One important factor that could affect results of the analysis, and that also has the potential to explain part of these cross-country differences in average literacy scores and their changes, are cross-country differences in the percentage of immigrants. Figure 13 reveals the distribution of literacy scores in the IALS and the PIAAC for both the native population and immigrants (ages 25-65). Figure 13 clearly demonstrates that literacy scores of immigrants are more closely concentrated in the low skill levels in both surveys, which corresponds with previous studies based on the IALS (Devroye and Freeman, 2001; Freeman and Schettkat, 2001). The primary reason for low performance among immigrants is the fact that literacy tests are done in the national languages of countries. Immigrants often encounter language barriers and consequently acquire fewer points. This problem is even more evident in this analysis, which is based on literacy tests that assess reading and understanding of text, as opposed to the numeracy tests that were used in the above-mentioned and other studies. As a result, cross-country variations in the proportion of immigrants and changes in their proportion have the potential to explain cross-country differences in scores, as well as changes over time. Norway, Sweden, and Denmark represent countries where overall average literacy test scores decreased the most. At the same time, they experienced the highest increase in the share of immigrants. On the other hand, the largest immigration countries (Anglo-Saxon countries) are also the countries with the lowest average literacy scores. It is likely these low literacy scores and decreases in literacy scores, can be partly explained by the lower average literacy scores of immigrants and their high (increasing) shares in the adult

population. To summarize, immigrants acquired schooling elsewhere, their scores tend to be underestimated due to language difficulties, the reasons for choosing a specific immigration country are idiosyncratic, and there are large cross-country differences in the shares of immigrants. I thus focus exclusively on the native population (immigrants are excluded).[67]

**Figure 13: Distribution of literacy skills in IALS and PIAAC, native population and immigrants (ages 25-65)**




*Source:* Calculations are based on the IALS and the PIAAC.

[67] Table 20 lists the summary statistics of literacy scores when immigrants are excluded.

## 4.3 A tradeoff between educational efficiency and equality

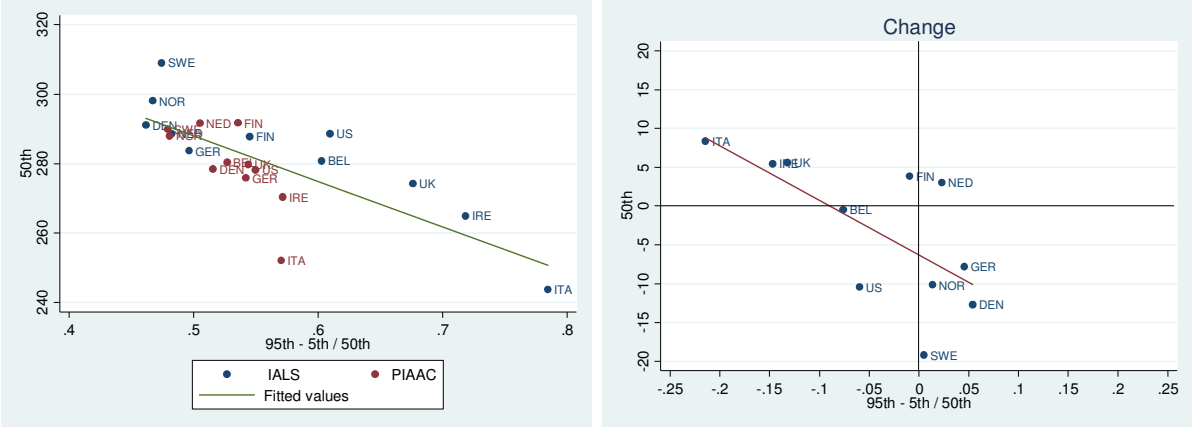
High economic inequality has been tolerated by many economists who contend that it is necessary for high efficiency (Okun, 1975). It is argued that in most economic situations, it is not possible to achieve both efficiency and equality simultaneously, and therefore compromise is necessary. Higher equality can only be achieved at the expense of lower efficiency, primarily because it is assumed to decrease incentives necessary to increase performance. Relevant to the analysis in this paper, if the tradeoff holds true, it would imply that countries which are top performers in terms of high average literacy scores should, at the same time, have relatively high inequality of literacy scores, and vice versa. Moreover, countries that want to increase their literacy test performance must accept rising inequality in literacy scores.

In order to test this hypothesis, median literacy test scores are compared to the dispersion of literacy test scores, which is measured by the ratio of the difference between the 95$^{th}$ percentile score and the 5$^{th}$ percentile score, divided by the 50$^{th}$ percentile score (see Freeman *et al.*, 2011). Figure 14 shows the cross-country relationship between average (median) literacy scores and the inequality in literacy scores. The relationship is negative and highly significant in both the mid-1990s and in 2011, which contradicts the equality-efficiency tradeoff. Countries that have high average literacy scores (high performance) have, at the same time, high equality of scores in both surveys (Sweden, Norway, Denmark, and the Netherlands). The opposite is true for Italy, Ireland, and the UK. The cross-country correlation coefficients are -0.98 in the IALS and -0.90 in the PIAAC. These results are consistent with Freeman *et al.* (2011), who use PISA numeracy scores and also find a positive relationship between students' math test scores and equality in scores in the two PISA waves. Correlation coefficients in their analysis are slightly lower (-0.87 in 2000, and -0.75 in 2009).

When examining changes between the two surveys (right diagram of Figure 14), a certain pattern emerges. Countries that experienced a substantial drop in average literacy scores (Denmark, Sweden, Norway, and Germany) simultaneously experienced an increase in inequality in literacy scores. Italy, Ireland, the UK, and (to a lesser extent) Finland improved their literacy scores and simultaneously increased equality of literacy test scores. These countries did not have to sacrifice average performance for the sake of greater equality. The

biggest outlier, and the only country where the tradeoff holds, is the US (and, to a lesser extent, the Netherlands). In the US, equality in literacy scores increased, but this was combined with a significant drop in average performance (a change in the opposite direction happened in the Netherlands, albeit at a lower level). The situation in the US may be explained by the fact that whereas all of the higher-skilled groups experienced a significant drop in scores, the lowest-skilled group experienced a tremendous increase in literacy scores. The overall effect on literacy scores was thus negative.[68] Another outlier is Sweden, where a substantial drop in average literacy scores was accompanied by almost no change in skill inequality. Again, here as well, the drop in scores was not driven by the change in the low-skilled group, but, rather, by the change in the high-skilled group.

**Figure 14: Average literacy scores and dispersion of literacy scores, IALS, PIAAC, and changes**



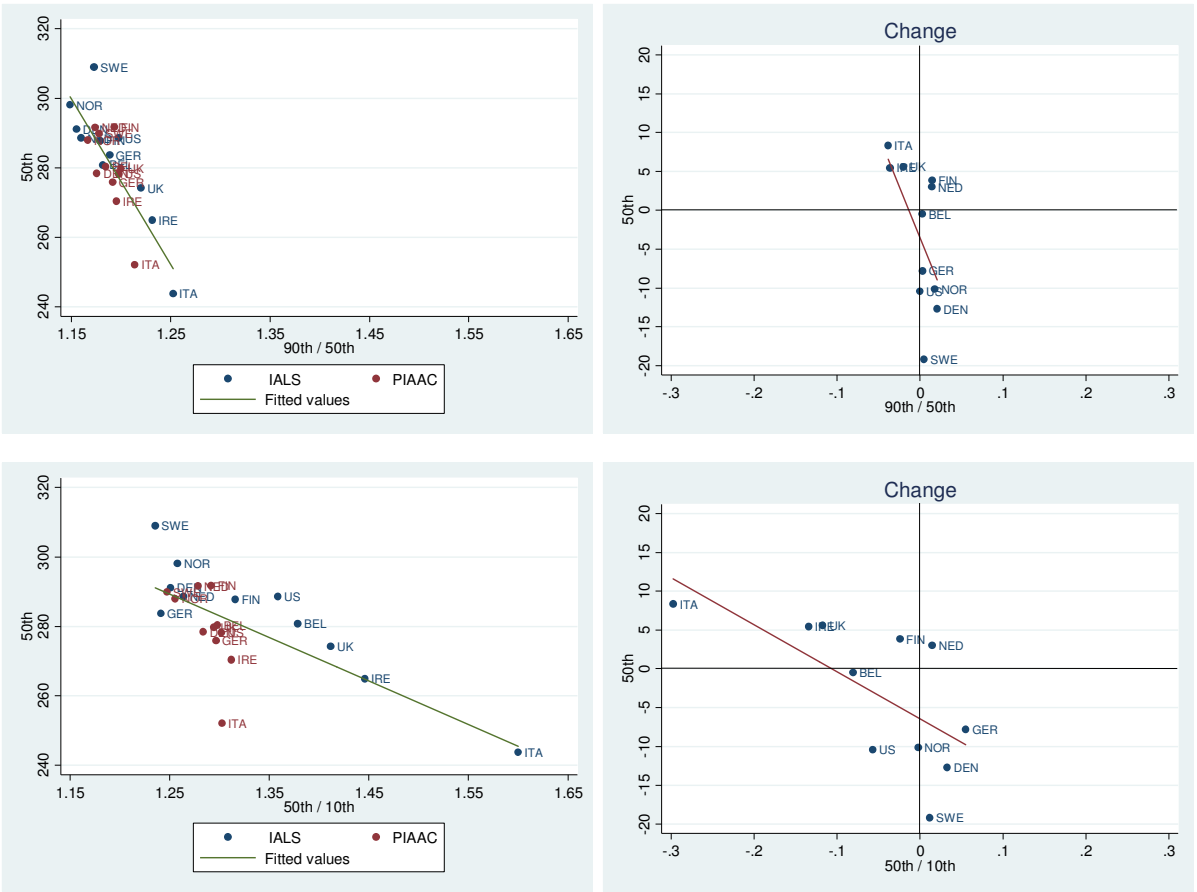

*Source:* Calculations are based on the IALS and the PIAAC.

In order to gauge the robustness of previous results, supplementary measures of dispersion are added. Figure 15 shows scatter diagrams that plot average literacy scores against additional standard measures of dispersion – decile ratios D9/D5 and D5/D1.[69] These diagrams are consistent with the findings shown in Figure 14. Regardless which measure of dispersion is used, there is a significant negative relationship between average literacy scores and inequality in literacy scores. At the same time, changes between the surveys demonstrate that countries which managed to reduce skill inequality achieved this result by increasing the average skill level and vice versa. The only countries where the results seem to be

[68]See Figure 4.
[69]Similar results are obtained if the coefficient of variation is used as a measure of dispersion.

inconsistent are again the US and the Netherlands. Furthermore, examining the decile ratios allows for a comparison of the dispersion in average literacy test scores in the bottom/top half of the score distribution. Some interesting facts become evident. First, inequality in scores is much more dispersed in the bottom half of the score distribution, especially in the IALS. Changes in score inequality were also more substantial in the bottom half of score distribution. Countries that simultaneously managed to achieve higher scores and higher equality in scores in fact improved equality of scores in the bottom half of the score distribution. On the other hand, countries that suffered a substantial drop in average literacy test scores experienced almost no change in the top half of the score distribution but experienced slight losses in equality in the bottom half of the score distribution (apart from Norway, where the opposite holds true).

**Figure 15: Average literacy scores and dispersion of literacy scores, IALS, PIAAC, and changes**

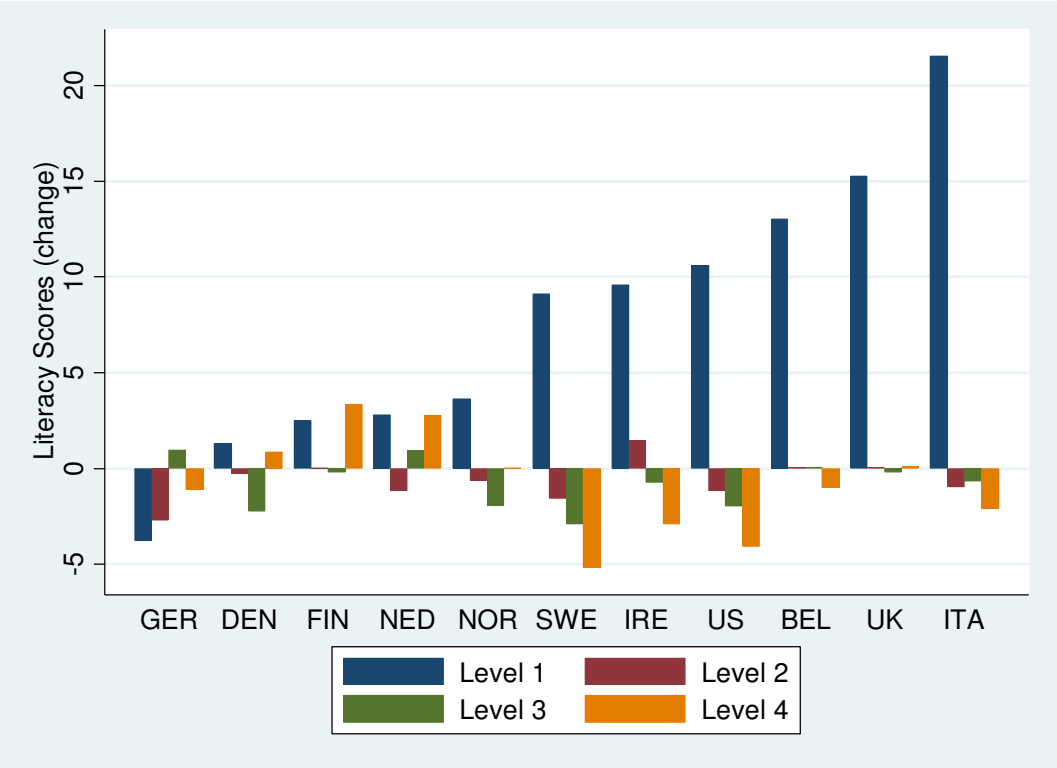



*Source:* Calculations are based on the IALS and the PIAAC.

The fact that top "performers", in terms of the highest average literacy test scores, actually improved equality of scores in the bottom half of the score distribution might imply that this was achieved simultaneously with increasing average literacy scores and improving the average performance of the low-skilled. Figure 16 reveals the change between the IALS and the PIAAC in average literacy scores by skill level, which confirms the previous assumption. The literacy test score results from both surveys were then divided into six literacy skill levels. Skill levels are defined according to literacy score results in the following way: L0<176; L1=176-226; L2=226-276; L3=276-326; L4=326-376; L5>376 points.[70] Italy, the UK, and Ireland managed to improve the average literacy scores of the lowest-skilled adults by as much as 20, 15, and 10 points, respectively, and this was evidently the primary driver behind their overall average score increases. Their improvement would have been even higher had these countries not experienced a decline (although not substantial) in all of the other skill groups, which might pose a serious concern. Whereas there seems to be no particular pattern related to the countries that experienced drops in average literacy scores, it is at least possible to observe that there was no substantial change in the lowest skill group of these countries. Germany is an exception and the only country where low-skilled adults suffered a drop in average literacy scores (4 points), although Germany had the highest score at the outset (top performer in IALS).

[70] For the purpose of this analysis, the lowest levels of 0 and 1 and the highest levels of 4 and 5 are merged together due to the small sample size.

**Figure 16: Changes in literacy scores between IALS and PIAAC by skill level**




*Source:* Calculations are based on the IALS and the PIAAC.

High literacy scores are associated with low inequality in literacy scores. An increase in average literacy scores is associated with a decrease in inequality in scores. My findings further imply that high literacy scores are achieved by improving the performance of adults in the bottom half of the score distribution. However, it is necessary to keep in mind that in order to arrive at definite conclusions, additional in-depth analysis is necessary. These results are descriptive and use a narrow measure of skill. Nevertheless, they can still provide some preliminary insights about the tradeoff between educational equality and educational efficiency. Although Okun (1975) emphasized the existence of the tradeoff between equality and efficiency in most economic situations, in the same work[71] he actually claims that both efficiency and equality can be increased if low income and wealth equality derive from low equality of opportunity. Accordingly, he called for public policies to equalize opportunities. Narrowing the educational financing gap and increasing access to education should lead to both higher efficiency and equality, contrary to his famous "big tradeoff" between the two.

[71] This argument is vastly ignored in the literature.

## 4.4 Intergenerational educational mobility

While there is debate regarding whether inequality of outcomes is necessarily negative for societies and economies, and it should be a matter of concern, most economists are more concerned with equality of opportunity (Roemer, 1998, Stiglitz, 2015; Atkinson, 2015; Putnam, 2015). Inequality of opportunity is less tolerable than inequality of outcomes. In a world where equal opportunities exist, each individual has an equal chance to use his/her potential fully, which should lead to higher productivity and enhanced employment and economic growth in a country. At the individual level, if equality of opportunity exists, everyone who is talented, motivated and works hard should be able to develop his/her skills and be rewarded for it through higher earnings and better employment opportunities. High equality of opportunity or high intergenerational mobility means that family background and the socioeconomic status of parents should not be strongly related to children's success in life and in work.

There are different ways of measuring intergenerational mobility. In the economics literature, the most common is intergenerational income/earnings mobility which examines the dependence of children's income or wages on their parents' income or wages. Alternatively, intergenerational educational mobility is usually measured by estimating the relationship between parental and children's education measured by completed years of schooling.[72] There is an extensive body of literature that addresses these two types of mobility (Björklund and Jäntti, 2009; D'Addio, 2007; Corak, 2006; Blanden *et al.,* 2005). This paper uses a slightly different approach. Namely, in order to determine the level of equality among educational opportunities in different countries, the effect of the father's educational level on children's literacy test scores is estimated. I expect to find a low (high) effect of fathers' educational attainment in countries with high (low) equality of educational opportunity. For the purpose of this analysis, the father's educational level is used, allowing for better comparability with other studies in similar extant literature. However, the same results hold if the mother's educational level is used instead.[73] The father's educational level is accounted for by including a dummy variable that accounts for the father attaining a tertiary education level or

[72] Intergenerational earnings mobility and intergenerational educational mobility are related, given the strong association between education and earnings.

[73]There is only a slight difference in the size of the coefficients, and in the case of the IALS, coefficients are slightly higher for fathers than mothers, whereas in the PIAAC, the opposite holds. All regression tables are available on demand.

higher. [74] I estimate the effect of parental background on children's outcomes by applying OLS to the following regression equation for both the IALS and the PIAAC surveys:

$$(5)\ scores_i = \alpha + \beta\ father's\ education_i + C\ age_i + D\ age2_i + F\ female_i + u_i$$

Where scores are average literacy test scores, father's education is education level indicator, age corresponds to age, female is a gender indicator, u is a residual, and A, B, C, D, F are parameters to be estimated. First, pooled regression results are presented in Table 18. All coefficients related to the father's educational level are highly significant and positive. In the IALS, having a father with a university degree or higher is associated with around 30 more literacy points in the pooled regression. Also, in the PIAAC, children whose fathers have a tertiary education score 30 points more on average. Because of the strong link between education and wages, a high estimated coefficient could mean that high inequality in this society will lead to even greater inequality in the next generation. Columns 3 and 4 list the estimation results for quantile regressions for adults at the 5$^{th}$ and 95$^{th}$ percentile of the score distribution. By estimating quintile regressions, it is possible to determine whether the effect of the father's education is different across the adults' distribution of scores. Is the effect of having a highly educated father greater for low-skilled or high-skilled adults? The quantile regression coefficients are considerably higher at the 5$^{th}$ percentile of the skill distribution than the 95$^{th}$ percentile of the skill distribution in both surveys (the coefficient more than doubles). Fathers' background effects thus differ across the score distributions of their children. An advantageous parental background is demonstrably more important for less-skilled adults than high-skilled adults. This finding may also lead to the conclusion that an increase in the father's educational level leads to less inequality of opportunity. Additionally, the effect of higher parental education is stronger in the bottom half of the score distribution.[75]

In all regressions, coefficients for squared age are significant and negative, primarily because scores fall with age exponentially (see Section 4.5). The female dummy is also significant and negative in all of the models in both surveys. However, it is necessary to keep in mind that there are also unobservable factors that are included in the coefficients (parental enthusiasm,

[74]There are three educational levels: low (upper secondary schooling), medium (secondary and post-secondary, non-tertiary education), and high (tertiary education or higher).
[75] However, there is a small number of adults who have low scores and whose fathers are highly educated.

readiness and competence to help their children)[76]. When estimating intergenerational mobility, it is impossible to control for heritable ability, and to control for the fact that more able fathers might have more able children who obtain higher literacy test scores (the joint nature and nurture effect is estimated). This is where cross-country analysis becomes very useful, because there is no reason to assume that heritable ability, genetic factors, and intensity of parenting will vary across countries in some systematic way (Solon, 1999; OECD, 2010b).

**Table 18: Pooled regression of literacy test scores on fathers' educational level in IALS and PIAAC**

| | IALS | | | PIAAC | | |
|---|---|---|---|---|---|---|
| Variable | Scores | Quintile 5 | Quintile 95 | Scores | Quintile 5 | Quintile 95 |
| Father High Education | 30.27 | 48.68 | 16.15 | 30.6 | 40.39 | 19.43 |
| | (1.13) | (3.78) | (1.67) | (0.56) | (1.42) | (0.98) |
| Age | 2.03 | 1.66 | 2 | 0.89 | 0.2 | 1.15 |
| | (0.23) | (0.78) | (0.34) | (0.14) | (0.36) | (.25) |
| Age2 | -0.04 | -0.04 | -0.03 | -0.02 | 0.2 | -0.02 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Female | -3.67 | -0.56 | -4.07 | -3.02 | 2.49 | -5.36 |
| | (0.59) | (1.99) | (0.87) | (0.39) | (0.98) | (0.68) |
| Constant | 262.37 | 189.78 | 321.58 | 274.88 | 211.53 | 332.6 |
| | (5.07) | (16.93) | (7.48) | (3.25) | (8.15) | (5.62) |
| R2 | 0.13 | | | 0.17 | | |

*Source:* Calculations are based on the IALS and the PIAAC.

*Note:* Standard errors are in parentheses.

### 4.4.1 Country regressions

Table 19 presents the OLS regression coefficients (Equation 5) for individual countries in both surveys. A comparison of intergenerational educational mobility across countries may help us to understand why country differences exist and what can be done in order to improve mobility. There is substantial cross-country variation in the size of the coefficients. Fathers' tertiary educational levels play a different role in different countries. In the mid-1990s, countries with the highest intergenerational educational mobility were Germany, Belgium, Sweden, Norway, and the Netherlands and countries with the lowest intergenerational mobility were Ireland, Italy, the UK, and the US. In 2011, the country ranking did not change considerably. The highest intergenerational educational mobility was evident in Sweden,

[76] Although these variables are likely to be correlated with the fathers' education level, and consequently could cause an upward bias of the estimator

Norway, Denmark, and the Netherlands, and the lowest was in the US, the UK, and Ireland. Scandinavian countries appear to be more successful in ensuring equality of opportunity than Anglo-Saxon countries in the both the mid-1990s and 2011. These results are consistent with the literature on intergenerational earnings mobility (Björklund and Jäntti, 2009; Solon, 2002). Columns 2,3,5 and 6 of Table 19 list the results of the quintile regressions (Equation 5) for adults at the 5$^{th}$ and 95$^{th}$ percentile of the literacy score distributions. All coefficients are significant, apart from those for Belgium and Germany. As in the pooled regression model, cross-country coefficients are greater at the 5$^{th}$ quintile of the skill distribution than at the 95$^{th}$ quintile of the skill distribution in every country in both surveys. Having a highly educated father is more closely related to higher test scores for low-skilled adults when compared with high-skilled adults. This means that improvements in the educational level of fathers have a stronger effect on low-skilled adults than on high-skilled adults. Consequently, increasing parental educational levels will lead to a decline in skill inequality.

**Table 19: Country regressions of literacy test scores on fathers' educational level in IALS and PIAAC**

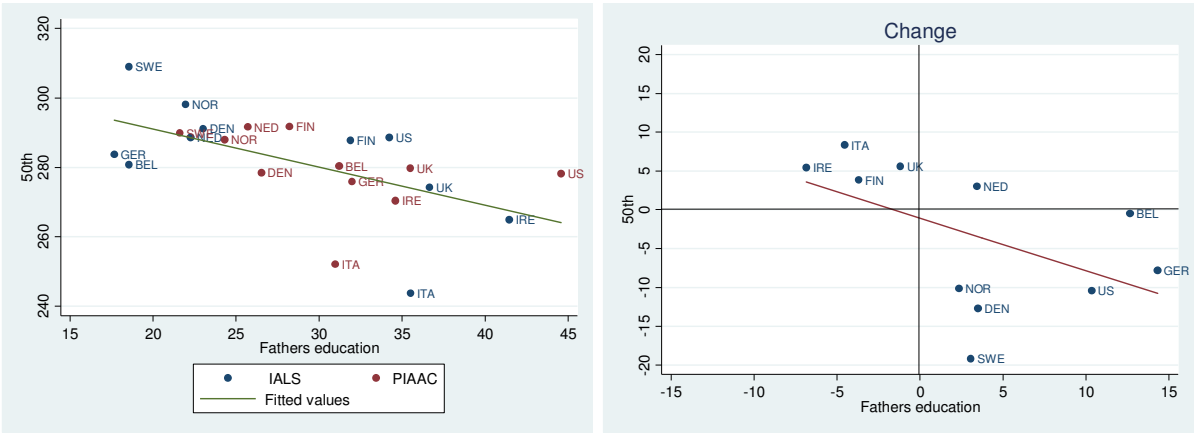
| Quintile | | Quintile 5 | Quintile 95 | | Quintile 5 | Quintile 95 |
|---|---|---|---|---|---|---|
| Country | Father tertiary | Father tertiary | Father tertiary | Father tertiary | Father tertiary | Father tertiary |
| Survey | | IALS | | | PIAAC | |
| BEL | 18.55 | 26.28 | -0.26 | 31.21 | 48.26 | 15.15 |
| | (6.67) | (16.48) | (6.36) | (2.02) | (4.48) | (2.98) |
| DEN | 23.02 | 40.23 | 16.85 | 26.52 | 30.43 | 18.83 |
| | (2.34) | (6.72) | (3.63) | (2.10) | (3.43) | (2.31) |
| FIN | 31.90 | 43.26 | 22.89 | 28.22 | 33.4 | 22.11 |
| | (5.35) | (12.79) | (6.99) | (2.70) | (5.23) | (3.77) |
| GER | 17.67 | 15.31 | 11.74 | 31.99 | 35.44 | 19.14 |
| | (5.58) | (10.44) | (6.06) | (3.47) | (7.20) | (3.43) |
| IRE | 41.45 | 70.39 | 33.35 | 34.61 | 42.38 | 22.27 |
| | (7.65) | (18.84) | (10.81) | (2.65) | (5.59) | (3.45) |
| ITA | 35.51 | 47.62 | 10.86 | 30.98 | 30.55 | 21.67 |
| | (6.31) | (11.97) | (6.67) | (4.97) | (7.83) | (4.92) |
| NED | 22.27 | 29.08 | 12.89 | 25.71 | 34.51 | 15.37 |
| | (3.02) | (7.55) | (3.58) | (2.08) | (4.78) | (2.55) |
| NOR | 21.96 | 47.01 | 9.8 | 24.32 | 30.77 | 18.36 |
| | (2.48) | (7.23) | (3.43) | (1.82) | (4.23) | (2.78) |
| SWE | 18.55 | 22.82 | 9.77 | 21.62 | 26.21 | 20.19 |
| | (4.97) | (10.30) | (5.11) | (2.17) | (3.91) | (2.88) |
| UK | 36.67 | 44.71 | 19.15 | 35.50 | 43.98 | 22.75 |
| | (5.40) | (11.90) | (4.55) | (2.75) | (3.94) | (2.52) |
| US | 34.23 | 64.81 | 13.6 | 44.58 | 40.34 | 38.04 |
| | (4.32) | (9.21) | (5.30) | (2.90) | (5.44) | (3.55) |

*Source:* Calculations are based on the IALS and the PIAAC.

*Note:* Standard errors are in parentheses.

My regression results demonstrate that there is a substantial cross-country variation in intergenerational educational mobility. In the next step, it is essential to examine whether cross-country differences in intergenerational educational mobility are related to cross-country differences in average test performance. Figure 17 plots the country-specific regression coefficients (for fathers having a tertiary education or higher) of Equation 5 against average (median) literacy test scores. The relationship is significant and positive in both the IALS and the PIAAC (the correlation coefficients are -0.76 and -0.57, respectively). Countries that have high intergenerational educational mobility have, on average, high literacy scores as well (PIAAC: Sweden, Norway, Denmark, and the Netherlands, IALS: Germany, Belgium, Sweden, Norway, and Denmark), and countries with the lowest intergenerational mobility and the lowest average scores are the US, the UK, and Ireland (IALS: Ireland, Italy, the UK, and the US). Changes between the two surveys also reveal a certain pattern. Countries that improved average literacy scores experienced an increase in intergenerational educational mobility (Ireland, Italy, Finland, and the UK), whereas countries that experienced declines in average literacy scores (Norway, Denmark, Sweden, the US, Germany, and, to lesser extent, Belgium) simultaneously experienced decreases in intergenerational educational mobility. To conclude, increases in literacy test scores are positively associated with increases in intergenerational educational mobility.

**Figure 17: Average literacy scores and estimated coefficients of father's educational level on children's literacy scores, IALS, PIAAC, and changes**




*Source:* Calculations are based on the IALS and the PIAAC.

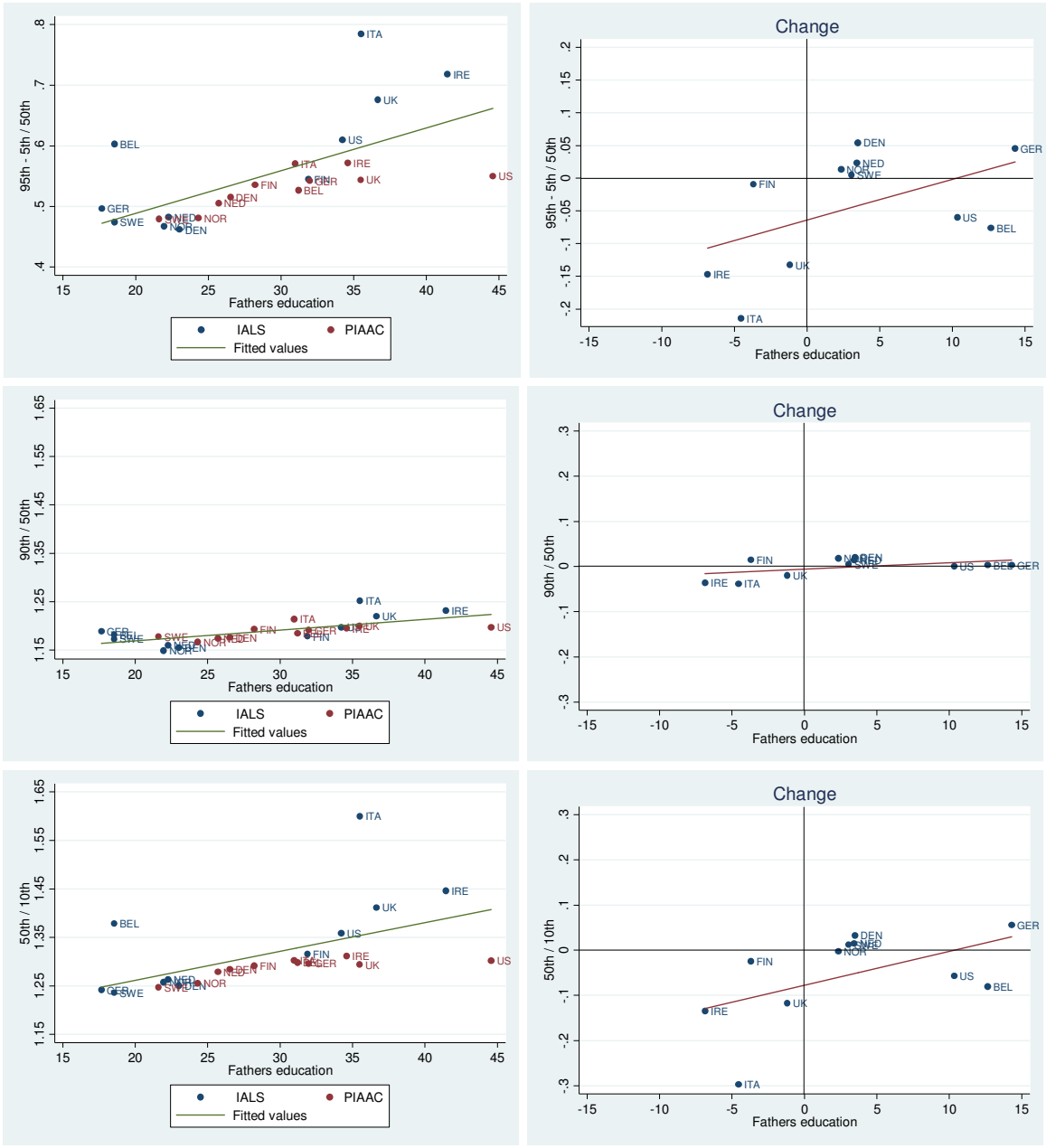
*Note:* Father education represents the estimated regression coefficient of fathers' educational levels on their children's literacy scores.

Finally, it is important to determine whether there is an association between equality of educational outcomes and equality of educational opportunities by determining if there is a relationship between estimated coefficients of fathers' education and children's dispersion of literacy scores (measured by 95th-5th/50th, 90th/10th, and 50th/10th ratios). Figure 18 shows these variables for both surveys, as well as changes in the variables. In both surveys, there is a significant negative relationship between intergenerational educational mobility and dispersion in the literacy test score.[77] Countries in which intergenerational educational mobility is low (the US, the UK, Ireland, and Italy) simultaneously exhibit relatively high dispersion of literacy test scores. In contrast, Scandinavian countries, the Netherlands, and Germany (IALS) have low score dispersion and high mobility. Changes reveal a similar pattern along the same lines. Countries in which skill inequality increased (Norway, Sweden, Denmark, Germany, and the Netherlands) simultaneously exhibited decreases in intergenerational educational mobility (an increase of the effect of fathers' education on children's test scores). The UK, Italy, Ireland, and Finland experienced movements in the opposite direction. This result might be interpreted as a sign that low mobility creates higher levels of inequality. Since there is a strong link between skills, education and wages, it is easier for rich families to transmit their benefits to the next generation but harder for poor families to foster their children.

Decile ratios reveal some important insights regarding differences in the strength of the relationship across skill distribution. The positive association between equality of opportunity and equality of outcomes is higher in the bottom half of the score distribution. Countries that have high equality in the bottom half of the skill distribution have high equality of opportunity, and vice versa. Increased equality of scores at the bottom generally contributes to high equality of opportunity. The only two outliers are the US and Belgium, countries where decreases in skill inequality (driven by decreases in skill inequality in the bottom half of the skill distribution) were coupled with decreases in mobility.

[77]The correlation coefficients are 0.92, 0.87, and 0.89, respectively.

**Figure 18: Dispersion of literacy scores and estimated coefficients of father's educational level on children's literacy scores, IALS, PIAAC, and changes**




*Source:* Calculations are based on the IALS and the PIAAC.

To conclude, based on an international comparison of two surveys of adult literacy skills, this analysis demonstrates that higher average literacy skills are positively associated with greater skill equality and greater intergenerational educational mobility. By improving the literacy skills of low-skilled adults, countries managed to increase average literacy skill levels. Moreover, countries that have high average literacy test performance simultaneously exhibit high equality of test scores and high intergenerational educational mobility. Although

descriptive in nature, the policy implication of this result is very straightforward: Countries should maximize their efforts and foster policies to raise average literacy skills (especially by rising the skills of the low-skilled adults). These policies are extremely beneficial, and the equalization of educational outcomes and opportunities can simultaneously be achieved. However, it is first vital to determine what lies behind these cross-country differences and changes in literacy scores.

## 4.5 Country differences in average literacy scores and changes between IALS and PIAAC

In order to shed light on the differences in average literacy scores and their changes across countries, the differences in the distribution of literacy skills and demographic characteristics between IALS and PIAAC are first analyzed in the following section. As previously shown, in some countries average literacy scores declined, and in others scores increased in the period between the two surveys. These changes were associated with changes in equality of educational outcomes and educational opportunities. What is behind these changes? As shown in Section 4.1, one reason that can partly explain these differences is related to differences in the shares of immigrants and their changes (this is why only the native population was considered in the in-depth analysis). Table 20 lists summary statistics of literacy scores (immigrants are excluded).

**Table 20: Summary statistics of literacy scores, PIAAC, IALS, and changes (25-65)**

| Survey | IALS (1996) | | | PIAAC (2011) | | | Change | |
|---|---|---|---|---|---|---|---|---|
| Country | Mean | Median | St.Dev. | Mean | Median | St.Dev. | Mean | Median |
| BEL | 273.66 | 280.83 | 50.67 | 276.66 | 280.36 | 45.3 | 3 | -0.47 |
| DEN | 287.12 | 291.09 | 41.67 | 274.53 | 278.40 | 44.31 | -12.59 | -12.69 |
| FIN | 282.62 | 287.84 | 47.81 | 288.62 | 291.68 | 48.66 | 6 | 3.85 |
| GER | 282.78 | 283.64 | 42.71 | 272.95 | 275.85 | 45.73 | -9.83 | -7.79 |
| IRE | 258.88 | 264.91 | 57.09 | 266.63 | 270.36 | 47.33 | 7.75 | 5.45 |
| ITA | 236.31 | 243.77 | 58.03 | 250.7 | 252.11 | 43.77 | 14.39 | 8.34 |
| NED | 284.55 | 288.65 | 42.87 | 287.81 | 291.65 | 45.04 | 3.26 | 3.01 |
| NOR | 293.24 | 298.12 | 42.7 | 284.65 | 287.96 | 42.4 | -8.59 | -10.15 |
| SWE | 306.96 | 309.03 | 45.09 | 288.27 | 289.88 | 42.49 | -18.69 | -19.15 |
| UK | 267.95 | 274.17 | 56.86 | 277.15 | 279.77 | 47.09 | 9.2 | 5.59 |
| US | 283.01 | 288.63 | 53.21 | 275.34 | 278.22 | 46.68 | -7.67 | -10.41 |
| Pooled | 277.92 | 282.79 | 48.97 | 276.67 | 279.66 | 45.35 | -1.25 | -3.13 |

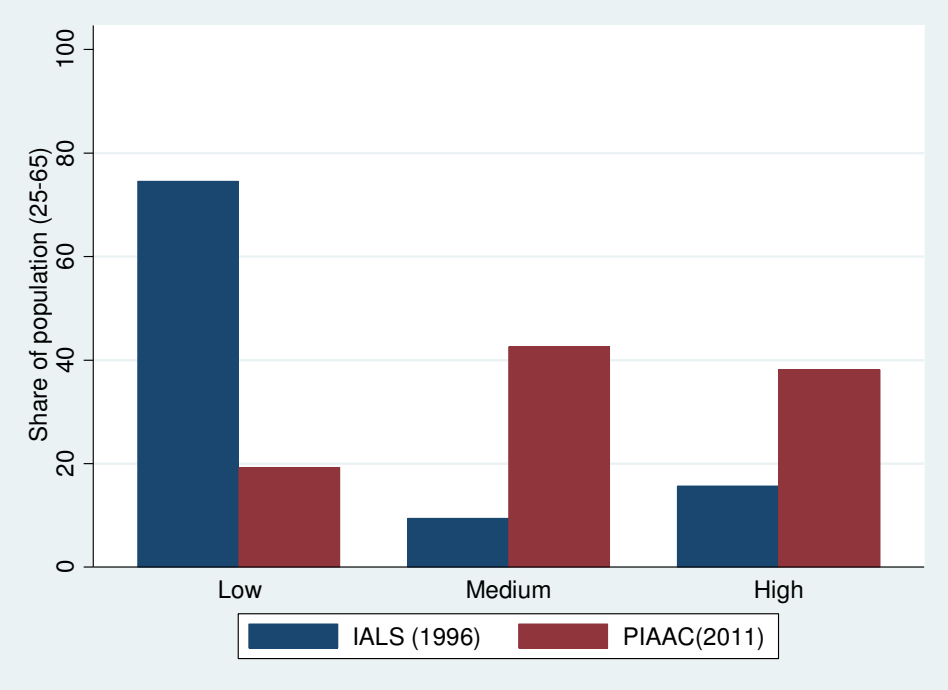
*Source:* Calculations are based on the IALS and the PIAAC.

According to information found in Table 20, there are substantial cross-country differences in average literacy scores and their changes. Literacy scores are on the decline in five countries, three countries show small change, and some improvements are evident in only three countries. Before delving into a deeper analysis, there are some obvious reasons that could explain these changes, and they are the first we will address. As previously explained, both surveys are based on the representative population in the relevant time periods. However, the representative population could have changed significantly in the interim between the surveys. In order to better understand the data, it is important to determine if there was a substantial change (apart from immigration) in age, educational levels, etc., of the representative population in participating countries, which might potentially explain these differences.

The fact that literacy scores did not improve substantially in many countries becomes even more surprising when changes in educational levels are observed. Figure 19 shows the shares of population by educational level in the pooled sample. Whereas in the IALS the majority of people had low educational levels (upper-secondary schooling), in the PIAAC this group has the smallest share, with a decrease of at least 40% in all individual countries. At the same time, this decrease was compensated by increases in the medium educational level (secondary and post-secondary, non-tertiary education) and the high educational level (university degree or higher). On average, education became more important, especially acquiring a university degree. The same pattern is evident in each individual country in the sample. According to the human capital theory, higher educational levels should produce better skills (which should then lead to higher wages). Figure 20 demonstrates that in both surveys, higher educational levels are associated with higher literacy scores, as expected. Individuals with a tertiary degree or higher have, on average, higher literacy scores when compared to the scores of adults with only medium or low educational levels. Higher educational levels lead to higher literacy scores and better skills. Results for individual countries reveal the same pattern.[78] However, although there was significant educational expansion in all countries (higher educational levels produce higher literacy skills), average literacy scores did not improve considerably in most countries (in some countries they even declined). Before the relationship between education and literacy skills is examined in more detail, other factors are discussed.

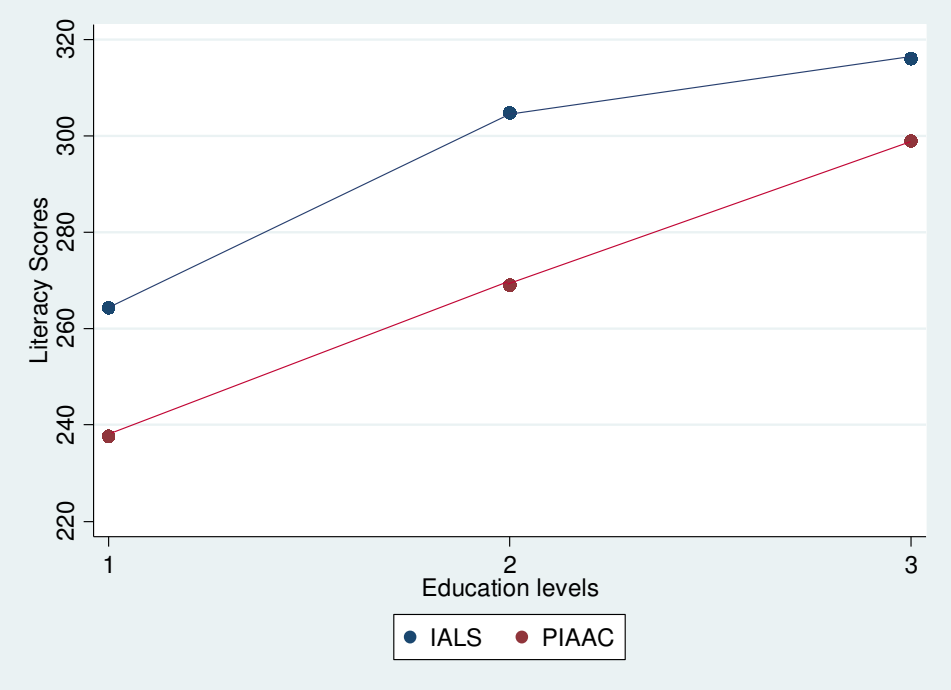
[78]All figures for individual countries are available on demand; pooled results are shown for the sake of simplicity.

**Figure 19: Share of population by educational level, IALS and PIAAC (25-65)**




*Source:* Calculations are based on the IALS and the PIAAC.

**Figure 20: Literacy scores and educational levels, IALS and PIAAC (25-65)**




*Source:* Calculations are based on the IALS and the PIAAC.

*Notes:* Educational levels: 1 – low, 2 – medium, 3 - high

Another factor that might affect average literacy scores, including changes, is the age structure of the population. Population aging is particularly evident in Western Europe and Scandinavia. Figure 21 reports the share of population by age group in the pooled sample. Whereas in the mid-1990s shares of population in age groups 25-34 and 35-44 were higher than shares of population in the older age groups (45-54 and 55-65), this trend was reversed in 2011. The most important change in the representative population between the two surveys happened in the oldest age group (55-65), whose share of the overall population increased in all participating countries. However, there are some cross-country differences in the share of older age groups and changes in them. Thus, population aging had a negative effect on average literacy scores, because literacy skills decline with age in all countries (see Figure 22). One should nevertheless be careful about interpreting these results as an age effect, since older age groups also have lower educational levels. Furthermore, one should also bear in mind that these results are related to literacy skills only (certain types of skills), which are usually the highest shortly after leaving formal schooling but tend to decline over time (forgetting).Experience increases with age, and so do other types of skills that are not captured in the measure of literacy skills (which explains why mature adults earn higher wages).

**Figure 21: Share of population by age group, IALS and PIAAC (25-65)**

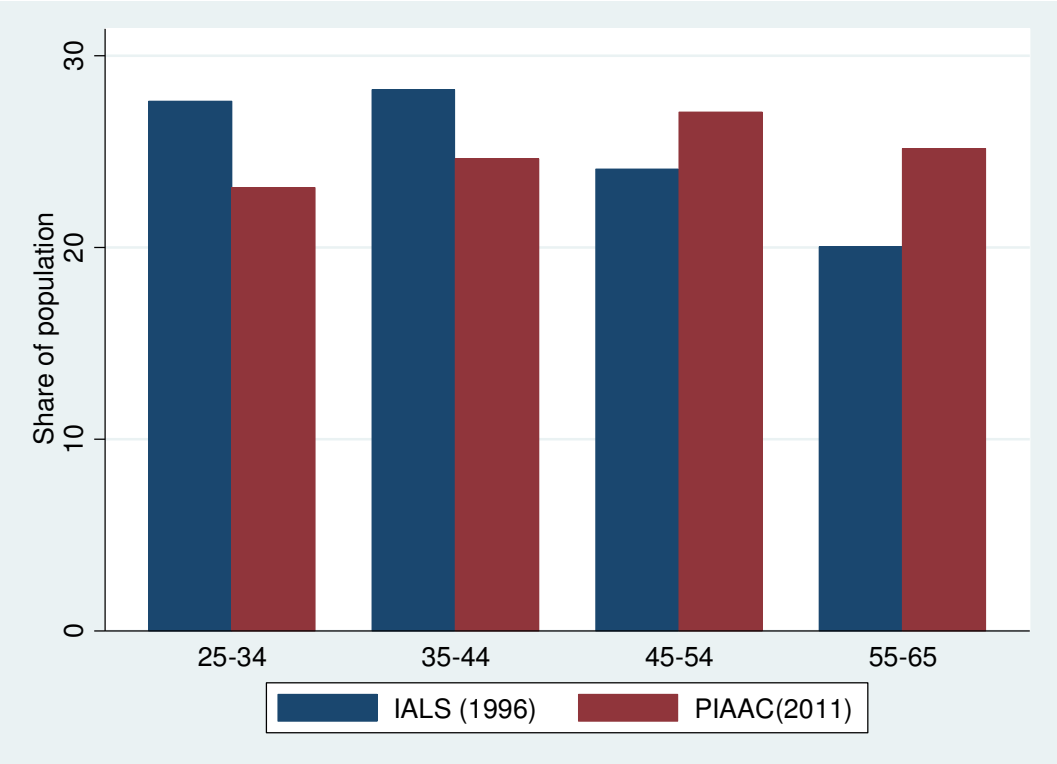
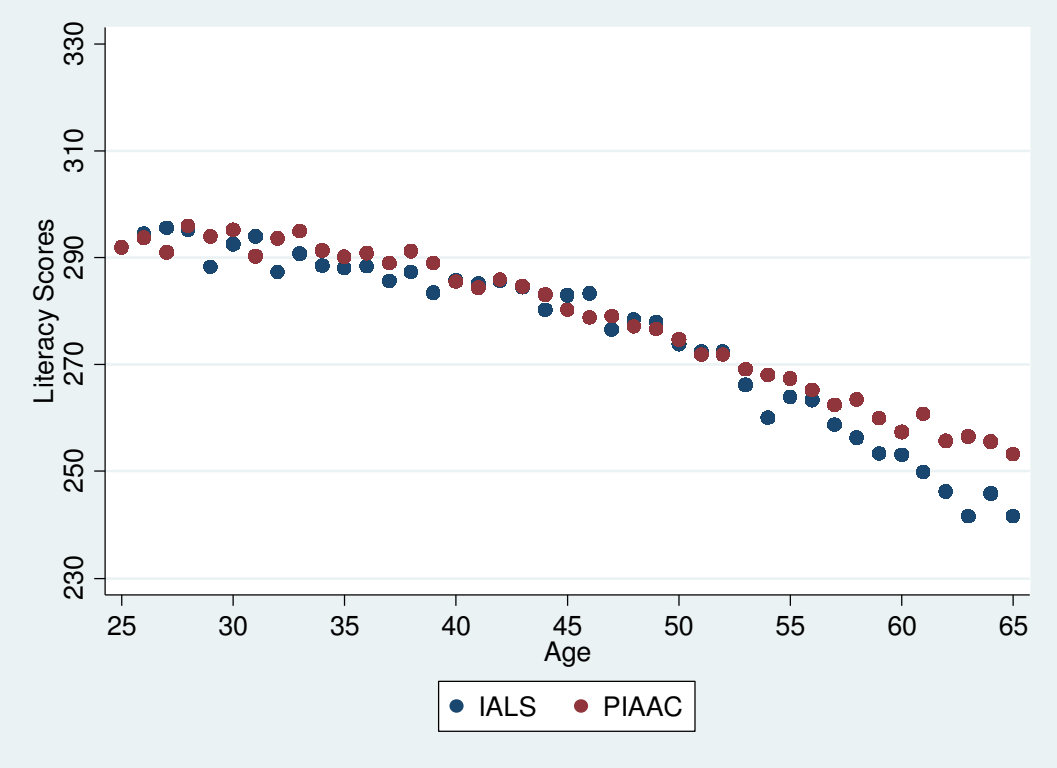


**Figure 22: Literacy scores and age, IALS and PIAAC (25-65)**




*Source:* Calculations are based on the IALS and the PIAAC.

### 4.5.1 Age, cohort, and score effects

How literacy scores change with age is important, especially in times of substantial population aging. Figure 22 demonstrates that literacy skills tend to decline with age. Possible reasons for the negative relationship between literacy skills and age include age effects (skills of 45-year-old adults are lower than skills of 35-year-old adults because of age) or cohort effects (35- and 45-year-old adults were born 10 years apart, and they received different educations in terms of quality, as well as different parental and peer influence and different social and technological environment). The problem with these types of surveys is that it is not possible to make a distinction between the two effects, since this is not a panel data set that allows for the study of one person over a period of time. However, there may be another way to address this issue. In order to investigate how big the age effect is, it is necessary to control for the cohort effect. By matching birth cohorts in both surveys (creating synthetic cohorts), it is possible to follow the same birth cohorts in both surveys and account for unobserved differences between countries and cohorts, as well as differences in distribution. In this data set, it is possible to match two cohorts: 30 to 39-year-olds (IALS) with 45 to 54-

year-olds (PIAAC), and 40 to 49-year-olds (IALS) with 55 to 64-year-olds (PIAAC).[79] As emphasized previously, both surveys are based on representative populations of adults. Table 21 shows average literacy scores according to the above-mentioned age cohorts. Average literacy test scores declined in all countries and in both cohorts, and these changes in literacy scores can be attributed to age effects. Furthermore, the age effect appears to accelerate with age (cohort 2 suffers more significant declines in scores than cohort 1 in all countries). The skill decline was especially pronounced in countries that suffered overall declines in scores: Denmark, Germany, Norway, and Sweden. Cohort results support cross-country results. However, the decline in skills is even greater than in the overall average results (see Table 17). The age effect is underestimated in the overall average results; average scores are higher due to a substantial increase in education. According to the analysis presented herein, over the past 15 years there has been considerable educational expansion, but at the same time, average scores did not improve everywhere (although higher educational levels are related to higher scores). Previous results also showed that population aging had a substantial negative effect on average literacy scores. How significant are these two effects, and which effect dominates? Can these two effects fully explain the difference in scores, or is there some other effect that is not captured by these two factors but is still important in explaining differences in average literacy scores and their changes between the surveys?

**Table 21: Literacy scores by cohorts, IALS, and PIAAC**

| Country | Cohort 1 | | Cohort 2 | | Cohort 1 | Cohort 2 |
|---|---|---|---|---|---|---|
| | IALS | PIAAC | IALS | PIAAC | Difference | Difference |
| BEL | 286.34 | 274.22 | 275.50 | 256.39 | -12.12 | -19.11 |
| DEN | 298.27 | 270.50 | 291.90 | 255.16 | -27.77 | -36.74 |
| FIN | 300.32 | 287.72 | 282.67 | 261.20 | -12.59 | -21.47 |
| GER | 291.06 | 268.23 | 285.72 | 256.97 | -22.84 | -28.76 |
| IRE | 270.45 | 259.95 | 264.79 | 249.71 | -10.50 | -15.08 |
| ITA | 249.76 | 250.27 | 240.80 | 233.83 | 0.52 | -6.97 |
| NED | 300.80 | 283.89 | 289.50 | 265.73 | -16.91 | -23.76 |
| NOR | 304.93 | 281.68 | 294.89 | 263.37 | -23.25 | -31.51 |
| SWE | 322.21 | 285.77 | 310.50 | 269.49 | -36.44 | -41.01 |
| UK | 279.46 | 272.64 | 276.24 | 267.15 | -6.82 | -9.09 |
| US | 289.52 | 272.67 | 287.25 | 268.18 | -16.85 | -19.07 |
| Pooled | 284.49 | 270.00 | 280.80 | 261.92 | -14.49 | -18.88 |

*Note:* Cohort 1: 30-39 years old (IALS) and 45-54 years old (PIAAC); Cohort 2: 40-49 years old (IALS) and 55-64 years old (PIAAC).

[79]Birth years of these cohorts are 1957-1966 and 1946-1955, respectively. Since the IALS was conducted between 1994 and 1998, age can vary (+/-2) across countries, depending on the year of the survey.

One possible way to determine which factors contributed the most to the changes in average literacy scores is to decompose the differences in scores by country. For this purpose, differences in scores between the IALS and the PIAAC are decomposed into changes that derive from changes in literacy scores in the same age-educational groups (score effect), changes that derive from a change in the age-educational structure (their shares), and changes that derive from their interactions (see Equation 6). Table 22 reports the results of the above-mentioned decomposition method. Column 4 of Table 22 shows that the changes in age and educational structure (shares) had a positive effect on differences in scores, and this is a consequence of increases in educational levels across countries (substantial decline of the share of adults with low educational level). Consistent with the human capital theory, increased educational levels is a primary driver of higher literacy skills, as expected. However, results in the third column of Table 22 clearly show that the score effect seems to be the most significant negative factor of the differences in scores in all of the countries. People in the same age-educational group simply have lower scores by as much as 30 points (Germany, Sweden, and Denmark) in the PIAAC when compared with the IALS. In particular, countries that suffered a drop in overall average literacy scores had much higher score effects than structural effects. The opposite holds true for Ireland, Italy, and the UK, where the structural effects dominate over the score effect. Therefore, there was an overall rise in average literacy scores between the surveys. This exercise clearly shows that increasing the share of adults with higher educational levels contributed to average increases in literacy scores. However, this decomposition exercise also revealed a substantial drop in literacy scores in the same age-educational group in all countries. This is a big concern and implies that there is a considerable difference in scores that cannot be explained by compositional differences. The existence of the unexplained score effect may lead to a conclusion that educational efficiency is on the decline in all countries, and the decline appears to be especially high (more than 24 points) in Germany, Sweden, Denmark, Norway, and the US[80], countries that simultaneously experienced the biggest drop in average literacy scores. Since literacy scores, per definition, capture the aspect of educational quality (rather

[80] Changes in average PISA (Programme for International Student Assessments) reading test scores that measure cognitive skills of 15-year-old students correspond very well to the changes in IALS and PIAAC in the similar time period (2000 and 2012). Over this 12-year period, average reading scores were on the decline in Sweden (see Wennstroem, 2016; Loefbom and Sonnerby, 2015), the US, Norway, and Denmark, whereas reading scores in the UK, and Italy improved significantly. PISA math scores (available only since 2003), show that all countries, apart from Germany and Italy, experienced a significant drop in math scores, which is definitely a sign that something is going on with the educational systems of the selected core OECD countries and, very likely, it is expected that when these generations grow older, we are going to see a reduction in cognitive scores for adults unless some policy action is taken.

than quantity which is measured by years of formal education), such a significant unexplained negative part imply that quality of education might be endangered.

$$(6) Score_{PIAAC} - Score_{IALS} = \sum_{i,j} a_{ij} * \Delta Score_{ij} + \sum \Delta a_{ij} * Score_{IALSij} + \sum \Delta a_{ij} * \Delta Score_{ij}$$

**Table 22: Decomposition of score differences by country**

| Country | Difference | Age-educational group | Age-educational structure | Interaction effect |
|---|---|---|---|---|
| BEL | 3.00 | -19.93 | 19.32 | 3.62 |
| DEN | -12.60 | -30.85 | 13.05 | 5.19 |
| FIN | 5.99 | -9.91 | 21.47 | -5.58 |
| GER | -9.84 | -43.26 | 18.31 | 15.11 |
| IRE | 7.74 | -17.52 | 29.37 | -4.12 |
| ITA | 14.39 | -4.89 | 12.60 | 6.68 |
| NED | 3.26 | | | |
| NOR | -8.59 | -24.03 | 17.41 | -1.98 |
| SWE | -18.69 | -34.61 | 14.71 | 1.22 |
| UK | 9.19 | -21.76 | 28.23 | 2.73 |
| US | -7.68 | -29.41 | 20.63 | 1.09 |
| Pooled | -1.25 | -23.08 | 21.33 | 0.51 |

*Source:* Calculations are based on the IALS and the PIAAC.

Although immigration, population aging, and changes in educational levels across countries explain part of the changes in average literacy scores, further analysis indicates that a certain aspect of literacy score differences remains unexplained. Whereas education exhibits a positive effect on average literacy scores (and is a primary driver of rises in average literacy scores across countries that improved their scores), score effect accounts for a substantial portion of literacy score differences. This negative effect might be an indication that educational efficiency and quality is on the decline in most countries. However, in order to gain real insights into the quality of education and differences as well as changes between countries, additional in-depth analysis is necessary, as well as a deeper exploration of individual countries and possible changes in policies.

## 4.6 Better educated but less skilled?

The analysis in the previous section of this paper demonstrated that although more adults acquired higher educational levels in all countries, average literacy skills did not improve in the majority of the analyzed OECD countries. Furthermore, the decomposition exercise indicated that most of the decline is not related to compositional differences, but is likely to be related to declines in educational efficiency. These results are astonishing and require further investigation. Either this postulation requires additional evidence, or it casts some doubt on the validity of the results and/or data. Given the importance of this topic in economic policy, it is necessary to explore relevant issues in depth, which is the purpose of this section.

Although linking the two surveys for the purpose of analysis was recommended and encouraged by the OECD,[81] the fact that countries which are known as top "performers" in terms of high average literacy scores experienced a substantial decline is surprising. As previously stated (see Section 4.2), although both the IALS and the PIAAC tested the domain of literacy, they are not the same tests. Moreover, the OECD had to rescale previously separate prose and document literacy scores in the IALS, combining them in a new single PIAAC literacy scale to ensure comparability (the rescaling process changed scores, and only adjusted files can be used for comparison).[82] Consequently, it may still be wise to double-check OECD claims to rule out the possibility that the scaling procedure was different, or that the difficulty of tasks varied between the two surveys. Both surveys were based on representative samples of the target populations and were administered at adults' homes by well-trained interviewers. The sample size is higher in the PIAAC[83] and entails a minimum of 5,000 respondents, whereas respondents total approximately 2,500 in the IALS. By design, there was commonality between the concepts of prose and document literacy and literacy. Not only are the definitions of the concepts very similar, but there is also a high number of common test items. The mode of delivery between the two surveys varied slightly (only the paper-based mode was available for the IALS, while both paper-based and computer-based modes were available for the PIAAC). The OECD performed a field test, which proved that there is no significant difference in literacy test scores related to mode of delivery. All

[81] See Technical Report of the Survey of Adult Skills (2013a).
[82] Numeracy competencies, although tested in both surveys, are not comparable.
[83] PIAAC data have a multilevel (hierarchical) structure in which individual data (lower-level observations) are nested in country-level data (higher-level clusters). A major strength of the PIAAC is its cross-national nature (for more information on survey design see Perry and Helmschrott, 2014; OECD, 2015a).

comparable background questions were marked as trend variables in order to make comparison easier, and some other identical variables had to be recoded because their categorizations differed. All of these comparable variables were then included together with full descriptions in the new files and were made available by the OECD. Therefore, only adjusted new IALS data can be used for comparison.[84] Furthermore, standardization and monitoring of survey implementation, as well as quality assurance "are among the most comprehensive and stringent ever implemented for an international household-base survey" (OECD, 2016:81). The PIAAC presents the most complete skill survey, which was comparable across countries until now. Detailed measures of cognitive skills in every day life and work were taken in homogeneous groups of countries. Although it does appear that linking the two surveys can be done, additional caution is necessary. Are the IALS and the PIAAC truly comparable, as suggested by the OECD? Are the declines in literacy scores at each educational level a sign of declines in educational efficiency across countries? Although it may be difficult to compile final answers to these questions, there are a few additional exercises that will shed light on this particular issue.

### 4.6.1 Shifting the focus to the youngest age cohort

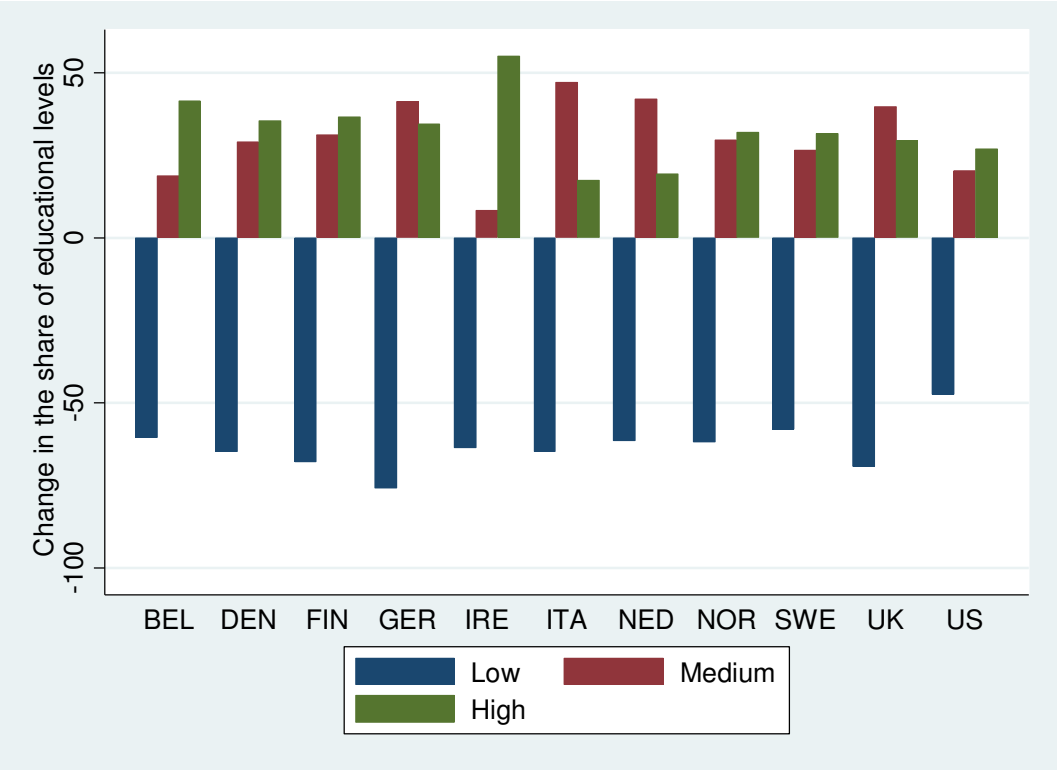
One way to shed light on the possible changes in educational efficiency (changes in the quality of educational systems) is to focus on the analysis of the youngest age cohort in the sample. If there was a change in the educational system and its quality, it will not be reflected in the older age cohorts. The youngest age groups should have either benefitted or suffered from possible changes in the quality of education. The youngest age cohort is the cohort with the highest scores in both surveys and in all countries. Since literacy scores decline with age and tend to be the highest shortly after completing school, focusing on the youngest age cohort represents an adequate and necessary step in evaluating possible changes in educational quality (and simultaneously eliminating the age effects).

Since changes in the educational system should be reflected in the youngest age cohort, it is necessary to determine precisely how their educational levels changed. Figure 23 displays changes in the share of 25- to 34-year-olds according to educational level. As expected, this

[84] Also, response probability between the two surveys was changed from 80 percent to 67 percent; therefore IALS data had to be recalibrated in order to be comparable and this is one of the biggest changes between the surveys and represents another explanation as to why it is necessary to use adjusted IALS files (see Technical Report of the Survey of Adult Skills, 2013a).

age group went through a significant expansion in education. The share of adults with low educational levels dropped significantly and was redistributed into medium and high educational levels[85].

**Figure 23 : Changes in the share of people by educational level, 25- to 34-year-olds**




*Source:* Calculations are based on the IALS and the PIAAC.

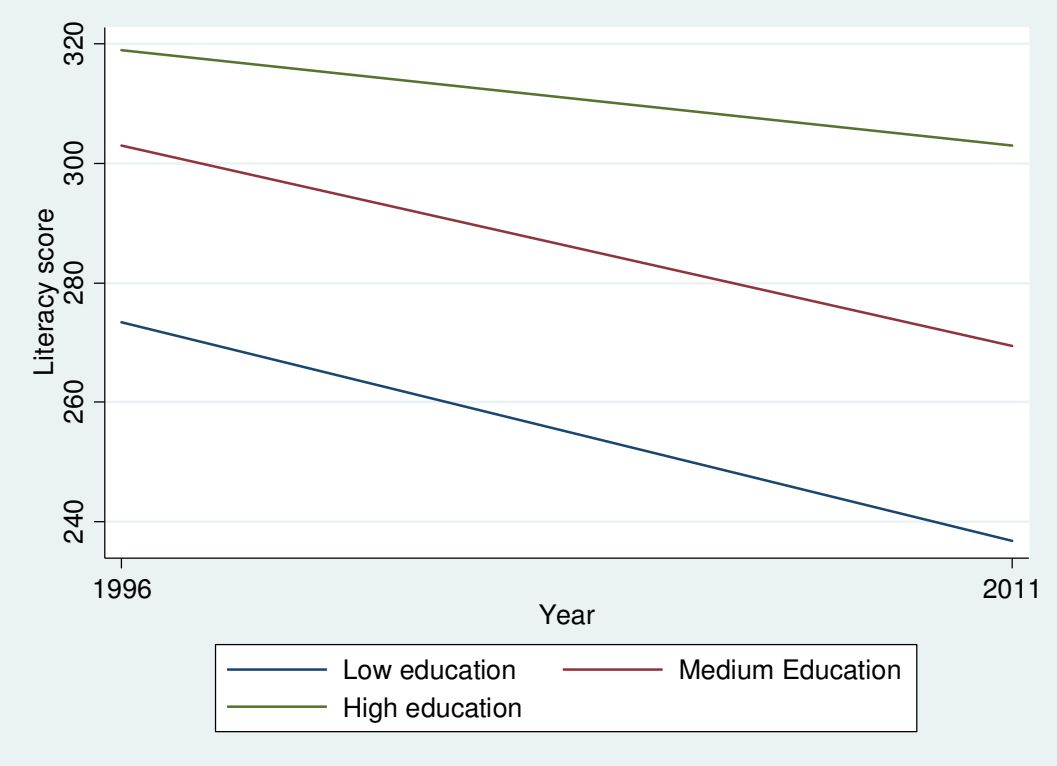
Figure 24 shows the differences in average literacy scores between the IALS and the PIAAC according to educational level for the youngest age cohort.[86] The youngest age cohort increased its average educational levels but the average literacy scores at each educational level dropped. This age cohort suffered a substantial decline in average literacy scores at all educational levels (and in all countries). The decline was especially pronounced for adults with low and medium educational levels. Since adults with low educational levels (less than high school) represented a relatively small proportion of the total population in 2011, their

[85] This led to higher average literacy scores in this age group in Ireland, Finland, Italy, the UK, Belgium and the Netherlands by 10, 7, 6, 6, 3 and 2 points, respectively (Sweden, Norway, Denmark, the US and Germany suffered a decline).

[86] In comparison to the other age cohorts, the youngest age cohort suffered the biggest drop in scores for adults with low and medium educational levels in most of the countries. At the same time, adults with high educational levels suffered relatively smaller declines among the 25-34 age group when compared with the other age groups (tables are available on demand).

results are relatively less worrisome. However, such a substantial drop in average scores for adults with medium educational levels is somewhat troublesome. This might be another indication that educational quality is indeed on the decline at all educational levels, but especially so at the low and medium educational levels. In fact, whereas adults with the highest educational level experienced a drop of 16 points, this number reaches almost 37 points for their counterparts with the lowest education level. The drop in scores was significant at each educational level, but diminished with rising educational levels. However, the pooled results, hide a variation across countries, and this is why it is necessary to look at individual countries.

**Figure 24: Changes in average literacy scores by educational level, 25- to 34-year-olds**




*Source:* Calculations are based on the IALS and the PIAAC.

Next, average literacy scores of the youngest age groups (25- to 34-year-olds) across ability distribution are examined. Comparing the literacy scores of the youngest age groups across ability distribution allows us to determine if there are different relative changes between different countries. If the literacy scores in the PIAAC are indeed underestimated, we would expect to find the same pattern across different countries. If questions were more difficult in

the PIAAC, then there is no reason to assume that this would vary across countries. Additionally, if there is the same pattern across different countries showing higher/lower scores at the top/bottom of the skill distribution, then the logical conclusion would be that the tests were harder/less hard at the top/bottom in the mid-1990s than in 2011. Table 23 reveals score differences across ability distribution for the youngest age cohorts for selected countries. Although this age group benefitted substantially in terms of educational expansion, higher scores are only visible in Belgium, Finland, Ireland, Italy and the UK. In Belgium, adults between the 10th percentile and the 25th percentile of the score distribution improved their scores in 2011, whereas adults at the top of the distribution (90th percentile) experienced almost no change at all. In Denmark, at the top of the skill distribution there were no substantial changes, whereas until the 25th percentile results were much lower in the PIAAC (12 points). In Finland, scores increased everywhere, but much less so at the very bottom of the skill distribution than in other parts of the skill distribution. In Germany, the difference between the two surveys seems to be the highest at the 10th percentile (13 points less), but it then reduces substantially in the rest of the distribution. In Ireland, results are higher throughout the entire distribution for the youngest age cohort, but especially so at the 10th percentile (23 points difference). A similar pattern is observed in Italy. In the Netherlands, adults at the 10th and 25th percentile of the skill distribution have lower scores in the PIAAC, whereas scores are higher in the PIAAC in the rest of the skill distribution. In Norway, scores dropped significantly between the surveys (10 points) until the 25th percentile, but the drop is then reduced to 7 points at the 75th percentile and reaches approximately 5 points at the 90th percentile of the skill distribution. In Sweden, literacy scores drop throughout the entire distribution (around 20 points). In the UK, scores increased across the board, but the increases were much more modest in the upper part of the skill distribution when compared with the lower part. Adults in the 10th percentile of the skill distribution improved their scores by almost 14 points, while the difference was only 2 points for adults in the 90th percentile. In the US, scores are almost unchanged at the 10th percentile of the distribution but then drop throughout the rest of the skill distribution (8-10 points). If our results had shown that scores are improving at the bottom in all of the countries or increasing at the top in all of the countries, we could have concluded that there are significant differences between the tests that are producing these consistent results. However, these mixed patterns across countries provide evidence that we are observing real changes rather than changes in test difficulty levels/grading procedures. It is obvious that not only the magnitude, but also the patterns of

score differences vary across countries. All of these results represent evidence that we are dealing with something beyond measurement issues.

**Table 23: Score differences across ability distribution, 25- to34-year-olds**

| | Percentile | | | | |
|---|---|---|---|---|---|
| Country | 10th | 25th | 50th | 75th | 90th |
| BEL | 4.07 | 2.18 | 0.66 | 2.05 | 0.61 |
| DEN | -13.83 | -12.03 | -6.11 | -3.03 | -1.86 |
| FIN | 3.40 | 5.07 | 7.19 | 8.77 | 10.07 |
| GER | -12.55 | -3.38 | 0.97 | -2.64 | -6.32 |
| IRE | 23.41 | 11.59 | 7.02 | 4.86 | 3.26 |
| ITA | 18.79 | 5.80 | 3.61 | 3.00 | -0.28 |
| NED | -5.74 | -1.30 | 3.68 | 6.63 | 9.47 |
| NOR | -9.77 | -10.36 | -7.64 | -6.81 | -5.94 |
| SWE | -20.38 | -18.28 | -18.06 | -20.53 | -21.79 |
| UK | 13.79 | 9.04 | 4.01 | 1.25 | 2.08 |
| US | -0.72 | -8.13 | -10.20 | -10.17 | -8.19 |

*Source:* Calculations are based on the IALS and the PIAAC.

Since the youngest age group is the cohort that was designated to best reflect changes in the educational system, focusing the analysis on this group revealed some interesting facts. Although this age group profited the most in terms of expansions in education, higher average scores were not evident in all countries. Moreover, examination of average literacy scores at the three different educational levels reveals declines at every educational level for the young age cohorts as well. This is particularly true for adults with medium and low educational levels in every country in the sample (the magnitude of the change was less pronounced for tertiary educated adults). It appears that although increasing the number of students with higher educational levels was definitely a positive development, at the same time educational systems did not manage to address these increasing numbers in a satisfactory manner, and consequently quality suffered. Despite having the highest educational level of any other cohort, “millennials” did not manage to attain the adequate skill level, and this finding is concerning, not only for the cohort, but also for the economy in general. Lower skills and lower quality of education may have long-term consequences on productivity, growth, and inequality.

### 4.6.2 Skill depreciation function

Previous analysis demonstrated that scores decline with age; regression analysis can estimate how much scores decline per year. Estimating the skill depreciation function in the mid-1990s (IALS) allows for the prediction of scores of certain 10-year birth cohorts in 15 years; it is possible to predict how many test points this particular birth cohort will have as it ages. Finally, these predicted scores can then be compared with the average scores of the matching 10-year birth cohorts in 2011 (PIAAC). If the predicted IALS scores deviate substantially from the average PIAAC scores of the matching birth cohorts, and there is a pattern across all countries, this might be an indication of a measurement error between the two surveys[87]. For example, if the scores in the PIAAC are much lower than the predicted scores from the IALS in all countries, this could be a sign that the PIAAC test was more difficult or that the scaling procedure was different, indicating that the average literacy scores are underestimated (and consequently the scores are not comparable between the surveys). First, the following skill depreciation function has been estimated for the IALS survey:

$$(7)\ scores_i = A + B\ age_i + C\ education_i + u_i$$

Where scores are average literacy test scores, age corresponds to age, education is an educational level indicator (low, medium, high), u is a residual, and A, B, and C are parameters to be estimated. Column 1 of Table 24 reports the results from the OLS regression of average literacy test scores on age in a model that includes controls for various educational levels (see Equation 7). The results reveal significant partial negative correlations between age and literacy scores when controlling for educational levels in all countries. The size of the coefficient varies between countries and ranges from -0.410 in the U.S. to -1.673 in Finland. Literacy skills tend to be the highest after leaving school and then decline steadily with age. As expected, higher educational levels are related to higher scores, and these coefficients are significant in all countries (tables available on demand). However, additional caution is necessary when interpreting these results. Estimations of partial age effects are sensitive to sample size and specified age range, which may be problematic (e.g., the age effect is insignificant if estimated on only one 5-year or 10-year cohort in most countries). One reason for these inconsistencies is the fact that the sample size is too small (on average around 500 observations). Consequently, this analysis is focused on prime-age workers (30-55 years of

[87] Which can be explained by different scoring procedure or different levels of test difficulty.

age). Also, the effects appear to be sensitive to changes in model specifications. The second specification of the model (Column 2 of Table 24) includes an additional female dummy, but this effect is insignificant in all but three countries.[88] Additionally, the size of the age effect changes only marginally. In the third model, partial age effects are presented conditional on occupation. Age effects are very sensitive, and the size of the partial age effect is reduced significantly when controlling for occupation (cross-country ranking in terms of the size of the coefficient does not change). However, since the occupation data are not available for all individuals, the number of observations reduces significantly. Furthermore, the occupation dummy entails only 10 categories and may be too broad. As Model 4 shows, education and occupation are highly correlated, and this model may suffer from omitted variable bias. Given all of these factors, a model with educational controls (instead of occupational controls) appears to be the most appropriate. Although the sign of the age coefficient appears to be very robust to changes in model specifications in all countries, the fact that the estimates are quite sensitive to the size of the coefficient is not optimal. However, smaller coefficients in Models 3 and 4 may result from a smaller number of observations. This is why in the following analysis the first model specification is used.

**Table 24: Estimated partial age coefficients, based on the IALS survey**

| Country/Model | (1) | St.Er. | Obser. | $R^2$ | (2) | St.Er. | (3) | St.Er. | (4) | St.Er. |
|---|---|---|---|---|---|---|---|---|---|---|
| BEL | -1.086 | 0.279 | 1048 | 0.323 | -1.088 | 0.277 | -0.882 | 0.229 | -0.748 | 0.216 |
| DEN | -1.148 | 0.110 | 1699 | 0.328 | -1.148 | 0.110 | -1.013 | 0.116 | -1.019 | 0.115 |
| FIN | -1.673 | 0.177 | 1639 | 0.341 | -1.673 | 0.177 | -1.358 | 0.178 | -1.350 | 0.175 |
| GER | -0.581 | 0.284 | 1003 | 0.171 | -0.582 | 0.287 | -0.675 | 0.302 | -0.693 | 0.298 |
| IRE | -1.218 | 0.190 | 1214 | 0.308 | -1.219 | 0.187 | -1.011 | 0.289 | -0.942 | 0.282 |
| ITA | -1.432 | 0.195 | 1719 | 0.277 | -1.417 | 0.195 | -0.922 | 0.258 | -0.919 | 0.259 |
| NED | -1.409 | 0.143 | 1667 | 0.327 | -1.409 | 0.143 | -1.184 | 0.141 | -1.171 | 0.139 |
| NOR | -1.133 | 0.206 | 1723 | 0.368 | -1.133 | 0.206 | -1.076 | 0.181 | -1.029 | 0.174 |
| SWE | -0.920 | 0.162 | 1311 | 0.202 | -0.916 | 0.165 | -0.982 | 0.174 | -0.959 | 0.162 |
| UK | -0.886 | 0.246 | 3696 | 0.285 | -0.889 | 0.250 | -0.827 | 0.228 | -0.767 | 0.235 |
| US | -0.410 | 0.205 | 1339 | 0.357 | -0.409 | 0.208 | -0.616 | 0.244 | -0.483 | 0.236 |
| Controls | | | | | | | | | | |
| Education levels | x | x | x | x | x | x | | | x | x |
| Female | | | | | x | x | | | | |
| Occupation | | | | | | | x | x | x | x |
| Interaction effect | | | | | | | | | | |

*Source:* Calculations are based on the IALS.

[88] In the U.S. and Finland, females score on average 7 to 9 points higher scores when controlling for education. According to other studies, women do tend to do better than men in the literacy tests. In Italy, the effect is significant but negative (8 points lower scores on average).

Given the coefficients from the previous exercise, it is possible to predict scores of certain 10-year birth cohorts in 15 years (30-39 year-olds[89]), and it is also possible to predict how many test points this particular birth cohort will have as it ages (45-54 year-olds). Finally, these predicted scores are then compared with the actual average scores of the matching 10-year birth cohort in 2011 (PIAAC). Table 25 presents estimated predicted IALS scores (based on the estimated age coefficients from the Model 1 and Model 3) and the PIAAC scores of the matching birth cohort.[90] Columns 2 and 3 of Table 25 present predicted IALS scores for the ten-year birth cohorts and difference to the PIAAC scores (after accounting for age and educational effects). These predicted test points deviate from the PIAAC scores of the same birth cohorts (the difference varies between -18 to 20 points across countries). Yet again, since the tests were the same in all countries, there is no reason to assume that the results would be overestimated in some countries and widely underestimated in other countries. Since it is impossible to discover a pattern in the deviation of the results, this can be taken as evidence that there is no measurement error. Moreover, if these expected differences are compared to the actual differences in average results (mean) based on the entire samples from the two surveys, it is clear that over/underestimation is consistent with the actual differences between the surveys (which may suggest that these differences are real and must be explained by some other exogenous factor). The average scores seem to be underestimated in 2011 in Sweden, Norway, Denmark, Germany, and the US; at the same time, these are the countries that suffered an overall decline in average scores (the size of the differences varies, but the signs are the same). In Italy, Ireland, the UK, Finland, Belgium, and the Netherlands, the scores seem to be overestimated in the PIAAC. At the same time, these are the countries that experienced overall increase in scores. Most likely, this could mean that the scores are either increasing or decreasing, and it could also mean that this is attributable to some other reasons not related to age, educational levels, or measurement issues. Although these results might indicate that there may be measurement issues between the surveys (results are either overestimated or underestimated), the fact that there are substantial cross-country differences in these deviations countermands this argument. If tests were more difficult or the scaling procedure was different in the PIAAC when compared with the IALS, we would expect to see underestimated scores in all countries, but this is not what the data shows. This actually leads to the conclusion that these differences are based on some other real changes in scores.

[89] The number of observations varies from 467 in Belgium to 795 in Italy; the UK is an exception with 1,718 observations.

[90] Given the data, it would also be possible to match one more 10-year birth cohort, those 55-64 years of age, in the PIAAC. However, the oldest age group is somewhat special and also has the lowest scores. That is why the analysis is focused on the 10-year younger matching birth cohort.

However, this analysis might be an indication that the fall in educational efficiency offers a valid explanation. These results are robust (at least the sign of the difference) to various changes in model specifications and various age groups. Again, the signs and the direction of the difference correspond to the sign of the overall difference in scores based on the entire sample.

**Table 25: Predicted IALS scores and PIAAC scores of the matching birth cohorts**

| Country | PIAAC scores (45-54) | Model 1[91] | | Entire sample(25-65) |
|---|---|---|---|---|
| | | IALS scores,predicted (30-39 in 15 years) | PIAAC-IALS | PIAAC-IALS |
| BEL | 274.22 | 268.79 | 5.43 | 3 |
| DEN | 270.5 | 281.49 | -10.99 | -12.59 |
| FIN | 287.72 | 276.94 | 10.79 | 6 |
| GER | 268.23 | 281.09 | -12.86 | -9.83 |
| IRE | 259.95 | 251.66 | 8.28 | 7.75 |
| ITA | 250.27 | 229.65 | 20.62 | 14.39 |
| NED | 283.89 | 276.46 | 7.42 | 3.26 |
| NOR | 281.68 | 289.32 | -7.64 | -8.59 |
| SWE | 285.77 | 303.86 | -18.09 | -18.69 |
| UK | 272.64 | 266.41 | 6.23 | 9.2 |
| US | 272.67 | 283.7 | -11.03 | -7.67 |

*Source:* Calculations are based on the IALS and the PIAAC.

As delineated above, the results presented in the previous exercise suffer from many shortcomings. They are sensitive and not robust, which is not optimal. Moreover, the number of observations is small, and there are some other data limitations as well, which is often the case in such research. However, if there was a measurement issue, the previous exercise should have been able to show indications of it. This was surely not the case. If nothing else, this exercise at least finds no evidence for a measurement issue, and this is an important conclusion. Nevertheless, in order to more deeply examine the issue of the quality of education, it is helpful to go beyond the data presented in this study and look at other international tests that also examine the ability of pupils.

[91] Predicted literacy scores based on Model 1 from the previous table

### 4.6.3 Comparison with PISA scores

Another method of determining whether changes in literacy scores presented herein are plausible is to compare PIAAC literacy score results with the results of other, similar tests conducted in the same countries during the same time period. PISA (Programme for International Student Assessments) is an international survey that measures cognitive skills of 15-year-old students. PISA has been conducted every three years since 2000 and therefore allows for comparisons in changes to reading scores between 2000 and 2012. Furthermore, PISA survey does not address comparability issues (it is the same test). This kind of comparison is far from perfect, especially since reading tests in PISA and literacy tests in IALS and PIAAC are not identical. Furthermore, the years of the surveys, although similar, do not match perfectly, and what is even more important, the age of the population is different. However, this kind of comparison can give us a rough indication of whether something real is happening within the educational systems and with cognitive skills in general. The first three columns of Table 26 list PISA reading results for 11 OECD countries. Average PISA reading test scores correspond very well to the average literacy scores in the IALS and the PIAAC, and their changes are presented in this study (at least country ranking and a sign of the change). Over this 12-year period, average reading scores were on the decline in Sweden, the US, Norway, and Denmark, whereas reading scores in the UK, Italy, and Belgium increased. The same results hold true for our analysis as well (at least if one looks at the sign of the change). However, looking at the size of the change actually reveals that in most of the countries, there were no big changes in average PISA reading test scores during the period spanning from 2000 to 2012. However, a few countries stand out. Sweden suffered the biggest decline in reading scores, followed by the US.

**Table 26: PISA reading and math scores in 2012, 2003, and 2000**

| | Reading | | | Math. | | |
|---|---|---|---|---|---|---|
| PISA scores | 2012 | 2000 | Change | 2012 | 2003 | Change |
| Belgium | 509 | 507 | 1 | 515 | 529 | -15 |
| Denmark | 496 | 497 | -1 | 500 | 514 | -14 |
| Finland | 524 | 546 | -22 | 519 | 544 | -26 |
| Germany | 508 | 484 | 24 | 514 | 503 | 11 |
| Ireland | 523 | 527 | -3 | 501 | 503 | -1 |
| Italy | 490 | 487 | 2 | 485 | 466 | 20 |
| Netherlands | 511 | 513 | -2 | 523 | 538 | -15 |
| Norway | 504 | 505 | -1 | 489 | 495 | -6 |
| Sweden | 483 | 516 | -33 | 478 | 509 | -31 |
| United Kingdom | 499 | 495 | 4 | 494 | 495 | -1 |
| United States | 498 | 504 | -7 | 481 | 483 | -2 |

*Source:* Calculations are based on the PISA.

In light of the fact that a substantial drop of 33 points in average reading scores for pupils in Sweden between 2000 and 2012 is similar to the almost 19-point decline in literacy scores for adults between 1996 and 2012 in Sweden (the highest drop in a PIAAC-IALS comparison), and given the notable drop of 7 points in both surveys in the U.S., these declines call for additional scrutiny. This phenomenon may offer strong evidence that educational quality is indeed declining in these two countries. Fortunately, a rich body of literature exists that is examining these issues and seeking to explain these changes. In Sweden, Henrekson and Jävervall (2017) investigated all of the important surveys of student performance in Sweden (PISA, TIMSS, and PIRLS[92]). They found that beginning in the 1990s average scores began dropping in almost every subject and assessment, whereas pupils' grades were simultaneously improving. There is concern that a change in educational policy (that took place in the 90s) which focused on decentralization, deregulation and privatization of the educational system (without regulating school competition) contributed to the decline in educational quality. The above-mentioned policy reform led to school competition in other dimensions besides educational quality – grading, material and hedonic rewards, which led to a decline of knowledge (see Wennstroem, 2016). Loefbom and Sonnerby (2015) additionally demonstrate that the same age cohort from PISA suffered similar decline in the PIAAC test scores: an evidence for long-term consequences of a lower pupils' test performance. In the US, there is a debate related to school funding, inadequate teacher training, and inequality of educational

[92] The TIMSS (Trends in International Mathematics and Science Study) and the PIRLS (Progress in International Reading Literacy Study) are international comparative assessments of student performance conducted in more than 60 countries.

opportunities as possible drivers of the declines in PISA test scores and quality of education. There are also calls for stronger investments in education (National Education Association) and increasing efforts to develop outstanding teachers (see Paine and Schleicher, 2011). The only two outliers (although they are significant), are Finland and Germany. Whereas adults' average literacy scores in Finland experienced no big change, average pupils' reading test scores suffered a significant decline in recent years. Finland was one of the top performers in PISA scores at the beginning of the 21st century (and was a role model for other countries), but has exhibited a sharp decline since 2009, especially in the recent years. Consequently, changes in the same direction (negative) are likely to be visible in subsequent PIAAC surveys as pupil cohorts age and begin to participate in PIAAC testing. However, their average performance is still relatively high, which makes these circumstances less alarming. On the other hand, Germany, a country that experienced a big decline in literacy scores in the PIAAC survey, actually improved its reading scores considerably according to the PISA data. However, one cannot help but notice that whereas in the IALS survey Germany was a top "performer," in PISA 2000 its reading scores were extremely low (this contradiction requires some additional analysis which is beyond the scope of this paper). Finally, the United Kingdom slightly improved its average PISA reading scores (4 points), which is consistent with its increasing average PIAAC literacy scores (9 points).

Additionally, for the sake of further comparison, the second part of Table 26 lists PISA math scores (regrettably available only since 2003), and these results show that all countries, apart from Germany and Italy, experienced a significant drop in average test scores, which is definitely a sign that something is going on with the educational systems of the selected core OECD countries and, very likely, it is expected that when these generations grow older, we are going to see a reduction in cognitive scores for adults unless some policy action is taken. Further research should move in the direction of examining differences in educational systems and their quality in order to identify the reasons why these scores may be on decline.

If nothing else, this comparison demonstrated that at least two countries whose adults' performance deteriorated significantly experienced the same changes among their pupils, which is a confirmation of sorts for the plausibility of these surprising results and the overall decline in school quality. On the other hand, most of the other countries experienced no substantial change in average PISA reading test scores, which is neither a confirmation nor

dismissal of the results presented herein (although the sign of the change was generally in the same direction).

### 4.6.4 Matching the same birth cohorts in the PISA and the PIAAC

Rather than comparing average scores based on the entire population in the PIAAC, another interesting possibility offered by the data presented would be to match the same birth cohort in the PISA and the PIAAC and see how cross-country differences change. Since the PISA test in the year 2000 was testing reading skills of 15-year-olds, 11 years later (as the same birth cohort aged) their literacy skills were tested in the PIAAC. This allows us to again investigate whether PIAAC scores are plausible, and also whether there are long-term effects pertaining to high/low average performance of the relevant countries. Differences in the test performance of the PISA survey are actually a strong indicator of the quality of primary and secondary education. Moreover, literacy skills tend to be the highest after leaving school. After all, both surveys are intended to monitor and assess the quality of learning opportunities. The problem is that the two surveys have used different metrics, and therefore it is not possible to compare scores directly. However, we can look at the cross-country differences, whether countries performed below or above average, and whether these cross-country differences and rankings were persistent.

Figure 25 reveals a high statistically significant correlation between the reading and literacy scores (the correlation coefficient is 0.65). Students born in the year 1985 exhibited high reading performance in Finland, Sweden, the Netherlands, Belgium, and Norway. Simultaneously, the same birth cohort (11 years later) exhibited high performance on the literacy test scores in the PIAAC. On the other hand, Italy, Germany, the UK, and the U.S., performed relatively poorly and these results were repeated in the PIAAC survey. Denmark exhibited mediocre performance in both surveys. The only outlier is Ireland, which did particularly well and had the second best result in the PISA, but performed below the OECD average in the PIAAC. Students who did well on PISA scores also did well on PIAAC scores. At the same time, it appears that there is a high persistence in cross-country differences in scores, which confirms that disparities in school systems not only affect the scores of 15-year-old students, but also tend to persist over time. This indicates the importance of the quality of primary and secondary education, but it also may indicate that the quality of educational systems between countries is reflected at all educational levels. This makes policy

intervention even more necessary. Performance levels at the end of compulsory schooling and the quality of compulsory schooling have long-lasting effects. This is why focusing on high-quality compulsory schooling is a must and needs to be on every policy agenda. These results are in line with our young cohort analysis, which also showed that the decline in scores was higher at the below-tertiary level.

**Figure 25: PISA reading scores and PIAAC literacy scores, same birth cohort**


*Source:* Calculations are based on the PISA and the PIAAC.

These conclusions presented in this study have serious policy implications. The primary goal of every educational system is to increase the abilities of pupils by providing better skills and higher productivity, which will in turn ensure higher wages and a better standard of living. The fact that average educational levels are rising in all countries is definitely encouraging. However, educational systems must be well prepared to address higher numbers of pupils while ensuring that educational quality remains intact.

## 4.7 Policy implications

The aim of this study was to shed light on, and contribute to, the ongoing and important debate related to the tradeoff between educational equality and efficiency. The empirical analysis based upon this study indicates that simultaneously achieving higher quality (efficiency) and greater equality is possible. Increases in efficiency in terms of higher literacy scores are related to higher equality of educational outcomes and opportunities. Human capital and better skills are very important in today's modern society – higher skills lead to better employment chances, higher income, better health, social and political participation. Furthermore, supporting poor families and their children, increasing their opportunities, will benefit the whole society is extremely valuable not only for equality, but also for long-term productivity, and growth (Okun, 1975; Furman 2016, Putnam, 2015).

This paper reveals that there has been an expansion in educational attainment across OECD countries, which was the primary driver behind literacy skill improvement. This positive trend must be continued and further supported by a set of well-designed government policies. However, concentrating so heavily on the educational expansion, policy-makers seem to be overlooking the danger that the quality of schooling may be declining. The decomposition exercise revealed that literacy test scores at each educational level dropped in all countries. This is a cause for concern and advances a debate related to the quantity and quality of education. Further examination of PISA test scores provided additional evidence that the quality of education is declining in many developed countries. Although it is definitely a positive trend to have an increasing number of better educated people, it seems that educational institutions were not well prepared to cope with greater numbers of students, and consequently quality suffered. This needs to change. Educational systems must do more to provide adequate education that will lead to better skills and better outcomes for their students. The fact that literacy skills drop with age suggests that there is also another problem that need to be embarked upon and is related to skill decline over the life cycle. Keeping skill level high requires more application of skills at the job and higher investment in training.

Several central policy implications can be drawn from this study. Focus on expansion in education, higher spending on education, enhanced access for everyone, equal access to schooling at all levels (and especially preschool education) is extremely vital. But focus on

educational reform, better quality of schools and increased performance among disadvantaged schools, and homogeneity across all regions is equally important. Many economists stress even more strongly the importance of early childhood education and its effect on the good start in life and learning that it will affect overall life chances (Heckman 1999; Duncan and Brooks-Gunn, 1997; Blankenau and Youderian, 2015). Public expenditure toward early childhood education is especially important, since having no access to it leaves lifelong scars. But, rather than only looking at how much the country spent, a significant measure could also be how the money is spent and the quality of the schooling system. For example, some research shows that early tracking according to ability increases educational inequality and reduces intergenerational mobility (Hanushek and Woessmann, 2005; Schuetz *et al.*, 2005). Although Hanushek (1999) claims that no significant gains are realized from a reduction in class size, other researchers reject this argument and highlight various benefits of smaller class size (Krueger and Whitmore, 2002; Piketty, 2004; Finn *et al*, 2005; Konstantopoulos and Chun, 2009). As previously discussed in this study, Sweden provides a sound example which indicates that school choice reform, as advocated by many, might not be a good policy (Wennstroem, 2016). Furthermore, the OECD (2015b) stresses the importance of focusing on students, institutions and systems in order to achieve educational improvement. The OECD insists on investing in teaching and teachers; setting high standards for all students and using data to follow student progress; recognizing the key role of leadership; supporting disadvantaged students and schools; and ensuring sound policymaking with consistent accountability mechanisms (see OECD (2015b) for additional information on different programs and their evaluation).

Additionally, when dealing with inequalities of opportunities and outcomes, macroeconomic policies, role of state, and institutional factors can make a big difference. Government spending that target investment in education (early childhood programs, broader access to university) and health are essential (particularly for children from poor families and poor neighborhoods). Furthermore, family leave, minimum wage, social safety net, unemployment insurance, earn income tax credits, anti-poverty programs and others, will help lifting living standards and opportunities of disadvantaged families and their children which should lead to more equality of opportunities, better skills and efficiency! However, it is also important that the programs are well targeted, well-funded and carefully designed (Haskins and Sawhill, 2009). Furman (2016) called for policies to reduce inequality of opportunity by increasing investments in education, health, and well-being of poor children, as well as providing safety

nets, reforming the criminal justice system, and limiting economic rents. Putnam (2015) stresses the role of disparities in schooling systems, family structures, child development and parenting, and communities in producing existing inequalities of opportunities. However, by designing the right policies to tackle these disparities, existing inequalities could be reduced. This approach will benefit both equality and efficiency, as the research in this study has demonstrated.

## 4.8 Conclusion

Based on the international comparison of two surveys of adult literacy skills conducted in the mid-1990s and 2011, this paper demonstrates that higher literacy skills are positively associated with greater skill equality and greater intergenerational educational mobility. Countries that have strong average test performance simultaneously exhibit high equality in literacy test scores. At the same time, these countries tend to have greater intergenerational educational mobility (measured by the effect of fathers' education on children's literacy test scores). Quantile regressions confirm this finding: Having a highly educated father has an equalizing effects on both educational opportunities and educational outcomes of children. These results have very important policy implications. Adult cognitive skills can be used as an equalizer in both educational outcomes and educational opportunities (in this paper, we focused on literacy skills only, but there is a high correlation between literacy and numeracy test scores). By increasing average skill levels (especially by improving the skills of low-skilled adults), countries can improve equality of educational outcomes and equality of educational opportunity. Given the strong association between parental educational levels and children's outcomes, the benefits of such policies are expected to be very high, because inequality in both current and future generations can be expected to decrease.

In order to determine what is behind the differences in average literacy scores and their changes, this paper examined cross-country differences in average literacy scores and as well as changes in scores between the mid-1990s and 2011. Demographic differences and changes in demographics, including immigration, age, and education, have a significant effect both on cross-country differences in scores and changes in scores. Whereas population aging negatively affects average literacy scores, higher education is positively associated with higher skill levels. Higher educational levels produce better skills, and an increase in

educational level was the primary driver behind higher scores in countries that improved their average literacy score levels. However, despite this tremendous educational expansion, further analysis demonstrated that when controlling for education and age, an aspect of the differences in literacy skills remains unexplained, and this is ascribed to decreases in educational efficiency and quality in all countries (especially because literacy skills as a measure of human capital do capture the aspect of quality rather than the aspect of quantity of education).

From a policy perspective, countries must find ways to implement measures and policies that will lead to increases in educational efficiency and a higher correlation between education and literacy skills (which is necessary to succeed in work and society). Rises in educational attainment alone are not sufficient. Focus on educational reform, improvements in the quality of education, enhanced access for everyone (especially for ECEC), and increased performance among disadvantaged schools is important as well as investing in skills throughout the life cycle. However, early childhood welfare and family policies, as well as the active role of the welfare state (social spending and redistribution) may be equally important in efforts to reduce inequalities.

Nevertheless, it is important to bear in mind that a cross-country analysis is rather problematic. There are only a small number of participating countries, and these countries differ in many respects. Although there was an effort to create a homogeneous sample of 11 advanced countries in both surveys, important differences between countries remain. Furthermore, results presented herein are correlational and descriptive, and they do not prove causality. The measure of skills employed in this paper is very narrow, and results obtained herein might not be consistent with the results obtained when other skill measures are employed. Another potential problem is related to possible measurement issues that might have occurred when linking two surveys (although the OECD claims that literacy test scores are comparable). However, these preliminary results offer some starting points for further research and provide initial insights into these important policy issues. For further analysis, it is crucial to understand where the differences in equality of outcomes and opportunities originate, to identify the differences between educational systems, institutions, and policies in specific countries, and to determine their potential effects on educational efficiency and inequality.

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