Explaining Country Variation in Employee Training: An Institutional Analysis of Education Systems and Their Influence on Training and Its Returns

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Abstract

This article studies the relationship between employee training and institutional factors of initial skill formation and industrial relations across 14 European countries. Rather than focusing on individual participation rates and returns, the aim is to explain the observed country variation in training incidence and its returns. It turns out that there are direct links between the system of initial skill formation and training that differ between incidence and returns. Although cross-country training incidence seems to vary according to educational attainment levels and the financial input into education, the returns to training are strongly associated with the quality and stratification of secondary schooling. This finding suggests that the aggregate level of training provided is associated with educational attainment levels in terms of skill demand as well as educational expenditure, whereas training-related productivity gains are higher in systems in which school leavers and the workforce actually do possess higher skills. Educational stratification seems to increase inequality beyond education by increasing training-related earnings differentials.

Introduction

The skill-driven transformation of work has brought forth a perspective of skill formation across the life course in which job-related employee training aims to enhance the productivity of the workforce by matching the skills they supply to ever changing labour market demands. Although skill formation approaches differ markedly across countries, job-related training is predominantly provided by the firm, commonly takes place during paid working hours and in most European countries, workers usually do not share the training costs by taking wage cuts (Booth et al., 2003; Brunello et al., 2007; Hansson, 2008). Firms focus training investments on those groups of workers from whom they expect larger productivity gains. In particular, higher educated workers are more likely to receive training because, on average, training is more effective for the highly skilled (OECD, 2004; Brunello et al., 2007; Hansson, 2008). While employees are generally willing to participate in firm sponsored training (Müller and Jacob, 2008), their efforts and motivation may be higher if they too benefit, e.g. through wage premiums (Smits, 2008). The intensity of training provision varies significantly across European countries and the few available comparative studies on the returns to training suggest that they also differ largely (e.g. OECD, 2004; Bassanini et al., 2005; Dieckhoff et al., 2007).

Consistent with human capital theory (Becker, 1964), supply and demand side factors in terms of the quantity of initial educational attainment levels among the workforce and the population as a whole are associated with cross-country training differences (Brunello, 2001). However, observed country variation in firm sponsored training has also challenged standard human capital theory because firms tend to invest more in training in systems with a more compressed wage structure and, despite the risk of labour turnover, they are willing to fund not only firm-specific but also general training (Acemoglu and Pischke, 1999; Booth et al., 2003; Brunello et al., 2007). Institutionalist models, taking into account

the regulations imposed by labour market institutions, were found to better comply with comparative training data than standard theory (Acemoglu and Pischke, 1999; Dieckhoff, 2007). In particular, the system of industrial relations as constituted by the influence of unions, wage setting mechanisms, and employment protection legislation has been found to relate to country variation in training incidence. However, the evidence of the impact of the institutional factors on training is still far from being consolidated (Pischke, 2001).

Three areas that call for further empirical investigation are addressed in this paper: first, the association between initial education and job-related training has been studied with reference to the quantity and design of initial educational provision, but not with regards to the quality of provision. Second, studying the relationship between education and training needs to control for confounding variables, like the economic context of and the financial input into education, as well as the system of industrial relations. And third, the links between the institutional framework and cross-country variation in training returns have not been analysed in detail, although it is of interest, whether the training in systems with higher aggregate educational attainment levels actually is more effective, i.e. whether it yields higher gains in productivity. Therefore, this paper investigates the associations of training incidence and returns to a comprehensive set of initial skill formation and industrial relations factors. At first, participation rates and average income effects for those who receive training are estimated per country, their relationships to the institutional variables are then analysed.

Theory and previous research on institutional determinants of training

Complementarities between education and training

In line with human capital theory, training studies have found that on average, higher educated workers receive more training. Starting from this relationship at the individual level, Brunello (2001) comparatively analysed the association between education and

training at the country level and found that training incidences are higher in systems with a higher aggregate supply of educational attainment levels. The general explanation is that better educated workers are trainable at lower cost and that this training is more effective in terms of productivity gains. On the demand side, more training occurs in systems with a higher skill intensity of jobs because the skills required by these occupations are changing more dynamically and hence require continuing training (Brunello et al., 2007; Müller and Jacob, 2008). The alternative expectation that training incidences decrease with education because high-skilled labours need less further training is not supported by the available empirical findings at the country level (Brunello, 2001; Bassanini et al., 2005; Brunello et al., 2007). I, therefore, expect that the higher the level of skills supply and demand in a country, the more training takes place.

In addition to the quantity of education in terms of supply and demand, Brunello (2001) and Brunello et al., (2007) study the relationship between further training incidences and the design of secondary schooling. To this end, national education systems are classified along the dimensions of stratification and the extent to which vocational specializations are provided within secondary schooling. Stratified systems track students, at relatively early stages, into distinct educational paths, providing them with various educational opportunities, including vocational tracks that systematically translate into different labour market prospects (Müller and Jacob, 2008). In stratified and vocational-specific systems, higher shares of school leavers possess job-specific qualifications. This reduces the overall need for further training after labour market entry as compared with comprehensive systems in which higher training needs follow from the less specialized qualifications provided. In line with this expectation, Brunello (2001) found a higher number of training incidences in comprehensive schooling systems. Skills obsolescence in the course of technical change may have the opposite effect due to the early and relatively narrow

specialisation in stratified systems. In that case, training would appear as a substitute for obsolete education. This has been found at the individual level when comparing older and younger workers with similar qualifications (Brunello, 2001), but not in cross-country comparisons. I, therefore, expect that system stratification in secondary schooling to be negatively related to training incidences.

While Brunello (2001) analysed the relationship between further training and the design of secondary schooling, to my knowledge, to date, no empirical research has been conducted on the training implications of skill-based measures of school quality. The Program for International Student Assessment (PISA; OECD, 2007) provides comparable measures of cognitive student abilities at the end of compulsory schooling and thus indicates country variation in school-based human capital accumulation. It follows that in high-quality school systems, labour market entrants possess higher general skills than in other systems. Analogous to educational attainment levels, a positive relationship between training and school quality is expected.

While the available empirical results show that firm sponsored training is associated with positive wage effects (Hansson, 2008), the evidence about the association between initial education and training returns is scarce. Tentative results by Bassanini et al., (2005) suggest a positive relationship of aggregate educational attainment levels and returns. The impact of the quality of initial schooling and system stratification on training returns has yet to be studied. According to human capital theory, well-educated and highly skilled labours are more productive, easier to train and their continuing training is associated with larger gains in productivity. Ceteris paribus, the higher the skills of labour market entrants the higher the productivity gains from training. If education and training are complements and the returns to both education and training are positive, I expect that skill demand and

supply as well as school quality are positively related to cross-country differences in the returns to training.

Considering educational stratification, comparative research on the effects of schooling suggests that stratification increases inequality in educational attainment and in subsequent labour market opportunities (Hanushek and Wößmann, 2006). Hence, stratification is expected to increase earnings inequality and—if training incidence is negatively related to both stratification and the wage effects of training at the country level (Bassanini et al., 2005)— training returns should be higher in stratified systems.

Industrial relations and training

The impact of industrial relations on training has been extensively studied. In a review, Acemoglu and Pischke (1999) stress the relevance of labour market institutions for the training decisions of firms, among them are trade unions and collective bargaining, labour protection and competition. Unions are expected to influence training either directly through negotiations over training plans or indirectly through wage bargaining. Wage agreements contribute to a higher wage floor and a more compressed wage structure; this is an incentive for employers to train when post training wages are below the productivity gains associated with training or when the productivity of workers is below the (union) wage, to close the gap. This implies that a higher union density decreases the returns for employees. When unions have control over the quality of training, more and better training may result to meet occupational standards. Another positive stimulus is associated with unions' activities in reducing labour turnover: because the risk of losing highly qualified workers is reduced, more training is provided to the employed. Most empirical studies find a positive relationship between unions and training incidence, however, no clear-cut empirical association regarding the returns has been found so far (Booth et al., 2003; Bassanini et al., 2005; Dieckhoff et al., 2007).

EPL impedes turnover by increasing mobility costs. In systems with strict EPL it is costly to dismiss workers and as a result, new hires are more carefully selected and on average of better quality. Then, more training and greater returns are a consequence of the fact that workers were better skilled in the first place (Booth et al., 2003). An alternative consequence is that then there is less need for further training (Müller and Jacob, 2008). The expected effect of market competition on training is mixed (Bassanini et al., 2005). On the one hand, a higher degree of competition might be negatively related to training incidence and returns by reducing profit margins. On the other hand, competition is expected to foster innovation and efficiency, which is complemented by an increase in the need for higher skills and more training. Empirical studies show that training increases with innovativeness and knowledge-intensive production and thus, market competition is positively related to training incidence (Bassanini et al., 2005).

Data and method

A two-step hierarchical estimation approach is adopted (Achen, 2005; Lewis and Linzer, 2005). In the first step, training incidence and effects are estimated per country, and in the second step the country variation in these estimates is regressed on the institutional variables of initial skill formation and industrial relations. Two-step modelling is recommended when the number of observations is high within groups but low at the group level (Achen, 2005), as is the case here.

First step: Estimating training incidence and returns

Incidence and returns are estimated from the first round of the Adult Education Survey (AES), which provides comprehensive data on adult learning activities and a wide range of background characteristics for 26 European countries. The AES is representative of the 25–64–year–olds and designed to be valid cross-national, and thus providing an opportunity for comparatively analysing training.[1] Out of the 14 countries used in this

study, eight collected data in 2007, four collected data in 2006 and two collected data in 2008. Any bias that may result from different survey years is considered negligible, because according to Labour Force Survey figures training incidence remained fairly stable and systematic time effects in training-related income patterns are unlikely, not least due to the relative income measure used. Moreover, all surveys were finished by the outbreak of the financial crisis in 2008.

The AES regards training as non-formal learning, which comprises organized and sustained educational activities beyond initial education. The question reads as follows: "During the last 12 months have you participated in any of the following activities with the intention to improve your knowledge or skills in any area?" Participation in a) private lessons or courses (classroom instruction, lecture, theoretical, and practical course), b) open and distance learning courses, or c) seminars and workshops are considered, if the aim was to improve job-related skills and the firm sponsored the costs. Although the potential effect of training is subject to its volume of instruction and learning hours (OECD, 2005), training is analysed as a dichotomous variable because of two methodological issues that would bias the returns estimates. First, the volume of reported training that occurred outside the reference period of 12 month is not observed and thus, training that started before the reference period is only partially covered. Second, the AES quality reports indicate that respondents in most countries had difficulty specifying the volume of the training they received.

In the AES, income is available in quintile groups per country, which has disadvantages, because interpretation of income effects is not as straightforward as in usual wage regressions. Rather than reporting wage differences in percentage points, income returns must be interpreted as the average difference in quintiles of the income distribution between participants and (comparable) non-participants. Part of the training effect is likely

hidden because participants who were already in the highest income group before training cannot progress. Another potential source of underestimation is that some of the reported training may not have been completed at the time of the survey (i.e., when the income is measured). The restrictions mentioned apply to all countries and would bias the results only if they were associated with systematic cross-country differences, e.g., regarding the time until training pays off or the sequence of training and promotion. After all, the relative income measure has the advantage that it is directly comparable across countries. As is the case with most cross-section training studies, only short-term training effects can be studied.

Because training assignment typically is a non-random process of employer- and self-selection, employees who possess characteristics associated with higher income levels are more likely to receive the training. Without appropriate adjustments for selection, the estimated training effect is confounded with differences independent of training. Only if all variables influencing the selection process are observed can the true training effect be obtained (Rosenbaum and Rubin, 1983). As hardly any observational data cover all the information needed to model selection completely, the goal is to reduce the selection bias as far as possible by exploiting the rich AES background data. Income returns are estimated by matching participants to comparable non-participants in order to make the selection into training ignorable, essentially by exploiting the provided information on the situation before training (Morgan and Winship, 2007).

Table 1 shows summary statistics for the treatment, outcome, and variables used in the matching technique. Besides the socio-demographic variables like sex, age and migration background, one important matching variable is educational attainment level. To disentangle formal education and training, the sample is restricted to employees who finished their education at least 2 years before the survey. Consequently, the minimum

potential labour market experience is 2 years. With its focus on knowledge, expertise, and income, the International Socio-Economic Index of Occupational Status (ISEI; Ganzeboom and Treiman, 2003), measured pre-training, is the key control variable regarding the occupational situation before training. To avoid income effects being confounded with employer changes, the sample has been restricted to employees with a job tenure of at least 2 years. In addition, the following information about their current job is included: part-time work, firm size, and industry category (employees in military services are excluded).

(Insert Table 1 about here)

Matching is done by the multivariate matching technique GenMatch (Sekhon, 2011) using the R software (R Core Team, 2013). GenMatch maximizes balance in the matching variables, including quadratic terms and interactions (see Table 1) through an evolutionary search algorithm, which determines the weight each covariate is given.[2] Per country average treatment effects for the treated (ATT) are estimated by one-to-one matching with replacement and robust standard errors (SEs).[3] ATT is the mean difference between the income realized by those who took the treatment and their potential outcome under the control state (Morgan and Winship, 2007). Assuming that treatment selection is an ignorable conditional on the observed covariates, one can impute the potential outcome for treated units in the control state using the average income of the matched non-participants. Still, unobserved variables that influence both treatment assignment and income, for example motivation, work ethic, or ability, might result in biased estimates if they are unevenly distributed among participants and non-participants. In addition to the restrictions associated with the data outlined above, the causal interpretation of the estimated effects is limited. However, as most of the restrictions apply to all countries similarly and the unequal variation in the individual-level training estimates across countries is taken into

account in the second step, it is reasonable to perform an institutional analysis based on these estimates.

Incomplete data are imputed five times per country and gender by a fully conditional specification, where a model is specified for each variable with missing values and all other variables serve as main effects, assuming that values are missing at random (MAR). As missingness is generally low, any bias that may arise from a possible violation of the MAR assumption is negligible. The final ATT is the mean of the ATTs estimated separately from the five imputed data sets. SEs are calculated by taking into account the sampling variances and the variance of parameter estimates (Rubin, 1987).

Second step: Institutional determinants of training

At the country level, the institutional variables of initial skill formation and industrial relations draw on various data sources (see Table 2). Their relationship to country variation in training incidence and returns are analysed using bivariate correlation and graphical representations followed by a series of multivariate regression models. As the dependent variables (DVs) in the multivariate models were estimated in the first step, the residuals are weighted by the inverse of the SEs of the DV estimates to account for unequal uncertainty across countries. Because, in our application, the sampling error in the DV accounts for the whole regression residual, this procedure yields exactly the same result as the feasible generalized least squares estimator (FGLS) proposed by Lewis and Linzer (2005).[4]

(Insert Table 2 about here)

In order to cope with the small number of countries, the institutional variables are modelled as factors in the second step, unless empirical analysis rejects the theoretical assumptions about the factor structure, which are derived from theoretical assumptions outlined above. School quality is represented by the country-average PISA literacy scores

in reading, math, and science, and stratification by the age of first tracking and the number of tracks available to 15–year–olds. The supply factor is represented by the share of tertiary educational attainment levels among the workforce and the population, whereas demand is measured by one indicator variable—the proportion of workers in jobs that typically require qualifications at the tertiary level—which is modelled directly. The input into the education system, in terms of expenditure on human resources (% of GDP on educational institutions and on research and development (R&D), share of private expenditure) and per capita GDP, is combined into one factor that serves mainly as a control in the outcome models to check for the robustness of school quality and stratification estimates. As discussed in the theory section, industrial relations are indicated by measures of union density, collective bargaining coverage, competitiveness, innovation, and employment protection. Confirmatory factor analysis (CFA; Brown, 2006) is carried out to validate the assumption that the observed indicators effectively reflect the variations in the factors. The empirical justification of the factors is presented in the findings section in terms of CFA measurement models including goodness of fit statistics. The CFA and the multivariate outcome models are performed by the robust maximum likelihood estimator implemented in Mplus (Muthén and Muthén, 2012).

Findings

Estimated training incidence and income effects

Training incidence and returns differ greatly across countries (Table 3). Incidence is highest among the Nordic countries, Sweden, Finland, and Norway, where around half of the employees have received firm sponsored training within the 12 months before the survey. In Austria, Estonia, and France, the share of employees who received training ranges between 24% and 29%. In Denmark, employee training is similar to that seen in Lithuania and Belgium, where roughly one fifth of the employed participated. While

employee training in Croatia is almost as high (16%) as in Belgium and Denmark, rates are lower Bulgaria (12%) and Cyprus (13%), and the lowest percentage of employee training can be found in Portugal (5%). Estimated income effects of these training spells are positive in all 14 countries, indicating that workers who have received employer-sponsored training are, on average, in higher income brackets than comparable employees who have not had training. However, in Bulgaria, Estonia, and the Slovak Republic, sample sizes are not large enough to obtain significance. The significant short-term effects in the other countries range from 0.17 in Norway up to 0.56 in Croatia, which are the mean differences in the income quintiles between participants and comparable non-participants per country. An estimated return of 1 would imply that employees who received firm-sponsored training are on average 1 quintile of the income distribution above their peers who did not receive training. Thus, the 0.56 estimation in Croatia can be interpreted as, on average, 56% of the participating employees have reached the next higher income quintile after training. Effects are almost as high in Belgium (0.45), Austria, Lithuania (0.38 each) and Finland (0.36). Along with Sweden, estimates in France, Cyprus, Portugal and Denmark range between 0.20 and 0.30.

(Insert Table 3 about here)

Justification of the institutional factors

To empirically justify the theoretical concepts underlying the institutional factor structure prior to implementing it in the outcome models, Table 4 shows the results of the measurement models within Confirmatory Factor Analysis (CFA).[5] The first CFA model consists of school quality—measured by the countries average PISA scores in the three domains of reading, math and science—and educational stratification which is measured by two indicators, the number of tracks available to 15–year–olds (1-5) and the age of first tracking (reversely recoded so that a higher value indicates higher stratification). The

quality indicators are constrained to load equally on the factor, which significantly improves model fit. The satisfying goodness-of-fit measures indicate that the factor structure works well and the model estimated variance/covariance matrix is close to the empirical one. The other three measurement models extend the first one, each including one additional factor, namely skill supply (CFA 2), input and context (CFA 3), and industrial relations (CFA 4). Goodness-of-fit is satisfying for all of these 3 factor models, indicating that the assumptions about the factor structure in the country-level indicators are justified. Two indicator variables are directly modelled in the outcome equations without contributing to a factor. The first one is skill demand and the second one is EPL, which is not jointly explained by the industrial relations factor. Across all four CFA models, there is a weak but consistent negative correlation between school quality and stratification. Consequently, school quality is positively associated with the factors of skill supply, input/context and industrial relations while their relationships to system stratification tend to be negative, particularly to skill supply. Above their factor correlation, the specified item correlation between student performance in numeracy and competitiveness supports the view that student performance reflects an economy's capacity and readiness for innovation (Brunello et al., 2007). The negative correlation between the reading score and the age of first tracking throughout the models indicates that in the early tracking school systems, reading abilities, on average, are lower than in the other systems.

(Insert Table 4 about here)

Institutional factors and training

As depicted in the first row of Figure 1, the bivariate relationships between training incidence and skill supply, and skill demand and system stratification are consistent with the expectations derived from theory and previous research. Cross-country training rates are positively related to the share of workers in jobs that typically require a qualification at

the tertiary level (skill demand indicator) and the Pearson correlation coefficient of 0.76 indicates a strong relationship. This supports the explanation that high-skill occupations are particularly subject to skill-biased technological change and require ongoing training. Likewise, training incidence increases with educational attainment levels among the workforce and the population (skill supply factor), implying that in terms of productivity, it is more efficient for employers to train better educated workers. However, compared with skill demand the correlation is weaker, suggesting that employer sponsored training is more driven by demand than by supply.

Regarding the organization of the secondary schooling, more employee' training takes place in countries with less stratified systems, implying that the prevalent general education in more comprehensive systems is associated with higher aggregate training needs after labour market entry. Likewise, the higher the degree of stratification, i.e. the more vocational specialization is provided within initial education, the lower the need for further employee training. This is in line with the argument that job-related training compensates for the lack of vocational specificity in school, whereas the alternative consequence of higher training needs owing to skill obsolescence is not supported at the system level. The finding that cross-country employee training rates increase with higher aggregate student performances in reading, science, and math contributes to the training literature. Consistent with the theoretical expectation, school quality, in terms of cognitive abilities, fosters aggregate training investment decisions of firms as they mirror the potential for innovativeness of labour market entrants.

(Insert Figure 1 about here)

While training incidence is associated with the skill intensity of occupations and the educational composition of the labour market, private returns to training are not, and seem to be independent of skill demand and supply across the 14 countries (second row in

Figure 1). But according to the analysis, both quality and stratification of schooling systems are not only related to incidence but also to the training returns. An interpretation might be that while a higher demand for and supply of skills in terms of educational attainment levels leads to more employee training, this training is more productive in countries in which school leavers and the workforce as a whole actually do possess higher skills. The observation that a substantial variation in proficiency levels exists among similar educational levels and that school quality and adult proficiency levels are strongly correlated is in support of this view (OECD, 2013). Hence, in systems with more able school leavers (and workers), the apparent higher aggregate productivity gains of training allow firms to impart a higher share of the training benefits with their employees through wage gains. Likewise, stratification also tends to correlate positively with training returns, while it is negatively associated with training incidences, implying that given system stratification, the negative relationship between incidence and returns confirms the expectation that stratification increases educational inequality which in turn translates into lower training opportunities and a higher aggregate wage gap between participants and non-participants.

The levels of financial input into education and the economic wealth of countries—as jointly captured by the input/context factor depicted in Figure 2—are strongly related to country variation in training provision: more trainings take place in countries with higher spending on initial education institutions and R&D, with lower shares of private expenditure in initial education and with a higher average GDP per capita. Yet, just like the skill demand and supply variables, these input and context variables do not make a difference in training returns across the 14 countries. Consistent with prior empirical results, the system of industrial relations (union density, collective bargaining coverage and competitiveness) is positively related to training incidence. Again, cross-country

differences in the returns to training are unrelated to these industrial relations variables. Hence, the results give no indication that unions and collective bargaining reduce wage effects by enabling firms to collect the greater part of the returns when bargained wages do not reflect the productivity gains. EPL is negatively related to training incidence, though the correlation is weak and statistically insignificant. In contrast, the positive and significant correlation between EPL and training returns is in line with the argument that to avoid turnover, systems with stricter EPL firms are more likely to share the benefits with their employees.

(Insert Figure 2 about here)

Multivariate analysis of the complementarities between education and training

Multivariate analysis is carried out to determine whether the initial skill formation variables are still related to training incidence and returns once controlling for the other institutional variables.[6] Regressing training incidence on both school quality and stratification replicates the general bivariate result of a positive association to school quality and a negative association to stratification, respectively (Model MI-1 in Table 5). Although country variation in skill supply does not matter (MI-2), these relationships are confounded by cross-country differences in skill demand (MI-3), in overall and private levels of expenditure on education including R&D and in economic wealth (MI-4), and in industrial relations (MI-5). Country variation in the strictness of EPL is also not associated to training incidence when controlling for other institutional factors (MI-6). Obviously, a compound of institutional factors accounts for the observed cross-country heterogeneity in training provisions and cannot be unambiguously attributed to one single institutional factor. However, the analysis suggests that differences in skill demand and in the input/context of education systems do matter even when holding constant school quality, stratification, and EPL. Thus, the share of skill-intensive jobs along with the level of

economic wealth and financial input into initial education can be identified as the main confounding variables in explaining firm-sponsored training activities because once these variables are included in the models, the effects of school quality and stratification disappear. Skill supply, industrial relations and employment protection seem to have no effect on country-level training provision at all. Indeed, systems with a higher school quality invest, on average, more in human resources, including a higher incidence of training, but once skill demands, the financial inputs into education and GDP as well as industrial relations are controlled for, the direct link between school quality and training incidence is broken. Likewise, the negative relationship between stratification and training incidence becomes statistically insignificant once accounting for skill demand and input/context, but it is not sensitive to differences in the industrial relations. The impact of the industrial relations variables on training incidence seems to be confounded by the initial skill formation variables because multivariate analysis yields no significant direct effect. However, the estimated coefficient is positive and might be significant in a larger country sample.

(Insert Table 5 about here)

As compared with training incidence, the multivariate pattern of association between training returns and the initial skill formation variables is reversed. While country variations in skill demand and in input/context are unrelated to training returns, the positive relationship between training returns and school quality as well as stratification is strong and robust to the inclusion of all other institutional factors considered. Moreover, the association becomes even more apparent in the multivariate analysis (Models MR 1–10 in Table 5). Hence, the impact of these two initial skill formation factors on training returns is not sensitive to important potential confounders, including differences in the economic wealth and the financial input into initial education, skill demand and supply, industrial

relations, and EPL. While the share of skill-intensive occupations and educational attainment levels among the workforce and the population is positively related to training returns only when controlling for EPL, all bivariate and multivariate analyses robustly indicate a direct positive impact on school quality. It can be concluded that the productivity gains associated with training are higher in countries with a more able workforce and that the distribution of these higher benefits is not determined by differences in labour market regulations across the 14 countries. Rather, firms seem to share this *ability-surplus* with their workers and do not reap it all for themselves, possibly to keep workers' training efforts and motivation up. Early tracking of students into different ability schools and programmes has been found to increase educational inequality (Hanushek and Wößmann, 2006). The result of lower participation rates and higher returns in stratified systems show that these systems continue to increase inequality in labour market opportunities and outcomes. Moreover, the lower incidence and the higher average wage premium in these systems point to an under-provision of training.

While EPL seems to be unrelated to training incidences, its positive association with training returns is robust to the other institutional variables. Thus, training needs at the country level seem to be unrelated to a more careful selection of workers who match the job requirements better in systems with stricter EPL. The positive relationship between EPL and training returns corroborates the argument that firms are more likely to share the benefits with their employees in systems with stricter EPL to avoid costly labour turnover.

Discussion

This article studied the relationship between job-related employee training and institutional factors across 14 European countries. Country variation in both training incidence and returns were analysed based on the AES, which has not previously been used to estimate income effects of training. Within an institutional approach, the relationship between the

two country-level training variables and initial skill formation, as well as industrial relations factors were examined.

In line with prior research, the analysis shows that cross-country differences in training incidence and returns are large. Regarding country variation in training incidence, the results are mainly in line with the view that employee training complements education. The higher the aggregate skill demand and supply and the more financial input into initial education and school quality, the more firm-sponsored training is provided across the 14 countries, while stratification is negatively related to training incidence. However, as tested through multivariate analysis, only the level of skill demand and funding seem to have a direct effect independent of the other institutional factors. The relatively low significance level of this result is most likely because of the small sample size at the country level.

The association between the institutional setting and training returns differs quite a lot from its association to incidence in that the direct associations between initial skill formation factors and training returns appear to be strong and robust. Most notably, school quality and educational stratification contribute substantially to explaining country variation in training returns. These two variables are positively related to the training effects, whereas skill demand and the financial inputs into education—which are the main drivers of aggregate training provision according to the analysis—only make a moderate difference in cross-country training returns. This suggests that independent of the aggregate level of training provided, the productivity gains due to training are higher in systems in which school leavers and the workforce actually do possess higher abilities. To put it another way, the effectiveness of firm-sponsored training measures is rather determined by aggregate skill levels than by formal educational attainment levels suggesting that skill-based measures of human capital accumulation indicate the productivity potential. Being positively related to the returns and negatively to the

incidence of training, educational stratification is increasing inequality beyond initial skill formation by affecting trainings opportunities and subsequent earnings differentials. This institutional impact of initial skill formation corroborates the notion of the complementariness between education and training, in which formal education attainment levels and the financial inputs into education determine the aggregate level of training provided while the returns to training are closely related to school quality and stratification. This extension of the previous research on the complementariness of education and training is the main contribution of the article. In particular, institutional relationships regarding training returns have not been found before.

The analysis of the industrial relations variables that constitute the welfare state yields mixed results. The positive bivariate relationship between training incidence and unions, and collective bargaining and competitiveness is in line with previous research, but the impact of these variables is confounded by differences in initial skill formation. Hence, the analysis suggests that the system of industrial relations influences firms' training decisions indirectly, with the exception of EPL. In systems with stricter EPL, employees benefit more from training, presumably to secure the training investment and to avoid costly labour turnover.

Several limitations apply to the conclusions drawn. Incidence and returns estimates are based on cross-sectional data, which refer to different years. The data have features that might lead to unevenly distributed bias in the returns estimates across countries. Moreover, the small sample size at the country level restricts the multivariate analysis of the institutional determinants. However, the data offer comparable information on training and background variables that make it an opportunity for comparative analysis. If the main results hold when using different data and a larger number of countries, they will extend the view of how employee training is embedded in the institutional framework. Regardless,

the results deserve further inquiry, in which an institutional approach should account for the quality and design of initial skill formation.

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Table 1: Summary statistics of key variables (individual level, n=32,038)

	Min	Max	Mean	SD	missings
Treatment:					
Employer sponsored job-related training (D)	0	1	0.20	0.40	-
Outcome:					
Net-income level (quintile number)	1	5	3.05	1.36	4.03%
Covariates used in matching:					
Male (D)	0	1	0.48	0.50	-
Age	25	64	43.71	9.85	-
Education attainment level (C)	0	4			-
Degree of Urbanisation (C)	1	3			-
Kids aged 0-5 years in household (D)	0	1	0.16	0.36	0.04%
Pupils 6-13 years in household (D)	0	1	0.25	0.44	0.04%
Persons aged 65+ in household (D)	0	1	0.08	0.27	0.04%
Migrant (D)	0	1	0.08	0.27	0.12%
Foreign language speaker (D)	0	1	0.07	0.26	0.01%
Potential LM experience in years	2	54	23.16	11.20	-
Occupational status before reference period (ISEI)	16	80	45.11	15.37	-
Current job is part-time (D)	0	1	0.09	0.29	0.12%
Firm size of current job (C)	1	3			0.92%
Tenure in current job in years	2	50	12.88	9.77	1.18%
Industry of current job (NACE)	1	12			0.72%

Employees aged 25-64 who were with the same firm before and after training and who left formal education at least two years before the survey. Employees in military service are not included. In the multivariate matching, quadratic terms of (i) age, (ii) potential labour market experience and (iii) the ISEI-score before training are included as well as an interaction between migrant and foreign language speaker. (D) indicates Dummy, (C) indicates categorical variable. Source: AES 2005-08.

Table 2: Data sources and factor structure of institutional factors at the country level

Factor	**Indicator**	**Data sources, year**
School quality	PISA scores in reading, math and science	OECD (PISA 2006)
Stratification	Age of first tracking	OECD, CEDEFOP, EURYDICE
	No. of tracks available to 15 year olds	OECD, CEDEFOP, EURYDICE
Skill supply	% of workforce with tertiary qualifications (ISCED 5–6)	Eurostat (2007)
	% of population with tertiary qualifications (ISCED 5–6)	Eurostat (2007)
Skill demand	% employed in high-skill occupations (ISCO 1–3)	Eurostat (2007)
Context/input	Economic wealth: GDP per capita	Eurostat (2007)
	Expenditure on education (% of GDP)	Eurostat (2007)
	Private expenditure on education (%share)	Eurostat (2008)
	Expenditure on R&D (% of GDP)	Eurostat (2007)
Industrial relations	Union density	Worker-participation.eu
	Collective bargaining coverage	Worker-participation.eu
	Competitiveness: composite indicator CCI	Eurostat/JRC
	Employment protection legislation (composite indicator)	OECD (2008), ILO (BG, HR)

See supplementary material for descriptive statistics.

Table 3 Incidence and average income effects (ATT) of employer sponsored job-related training

CNT	Survey year	n	Incidence	Returns
AT	2007	2,024	0.29 (0.01)	0.38 (0.09)
BE	2008	1,685	0.19 (0.01)	0.45 (0.10)
BG	2007	2,370	0.12 (0.01)	0.01 (0.10)
CY	2006	2,083	0.13 (0.01)	0.27 (0.08)
DK	2008	1,718	0.20 (0.01)	0.22 (0.08)
EE	2007	1,857	0.27 (0.01)	0.18 (0.12)
FI	2006	1,383	0.49 (0.01)	0.36 (0.09)
FR	2007	6,649	0.24 (0.01)	0.28 (0.05)
HR	2007	1,002	0.16 (0.01)	0.56 (0.17)
LT	2006	1,476	0.23 (0.01)	0.38 (0.18)
NO	2007	1,545	0.46 (0.01)	0.17 (0.07)
PT	2007	3,922	0.05 (0.00)	0.24 (0.08)
SE	2006	1,858	0.55 (0.01)	0.29 (0.11)
SK	2007	2,466	0.03 (0.00)	0.28 (0.15)

Source: AES 2005-08. Employees aged 25–64 who were with the same firm before and after training and who left formal education at least two years before the survey. *Robust standard errors in parentheses.

Table 4: CFA Measurement models: factor loadings and goodness of model fit (standardized solution)

	CFA1	CFA2	CFA3	CFA4
Quality of schooling				
PISA 2006 average science score[+]	1	1	1	1
PISA 2006 average reading score[+]	1[x]	1[x]	1[x]	1[x]
PISA 2006 average math score[+]	1	1	1	1[y]
Stratification				
No. of tracks available to 15 year olds	1	1	1	1
Age of first tracking	0.85***,[x]	0.77***,[x]	0.65***,[x]	0.80***,[x]
Skill supply				
% employed with ISCED 5-6		1		
% population with ISCED 5-6		1.12***		
Input and context				
Education expenditure(%of GDP)			1	
Private expenditure (% share)			-1.22**	
R&D expenditure (%of GDP)			1.46**	
GDP per capita			1.20***	
Industrial relations				
Union density[+]				1
Collective bargaining[+]				1
Competitiveness (CCI)				1.57***,[y]
Covariances				
Between quality and stratification factor	-0.30*	-0.31*	-0.30	-0,31*
Between quality and third factor		0.33*	0.45**	0.43**
Between stratification and third factor		-0.67***	-0.33	-0.14
Between indicators [x]	-0.12***	-0.13***	-0.12***	-0.11***
Between indicators [y]				0.10**
Goodness of model fit				
Chi-Square (p-value)	0.95	0.92	0.41	0.42
Comparative fit index CFI	1	1	0.99	0.99
RMSEA	0	0	0.05	0.05

[+] The indicators are constraint to load equally on the factor, which significantly improves model fit. ***,**,* coefficients statistically significant at the 1%, 5%, 10% level.

Table 5: Multivariate models explaining training incidence and returns, standardized coefficients

REGRESSING TRAINING INCIDENCE	**MI-1**	**MI-2**	**MI-3**	**MI-4**	**MI-5**
Quality of schooling (Factor)	0.45***	0.46***	0.04	-0.08	0.26
Stratification (Factor)	-0.50***	-0.51**	-0.24	-0.13	-0.51***
Skill supply (Factor)		0.00			
Skill demand (Indicator)			0.67		
Context and input (Factor)				0.82**	
Industrial relations (Factor)					0.23
R-Square	0.60***	0.65***	0.58***	0.78***	0.59***
REGRESSING TRAINING INCIDENCE	**MI-6**	**MI-7**	**MI-8**	**MI-9**	**MI-10**
Quality of schooling (Factor)	0.45***	0.46***	0.01	-0.08	0.26
Stratification (Factor)	-0.50***	-0.55**	-0.25	-0.12	-0.49***
Skill supply (Factor)		-0.06			
Skill demand (Indicator)			0.73*		
Context and input (Factor)				0.82*	
Industrial relations (Factor)					0.25
Employment protection legislation (Indicator)	-0.09	-0.12	0.11	-0.11	0.01
R-Square	0.60***	0.66***	0.61***	0.79***	0.63***
REGRESSING TRAINING RETURNS	**MR-1**	**MR-2**	**MR-3**	**MR-4**	**MR-5**
Quality of schooling (Factor)	0.71***	0.67**	0.76***	0.96***	0.76**
Stratification (Factor)	0.64***	0.50**	0.48**	0.55***	0.61***
Skill supply (Factor)		-0.02			
Skill demand (Indicator)			-0.16		
Context and input (Factor)				-0.32	
Industrial relations (Factor)					-0.08
R-Square	0.66***	0.54***	0.62***	0.69***	0.73***
REGRESSING TRAINING RETURNS	**MR-6**	**MR-7**	**MR-8**	**MR-9**	**MR-10**
Quality of schooling (Factor)	0.72***	0.64***	0.44**	0.69**	0.71***
Stratification (Factor)	0.56***	0.73***	0.61***	0.56***	0.55***
Skill supply (Factor)		0.31*			
Skill demand (Indicator)			0.40*		
Context and input (Factor)				0.04	
Industrial relations (Factor)					0.01
Employment protection legislation (Indicator)	0.36***	0.63***	0.62***	0.34***	0.35***
R-Square	0.77***	0.82***	0.81***	0.76***	0.77***

***,**,* coefficient statistically significant at the 1%, 5%, 10% level.

[1] Following the experience of previous surveys, Eurostat developed the concepts and definitions with support from a task force (European Commission, 2005). As recommended, most countries implemented stand-alone surveys. Out of the 14 countries used in this study, only France used another vehicle and collected the data within its Labour Force Survey.

[2] Per country balance metrics of the covariates used in the matching are available in the supplementary materials (standardized mean differences). Although the huge pre-matching differences regarding the key matching variables occupational status and educational attainment are reduced in large part, minor differences remained. To allow for an inspection of the pre- and post-matching distributions of these variables, plots are also available.

[3] All ties, i.e. more than one non-participant match one participant, are kept and averaged. The alternative of breaking ties at random results in an underestimation of the variance of estimates, while matching without replacement increases bias (Diamond and Sekhon, 2013).

[4] This is because the variance component, which is not due to sampling of the DV, is estimated to be less than nil here.

[5] The completely standardized solutions are estimated by robust maximum likelihood, which is insensitive to non-normality.

[6] Ten models are applied to the DVs. Model 1 consists of the main explaining constructs only, school quality and stratification. Models 2–6 each includes one additional institutional regressor. Because EPL is strongly related to training returns according to Model 6, Models 7–10 consists of school quality, stratification, and EPL, each with one additional variable.