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The sample for the Russian Federation does not include the population of the Moscow municipal area. More detailed information can be found in the Technical Report of the Survey of Adult Skills (OECD, 2014).

Summary and key findings

This study seeks to disentangle the returns to formal, non-formal and informal training and, thereby, fills three key knowledge gaps. First, many studies have estimated the returns to formal training. These studies often consider both formal and non-formal training activities together, without distinguishing the two types of learning. Nonetheless, disentangling the returns to formal and non-formal training could bring important insights for policy as non-formal training activities are, by their own definition, uncertified. Second, very few studies in the literature have taken informal learning into account. This leads to a biased assessment of the value of non-formal training. It also leaves out a major share of the learning that takes place at work, leading to limited policy efforts to enhance the visibility and portability of the acquired skills in the lifelong learning system and the labour market. Third, a large knowledge gap exists in how formal, non-formal and informal learning are distributed across individuals depending on the specific nature of their jobs and on the work organisation features of their workplace.

The paper exploits data from the OECD Survey of Adult Skills (PIAAC), the European Adult Education Survey (EU-AES), the European Continuing Vocational Training Survey (EU-CVTS) and the OECD Structural Analysis Database (STAN). Formal, non-formal and informal learning are measured according to standard definitions, and most of the analysis is restricted to learning that is job-related and that was undertaken in the previous 12 months. This amounts to assessing the returns to job-related training over a relatively short time period and irrespective of whether the training was undertaken with the current or previous employer.

Using several data sources, each with its own strengths, allows improving significantly on the way training is measured and on the international comparability of the results. In addition to the measurement of formal and non-formal training, PIAAC includes valuable information on the frequency of learning from others, of learning by doing and of learning new things at work which are used to assess the extent of informal learning at work. It also provides information on wages and individual and job characteristics that allows for an analysis of the key correlates of training participation. The EU-AES provides measures of training participation that are broadly comparable to those included in PIAAC in three separate waves, making the assessment of changes over time possible. The EU-CVTS represents a unique source of information on firms' investment in training, including valuable training unit costs exploited in this paper. Finally, information on value-added at the industry level is derived from STAN which can be linked to the other data sources to assess the impact of training on productivity and provide the basis for a cost-benefit analysis.

A key finding in this paper is that formal and non-formal training are just the tip of the iceberg of the learning that occurs in workplaces. Informal learning is far more important in incidence and intensity. This finding along with evidence of sizeable wage and productivity returns to informal learning underscores the importance of improving the learning culture in the workplace as a means of fostering human capital development in firms. High performance work practices are shown to encourage informal learning and increase its returns, possibly through more opportunities to apply what has been learnt. Therefore, from the policy point of view, more could be done to foster this learning culture by encouraging innovative human resource management practices.

A second policy implication of this work is that while employers reap significant benefits from their workers engagement in non-formal and informal learning, the skills that workers acquire through these forms of learning are not easily recognised by other employers. This weakens the ability of workers to capture fully the returns to their participation in non-formal and informal learning and may weaken their incentives to take up learning opportunities. It can also widen inequalities between workers who have access to formal and non-formal training and those who learn primarily by doing their job. Transparent, streamlined and widely-recognised certification mechanisms could improve the visibility of workers' human capital gains in the labour market, strengthen worker engagement in learning and help facilitate labour mobility when necessary.

The key empirical findings in more detail include:

- Informal learning is by far the most common form of job-related learning at work. The number of hours that workers spend learning informally represents about 80% of the total hours spent in non-formal and informal learning, in line with findings in the limited literature on this topic. This is the case even under the most conservative assumptions. Formal training tends to last significantly longer than the other forms of learning but involves very few workers.
- Looking at the incidence of training, about 70% of workers engage in informal learning activities over a 12 months period, compared with 41% who engage in non-formal training and just 8% who train towards a formal qualification. Only in Korea, the Netherlands and Denmark is the incidence of informal learning significantly below that of non-formal training.
- Northern European countries (Norway, Denmark, Finland, and Sweden) tend to show the highest incidence of any type of training – formal, non-formal and informal – along with New Zealand. At the other hand of the scale, countries such as Greece, Italy and the Russian Federation perform poorly in all three dimensions.
- There is a positive correlation between the different forms of training. This is particularly the case for non-formal training and informal learning, both at the country and individual level. In other words, countries with a high incidence of non-formal training also have a high incidence of informal learning. Similarly, at the individual level, the chance of receiving non-formal learning are 8% higher for workers who learn informally at work and the chances of learning informally at work are 7% higher for workers who have participated in non-formal training. In this sense, there is no evidence that one form of training substitutes for the other. On the other hand, as the incidence of informal learning is a lot higher than that of non-formal training, many workers who miss out on non-formal training are likely to experience at least some informal learning in the workplace. On average across all countries, 65% of workers who do not attend any non-formal training, learn from everyday work. Even in countries like France, Greece or Italy where non-formal training participation is below 30%, more than 60% of workers learn informally at work.
- Trends in training participation are only available for European countries. While participation in formal training remained roughly stable between 2007 and 2016, participation in non-formal job-related training increased in most countries and by about 10 percentage point on average. Significant increases were observed in Hungary but also Italy, Portugal and Switzerland while sizeable declines were only experienced in Bulgaria and Sweden. Participation in informal learning in everyday

life rose even more dramatically by about 17 percentage points in the EU on average, mostly due to a significant rise in the share of adults reporting that they learnt using computers. This is a different concept from informal learning at work but is symptomatic of a general rise in informal learning activities.

- Focusing on informal learning at work, about 56% of workers learn by doing their job at least once a week, on average across OECD countries. Learning from others and learning new things at work are experienced by 43% and 40% of workers, respectively, in the OECD on average. Pairwise correlations of the different types of informal learning are positive but only about 20% of workers experience all three forms of informal training in the OECD on average.
- All things being equal, the chances of learning informally at work decrease with age and tenure, increase with educational attainment but decrease with proficiency in literacy. One extra year of education increases the likelihood of learning informally at work by 0.5% but, among workers with the same number of years of education, opportunities to learn informally seem to be higher for those with lower literacy skills. Informal learning is less frequent among workers in part-time jobs and in private sector jobs while it is more likely among workers on non-standard contracts – fixed-term contracts, contracts through temporary work agencies, apprenticeship contracts or no contract at all.
- In general, the workers and jobs characteristics associated with a higher participation in non-formal and formal training coincide to a great extent with those associated with more frequent informal learning at work, with some notable differences. More than it is the case for informal learning, participation in non-formal training is disproportionately higher for workers with higher qualifications and higher literacy skills. Also, workers in non-standard contracts receive less non-formal training than their counterparts in permanent jobs, which is in line with previous findings in the literature. To some extent, this suggests that non-standard workers who receive relatively little non-formal training at work may be able to compensate with more opportunities for informal learning.
- Accounting for all forms of training provides more precise estimates of their separate returns on wages and productivity, correcting for some of the biases generated when informal learning is excluded. When the role of informal learning is accounted for, the estimated returns to non-formal training drop by between one and half a percentage point, depending on the controls included. Correcting for a number of socio-demographic and job characteristics and controlling for selection into training of the most motivated workers, participation in non-formal learning is associated with 11% higher wages, while participation in informal learning is associated with 3.5% higher wages.
- Participation in formal learning which is often seen as being general in nature is found to be associated with a small fall in wages. This result is not to be confused with negative returns to education as it refers to courses undertaken by adults after leaving the education system. Indeed, returns to education are positive and statistically significant. The fall in wages associated with formal training may reflect the time taken off work by workers who participated in formal courses which reduces their wages. This interpretation would be in line with the human capital theory prediction that workers pay for training of a transferable nature in the form of lower wages in the short run. The small and negative returns to formal training

may also be due to the short timeframe of this study and the inability to control for job mobility following training. In other words, positive returns to training may take longer to materialise and may require a job move that cannot be capture with the data used.

- Returns to tenure, a proxy for informal learning on the job, are not affected by the inclusion of the informal learning measure used in this paper. Each year of tenure is associated with a 1% increase in wages, whether or not informal learning is accounted for. This confirms the value of using more explicit indicators of learning informally at work, as returns to years of tenure may reflect to a significant extent seniority-pay practices, i.e. when the primary basis for pay increases is the employee's tenure.
- Returns to non-formal training are highest in Chile, Estonia, Ireland, Lithuania, Poland and Turkey and lowest in Greece and Austria. The picture is different for informal learning in the workplace: some of the lowest returns (negative) are found in countries where non-formal training has the highest returns internationally such as Turkey and Estonia; while countries with very low returns to non-formal training (notably, Italy and Austria) have relatively large returns to informal learning. In many countries, returns to formal learning are negative, in line with the negative returns overall.
- Returns to non-formal and informal learning are highest for tertiary-educated workers, suggesting that not only higher educated workers participated in more training than less educated workers, they also benefit more from it. By age, returns for youth are significantly lower than for older workers in all forms of training.
- Workplaces which apply High Performance Work-organisation Practices (HPWP) – i.e. where workers have more autonomy at work and work in teams – are found to offer more training than in other workplaces and which also yields higher returns. Workers in these workplaces are 12% more likely to experience informal learning. In addition, they also reap higher returns from both non-formal and informal training. This suggests that HPWP may amplify the benefits of learning at work. This may reflect both the type of learning that workers in HPWP workplaces receive and more opportunities to turn what they learn into immediate use because of the increased flexibility in organising their work.
- There is some evidence to support the idea that employers benefit from the training they provide more than workers do, i.e. the increase in value-added per hour worked associated with training is higher than the increase in wages. Using sector/country data on labour productivity from the STAN database and adapting the analysis above, each hour of informal learning is found to increases productivity by 1% while wages only increase by 0.5%, a relationship which is in line with findings in the literature. Each hour of non-formal training is associated with gains in productivity (12%) that are 3 times the returns on wages (4%) although the coefficients are not statistically significant.
- Using data on training costs from the EU-CVTS, this study finds that the benefits of training, computed as the increase in value-added per hour, are much higher than its costs. This is the case for non-formal training the cost of which can be recovered in about 16 working days and for informal learning the cost of which can be recovered in about 70 working days, under the stringent assumption that workers are only half as productive while learning informally.

- There is some indication that higher unit costs for training are associated with higher productivity gains, suggesting that better quality training yields higher returns. However, sample size for this analysis, conducted on 5 sectors and 20 countries, is very small and the results are not statistically significant.

Résumé et principaux constats

Cette étude vise à analyser distinctement les bénéfices de la formation formelle, non formelle et informelle ; elle comble, ce faisant, les lacunes existant à trois principaux égards. En premier lieu, nombre d'études se sont attachées à estimer les bénéfices de la formation formelle, mais considèrent souvent conjointement les activités formelles et non formelles de formation, sans établir de distinction entre ces deux types d'apprentissage. Or l'analyse distincte des bénéfices de la formation formelle et non formelle pourrait fournir de précieuses indications pour l'action publique, les activités non formelles de formation étant, de par leur nature même, non certifiées. En second lieu, rares sont, parmi les travaux de recherche existants, ceux qui prennent en compte l'apprentissage informel. En plus d'induire une évaluation biaisée de la valeur de la formation non formelle, cette approche exclut aussi une part considérable de l'apprentissage intervenant dans le cadre professionnel et peut limiter les initiatives politiques pour améliorer la visibilité de ce type de formation et la portabilité des résultats de l'apprentissage informel dans le système d'apprentissage tout au long de la vie et sur le marché du travail. En troisième lieu, les connaissances restent très lacunaires sur la distribution de l'apprentissage formel, non formel et informel entre les travailleurs selon la nature spécifique de leur emploi et les caractéristiques organisationnelles de leur lieu de travail.

Ce document s'appuie sur les données de l'enquête sur les compétences des adultes (PIAAC), l'enquête européenne sur l'éducation des adultes (UE-EEA) et l'enquête européenne sur la formation professionnelle continue (UE-CVTS) et la base de données OCDE pour l'analyse structurelle (STAN). Des définitions standard sont adoptées pour la formation formelle, non formelle et informelle, et l'analyse se limite en grande partie aux activités liées à l'emploi qui se sont déroulées dans les 12 mois précédant l'enquête. Ceci correspond à une évaluation des bénéfices de cours terme de la formation liée au travail, sans tenir compte du fait que la formation soit été entamée avec l'employeur actuel ou un précédent.

L'utilisation de différentes sources de données, chacune avec ses points de force, permet d'améliorer considérablement la mesure de la formation et la comparabilité internationale des résultats. Outre que la mesure de l'apprentissage formel et non-formel, l'enquête PIAAC inclut des informations sur l'apprentissage auprès d'autrui, de l'apprentissage par la pratique et de l'apprentissage de nouveaux éléments au travail qui sont exploitées pour évaluer d'étendue de l'apprentissage informel au travail. L'enquête PIAAC inclut aussi des informations précises sur les salaries individuels et sur les caractéristiques de l'emploi permettant d'identifier des relations clés avec la participation dans la formation. L'enquête UE-EEA inclut des mesures de participation dans la formation largement comparables à celles dans l'enquête PIAAC à trois dates successives, permettant une évaluation des changements dans le temps. L'enquête UE-CVTS représente une source d'information unique sur l'investissement des entreprises dans la formation, y compris des données sur les coûts de formation utilisés dans cette étude. Pour finir, la base de données STAN permet de calculer la valeur ajoutée à niveau sectoriel qui peut être liée aux informations contenues dans les autres enquêtes pour établir l'impact de la formation sur la productivité et évaluer le rapport coût-bénéfice de l'investissement en formation par les entreprises.

Une conclusion importante de cette étude est que l'apprentissage formel et non-formel représentent tout juste le sommet de l'iceberg de l'apprentissage qui a lieu au travail.

L'apprentissage informel est beaucoup plus important en terme de fréquence et durée cumulée. Ce résultat ainsi que l'évidence de bénéfices en termes de revenus et de productivité de l'apprentissage informel soulignent l'importance de l'amélioration de la culture de l'apprentissage dans le cadre professionnel comme vecteur de développement du capital humain des entreprises. Les pratiques d'organisation du travail à haut rendement semblent encourager l'apprentissage informel et accroître ses bénéfices, probablement en offrant davantage de possibilités de mettre en pratique les acquis de cet apprentissage. Sur le plan de l'action publique, davantage d'efforts pourraient être consentis pour favoriser cette culture de l'apprentissage en encourageant l'adoption de pratiques innovantes de gestion des ressources humaines.

Toujours sur le plan de l'action publique, cette étude montre aussi que tandis que les employeurs tirent des bénéfices significatifs de la participation de leurs employés à l'apprentissage non formel et informel, pour les travailleurs, ces types d'apprentissage présentent un inconvénient : les compétences qu'ils aident à acquérir ou renforcer sont moins facilement identifiables par les autres employeurs. Cet aspect diminue la valeur de l'apprentissage non formel et informel sur le marché du travail et réduit l'intérêt à y participer. Il pourrait aussi élargir les inégalités entre les travailleurs qui participe à l'apprentissage formel ou non-formel et ceux qui apprennent principalement par la pratique au travail. Un système de certification des compétences qui soit transparent, simple, et reconnu pourrait améliorer la visibilité des gains des travailleurs en capital humain sur le marché du travail.

Quelques-uns des principaux résultats sont exposés ci-après :

- L'apprentissage informel est de loin la forme la plus répandue d'apprentissage lié à l'emploi dans le cadre professionnel. Le nombre d'heures d'apprentissage informel chez les travailleurs représente environ 80 % du nombre total d'heures d'apprentissage non formel et informel, conformément aux résultats des rares travaux de recherche existant sur ce sujet. Ce résultat se confirme même dans le cadre des hypothèses les plus prudentes. L'apprentissage formel dure en moyenne beaucoup plus longtemps que les autre formes d'apprentissage mais il concerne très peu de travailleurs.
- L'examen de la fréquence de la formation montre qu'environ 70 % des travailleurs participent à des activités d'apprentissage informel sur une période de 12 mois, contre 41 % pour la formation non formelle et seulement 8 % pour la formation formelle à visée qualifiante. La fréquence de l'apprentissage informel n'est significativement inférieure à celle de la formation non formelle qu'en Corée, au Danemark et aux Pays-Bas.
- C'est dans les pays d'Europe du Nord (Danemark, Finlande, Norvège et Suède) et en Nouvelle-Zélande que la fréquence de la formation tend à être la plus forte, et ce quel que soit son type – formel, non formel ou informel. À l'autre extrémité du spectre, des pays tels que la Fédération de Russie, la Grèce et l'Italie affichent de mauvais résultats pour l'ensemble de ces trois dimensions.
- Une corrélation positive s'observe entre les différents types de formation. Ce constat vaut particulièrement pour la formation non formelle et l'apprentissage informel, tant à l'échelon national qu'individuel. En d'autres termes, lorsque la fréquence de la formation non formelle est élevée dans un pays, celle de l'apprentissage informel l'est aussi, en comparaison des autres pays. De même, à l'échelon individuel, la probabilité de participer à une formation non formelle est

supérieure de 8 % chez les travailleurs pratiquant l'apprentissage informel au travail, et celle de pratiquer l'apprentissage informel au travail est supérieure de 7 % chez les travailleurs ayant participé à une formation non formelle. En ce sens, rien ne prouve qu'un type de formation se substituerait à l'autre. D'un autre côté, la fréquence de l'apprentissage informel étant bien plus élevée que celle de la formation non formelle, nombre de travailleurs qui ne participent à aucune formation non formelle sont susceptibles de faire l'expérience d'une certaine forme au moins d'apprentissage informel sur leur lieu de travail : 65 % des travailleurs ne participant à aucune activité non formelle de formation ont l'occasion d'apprendre chaque jour au travail ; de même, à l'échelon national, dans des pays comme la France, la Grèce ou l'Italie où la participation à la formation non formelle est inférieure à 30 %, plus de 60 % des travailleurs apprennent de manière informelle dans le cadre de leur emploi.

- Les tendances en participation à l'apprentissage sont disponibles pour les pays Européens uniquement. Entre 2007 et 2016, la participation dans l'apprentissage formel est restée plutôt stable tandis que la participation dans l'apprentissage non-formel a augmenté d'à peu près 10 points pourcentage en moyenne. Des augmentations de taille se sont produite en Hongrie, en Italie, au Portugal et en Suisse tandis que des réductions importantes ont affecté la Bulgarie et la Suède. La participation dans l'apprentissage informel dans la vie de tous les jours a augmenté de façon encore plus marquée, à la hauteur de 17 points pourcentage dans l'UE en moyenne, principalement dû à une augmentation significative dans la part d'adultes déclarant avoir appris par le biais d'un ordinateur. Ceci est un concept différent d'apprentissage informel par rapport à celui présent dans l'enquête PIAAC mais est néanmoins symptomatique d'une hausse généralisée des activités d'apprentissage informel.
- L'examen plus spécifique de l'apprentissage informel au travail révèle qu'environ 56 % des travailleurs apprennent par la pratique dans le cadre de leur emploi au moins une fois par semaine, en moyenne, dans les pays de l'OCDE. L'apprentissage auprès d'autrui et celui de nouveaux éléments au travail s'observent respectivement chez 43 % et 40 % des travailleurs, en moyenne, dans les pays de l'OCDE. Les corrélations par paire des différents types d'apprentissage informel sont positives, mais seuls 20 % environ des travailleurs font l'expérience de l'ensemble de ces trois formes d'apprentissage informel, en moyenne, dans les pays de l'OCDE.
- Toutes choses égales par ailleurs, la probabilité d'apprendre de manière informelle au travail diminue avec l'âge et l'ancienneté, augmente avec le niveau de formation, mais baisse avec le niveau de compétence en litéracie. Cette probabilité augmente de 0.5 % pour une année d'études supplémentaire, mais, pour un nombre d'années de formation donné, les possibilités d'apprentissage informel semblent concerner davantage les travailleurs moins compétents. La fréquence de l'apprentissage informel est moindre chez les travailleurs à temps partiel et du secteur privé, mais plus élevée chez les travailleurs sous contrats atypiques – contrats à durée déterminée, contrats d'intérim, contrats d'apprentissage ou absence de contrat.
- Dans l'ensemble, les travailleurs qui ont le plus de possibilités de formation non formelle et formelle coïncident en grande partie avec ceux qui sont plus susceptibles de faire l'expérience d'un apprentissage informel, avec des différences notables toutefois. Plus que pour l'apprentissage informel, ce sont les travailleurs

plus qualifiés et compétents en littératie qui bénéficient disproportionnellement de possibilités de formation non formelle. En outre, les travailleurs sous contrats atypiques ont moins accès à la formation non formelle que leurs homologues sous contrats à durée indéterminée, ce qui concorde avec les résultats de travaux de recherche antérieurs étudiant la relation entre la formation en situation de travail et la stabilité de l'emploi. Dans une certaine mesure, ce constat semble indiquer que les travailleurs sous contrats atypiques qui n'ont accès qu'à peu de possibilités de formation non formelle au travail peuvent parvenir à compenser ce manque par davantage de possibilités d'apprentissage informel.

- La prise en compte de tous les types de formation permet de fournir des estimations plus précises de leurs bénéfices respectifs en termes de revenus et de productivité, en corrigeant certains des biais résultant de l'exclusion de l'apprentissage informel. Après prise en compte du rôle de l'apprentissage informel, les bénéfices estimés de la formation non formelle diminuent de 0.5 à 1 point de pourcentage, selon les variables de contrôle introduites. Dans le « meilleur » modèle – qui corrige un certain nombre de caractéristiques relatives au profil socio-démographique et à l'emploi, et prend en compte la sélection des travailleurs les plus motivés pour l'accès à la formation –, la participation à la formation non formelle est associée à une hausse des revenus de 11 %, contre 3.5 % pour l'apprentissage informel.
- La participation à la formation formelle, qui est souvent vue comme étant de contenu général, serait associée à une petite baisse des revenus. Ce résultat n'est pas à interpréter comme un bénéfice négatif de la formation initiale car il se réfère à des cours entamés par des travailleurs ayant déjà quitté le système éducatif. En effets, les bénéfices de la formation initiale sont bien positifs et statistiquement significatifs. La baisse modeste de revenus suite à une formation formelle. Cette interprétation serait en accord avec la théorie du capital humain qui prédit que les travailleurs paieraient de leur poche pour toute formation de nature transversale en acceptant des salaires plus bas dans le cours terme. Les modestes bénéfices négatifs de la formation formelle pourraient aussi être expliqués par le fait que cette étude ne couvre qu'une courte période après la formation et que les données ne permettent pas d'isoler les travailleurs qui ont changé d'employeur depuis. Autrement dit, les bénéfices de la formation formelle pourraient nécessiter plus longtemps pour apparaître ainsi que requérir un changement d'emploi qui ne peux pas être identifié.
- Les bénéfices de l'ancienneté professionnelle, souvent utilisée pour approximer l'apprentissage informel, ne sont pas influencés par l'inclusion des mesures d'apprentissage informel utilisées dans ce papier. Chaque année d'ancienneté est associée à une augmentation de salaire de 1 %, indépendamment de la prise en compte de l'apprentissage informel. Ceci confirme la valeur ajoutée d'utiliser des mesures plus explicites de l'apprentissage informel au travail, en vue du fait que les bénéfices de l'ancienneté professionnelle ont tendance à représenter des pratiques assez répandues de rémunération fondées sur l'ancienneté.
- Les bénéfices de la formation non formelle sont les plus élevés au Chili, en Estonie, en Irlande, en Lituanie, en Pologne et en Turquie, et les plus faibles en Autriche et en Grèce. Il en va différemment pour l'apprentissage informel sur le lieu de travail : certains des rendements les plus faibles (négatifs) s'observent dans des pays où les bénéfices de la formation non formelle sont les plus élevés à l'échelle internationale, tels que l'Estonie et la Turquie, tandis que dans des pays où les bénéfices de la formation non formelle sont très faibles (notamment en Autriche et

en Italie), ceux de l'apprentissage informel sont relativement élevés. Dans nombre de pays, les rendements de la formation formelle sont négatifs, en ligne avec les bénéfices négatifs globalement.

- C'est chez les travailleurs diplômés de l'enseignement tertiaire que les rendements de l'apprentissage non formel et informel sont les plus élevés, ce qui semble indiquer non seulement que les travailleurs plus instruits participent davantage aux activités de formation que leurs homologues moins instruits, mais aussi qu'ils en tirent davantage de bénéfices. Sur le plan de l'âge, les bénéfices sont significativement plus faibles pour les jeunes que pour les autres groupes, et ce quel que soit le type de formation.
- Les environnements professionnels adoptant des pratiques d'organisation du travail performantes (POTP) – soit ceux où les travailleurs jouissent d'une plus grande autonomie dans leurs tâches et travaillent en équipe – semblent favoriser une culture de la formation qui génère des bénéfices importants. Dans ce type d'environnements, la probabilité d'exposition des travailleurs à l'apprentissage informel est supérieure de 12 %. En outre, ces travailleurs tirent aussi des bénéfices plus importants des possibilités de formation auxquelles ils prennent part, qu'elles soient non formelles ou informelles. Ce constat semble indiquer que les POTP peuvent amplifier les bénéfices de l'apprentissage au travail. Ceci pourrait dériver de la nature de l'apprentissage que les travailleurs dans des cadres POTP reçoivent, ainsi que davantage de possibilités de mettre directement en pratique ce qu'ils apprennent grâce à la plus grande flexibilité de l'organisation de leur travail.
- Certains éléments étayent l'hypothèse selon laquelle les employeurs bénéficieraient davantage de la formation qu'ils proposent que leurs employés, i.e. l'augmentation en valeur ajoutée par heure travaillée associée à la formation est plus élevée que l'augmentation des salaires. D'après les données sectorielles/nationales sur la productivité du travail tirées de la base de données STAN, et après adaptation de l'analyse susmentionnée, chaque heure d'apprentissage informel augmenterait la productivité de 1 %, mais les revenus de seulement 0.5 %, relation concordant avec les résultats des travaux de recherche existants. Chaque heure de formation non formelle est associée à des gains de productivité (12 %) environ 3 fois supérieurs à la hausse des revenus (4 %), bien que les coefficients ne soient pas statistiquement significatifs.
- Sur la base de données sur les dépenses de formation de l'Enquête UE-CVTS, cette étude montre que les bénéfices de la formation, tels que mesurés par l'augmentation de la valeur ajoutée par heure, sont largement supérieurs à ses coûts. Ce constat vaut pour la formation non formelle et l'apprentissage informel, dont le coût peut respectivement être amorti en environ 16 et 70 jours de travail, même dans le cadre d'une hypothèse très prudente que les travailleurs engagés dans un apprentissage informel sont seulement à moitié productifs.
- Certains éléments semblent indiquer que des coûts unitaires plus élevés sont associés à une hausse des gains de productivité, suggérant qu'une formation de meilleure qualité génère de meilleurs rendements. Néanmoins, la taille de l'échantillon de cette analyse, menée sur 5 secteurs et 20 pays, est très réduite et ses résultats ne sont pas statistiquement significatifs.

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1. Introduction

1. Technological change and globalisation are putting increased pressure on countries to invest in their population's skills and competences. In most developed economies, policy makers are seeing adult learning as a crucial policy tool to strengthen economic competitiveness and employability, enabling those outside the initial education system to continuously maintain and improve their skills, avoiding skills obsolescence and depreciation and facilitating job mobility. It is also essential for firms to harness the benefits brought about by globalisation and digitalisation by ensuring that they have access to a skilled and adaptable workforce.

2. Several studies exist that assess the returns to initial education, showing how more years in school or a higher qualification – e.g. a high school diploma or a university degree – bring significantly higher wages when entering the labour market and throughout one's career. However, despite the importance placed on adult learning, empirical evidence of the returns to training undertaken later in life, notably in the workplace, is often limited to formal, certified courses. Other forms of learning on the job – such as workshops, employer-provided training and learning by doing – have been researched far less.

3. Many evaluation studies combine formal and non-formal training activities rather than distinguishing the two types of learning. Nonetheless, disentangling the returns to formal and non-formal training could bring important insights for policy. On one hand, individuals will want to have their full range of skills valued. On the other hand, employers will need to measure the competencies of their workforce so as to make full use of their human capital, avoiding a mismatch between workers' skills and the tasks they are assigned. If the returns to non-formal training activities proved to be important, policies to improve the validation and recognition of non-formal learning could be a key aspect of adult learning policies.

4. Additionally, very few studies in the literature have taken into account informal learning. Not only does this lead to a biased assessment of the value of on-the-job learning, but it also leaves out a major share of the learning that takes place at work. In fact, the few available studies that attempt to quantify the extent of informal learning happening at work find that it is several times more common than formal and non-formal training activities. In other words, formal and non-formal training are only the tip of the iceberg in the context of adult learning. This lack of full understanding of the value of informal learning leads to limited policy efforts to enhance the visibility and the portability of the acquired skills in the lifelong learning system and the labour market.

5. The recognition of non-formal and informal learning is also increasingly important in the context of broader ongoing labour market changes. First, as lifetime employment becomes an exception, the majority of individuals are expected to change job and career several times in their work life. In this context, the lack of recognition of the skills acquired through non-formal and informal learning could contribute to a decoupling of wages and productivity, with workers unable to bargain wages that correspond to the higher productivity achieved through training. It may also prevent job seekers from finding work that matches their skills. Secondly, the lack of recognition of skills acquired through informal learning is also likely to widen inequalities between standard and non-standard workers as workers in atypical employment contracts are more likely to engage in informal training which goes unrecognised and hence is undervalued when changing employers.

6. Finally, a large knowledge gap exists in how formal, non-formal and informal learning are distributed across individuals depending on the specific nature of their jobs and on the work organisation features of their workplace.

7. This study aims at disentangling the short-term returns to formal, non-formal and informal learning for workers and firms. Accounting for all forms of training provides more precise estimates of their separate returns on wages and productivity, correcting for some of the biases generated when informal learning is excluded. It also fills part of the knowledge gap regarding the determinants of participation into formal, non-formal and informal training.

8. Several data sources, at the individual and firm level, are exploited to provide a comprehensive picture of the incidence, correlates and returns to adult learning in its many forms. Data for OECD countries from the Survey of Adult Skills (PIAAC) as well as data for European countries from the European Adult Education Survey (EU-AES) are used to assess and compare the incidence of formal, non-formal and informal training. Compared with country-specific data exploited in the literature, PIAAC and the EU-AES allow for a more precise measurement of informal learning, in a consistent way across several countries. PIAAC also includes high-quality information on wages and a rich background questionnaire to obtain more precise estimates of the correlation between training participation and wage outcomes. The European Continuing Vocational Training Survey is exploited to quantify employers' investment in training by European countries. This is a unique data source including detailed information on the hours of training provided and the expenditure incurred. Finally, estimates of the effects of training on productivity and of the cost-effectiveness of training are obtained by combining individual data on participation in training with information on value added obtained from the OECD Structural Analysis Database.

9. The richness of the data is instrumental in separately identifying formal, non-formal and informal learning. However, the cross-sectional nature of the sources listed above only allows assessing the short-term returns to training – up to one year after participation. This is an important caveat, particularly in the assessment of the returns to formal training which tends to be of a general nature and yield returns in the longer term, potentially through a transition to a different employer. The cross-sectional nature of the data exploited also makes it difficult to pinpoint the *causal* relationships between training and wages. Standard econometric techniques to correct for selection bias are employed to help to address some of the concerns. Nevertheless, it is important to keep in mind that the term *returns* adopted for brevity in this paper is subject to caveats that could only be resolved with the use of panel data or natural experiments.

10. In what follows, Section 2 provides some theoretical background and summarises existing empirical evidence on returns to training. Section 3 describes the data sources. Section 4 looks at participation in and individual returns to the different forms of training. Section 5 compares productivity returns to returns on wages and Section 6 attempts an assessment of costs and benefits of non-formal and informal training. Section 7 concludes and draws some policy implications.

2. Literature Review

11. This section provides some theoretical background and a summary of empirical findings on the issue of returns to training. It focuses on individual wage returns and returns to firms in terms of increased productivity. Broader returns, notably to society as a whole as well as non-financial returns to individuals,[1] are not discussed because they are beyond the scope of the current paper. It is important to keep this in mind as the returns to different forms of training may be distributed differently among the actors involved (society, firms and workers), either benefiting all actors equally or rewarding only some. The distribution of returns should influence the sharing of training costs.

2.1. Some theoretical background

12. Several areas of economic theory provide predictions about the impact of job-related training on wages. All argue that the predicted outcomes vary depending on the assumptions made on market competitiveness and between general and job/firm-specific training.

13. Human capital theory provided some of the earliest contributions, acknowledging that investment in human capital on-the-job is a major determinant of wages through the productivity gains it brings about (Becker, 1962[1]; Becker, 1975[2]; Mincer, 1974[3]; Mincer, 1962[4]). As workers accumulate skills, their productivity and wages grow, acting as a reward but also as a disincentive to leave the firm.

14. The main point made by studies based on human capital theory is that the influence of specific training differs from that of general training. Specific training is tailored to the needs of the current employer. General training provides skills that can be used in all firms, and hence the training is general or portable across companies as individuals change jobs. According to human capital theory, the two forms of training – general and specific – are associated with different predictions, first with regard to their financing, and second with regard to who gets the returns.

15. In perfectly competitive labour markets, general training would be financed by the worker through the receipt of lower wages during training. The reason for this is that training is embodied in the worker who reaps all the returns and could leave at any time to another job where he/she would be equally productive. Since general training is fully transferable, workers' post-training wages will be the same across firms (Becker, 1962[1]). In the presence of credit constraints or wage rigidities (such as minimum wage regulations or collective agreements), however, firms will partly pay for general training if some mechanism can be put in place to ensure that workers will not leave the firm until the cost of training has been paid back. In this context, workers' wages will be above marginal productivity during training and below marginal productivity after training. But since such training is transferable across firms, workers should get higher returns elsewhere than at the firm that provided the training.

[1] For instance, trained workers are found to be much less likely to change or quit their jobs or to be made redundant ((Blundell et al., 2005[7]). Trained workers are also found to be much less likely to experience spells of unemployment.

16. In contrast, specific training is by definition only valuable to the firm providing the training. As a result, neither the firm not the worker has an incentive to pay its full cost since both would lose their entire investment in the event of a separation after training. Hence, to reduce potential under-provision, both parties would contribute to the financing of training. This sharing mechanism ensures that both firm and worker have the incentive to maintain the relationship after training and thereby to reap the returns (Hashimoto, 1981[5]; Leuven et al., 2005[6]).

17. Finally, if training comprises a mix of general and specific components, there will be some sharing of costs – i.e. wages at the training firm will be higher than productivity during training and below productivity after training, and wages at subsequent firms will reflect returns only to the general component of training, so that workers should get lower returns elsewhere than at the firm providing the training (Blundell et al., 2005[7]).

18. These theoretical considerations continue to provide a solid basis to understand training provision and returns. However, several empirical stylized facts diverge from the predictions of human capital theory. First, survey evidence shows that employers do pay for general training in spite of potential poaching of trained workers and, second, there is little evidence of workers receiving wage cuts during training (Acemoglu and Pischke, 1999[8]; Booth and Bryan, 2007[9]; Leuven et al., 2005[6]). These puzzles can be partly explained by search frictions that emerge when there is imperfect information on job opportunities elsewhere, mobility costs for employees in changing jobs; and heterogeneous preferences over the non-wage characteristics associated with various jobs (such as their location, work culture, colleague sociability, flexibility of hours, environment, distance from home).

19. Insights from the new oligopsony theory can also help explain deviations from the predictions of human capital theory. Recent papers using this approach show that, if the labour market is actually characterised by oligopsonistic wage-setting, some of the predictions of the human capital model are overturned. For example, the wage returns to general training may be less than the productivity returns (Barron, Berger and Black, 1999[10])and firms may find it profitable to pay for training even though it is general (Stevens, 1994[11]; Acemoglu and Pischke, 1998[12]; Acemoglu and Pischke, 1999[8]; Acemoglu and Pischke, 1999[13]).

20. Aside from human capital, however, there are other explanations for wage profiles that are upward-sloping with respect to training. Rather than the effects of training, these highlight firms' decisions to raise wages over time to reduce supervision costs, to cut the costs associated with labour turnover, to provide a disincentive for absenteeism, or to increase effort. This is important as these factors may confound estimates of returns to training, particularly when using cross-sectional data where causality is hard to establish.

21. Overall, the results in this paper are broadly consistent with the predictions of the human capital literature. Workers who enrol in formal training – the type of training that is more likely to be of a general nature – are found to be penalised with slightly lower wages while still engaged in the training programme. Non-formal and informal learning, on the other hand, are more likely to be job-specific and are found to exhibit positive short-term returns. However, some of the findings are also in line with theories focusing on labour market frictions. For instance, productivity returns to training are found to be larger than wage returns, particularly so for formal training.

2.2. Empirical findings

22. This section provides a summary of the existing empirical literature on returns to training and highlights existing knowledge gaps. It discusses separately, returns to workers and returns to employers.

2.2.1. Returns to workers

23. OLS estimates of wage returns to employer-provided training vary between 2% and 10% depending on the country, on the time frame, the sample used and the type of training under study (Blundell et al., 2005[7]; Bassanini et al., 2005[14]; Parent, 1999[15]; Blundell, Dearden and Meghir, 1996[16]). Given the very short duration of most training spells, these returns are very large compared with returns to one-year of initial education ranging between 5% and 10%.

24. However, several considerations are needed regarding: i) actual causality; ii) general vs job-specific training; iii) formal, non-formal and informal training; (iv) the time horizon of the estimated returns.

Estimating the true causal effect of education and training on individual earnings

25. OLS models applied to cross-sectional data do not allow to infer the true causal relationship between the higher earnings that are observed for more-trained workers and their participation in training. It is possible, for instance, that individuals with greater earning capacity and ability choose to acquire more education or training. If this is true, then OLS estimates of the return to training will be too large, as they will be unable to separate the contribution of unobserved ability from that of training and will ascribe them both to training participation (so-called 'ability bias'). Empirical evidence tends to confirm that the main part of the wage differentials across trained and untrained workers is explained by individual unobserved heterogeneities (Goux and Maurin, 2000[17]): the workers having the highest abilities are more likely to be selected for participation in a training programme.

26. Several methods exist to correct for this, ranging from the use of fixed-effect models when panel data is available, two-steps estimation techniques that correct for selection bias when only cross-section data is available and the exploitation of randomised or quasi-experiments settings. Most studies concur that when correcting for selection bias, the returns to training are lower than the OLS estimates (Albert, García-Serrano and Hernanz, 2010[18]; Bassanini et al., 2005[14]; Lee, 2009[19]). This may reflect the fact that the sample of workers is very heterogeneous, comprising groups with likely positive returns and others with null returns. Given the cross-sectional nature of the PIAAC data, the methodology exploited in this paper is to correct for sample selection using the Heckman two-steps estimator.

Distinguishing between general and job-specific training

27. The theoretical summary provided above suggests that distinguishing between general and job-specific training is important when assessing the likelihood of training participation and its returns. As a result, several researchers have attempted to implement this distinction.

28. When information on training content is not available, researchers have used the worker's seniority within her/his firm as a proxy for specific training while the time elapsed

in the labour market is supposed to reflect the accumulation of general human capital (Mincer and Jovanovic, 1981[20]; Duncan and Hoffman, 1979[21]). Question on the time needed to become fully trained in one's job have also been exploited by some researchers, sometimes in conjunction with tenure and experience (Duncan and Hoffman, 1979[21]).

29. A more precise distinction can be drawn using surveys that include information on the content of training. In this case, job-specific training is often equated to vocational training (Albert, García-Serrano and Hernanz, 2010[18]).

30. Estimated returns to general versus job-specific training vary across studies, depending on the time span and the definition used to distinguish between the two forms of training. Some researchers find support for the human capital theory finding that general training has a smaller (in some cases, negative) effect on wages than job-specific training (Sousounis, n.d.[22]; Duncan and Hoffman, 1979[21]). However, this relationship is overturned in studies that look at the lifetime returns which are found to be larger for general training than for job-specific training (Mincer and Jovanovic, 1981[20]). Others fail to find significant differences (Albert, García-Serrano and Hernanz, 2010[18]).

31. The discussion in the previous paragraph highlights the fact that the slightly negative returns to formal training found in this paper may be partly explained by the short-term horizon of the estimated returns. In fact, given the cross-sectional nature of the PIAAC data and the way training questions are formulated – based in the past 12 months – the returns to training estimated in this study are short-term returns to formal, non-formal and informal learning. The findings of this paper would be consistent with the returns to formal training, which is more likely to be of a general nature, taking longer to materialise, possibly through a job change. For instance, human capital theory would predict that since the training is of value to prospective trainees, equilibrium in the training market requires that employees pay for general job-related training by receiving wages below what could be received elsewhere in a job offering no training.

Approaches to accounting for informal learning

32. Most studies in the literature measure returns to formal and non-formal training, disregarding the crucial value of learning informally at work. This is despite empirical evidence that, in the workplace, informal learning is more frequent than formal training. Based on findings from a matched employer-employee survey, Barron, Berger and Black (1997[23]) show that both establishment and worker measures converge on the fact that there is much more informal learning than formal and non-formal training. Similarly, a Dutch study that developed a measure of the time during which a worker is learning at work shows that workers spend on average 35% of their working time on activities from which they learn (Borghans et al., 2014[24]). This is far more than the time workers spend in formal training courses: the authors conclude that informal learning activities account for 96% of the time in which workers are engaged in activities from which they learn. This can partly be explained by the lower direct and indirect costs of investments in informal learning relative to formal and non-formal training.

33. The study by Borghans et al (2014[24]) also shows that informal learning has grown in importance, rising from 31% of working time in 2004 to 35% in 2013, mostly due to a rise in informal learning among workers with an upper-secondary (vocational) or tertiary qualifications. The study finds that younger workers spend more time on activities that improve their competencies than older workers do. However, the learning potential of work appears to increase over time, especially for older workers. This increase might reflect older workers' need to remain productive at a later age in countries that have raised the

mandatory retirement age in recent years. The present paper also finds that younger workers are more likely to participate in informal learning than prime-age and older workers.

34. Given the size of informal learning at work, using highly-aggregated descriptions of 'training' would miss important differences in the determinants and effects of training (Blundell, Dearden and Meghir, 1996[16]). Not taking into account informal training explicitly in the wage equations may lead empirical assessments to bias the return to formal training upward (Nordman and Hayward, 2006[25]). For instance, assuming that high-wage workers have higher abilities than low-wage workers to learn by themselves (learning by doing), or to watch other workers perform their tasks and to imitate them (learning by watching), neglecting informal training is likely to yield an upward-biased estimate of the return to formal and non-formal training for better educated workers.

35. Blurred definitions partly explain the lack of evidence on separate returns to different forms of training. However, even with good definitions at hand (CEDEFOP, 2014[26]; EUROSTAT, 2016[27]), data to measure the formal, non-formal and informal training separately is often unavailable. This has resulted, particularly for informal learning, in the use of a number of different proxies, each with its pros and cons.

36. Early studies looking to measure investments in informal learning and their returns have used individual tenure in the incumbent firm (Bartel, 1995[28]; Lynch, 1992[29]; Parent, 1999[15]) and then estimated Mincerian earnings functions (Mincer and Jovanovic, 1981[20]). The main problem with this approach is that returns to tenure may be independent from the firm and affected, for instance, by collective bargaining agreements that set out pay increases based on seniority.

37. The data available today allow a more accurate distinction to be made between different types of on-the-job human capital accumulation. Several skills surveys[2] include information that allow identifying learning by doing (i.e. where learning happens irrespective of exchanges with others) and learning from intentional interactions between workers, for example as part of a team or during supervision. The qualitative research on workplace learning indicates that such features of work design provide increased opportunities for learning by "tacitly structuring learners' access to the knowledge they need to acquire" (Billett, 2001[30]). The strength of the current paper relies precisely on exploiting comparable survey data for several OECD and non-OECD countries that contains measures of formal training leading to a qualification, non-formal training activities, such as workshops, on-the-job training sessions or private courses, and time spent learning-from-others, learning-by-doing or learning new things at work.

38. Another study exploiting this type of information from the UK skills survey (Nordman and Hayward, 2006[25]) estimates returns to formal training and informal learning. Standard questions on participation in job-related training are exploited to measure what the paper refers to as formal training.[3] Informal learning is measured as the time it took for the respondent, after starting his/her job, to learn to do their job well. Both formal and informal learning are found to have a positive and significant effect on wages. In line with the hypothesis that not taking into account informal learning explicitly in the

[2] See, for example, OECD Survey of Adult Skills (PIAAC) or the UK Skills Survey, among others.

[3] What the authors call formal training encompasses both formal and non-formal training as defined by EUROSTAT (2016[27])and CEDEFOP (2014[26]) and in the present paper. In the text, this is referred to as formal training in keeping with the term used by the authors but also includes uncertified and employer-organised on-the-job training.

wage equations leads empirical assessments to bias upward the return to formal training, controlling for informal learning leads to a fall in the wage premium associated with formal training. However, the returns to formal training remain significant and positive.

39. The authors also test the value added of the variables used to capture informal learning over just using job tenure. The marginal returns to tenure falls considerably, but remain significant, when a more explicit measure of informal learning is included. In line with the arguments advanced by Billett (2001[30]), the study finds differentiated returns to formal and informal training depending on the complexity of tasks although both returns are higher and more significant for workers who perform their tasks in teams and are closely supervised. Finally, the study also shows that for workers with low and intermediate levels of qualifications, formal training may remain a more efficient way to upgrade skills and productivity of the labour force.

40. The analysis conducted in the current paper complements the above empirical work by further disentangling the returns to formal and non-formal training, using explicit survey questions on different forms of learning informally, providing comparable estimates across countries and extending the analysis to returns to employers. The findings in this paper are consistent with Nordman and Hayward (2006[25]): returns to non-formal and informal learning are positive, statistically and economically meaningful, and returns to non-formal training fall when controlling for informal learning. This study, however, finds a negative short-term return to formal training. Nonetheless, the paper by Nordman and Hayward (2006) aggregates formal and non-formal training into one category, which exhibits positive and significant returns. The present paper shows that the positive returns, in the short-term, are mostly driven by non-formal training activities. Finally, the analysis discussed at the end of the paper confirms that some High Performance Work Practices, such as working in teams, can improve the returns to all forms of learning activities.

The time-horizon of the estimated returns to training

41. Another difference between the UK data, exploited by Nordman and Hayward (2006), and the PIAAC data used in this paper, hangs on the timing of the training activities considered. Questions in PIAAC refer to the past 12 months, while the UK skills survey requires respondents to recall any training episode or activity ever experienced. As a result, while the returns to training that are estimated in this paper are short-term returns, the returns discussed in Nordman and Hayward (2006) are an average of long, medium and short-term returns. As several studies have shown strong evidence that skills acquired through employer-provided training considerably depreciate over time, resulting in declining returns (Blundell et al., 1999[31]), the returns captured using the UK skills survey may be mostly driven by recent training episodes, which are also easier for respondents to recall.[4]

42. Other papers have used the European Continuing Vocational Training Survey (CVTS), the European Community Household Panel (ECHP) or the European Survey of Income and Living Conditions (EU-SILC) to estimate returns to employer-provided training. Papers that use the CVTS (Bassanini et al., 2005[14]) will also provide short-term estimates for the returns to continuing vocational training to the extent that questions are formulated regarding the twelve months before the interview date, like in PIAAC. The ECHP and EU-SILC questionnaires also refer to the past twelve months. Nevertheless,

[4] As pointed out in Bassanini et al. (2005[14]), the retrospective nature of self-reported training measures introduces measurement errors because of recollection problems

because of their longitudinal nature, they allow for the reconstruction of individuals' training histories and for the estimation of long-term returns, while overcoming the issue of recall bias and the measurement error it brings about. Albert et al. (2010[18]) exploited successive waves of EU-SILC to estimate the returns to all forms of training together. The authors correct for selection into training using worker fixed effects, but find returns that are not statistically significant. One possible explanation could be the depreciation of skills acquired in early training episodes over time or the cancelling out of positive and negative returns to different types of training over time.

43. Goux and Maurin (2000[32]) use a French survey on vocational training ("*Enquête sur la formation et la qualification professionnelle*") to estimate the returns to employer-provided training. The survey was conducted once in 1993, but the question was phrased as «Have you participated in any employer-sponsored training programs between the beginning of 1988 and the beginning of 1993?". In this context, the returns estimated by these authors are an average over a five-year horizon. Conti (2005[33]), on the other hand, uses the Italian Labour Force Survey matched with Italian accounting data to compute the accumulated stock of formal and non-formal capital in each industry. The author claims that such constructed measure accounts for skills accumulated during the working life. Both papers find returns to training that are close to zero, potentially driven by skill depreciation.

44. Using a longer time horizon for the assessment of returns to training also opens up the possibility that workers change employer. This is particularly important for general training which is expected to reap higher benefits with subsequent employers, as lower wages during training reflect co-financing by employees. Few papers have looked at the effect of training based on whether it took place with the current of previous employers. A study that does so explicitly for the United Kingdom (Booth and Bryan, 2005[34]) confirms that returns to training that leads to a recognised qualification are higher with a subsequent employer than with the employer at the time of training. Most other studies rely on the comparison between returns to experience and returns to tenure when job changes occur, confirming that experience (i.e. assimilated to general training) has positive returns while tenure (i.e. as a proxy of job-specific training) does not (Dustmann and Pereira, 2008[35]). These studies lend further support to the view that the small and negative returns to formal training in this paper may be due to the short timeframe and the inability to control for job mobility following training.

2.2.2. Returns to employers

45. Employers fully or partially fund the training of workers in the hope of gaining a return on this investment in terms of being a more productive, more competitive and consequently more profitable firm in the future. In practice, however, it is very difficult to measure this return and very few studies have attempted to estimate it. The previous section summarised evidence that workers who participate in training receive higher real wages. These real wage increases have to be paid out of productivity gains and therefore should provide a lower bound on the likely size of productivity increases. In practice, the productivity gains are likely to be higher than this. For instance, when training has a large firm-specific component (i.e. training providing firm-specific knowledge and skills that have little or no value when an employee leaves the firm that provided the training) and, more generally, when labour mobility is effectively restricted, there may be productivity gains from training that are not passed on to the employee in terms of wages but are only reflected in direct measures of competitiveness, productivity and profitability.

46. There are numerous difficulties in measuring the returns to training for firms. In the first instance, it is extremely difficult to obtain data on firm productivity, competitiveness and profitability. Furthermore, as discussed above, there are problems in identifying empirical counterparts to the concepts of general and specific training, and in identifying whether and how much of the costs are borne by workers and by employers.

Despite these difficulties, several studies have shown that training does indeed have a positive impact on productivity. For instance, Dearden, Reed and Van Reenen (2006[36]) find that, in the United Kingdom, a 1% point increase in job-related training – without distinction between formal and non-formal training – is associated with an increase in value added per hour of about 0.6% and an increase in hourly wages of about 0.3%. They also show evidence using individual-level data sets that is may be due to training externalities within an industry (e.g. through a faster rate of innovation). Similarly, Konings and Vanormelingen (2015[37]) find that, in Belgium, a 1% percentage point increase in the proportion of trained workers – formal training only – is associated with 0.5% rise in value added. Colombo and Stanca (2014[38]) use Italian data to show that productivity is about 10% higher for trained workers relative to untrained workers, when both formal and non-formal training are accounted for. In the same study, wage returns are found to be significantly smaller. Barron, Berger and Black (1997[23]) find much larger effects on productivity – 20-25% – and much lower effects on wages (2-3%). Other papers find qualitatively similar results (Bartel, 1995[28]; Bartel, 1994[39]). Conti (2005[33]) also finds that firms reap more of the returns than workers. Nevertheless, other authors find more mixed results, suggesting that it is not so much whether you train workers, but rather what you train the workers in that affects establishment productivity (Black and Lynch, 1996[40]; Black and Lynch, 2001[41]).

3. Data sources

3.1. Classifying learning activities as formal, non-formal and informal

47. The first step when estimating returns to different forms of training is to find widely accepted definitions that can be easily applied to adult learning data. As indicated above, blurred definitions partly explain the lack of evidence on separate returns to different forms of training and make the comparison across studies in the literature very difficult. In this regard, Eurostat's Classification of Learning Activities (CLA) (2016[27]) provides a very useful list of criteria to operationalise the distinction between formal and non-formal training and informal learning (Table 3.1).

Table 3.1. Operational criteria for distinguishing between formal, non-formal and informal learning activities

Criterion	Formal	Non-formal	Informal
Intention to learn	X	X	X
Organisation	X	X	
Institutional framework and location	X	X	
Hierarchy level-grade structure ("ladder")	X		
Admission requirements	X		
Registration requirements	X	(X)	
Teaching/learning methods (predetermined/not flexible)	X	X	(X)
Duration of at least one semester (minimum of 30 ECTS)	X		
Recognition of the programme by the relevant national education or equivalent authorities	X		

Note: The hierarchy level-grade structure refers to the fact that the training has to be part of an educational ladder, whereby the recognised completion of one level (express using the ISCED classification) gives access to another higher level of education. Admission requirements refer to the requirements that have to be fulfilled to have access to learning, e.g. prior educational attainment. Registration requirements refer to requirements that have to be fulfilled to register, e.g. working in a given sector or occupation. ECTS refers to European Credit Transfer and Accumulation System.
Source: Eurostat Classification of Learning Activities (EUROSTAT, 2016[27]).

48. The key criteria that distinguishes informal learning from non-formal and formal training is whether the learning activity is institutionalised or not. According to the CLA (EUROSTAT, 2016[27]), institutionalised learning activities occur when there is an organisation that is responsible for setting the teaching and learning method, the learning

schedule, the admission requirements and the venue of the learning/teaching activity. This clearly sets aside informal learning activities which are not institutionalised.

49. The distinction between non-formal and formal training is more complex. As laid out in Table 3.1, non-formal training refers to institutionalised learning activities for which the programme is *not* recognised by the relevant national education authorities. This is usually because the provider is not recognised as being part of the country's regular education system (e.g. professional organisations, private commercial companies, non-governmental organisations).

50. Most of the above criteria can be operationalised in data used in this paper to distinguish between formal, non-formal and informal training.

3.2. The Survey of Adult Skills

51. Most of the empirical analysis in this paper is based on the micro-data from the first cycle of the Survey of Adult Skills (PIAAC, 2012, 2015). The list of countries included in the analysis and number of observations per country, the number of workers which forms the baseline sample for estimation of returns to training, and the year in which the survey was conducted (2012 or 2015) are presented in Table 3.2.

Table 3.2. Descriptive statistics from the Survey of Adult Skills

Country coverage and sample size, 2012 and 2015

	Number of observations	Number of workers	Survey year
Australia	7,430	5,603	2012
Austria	5,130	3,737	2012
Canada	27,285	19,678	2012
Chile	5,212	3,620	2015
Cyprus[1]	5,053	2,807	2012
Czech	6,102	3,673	2012
Denmark	7,328	5,342	2012
England	5,131	3,493	2012
Estonia	7,632	5,393	2012
Finland	5,464	3,887	2012
Flanders	5,463	3,386	2012
France	6,993	4,523	2012
Germany	5,465	4,070	2012
Greece	4,925	2,463	2015
Ireland	5,983	3,677	2012
Israel	5,538	3,662	2015
Italy	4,621	2,869	2012
Japan	5,278	3,881	2012
Korea	6,667	4,428	2012
Lithuania	5,093	3,218	2015
Netherlands	5,170	3,943	2012
New Zealand	6,177	4,538	2015
Ireland	3,761	2,418	2012
Norway	5,128	3,955	2012
Poland	9,366	5,152	2012
Russian Federation	3,892	2,242	2012
Singapore	5,468	3,989	2015

Slovak	5,723	3,319	2012
Slovenia	5,331	3,020	2015
Spain	6,055	3,386	2012
Sweden	4,469	3,355	2012
Turkey	5,277	2,318	2015
United States	5,010	3,560	2012
Total	208,620	138,605	

52. PIAAC includes rich information on the participation in training spells over the twelve months prior to the interview as well as questions that allow distinguishing between formal and non-formal learning, following most of the criteria set in the CLA (EUROSTAT, 2016[27]).[5] In addition, respondents are asked about a number of learning activities undertaken at work which can be used to proxy informal learning. The variables used to measure formal, non-formal and informal training as some other key control variables are described in detail below.

53. The richness of the PIAAC data is instrumental in separately identifying formal, non-formal and information learning. However, the cross-sectional nature of the PIAAC dataset does not allow assessing the long-term effects of training on wages, hence the returns estimated in the paper refer to the immediate outcomes of training, within 12 months of completion at most. This is an important caveat, particularly in the assessment of the returns to formal training which tends to be of a general nature and yield returns in the longer term, potentially through a transition to a different employer.

3.2.1. Formal training

54. An individual is considered to have participated in formal training in the last 12 months if the answer to the question "*During the last 12 months, have you studied for any formal qualification, either full-time or part-time*?" (question B_Q04a) is "*Yes*". Furthermore, such formal training is considered job-related whenever the individual answered "*Yes*" to the question "*Were the main reasons for choosing to study for this qualification job related?*" (question B_Q05c). It is important to note that such job-related formal training might have been undertaken in the context of a previous job or to improve outside opportunities. In other words, as defined in this paper, participation in job-related formal training does not necessarily refers to formal training provided by the current employer with direct application to the current job.

55. Only individuals in paid work who have left the first cycle of formal studies are included in the sample. Hence, formal learning does not refer to initial education but rather to certified courses undertaken by adults while in paid work. While these courses might be provided by an education institution, their returns are not to be confounded with returns to initial education.

3.2.2. Non-formal training

56. An individual is considered to have received non-formal training in the last 12 months if he or she answered "Yes" to any of the following questions from the background questionnaire of PIAAC Cycle 1:

[5] The only exception is the criteria regarding the duration of the activity – at least one semester or 30 ECTS – for which there is no information in PIAAC.

57. "*We would like to turn to other organised learning activities you may have participated in during the last 12 months, including both work and non-work related activities [Include activities that have not yet been completed. All activities should be counted even if the duration was only one hour. When answering the next questions, please exclude any activity you engaged in as part of the study you already reported on].* " (question B_R12)

- "*During the last 12 months, have you participated in courses conducted through open or distance education*?" (B_Q12a)
- "*During the last 12 months, have you attended any organised sessions for on-the-job training or training by supervisors or co-workers*?" (B_Q12c)
- "*During the last 12 months, have you participated in seminars or workshops?*" (B_Q12e)
- "*During the last 12 months, have you participated in courses or private lessons, not already reported?*" (B_Q12g)

58. Such non-formal training is considered to be job-related whenever the individual answered "*Yes*" to the following follow-up question: "*Was this activity mainly job-related*?" (B_Q14a). Two important facts are worth stressing. Firstly, as it is the case for formal training, the fact that this activity in job-related does not necessarily mean that it is directly related to the current job. Secondly, if the individual took part in more than one non-formal activity, the job-related nature of non-formal training will only refer to the latest activity taken in the last 12 months. Information about previous additional non-formal training activities is not collected in PIAAC Cycle 1.

59. In addition to the incidence of non-formal learning, the PIAAC questionnaire also investigates how much time workers have spent in non-formal learning activities over the previous 12 months. The questionnaire also includes a follow-up question on the share of training time that was job-related. However, the reporting scale (none of the time; up to a quarter of the time; up to half of the time; more than half of the time and all the time) does not allow a precise quantification of time spent in job-related non-formal training.

3.2.3. Measures of informal learning

60. Informal learning is measured using the following three questions from PIAAC's Cycle 1 background questionnaire:[6]

- "*In your own job, how often do you learn new work-related things from co-workers or supervisors*?" (B_Q13a)
- "*How often does your job involve learning-by-doing from the tasks you perform*?" (B_Q13b)
- "*How often does your job involve keeping up to date with new products or services*?" (D_Q13c)

61. The first question measures learning-from-others, which is one way of learning informally from the interactions between workers, as part of a team or during supervision. The second question measures learning-by-doing, which is another form of informal

[6] These variables have been used previously to measure informal learning, notably in de Grip (2015[55]) and Squicciarini, Marcolin and Horvát (2015[50]).

learning that can emerge without the presence of co-workers. The third question measures the learning requirements of the job.

62. To derive the incidence of informal learning, a binary variable is constructed that summarises participation in learning-from-others, learning-by-doing and learning new things. The variable is set to 1 whenever an individual reports a frequency of at least once a week for learning-from-others OR learning-by-doing OR learning new things and 0 otherwise. A measure of intensity of informal learning is also derived by transforming the frequency with which informal learning activities take place into hours of learning using the recoding rules presented in Table 3.3. The first column reports the answering scale as it appears in the Survey of Adult Skills. The other columns translate each category in the scale into a number of hours of learning informally per year assuming 252 working days in a year and 10 days of paid holidays. The minimum, average and maximum values for each answering category are reported. For instance, the answering category "less than once a week but at least once a month" is counted as 11 times a year as a minimum (once for every working month) but could be interpreted as being as high as 49 times (one week short of every working week), hence 29 times on average. In what follows, the average value in each answering category is used. Furthermore, each instance of informal learning is assumed to last one hour. The hours of each form of informal learning are then summed to obtain the total number of hours in informal learning. Finally, the total hours of learning are adjusted to account for individuals working part-time using their share of full-time hours.

63. These assumptions are very conservative. One could recode the answering categories into hours more generously (using either the maximum value possible in each category, as shown in column four of Table 3.3, respectively). In addition, each instance of learning informally could be assumed to last more than just one hour.[7]

Table 3.3. Intensity of informal learning

Recoding rules

	Number of hours		
Answering categories in PIAAC	Minimum in each category	Average in each category	Maximum in each category
Never	0	0	0
Less than once a month	1	5.5	10
Less than once a week but at least once a month	11	29	49
Less than once a day but at least once a week	50	145.5	241
Every day	242	242	242

Note: The average value is obtained averaging the minimum value possible for each category (as reported in "Minimum value attributed" in the table) with the maximum value possible for each category (0; 11; 51; 251; 252 respectively)
Source: OECD Secretariat own calculations.

64. PIAAC Cycle 1 also measures tenure with the current employer ("At what age or in which year/month did you start working for your current employer?" – question D_Q05a1). As discussed in the literature review above, tenure has been used quite extensively as a proxy for informal learning and including it in the analysis provides an

[7] For instance, Squicciarini, Marcolin and Horvát (2015[50]) make the assumption that each instance of informal learning lasts one day when estimating cross-country investment in training.

additional point of comparison with previous studies. It is also interesting to see whether and how returns to tenure are affected by the inclusion of more specific measures of informal learning in the workplace.

3.2.4. Other controls

65. As discussed in the literature review, the context in which learning takes place – the so-called level of complexity of the job – can have important consequences on the participation and returns to adult learning. PIAAC Cycle 1 includes a question that can be exploited to capture the intrinsic complexity of the respondent's job.

- "*Supposing that someone with the required level of qualification necessary for doing your job satisfactorily, were applying today. How much related work experience would they need to get this job*?" (D_Q12c)

66. A binary variable is constructed to measure the job's intrinsic complexity based on the previous experience that would be required to obtain the post and adequately perform the job:

- High experience requirement: if individual answers "*3 years or more*" to question D_Q12c.
- Medium experience requirement: if individual answers "*1 or 2 years*" or "*7 to 11 months*" to question D_Q12c.
- Low experience requirement: if individual answers "*1 to 6 months*" or "*Less than 1 month*" or "*None*" to question D_Q12c.

67. Throughout the analysis, the intrinsic complexity of the job is measured with this proxy and included in some specifications for comparison with the literature on returns to informal learning, as well as a robustness check.

68. PIAAC cycle 1 also collects information on a number of job aspects that have been associated with higher informal learning at work (Nordman and Hayward, 2006[25]), including: whether workers have any flexibility in deciding on the sequence of tasks they perform, how they do the work and the speed of the work; how often they organise their own time and plan their own activities; how often they co-operate or share information with others; how often they instruct, teach or train other people. Following the literature, and previous OECD work (OECD, 2016[42]), these items are combined to derive an index of high performance work organisation practices (referred to in the remainder of this paper as HPWP).[8]

[8] To construct a single scale, items are standardised – across countries – to have mean of 2.76 and variance equal to one. The value of Cronbach's alpha for the resulting sum scale is 0.7, suggesting that the items are well suited to form a single scale. Also worth noting that the HPWP scale constructed by OECD (OECD, 2016[42]) included a second component aimed at capturing management practices such as bonus pay, working time flexibility and training participation. This second component is not used in this paper because of the overlap with the variable of interest: training participation.

3.3. The European Adult Education Survey

69. The European Adult Education Survey (EU-AES) investigates adults' participation in education and training (formal, non-formal and informal learning) and is one of the main data sources for European adult learning statistics. The EU-AES covers the resident population aged 25-64 in all country members of the European Union. Three waves have been conducted so far, in 2007, 2011 and 2016. The reference period for the participation in education and training is the twelve months prior to the interview, consistent with the reference period used in PIAAC. While PIAAC provides richer background information to study the correlates and outcomes of training, EU-AES is a useful complement to study changes in training participation over time.[9]

70. In EU-AES, the definitions of formal and non-formal training are consistent with those used in PIAAC with the only caveat that it is not possible to single out formal training that is job related. On the other hand, the measures of informal learning are rather different and include the following activities:

- Learning from friends, family or work colleagues;
- Learning by using printed materials;
- Learning by using computers;
- Learning through television, radio and video;
- Learning by guided tours of museums, historical/natural/industrial sites; and
- Learning by visiting learning centres (including libraries)

71. While this definition is useful to assess the extent to which adults learn in an informal way in everyday life, it does not allow isolating informal learning that takes place at work or that might be work-related and expected to affect wage and productivity outcomes.

3.4. The European Continuing Vocational Training Survey

72. Data on employers' investment in training is derived from the European Continuing Vocational Training Survey (EU-CVTS). The EU-CVTS collects comparable information on continuing vocational training (CVT) in European enterprises of 10 or more employees, in 27 European countries and Norway. For the purpose of this study, the survey provides information on CVT content, volume and expenditure. Exploiting this data, a cost-benefit analysis for training investments can be carried out for 20 countries in five sectors.[10]

73. A caveat to matching cost information drawn from EU-CVTS with training information drawn from PIAAC is that information on costs is only available for CVT courses while for other forms of CVT only participation is documented. CVT courses are typically clearly separated from the active workplace (learning takes place in locations specially assigned for learning like a classroom or training centre). The courses show a high

[9] The European Labour Force Survey also includes information about participation in training but the reference period is the 4 weeks prior to the survey, making it less useful to assess changes in the incidence of training over time that are complementary to the cross-sectional evidence extracted from PIAAC.

[10] Only 20 of the countries covered by CVTS are also covered in PIAAC.

degree of organisation (time, space and content) by a trainer or a training institution. The content is designed for a group of learners (e.g. a curriculum exists). Two distinct types of CVT courses are identified: *internal* and *external* CVT courses. This excludes guided-on-the-job training, participation (instruction received) in conferences, workshops, trade fairs and lectures, participation in learning or quality circles, self-directed learning/e-learning.

74. As a result, CVT courses are likely to be just a subset of the formal and non-formal training spells measured in PIAAC. Overall, most of the CVT courses would be classified as non-formal, as they are provided either internally at the firm or externally, but not in formal education and training institutions (only 15.5% of firms that provide external CVT courses use formal education and training institutions as providers).[11]

75. Training cost per hour – the main statistic derived from EU-CVTS – are computed as the sum of direct and indirect costs for non-formal training and indirect costs only for informal learning. Direct costs reported in EU-CVTS include:

- Fees and payments for CVT courses;
- Travel and subsistence payments related to CVT courses;
- The labour costs of internal trainers for CVT courses (direct and indirect costs);
- The costs for training centres, training rooms and teaching materials.

76. Indirect costs are also provided by EU-CVTS respondents and refer to labour costs of employees participating in CVT courses during the time of the training.

3.5. The OECD Structural Analysis database

77. Finally, data on labour productivity is derived from the OECD Structural Analysis database (STAN). The STAN database is a comprehensive tool for analysing industrial performance at a relatively detailed level of activity across countries. It includes annual measures of output, value added and its components, labour input, investment and capital stock, from 1970 onwards. This allows constructing a wide range of indicators to focus on areas such as productivity growth, competitiveness and general structural change. STAN is primarily based on member countries' annual national accounts by activity tables and uses data from other sources, such as results from national business surveys/censuses (maintained by OECD, Eurostat or compiled directly from national sources) to estimate any missing detail.

78. For the purpose of this paper, the STAN database is used to compute measures of labour productivity exploiting information on value added, employment, hours worked and capital for each sector-by-country cell. Exploiting this data, measures of labour productivity can be derived for 14 sectors[12] and 28 of the countries covered by the PIAAC

[11] The correlation between CVT participation and participation in formal training (PIAAC) is only 0.13, while it is 0.61 for participation in CVT and participation in non-formal training.

[12] With some missing observations for Japan and New Zealand.

analysis.[13] The link between the training incidence computed using PIAAC and labour productivity computed with STAN is done at this sector-by-country level.

[13] Israel and Cyprus are not included in STAN and Chile, Spain and Turkey are not included in the analysis because data on capital is not available.

4. Training participation and individual returns

79. This section explores the participation in job-related formal, non-formal and informal learning, at the individual and country level. It then assesses the wage returns to the participation in different forms of training.

4.1. Descriptive facts

4.1.1. Training incidence and intensity

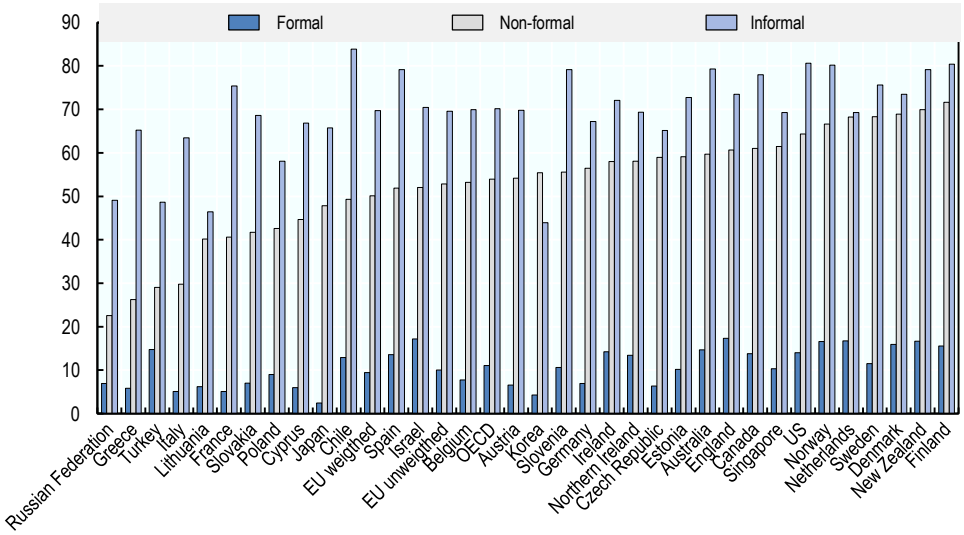
80. In line with findings in the literature, informal learning is by far the most common form of learning for workers.[14] In the OECD on average, 70% of workers engage in informal learning activities over a 12 months period, compared to 54% who engage in non-formal learning and just 11% learning towards a formal qualification. The proportions are similar when averaging across the 20 EU countries covered by the analysis, with only a slightly lower incidence of formal and non-formal training. Only in Korea, the Netherlands and Denmark, is the incidence of informal learning significantly below that of non-formal learning. On the other hand, formal learning remains very rare and its incidence reaches a maximum of just over a fourth of the incidence of informal learning in Denmark, England and Turkey.

81. Northern European countries (Norway, Denmark, Finland, and Sweden) tend to show the highest incidence of any type of training – formal, non-formal and informal – along with New Zealand (Figure 4.1). At the other hand of the scale, countries such as Greece, Italy, and the Russian Federation perform poorly in all three dimensions. At the country level, there is no evidence that informal learning (learning-by-doing and learning-from-others) may be used to compensate for the lack of other forms of training. In other words, no countries stand out where the low incidence in formal and non-formal training is compensated by a particularly high incidence of informal learning.

[14] It is worth noting that this is despite a fairly stringent definition of informal learning at work requiring that workers learn informally at least once a week but less than once a day (the second highest answering category available), in at least one of the forms of informal learning considered.

Figure 4.1. Incidence of formal, non-formal and informal training

Percentage of workers experiencing each type of training

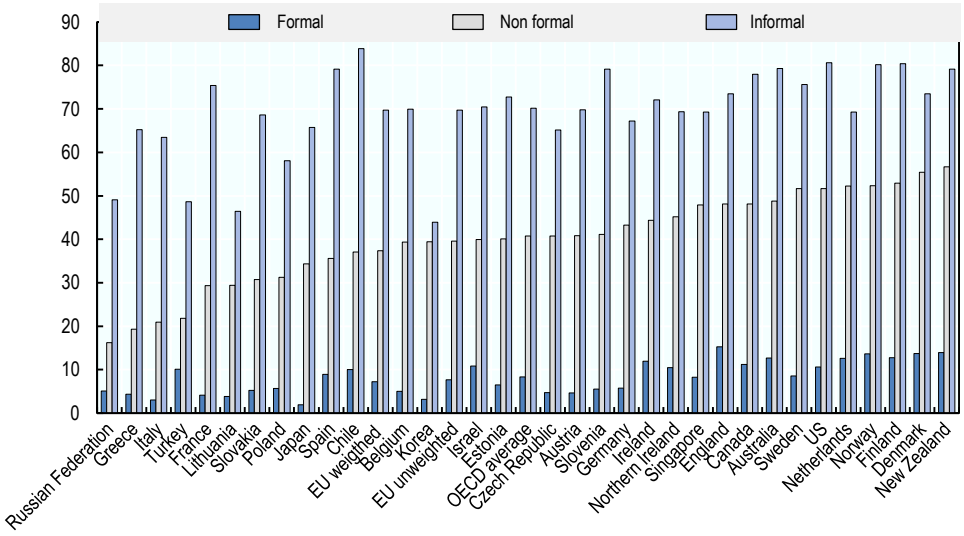


Note: All types of training are considered, even if non-job related. Formal (non-formal) training refers to the percentage of workers who participated in formal (non formal) training over the previous 12 months; Informal training refers to the percentage of workers who learn informally at least once a week. OECD refers to the unweighted average of the OECD countries shown.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

82. The ranking of countries by incidence of formal and non-formal training does not change if we focus on job-related training only (Figure 4.2). Informal learning, by definition, is job-related. Once this restriction is applied, the incidence of non-formal and formal learning declines markedly, to just 41% and 8%, respectively, in the OECD, on average. It is important to keep in mind that this represents a lower-bound estimate of the incidence of job-related formal and non-formal learning. In fact, since the job-related nature is only investigated for the latest spell of training, workers who have taken part in more than one formal or non-formal activity over the previous 12 months but whose latest activity was not job-related would be counted as not having received any job-related formal/non-formal training even if previous activities were job related. Despite this limitation, given the focus on training that increases employability and productivity, the results presented in the rest of the paper refer to job-related formal and non-formal training.

Figure 4.2. Incidence of job-related formal, non-formal and informal training

Percentage of workers



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. Formal (non-formal) training refers to the percentage of workers who participated in formal (non formal) training over the previous 12 months; Informal training refers to the percentage of workers who learn informally at least once a week. OECD refers to the unweighted average of the OECD countries shown.
OECD average excludes non-OECD countries in PIAAC (namely Cyprus, the Russian Federation, Singapore).
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

83. As mentioned above, many in the literature have argued that informal learning represents the bulk of time spent by workers in learning activities.[15] PIAAC data confirm these findings, even when very conservative assumptions are made on the number of hours spent learning informally. Assuming just one hour of informal learning for each day that workers learn informally suggests that, on average in the OECD, about 80% of total non-formal and informal learning hours is spent in informal learning, in line with findings by Borghans et al. (2014[24]).[16] However, this ranges from just 60% in Korea to over 90% in

[15] For instance, Borghans et al. (2014[24]) find that Dutch workers spend 35% of their working time learning informally.

[16] The restriction to non-formal learning is job-related is dropped, as it requires significant approximations. In addition, the assumption is made that workers who engage in an informal learning activities spend one hour on it each time that they do. This is a very conservative assumption compared to other studies (Squicciarini, Marcolin and Horvát, 2015[50]) where a full day is counted.

France, Finland and Slovenia. Unfortunately, the time spent on formal training is not available in PIAAC.[17]

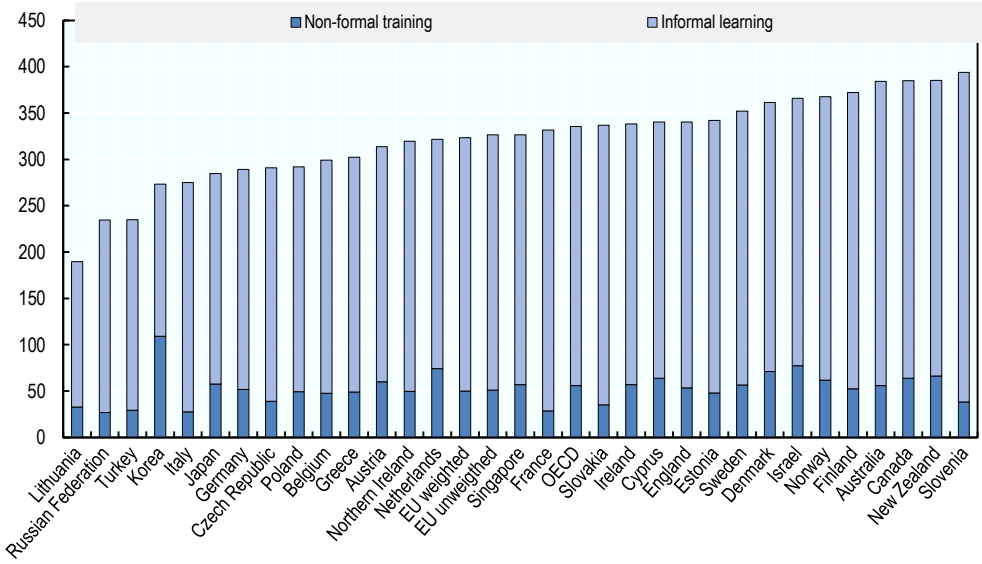
84. Although frequency is an important dimension of training, other aspects such as relevance and effectiveness are also key when comparing different forms of training. For instance, informal learning may be more relevant to small changes in the current requirements of the respondent's job than to major foreseen innovations. Similarly, one could argue that learning informally may be less effective than learning from an instructor and with the support of learning materials. These considerations may contribute to explain differences in returns to informal learning compared to returns to non-formal or formal training.

85. It is worth noting that there is a small negative relationship between non-formal training incidence and intensity at the country level – in other works, in countries where the incidence of non-formal training is higher, the average training spell tends to be shorter. However, the relationship is not statistically significant. On the other hand, the relationship between the likelihood of any informal learning (without restriction as to the frequency of informal learning) and its intensity (the number of hours of information learning) at the country level is positive and statistically significant. In other words, countries where informal learning is more common are also countries where more time is devoted to it.

[17] The EU-AES includes information on the number of hours spent in formal learning by adults – as opposed to all workers as reported in Figure 4.3. On average, across EU28 countries, each participant spent 398 hours or about 50 days in formal learning activities over a period of 12 months. Given an incidence of formal learning in EU-AES of about 6.6%, this translates into 26 hours per workers. Although the difference in definitions makes it difficult to add these figures to Figure 4.3, the order of magnitude confirms that non-formal and informal learning most likely constitute the bulk of job-related training, with informal learning taking up the majority of time.

Figure 4.3. Training intensity, non-formal and informal learning

Hours of non-formal and informal learning over the previous 12 months



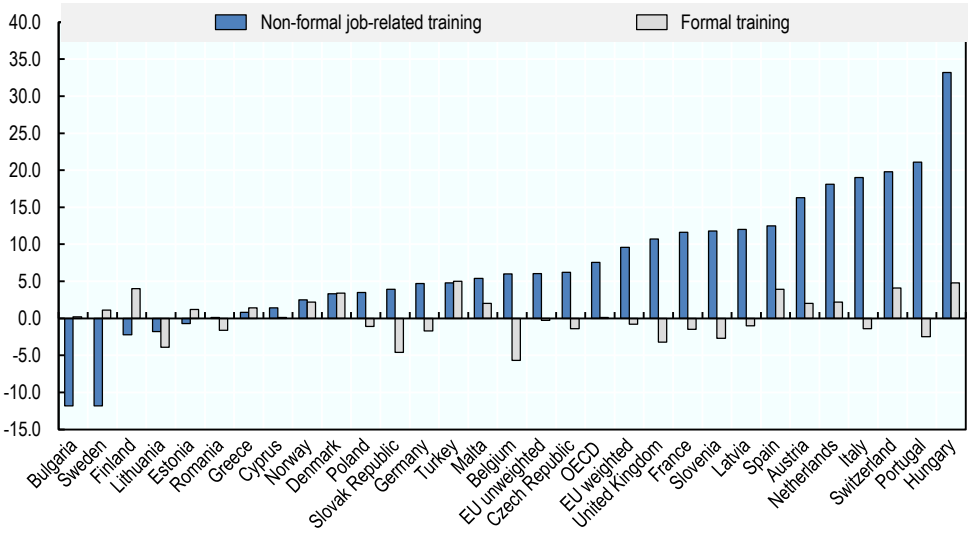
Note: Non-formal training is not limited to job-related training. The average value is attributed to the response categories to obtain the number of hours of informal training and hours are adjusted for part-time work (see Table 3.3 and Section 3.2.3 for more details). Workers who do not participate in any learning activity are included in the calculations as having undertaken zero hours. OECD refers to the unweighted average of the OECD countries shown.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

4.1.2. Changes over time

86. Changes over time in the incidence of adult learning can be derived from the EU-AES, keeping the caveats mentioned above in mind. Notably, job-related formal training cannot be singled out in EU-AES and informal learning includes a broad range of activities that are not necessarily job-related. Nevertheless, the PIAAC and EU-AES data on the incidence of training are highly and statistically significantly correlated (see Annex A for evidence of the positive correlation between EU-AES and PIAAC data on training activities). Thus, the EU-AES data can be expected to provide a picture of the general trends in adult participation in training and informal learning that is reasonably consistent with the PIAAC levels presented above. While formal training participation remained roughly stable between 2007 and 2016, participation in non-formal job-related training increased in most countries between 2007 and 2016 (Figure 4.4). Significant increases were observed in Hungary but also Italy, Portugal, Switzerland while large declines were only experienced in Bulgaria and Sweden.

Figure 4.4. Changes in the incidence of formal training and non-formal job-related training, 2007-2016

Percentage point change in the incidence of each type of training



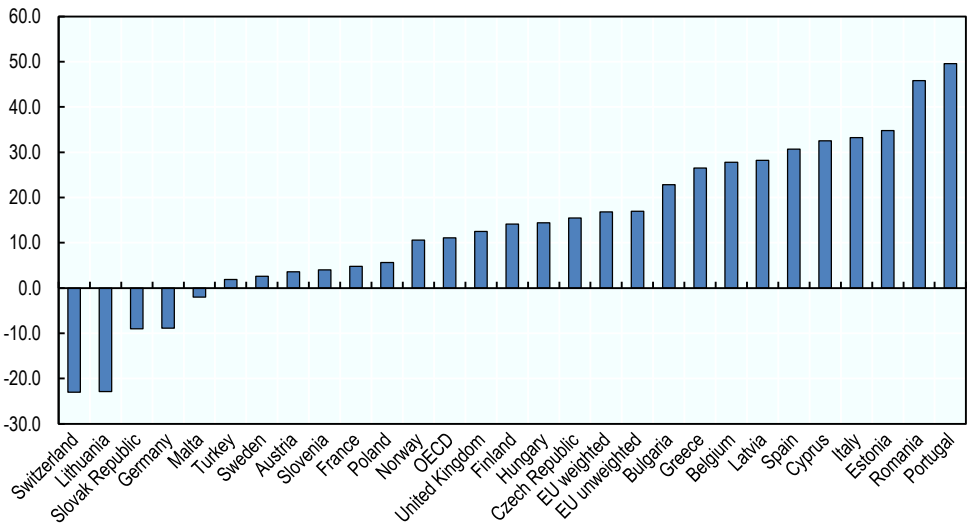
Note: Formal training is not limited to the job-related type. OECD refers to the unweighted average of the OECD countries shown.
Source: Eurostat Adult Education Survey, 2007 and 2016.

87. Participation in informal learning in everyday life rose by about 17 percentage points in the EU on average, mostly due to a significant rise in the share of respondents reporting that they learnt using computers (Figure 4.5). The increase was particularly steep in Portugal (50 percentage points). On the other hand, the incidence of informal learning fell by about 20% in Switzerland and Lithuania, due to sizeable falls in the share of adults learning from printed materials and learning from museums visits.[18]

[18] In Switzerland the incidence of informal learning was particularly high to start with, at about 65% in 2007, more than 20 percentage points above the EU average in the same year. This was not the case for Lithuania, where the incidence was close to average to start with but has fallen about 40 percentage points below since.

Figure 4.5. Changes in the incidence of informal learning, 2007-2016

Percentage point change in the incidence of each type of training



Note: Average of all informal learning activities, including: learning from others, learning from computers, learning from printed materials, learning from learning centres, learning from museums and learning from multimedia. OECD refers to the unweighted average of the OECD countries shown.
Source: Eurostat Adult Education Survey, 2007 and 2016.

4.1.3. Overlap and correlation between different types of training

88. The extent to which participation in different types of training overlaps is important for many reasons. It is important to know whether the same workers receive the various types of training or whether informal learning serves as an equaliser, providing learning opportunities for those normally not involved in non-formal or formal training. At the country level, the correlation between different types of training can shed light on whether countries substitute one type of training with another, with, for instance, countries where non-formal learning is particularly low offering more informal learning opportunities.

89. At the individual level, the three form of training are positively correlated (Table 4.1), suggesting complementarity rather than substitution.[19] However, as informal learning is a lot more frequent than either formal or non-formal training, the overlap between the three forms of training is only limited at just 4% in the OECD on average. In addition, just under 30% of workers participate in both non-formal and informal learning, in the OECD on average and about 35% engage in informal learning only (Figure 4.6). Looking deeper into this relationship, about 65% of those who do not get a chance to participate in non-formal learning have the opportunity of learning informally at work instead although this share is even higher among those who do participate in non-formal training (Table 4.2). Overall, by the simple fact of being much more widespread than

[19] Several alternative correlation methods have been used to account for the binary nature of the variables, including tetrachonic correlation and probit regression analysis. The correlation between participation in formal, non-formal and informal learning is mostly positive, significant but very low.

formal and non-formal training, informal learning does seem to provide significant learning opportunities for those excluded from more formalised courses. The question remains of who exactly benefits from informal learning and whether the same socio-demographic characteristics that increase its likelihood also increase the chances of formal and non-formal learning or whether informal workers benefits those who truly have little changes of participating in more organised training spells. This is looked at later in this paper.

Table 4.1. Correlation between workers' participation in different types of training

Correlation coefficients

	Correlation between formal and non-formal training participation	Correlation between formal and informal learning participation	Correlation between non-formal and informal learning participation
Australia	0.128	0.076	0.148
Austria	0.057	0.054	0.197
Belgium	0.068	0.050	0.121
Canada	0.103	0.043	0.129
Chile	0.151	0.047	0.112
Cyprus	0.176	0.055	0.144
Czech Republic	0.068	0.036	0.124
Denmark	-0.015	0.088	0.208
England	0.124	0.089	0.189
Estonia	0.113	0.052	0.150
Finland	0.040	0.059	0.106
France	0.043	0.046	0.144
Germany	-0.004	0.082	0.168
Greece	0.198	0.076	0.145
Ireland	0.120	0.044	0.110
Israel	0.114	0.063	0.147
Italy	0.132	0.055	0.127
Japan	0.082	0.053	0.189
Korea	0.132	0.068	0.134
Lithuania	0.096	0.038	0.118
Netherlands	0.086	0.081	0.174
Northern Ireland	0.129	0.078	0.181
New Zealand	0.126	0.095	0.154
Norway	0.031	0.053	0.136
Poland	0.104	0.088	0.163
Russian Federation	0.180	0.088	0.250
Singapore	0.108	0.085	0.162
Slovakia	0.120	0.087	0.164
Slovenia	0.093	0.034	0.140
Spain	0.135	0.042	0.125
Sweden	0.043	0.029	0.150
Turkey	0.262	0.115	0.218
US	0.060	0.057	0.132
Pooled sample	0.109	0.073	0.166

Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

Table 4.2. Overlap between non-formal and informal learning

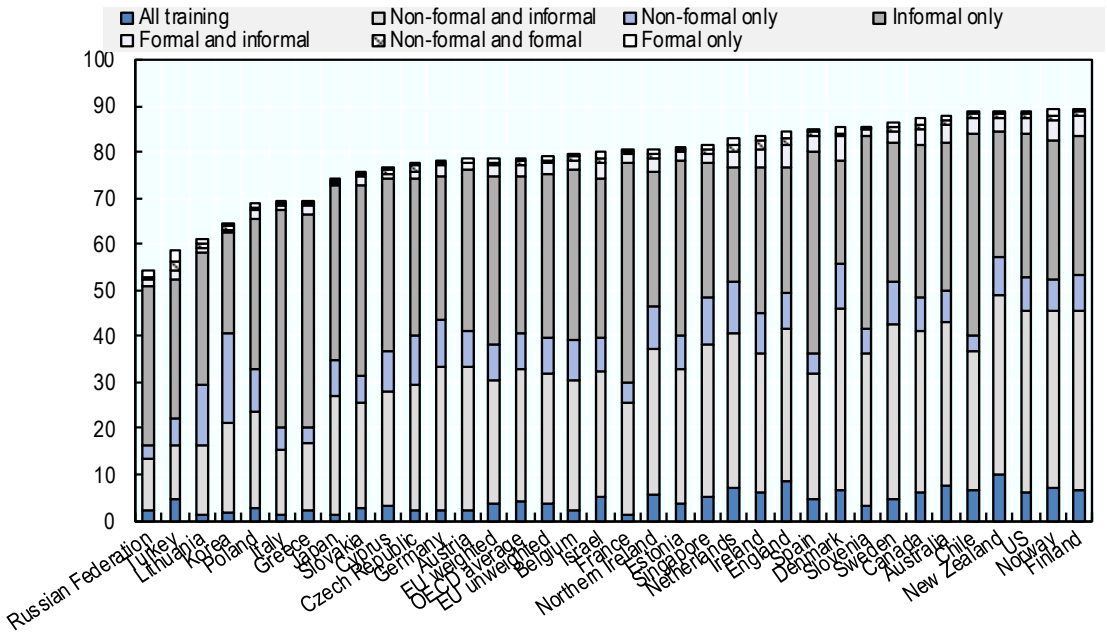
Share of workers

	Share of total workers		Share of workers in each non-formal training category		Row total
	Informal learning		Informal learning		
Non-formal learning	no	yes	no	yes	
no	19.8%/	36%	35.2%	64.8%	65321
yes	8.8%	35%	20.1%	79.9%	51081
Column total	33249	83153	33249	83153	116402

Note: Job-related non-formal training is computed based on workers who report that the latest training activity was job-related.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

Figure 4.6. Overlap between different types of training

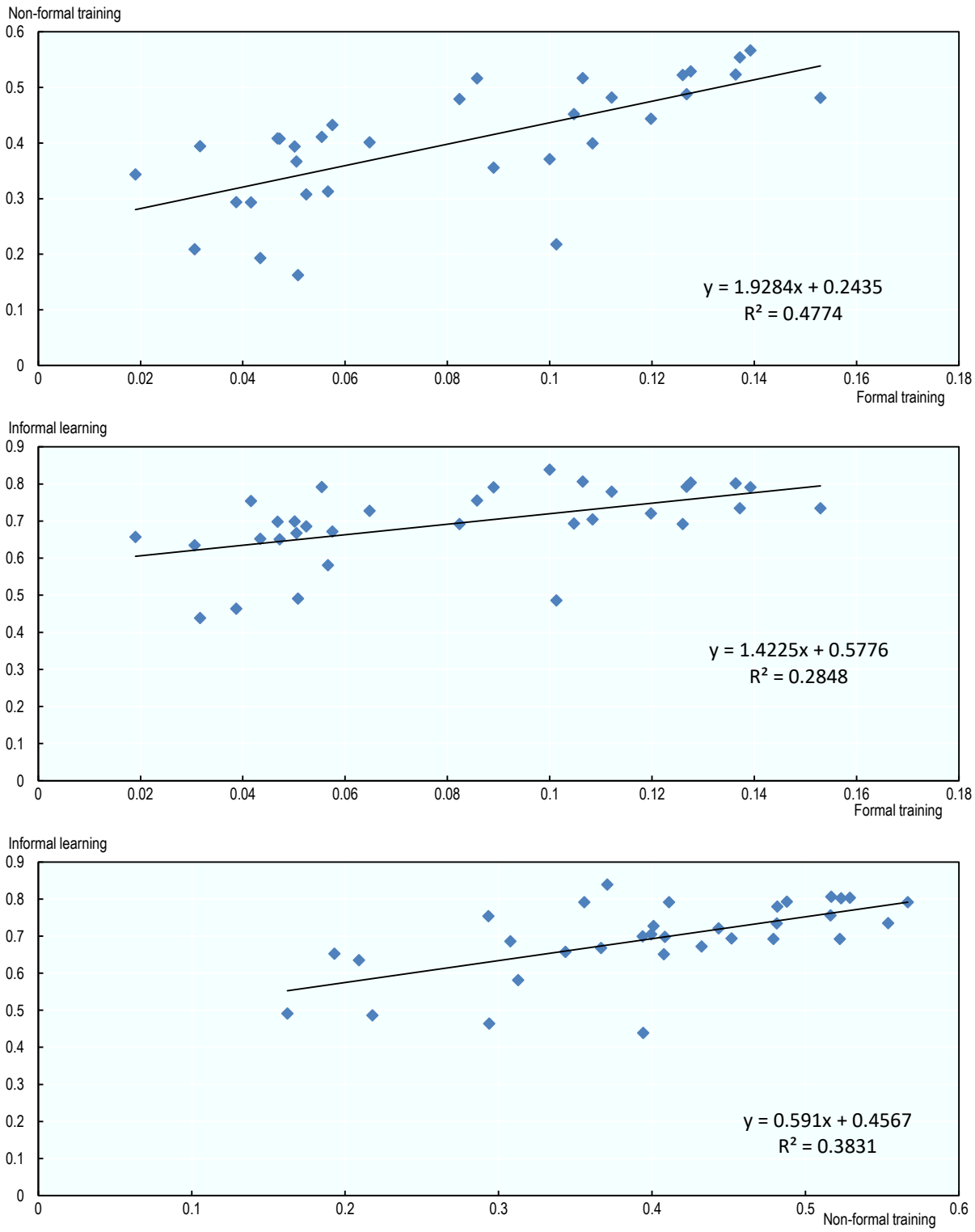
Share of workers who participate in more than one type of training



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. OECD refers to the unweighted average of the OECD countries shown.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

90. The correlation between different types of training is also positive at the country level. The highest correlation is observed between formal and non-formal training (Figure 4.7). As for the individual level analysis, there is no evidence of substitution of one form of training for another, for instance evidence of countries providing fewer opportunities for formal and non-formal training provide higher chances of learning informally at work, relative to their peers. However, since informal learning is much more common than formal and non-formal training, some compensation does take place. For instance, in countries like France, Greece or Italy, where non-formal training participation is below 30%, more than 60% of workers learn informally at work.

Figure 4.7. Cross-country correlation between different types of training



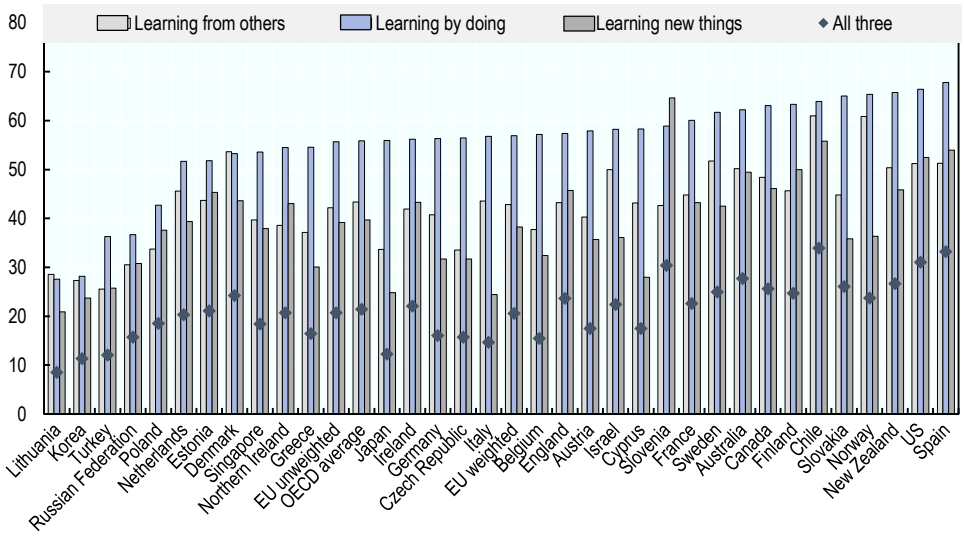
Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

4.1.4. A focus on informal learning in the workplace

91. This section looks more closely at informal learning, disentangling the relationship between the different proxies used in this paper. With the exception of Slovenia and, to a less extent Lithuania, the most frequently experienced form of informal learning is learning by doing (Figure 4.8). On average, across OECD countries, about 56% of workers learn by doing their job at least once a week. Learning from others and learning new things at work are experienced by 43% and 40% of workers, respectively, in the OECD on average. Interestingly, there is not so much overlap between the three forms of informal learning. Only about 20% of workers experience all three in the OECD on average. Pairwise correlations reveal that a relatively strong positive correlation between learning from others and learning by doing (0.68) but a smaller positive correlation between these two forms of information learning and learning new things (both slightly below 0.5).

Figure 4.8. Incidence of learning-by-doing, learning-from-others and learning new things at work

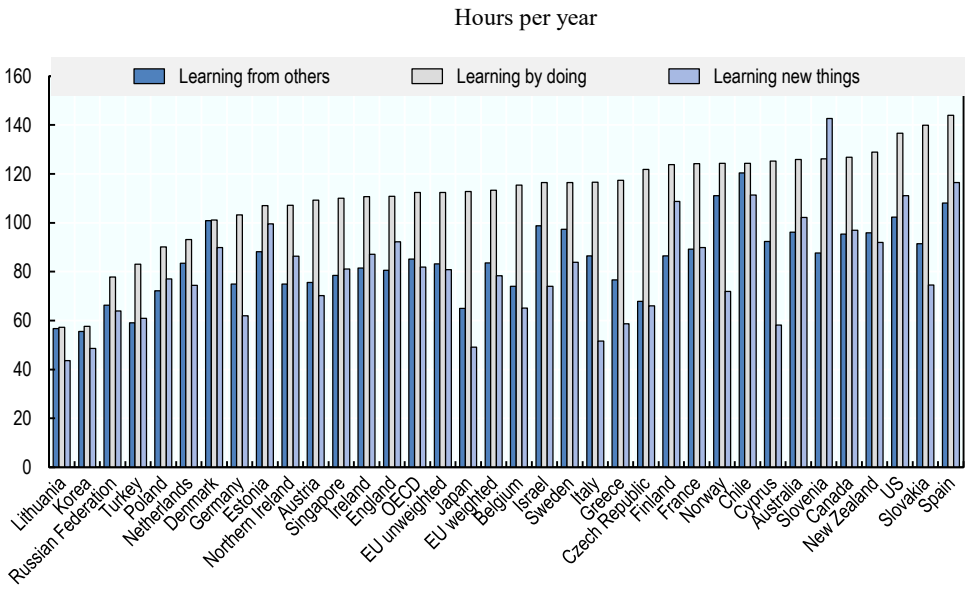
Percentage of workers who experienced informal learning



Note: Percentage of workers who experienced each form of informal learning and all three at least once a week. OECD refers to the unweighted average of the OECD countries shown.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

92. The picture is very similar when looking at the number of hours spent learning informally at work. Learning by doing is the form of informal learning most frequently experienced, with an average of 112 hours a year in the OECD (Figure 4.9). This is followed by learning from others (85 hours per year on average) and learning new things (82 hours per year on average).

Figure 4.9. Hours spent learning-by-doing, learning-from-others and learning new things at work

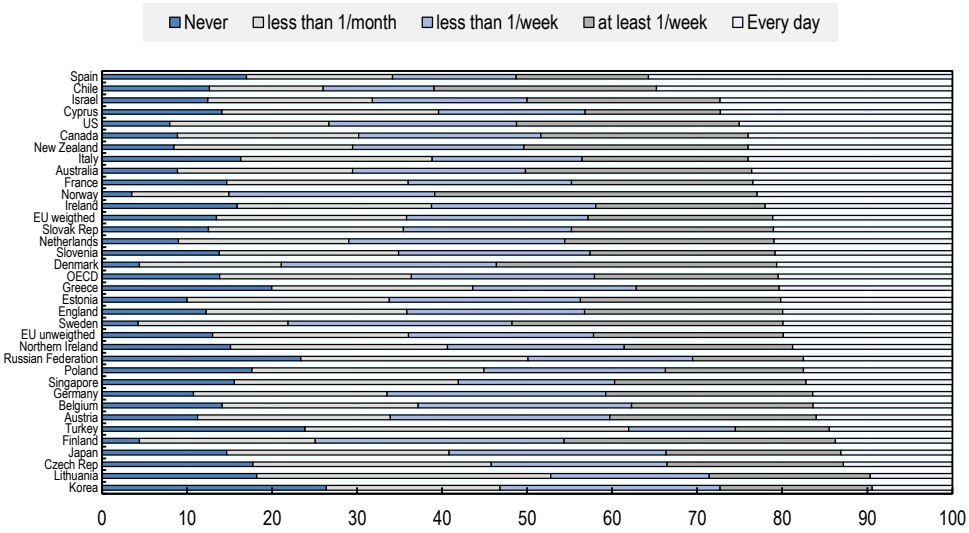


Note: Number of hours spent in each of the informal learning activities. The average value is attributed to the response categories to obtain the number of hours of informal training and hours are adjusted for part-time work (see Table 3.3 and Section 3.2.3 for more details). OECD refers to the unweighted average of the OECD countries shown.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

93. Looking at the distribution of responses on the frequency of informal learning also reveals that answers are rather well distributed across all categories, with significant variation across countries (Figure 4.10). In the OECD on average, about 14% of workers report never learning by doing while 23% reported doing so less than once a month, 22% at least once a month, 22% at least once a week and 20% every day. Similar average distributions are observed for learning from others and learning new things.

Figure 4.10. Frequency of learning from others in the workplace, by country

Share of respondents in each answering category



Note: OECD refers to the unweighted average of the OECD countries shown.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

4.1.5. Learning by individual characteristics

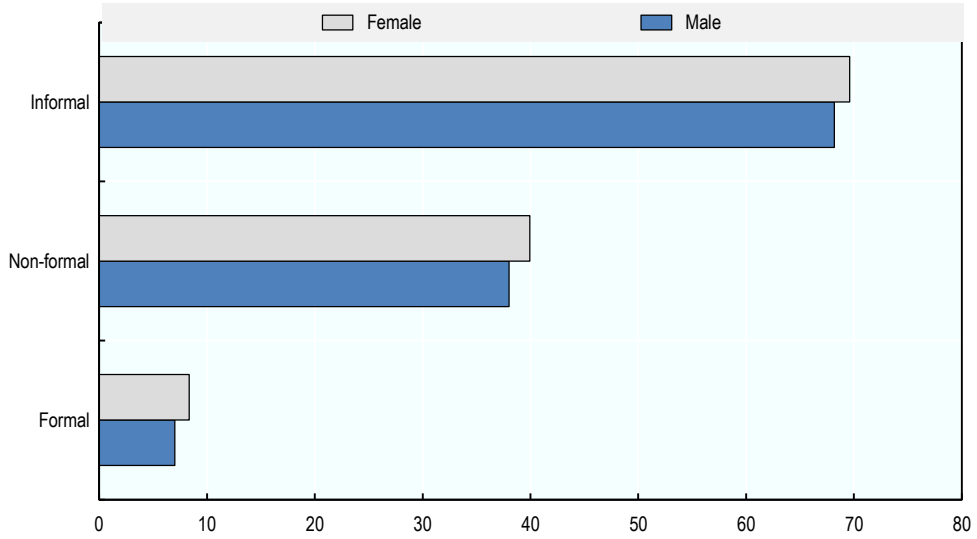
94. The inclusiveness of training is a topic high on policymakers' agendas. Several studies have highlighted how participation in training is skewed in favour of high-skilled workers and against those with low education, low skills and high risk of job loss (OECD, 2019[43]; OECD, 2019[44]). Few studies, however, have compared the inclusiveness of different forms of training. This section provides descriptive statistics of the incidence of formal, non-formal and informal learning by individual, job and firm characteristics.

95. Starting with demographic characteristics, female workers have a slightly higher probability of participating in all three forms of learning (Figure 4.11). Participation in training mostly declines with age. Workers 50 and older are the least likely to receive training, irrespective of its form. Those younger than 30 are the most likely to participate in formal training or experience informal learning but receive about the same non formal training as workers in the oldest age group (Figure 4.12). Hence, non-formal training investments appear to be concentrated on workers in the middle of their career.

96. More learning on the job takes place when workers start a new job and declines thereafter (Figure 4.13). A similar pattern is observed for the participation in formal training courses while the opposite is true for non-formal training for which participation increases with tenure. One possible interpretation is that informal learning is more likely to be about learning how to perform the worker's current job – hence more frequent among new hires – while non-formal training prepares the worker's for different tasks and/or position – hence more likely in mid- or late-career.

Figure 4.11. Participation in job-related training, by training type and gender

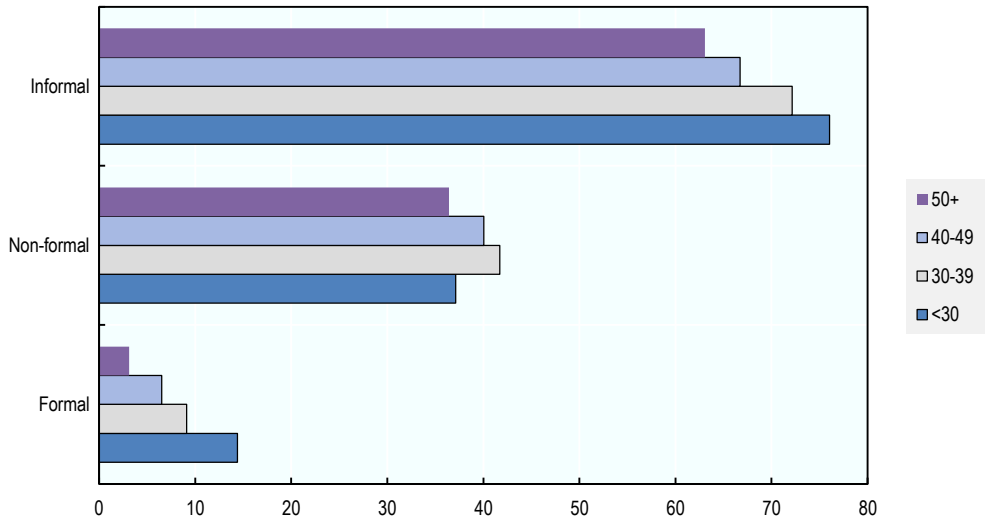
Share of workers who participate in formal, non-formal and informal job-related training, by gender



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

Figure 4.12. Participation in job-related training, by training type and age

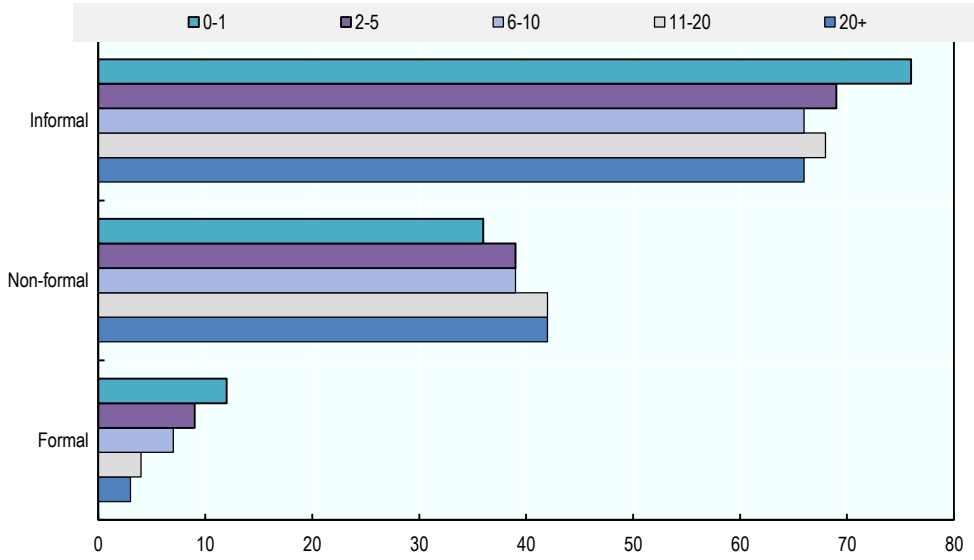
Share of workers who participate in formal, non-formal and informal job-related training, by age group



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

Figure 4.13. Participation in job-related training, by job tenure

Share of workers who participate in formal, non-formal and informal job-related training, by years of tenure

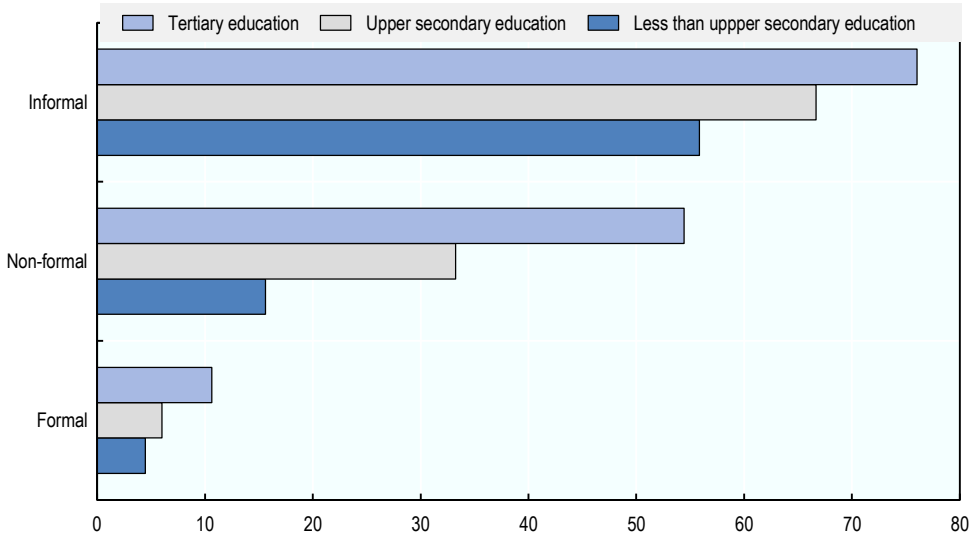


Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

97. In line with the findings in the literature, participation in all three forms of learning increases with educational attainment. The difference between tertiary graduates and their less qualified counterparts is particularly striking when looking at the participation in non-formal training (Figure 4.14). Exploiting the specificity of PIAAC which includes tests of literacy, numeracy and problem solving, it is possible to show that training participation across the board also increases with proficiency (see Figure 4.15 for proficiency in literacy, similar results are obtained when using proficiency in numeracy and problem solving). As it is the case for education, the differences across proficiency deciles are most marked for non-formal training participation.

Figure 4.14. Participation in job-related training, by training type and educational attainment

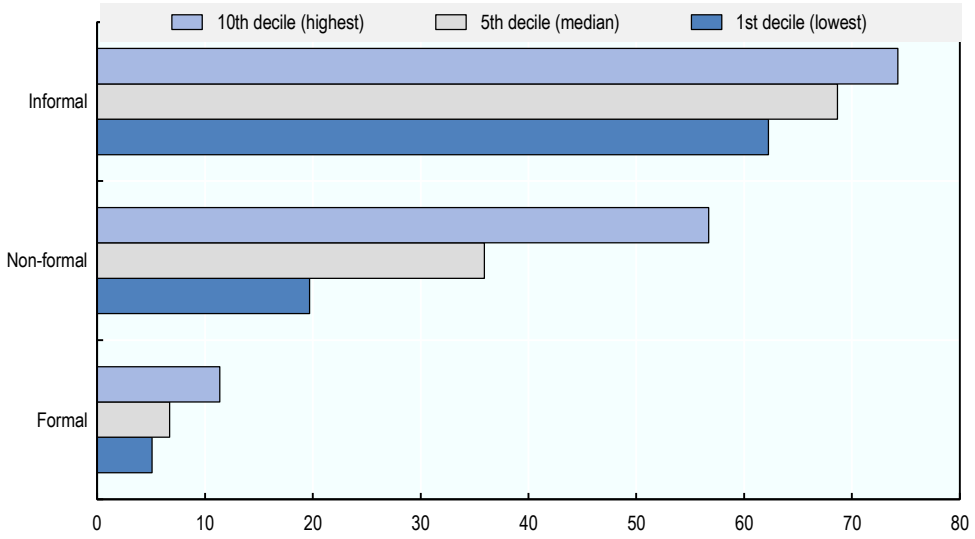
Share of workers who participate in formal, non-formal and informal job-related training, by educational attainment



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

Figure 4.15. Participation in job-related training, by training type and literacy proficiency

Share of workers who participate in formal, non-formal and informal job-related training, by literacy proficiency deciles



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

98. Moving on to job characteristics, the likelihood of participation in training tends to increase with occupational status. Among managers, 13% participate in formal training, 75% take part in non-formal training and 87% experience informal learning. At the opposite end of the spectrum, workers in elementary occupations have very low exposure to the three forms of training, 5%, 15% and 53%, respectively. However, there are significant exception to this pattern, particularly when it comes to formal and informal learning. For instance, participation in formal training is very high, exceeding 14%, among mid-level occupations such as teaching and health professionals, hospitality and retail managers and personal care workers. Similarly, technicians and associate professionals, hospitality and retail managers, ICT professionals and business and administration professionals experience rates of informal learning at work comparable or exceeding those of managers.

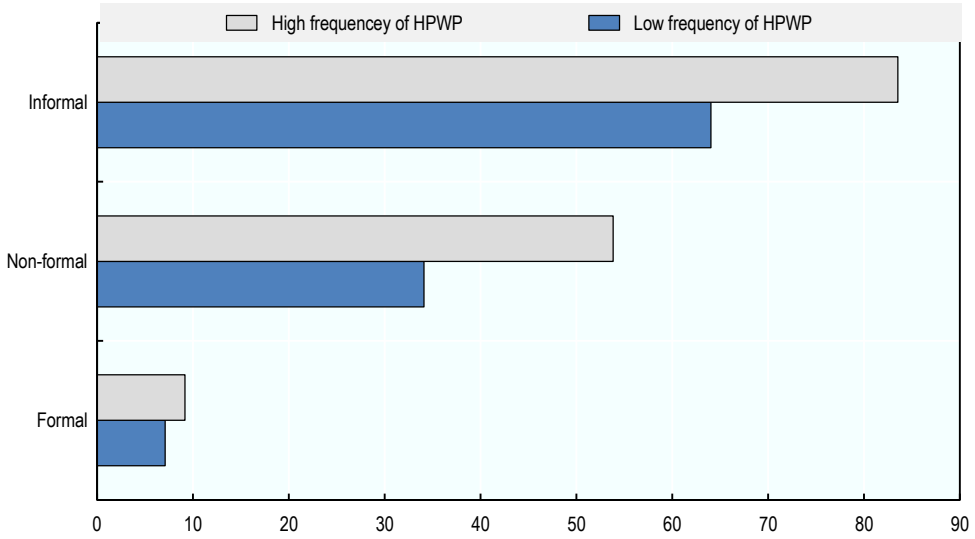
99. Consistently with the pattern observed by occupation, workers in the sectors of health, social work and education experience very high participation in all three types of training. Workers in finance and insurance or information and communication experience a very high incidence of non-formal and information learning but significantly less formal training. At the opposite end of the scale, workers in the Agricultural, forestry and fishing industry experience very little training, irrespective of its type.

100. In line with findings in the literature, workers who are more frequently exposed to HPWP – *i.e.* they have more autonomy, work in teams and exchange regularly with their peers (see section 3.2.4) – receive more training of the three types than their counterparts who work in more traditional contexts (Figure 4.16). The difference is particularly marked for non-formal and informal learning.

101. Workers in jobs highly exposed to structural change should have access to training allowing them to prepare for the change. To shed light on this point, the data collected in PIAAC cycle 1 can be used to assess the extent to which a job is exposed to the risk of automation based on the tasks it involves (Nedelkoska and Quintini, 2018[45]). Unfortunately, as it is the case for educational attainment and literacy proficiency, workers at high risk of automation receive the lowest, not the highest, training and this applies to all three types (Figure 4.17).

Figure 4.16. Participation in job-related training, by training type and organisational practices

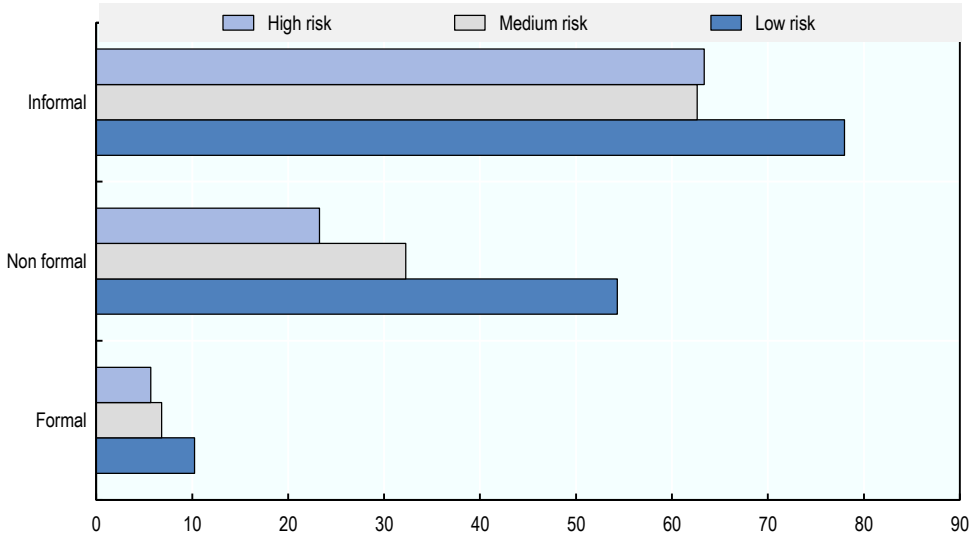
Share of workers who participate in formal, non-formal and informal job-related training, by frequency of high performance work practices (HPWP)



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. High frequency of HPWP refers to values of HPWP above the top 25th percentile of the pooled distribution. The remainder observations are labelled as low frequency HPWP.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

Figure 4.17. Participation in job-related training, by training type and risk of automation

Share of workers who participate in formal, non-formal and informal job-related training, by risk of automation



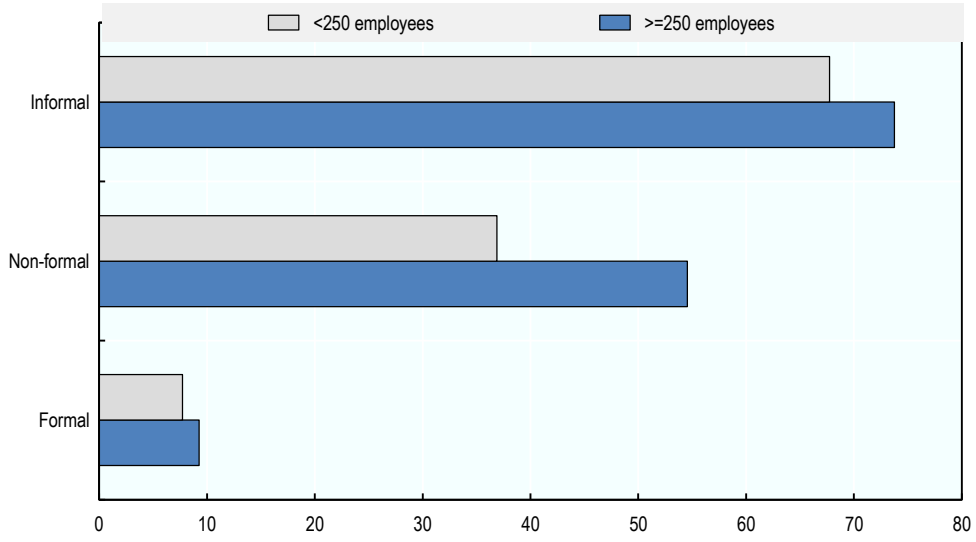
Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. See Nedelkoska and Quintini (2018[45]) for a detailed explanation of how the individual risk of automation is computed.

Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

102. Finally, firm characteristics such as size and employment growth are also correlated with training participation, probably reflecting the likelihood of provision by employers. Workers in large firms benefit from more training, particularly when it comes to non-formal and informal learning (Figure 4.18). Growing firms also provide more opportunities for learning. This finding is consistent with the empirical work developed by Kotey and Folker (2007[46]).

Figure 4.18. Participation in job-related training, by training type and firm size

Share of workers who participate in formal, non-formal and informal job-related training, by firm size



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

4.2. The determinants of informal training participation

103. In this section, the determinants for participation in formal, non-formal and informal training are investigated, formalising some of the descriptive statistics presented in the previous section. While there is a large body of evidence on the characteristics of workers, jobs and firms that influence participation in formal and non-formal learning, much less is known about the correlates of informal learning. For this reason, the focus in this section is primarily on informal learning in the workplace. However, comparisons are drawn with the correlates of formal and non-formal training with the purpose of identifying similarities and differences.

4.2.1. Empirical strategy

104. The model estimated is the following:

$$Training_{icok}^{j} = \alpha + \sum_{\bar{j}} \beta_j Training_{icok}^{\bar{j}} + \sum_{j} \rho_j X_{icok} + \gamma_c + \delta_o + \theta_k + \varepsilon_{icok}$$

where $Training_{icok}^{j}$ is a binary variable =1 if individual i, living in country c, working in occupation o and sector k, received training in the last 12 months. The type of training j can be either: job-related formal, job-related non-formal or job-related informal. As controls, the model includes: binary variables indicating whether the individual has also taken part in other forms of training ($\bar{j}$); and a vector $\boldsymbol{X}_{icok}$ of individual i's personal characteristics, characteristics of his or her job and employer. Finally, the following fixed-effects are included: γ_c for countries, δ_o for occupations and θ_k for sectors of activity (i.e. industry).

4.2.2. Main findings

105. The results largely confirm what was shown in the descriptive analysis presented above, but some differences and some additional covariates stand out.

106. First, the relationship between informal learning and age, tenure, education, the risk of automation and high performance work contexts are robust to the inclusion of a large set of individual, job, and firm characteristics (Table 4.3). Being ten years older is associated with a 3% lower probability of experiencing informal learning. One extra year of education increases the likelihood of learning informally at work by 0.5%. Those who work in contexts that apply HPWP are 12% more likely to experience informal learning. A 10 percentage point increase in the risk of automation (i.e. from 50% risk to 60% risk), is associated with a 1.3% lower probability of informal learning. Finally, the analysis confirms the relationship between informal learning and participation in non-formal training: participating in non-formal training is associated to an increase in the probability of experiencing informal learning by 7%. It also reveals a positive correlation – although smaller and weaker –between informal learning and formal training participation.

107. Second, the analysis highlights a few additional covariates not presented in the previous section. Notably, married workers and migrants are found to be less exposed to informal learning. Workers in part-time jobs and private sector jobs are also less likely to experience informal learning. Workers on atypical contracts – fixed-term contracts, contracts through temporary work agencies, apprenticeship contracts or no contract at all – are more likely to learn informally at work. Finally, workers in complex jobs (jobs requiring three or more years of experience) are more likely to experience informal learning.

108. Third, some of the descriptive relationships presented in the previous section are overturned once additional controls are included. The slight advantage of women over men in the participation in informal learning disappears, probably due to controls for family status and occupation. In addition, the positive correlation between proficiency and the exposure to informal learning changes into a negative and statistically significant relationship once other controls, notably educational attainment, are included: an increase in proficiency by 45 points (approximately a standard deviation), reduces the likelihood of exposure to informal learning by 4%. In other words, among individuals with the same level of educational attainment, lower skilled individuals participate more in informal learning.

Table 4.3. Likelihood of informal training participation, by individual, job and firm characteristics

Probit regression marginal effects

Dependent variable:	Informal learning		Formal training		Non-formal training	
Female	0.000		-0.005		-0.017	*
Age	-0.003	***	-0.002	***	-0.001	***
Married	-0.023	**	-0.010		0.006	
With dependent children	0.000		-0.009		0.021	*
Not a native speaker	-0.054	***	0.002		-0.054	***
Education (in years)	0.005	***	0.003	***	0.014	***
Employer has max 250 employees	-0.006		-0.007		-0.059	***
Employer grew in size	0.039	***	0.001		0.039	***
Private sector	-0.061	***	-0.009		-0.056	***
Part-time	-0.032	***	0.029	***	-0.079	***
Atypical contract	0.022	**	0.018	***	-0.018	*
Tenure in current job (years)	-0.003	***	-0.003	***	0.001	***
Experience required: 3+ years	0.046	***	0.011		0.061	***
Experience required: 7 months to 2 years	0.015	*	0.003		0.030	***
Proficiency score for literacy	-0.008	***	0.002	***	0.007	***
Individual risk of automation	-0.132	***	-0.033	**	-0.202	***
High performance work context	0.115	***	0.011	*	0.044	***
Received job-related non-formal training	0.070	***	0.022	***		
Received job-related formal training	0.038	**			0.054	***
Experienced informal learning			0.016	***	0.079	***
Country Dummies	Yes		Yes		Yes	
Occupation Dummies	Yes		Yes		Yes	
Industry Dummies	Yes		Yes		Yes	
Observations	75379		75379		75379	
Pseudo R2	0.116		0.144		0.175	

Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. The regression includes country, occupation (1-digit) and industry (1-digit) dummies. Marginal effects for categorical variables refer to a discrete change from the base level. Proficiency in literacy is measured on a 500-point scale but is divided by 10 for presentational purposes. Significance levels as follows: * $p < .1$, ** $p < .05$, *** $p < .01$
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

109. Overall, the correlates of participation in informal learning coincide with those of formal and non-formal training. However, few important differences stand out. Contrary to the finding that the incidence of informal learning declines with proficiency, the relationship between formal and non-formal training participation and proficiency in literacy is positive and statistically significant. This confirms findings in the literature that those who would benefit the most from training – i.e. the least skilled workers – tend to be under-represented. Workers in atypical contracts receive less non-formal training than their counterparts in permanent jobs, which is in line with previous findings in the literature studying the relationship between on-the-job training and job stability (OECD, 2014[47]). To some extent, this suggests that workers who do not benefit from non-formal training at work may be able to compensate with more opportunities for informal learning.

4.3. Individual returns to job-related training

110. In this section, the paper disentangles the private economic returns to training, distinguishing between returns to formal, non-formal and informal training. It attempts to compute the returns to formal and non-formal training correcting from potential biases arising from not accounting for informal on-the-job training. Finally, it also takes into account the issue of potential selection into training when estimating returns to formal, non-formal and informal training. Despite this correction, the estimated relationships should be taken as suggestive of causality. Precise causal linkages, i.e. actual *returns* to training, cannot be inferred without the use of panel data.

4.3.1. Empirical strategy

111. The specification is as follows:

$$ln(w_{ic}) = \alpha + \beta_1 Formal_{icok} + \beta_2 Nonformal_{icok} + \beta_3 Informal_{icok} + \sum_j \rho_j X^j_{icok} + \gamma_c + \varepsilon_{icok}$$

where the dependent variable ($ln(w_{icok})$) is the natural logarithm of the hourly wage of individual i, living in country c. $\boldsymbol{X}_{ic}$ is a vector of controls that includes personal characteristics of individual i (gender, age, marital status, education, literacy proficiency etc.), characteristics of individual i's job (type of employment contract, tenure, part-time hours) and employer (SMEs, private sector, if employer has been growing). The model also includes country fixed-effects γ_c.[20] The coefficients of interest in the analysis are β_1, β_2 and β_3. All types of training considered are job-related.

4.3.2. OLS results

112. The first three columns of Table 4.4 show the simple correlation of various forms of training with hourly wages, i.e. without controlling for individual, job and firm characteristics. Non-formal training is the most highly correlated to hourly wages, with participation associated with wages that are 30% higher (Model 1). Without any other controls, the exposure to informal learning is associated with a 10% increase in hourly wages (Model 2). The inclusion of all forms of training together leave the relationship between non-formal training and wages unchanged but reduces significantly the correlation between informal learning and wages to just 5% (Model 3). In this simple analysis (Models 1-3), formal training is found to be negatively correlated to wages, which is in line with the

[20] Please note that including controls such as occupational and industry dummies in addition to education, proficiency and other training variables creates a "bad control" problem (Angrist, Pischke and Pischke, 2009[56]). In other words, occupation and industry dummies bias the coefficients on education and skills because they are themselves outcomes of ability. They also bias the coefficients on training to the extent that wage gains following training may be due precisely to the fact that training allows workers to change job. Hence, these controls are omitted from the specification. When included, the effect of informal learning disappears but the "bad control" problem implies that the coefficients on education, proficiency and the training variables are no longer meaningful. In the case of informal learning, the respondent's occupation may also be highly correlated with the learning content of his/her job.

human capital theory prediction that general training[21] should be paid for by the employee and that this comes in the form of lower wages during training (see Section 2.).[22] To test this, participation in formal training is split to single out training that is still ongoing at the time of the interview and the results seem to confirm that the negative correlation comes from reduced wages during formal training (Model 4). It is important to keep in mind that returns to training may take a while to accrue and may materialise through a change in employer. This is particularly likely to be the case for formal training which tends to be of a general nature rather than specific to the worker's current job (Lynch, 1992[29]; Booth and Bryan, 2005[34]). Finally, returns to formal training undertaken by adults should not be confounded with returns to education undertaken prior to labour market entry. Indeed, each extra year of (initial) education is associated with a 5% increase in hourly wages.

113. Columns 4-5 of Table 4.4 include the additional controls for individual, job and firm characteristics. Even after the inclusion of these controls and in line with findings in the literature, non-formal training is found to be the most correlated with hourly wages: participants earn approximately 13% more than non-participants with similar characteristics and in similar jobs and firms. Including informal learning reduces this relationship by about half a percentage point. Workers exposed to informal learning at least once a week earn approximately 3% more than workers not exposed to it.

114. The inclusion of the informal learning proxy used in this paper also leaves the relationship between tenure and hourly wages unchanged. In the literature (Nordman and Hayward, 2006[25]), the reduction in the coefficient on tenure, which is often assumed to reflect by default the returns to the informal components of training, once informal learning is included has been used as a test of the validity of the informal learning proxy. However, it should be noted that in Nordman and Hayward (2006[25]) the informal learning proxy includes a measure of the time needed to become proficient at one's job after hiring which might explain why the authors expect it (and find it) to affect returns to tenure. Given the way informal learning is proxied in this paper, it could be seen more as a complement to tenure on the job than as a substitute measure of learning that takes place at work. The tenure variable still captures other effects, for instance a pure return to job seniority that could in part be independent of the firm (e.g. set in collective bargaining agreements).

[21] Formal courses tends to be classified as general training in the literature.

[22] Given the longer length of formal training spells on average compared to non-formal training, it is more likely that training is ongoing at the time of the interview. In addition, the general nature of formal training makes it less likely that employers would be willing to pay for it, leaving workers to contribute to the cost or take time off work to train.

Table 4.4. Returns to formal, non-formal, informal training

OLS regression coefficients

Dependent variable:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Formal training	-0.063***		-0.067***		-0.029**	-0.031*
Non-formal training	0.311***		0.304***	0.305***	0.129***	0.125***
Informal learning		0.097***	0.047***	0.047***		0.033***
Formal training prior				-0.032		
Formal training ongoing				-0.060*		
Tenure in current job (years)					0.011***	0.011***
Female					-0.178***	-0.178***
Age					0.003***	0.003***
Married					0.100***	0.101***
With dependent children					0.047***	0.047***
Not a native speaker					0.011***	0.013
Education (in years)					0.053***	0.053***
Employer has max 250 employees					-0.154***	-0.154***
Employer grew in size					0.072***	0.071***
Private sector					0.024**	0.025**
Part-time					-0.107***	-0.105***
Atypical contract					-0.057***	-0.057***
Proficiency score for literacy					0.021***	0.021***
Constant	2.782***	2.868***	2.748***	2.748***	1.471***	1.443***
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	105601	105601	105601	105586	83578	83578
R squared	0.3801	0.3424	0.3809	0.3811	0.5816	0.5820

Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. Proficiency in literacy is measured on a 500-point scale but is divided by 10 for presentational purposes. Significance levels as follows: * p < .1, ** p < .05, *** p < .01.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

115. It is important to note that the overall return to human capital, which would positively correlated with the worker's hourly wage, may involve both personal returns and firm-level externalities. It would be useful to consider these two sources of returns from human capital simultaneously to capture the "true" individual return to training, i.e. excluding the wage effect due to positive externalities that the training may generate within the firm. Unfortunately, without matched employer-employee data sets, it is not possible to control for these human capital externalities and distinguish between direct and indirect effects of training on individual wages. The relationship between training

participation and productivity is estimated in section 5. , by constructing a pseudo-link between PIAAC and industry-specific productivity data.

4.3.3. Correcting for sample selection

116. There is a possible source of bias in the OLS estimates of the returns to training. In many cases, workers can choose to participate in training or not depending on their attitudes to learning. They may also choose to work in a given occupation based on the training opportunities it offers. Similarly, employers offer training only to workers who have some unobservable characteristics (trainability and attitude to learning). If these selection effects are not accounted for, the estimated coefficients on the various training measures are likely to be biased upward. The empirical training literature proposes several approaches to solve these selection problems. The method used in this paper is the two-stage approach developed by Heckman (1979[48]).

117. To correct for this potential bias, the wage equation estimated by OLS is augmented with a Heckman-type selection correction term. In a first step, the probability of participating in formal and non-formal training is estimated on the same set of determinants included in the wage equation, as well as some exogenous variables that have an impact on the likelihood of participating in formal and non-formal training, but no direct impact on wages (the so-called exclusion restriction). From this estimation, the Inverse Mills Ratio is computed using the predicted probability of participating into formal and non-formal training ($\widehat{Training}_{icok}$) as follows:

$$\lambda_{icok} = \frac{\phi(\widehat{Training}_{icok})}{\Phi(\widehat{Training}_{icok})}$$

Finally, the Inverse Mills Ratio is included in the wage regression as an additional explanatory variable.

118. For the analysis in this paper, the exclusion restriction consists in including variables that proxy the individual's motivation to learning. Using PIAAC, attitudes to learning can be measured through questions on whether the individual: likes learning new things, relates new things to he/she already knows, likes getting to the bottom of difficult things, likes to figure out how different ideas fit together, and looks for additional information to clarify things that he/she does not understand. In addition, PIAAC collects information on the use of reading, writing, numeracy and ICT in everyday life which can be used to measure the respondents' attitudes to learning and skills enhancement. Both skills use in everyday life (reading, writing, numeracy and ICT separately assessed) and a summary measure of attitudes to learning are used in the Heckman correction model.

119. Results after correcting for selection are presented in Table 4.5 along with the results of Model 6 of Table 4.4 for ease of comparison with the uncorrected results. The selection correction term (the Inverse Mills Ratio) is statistically significant, suggesting that there is a problem of selection bias in the OLS results presented previously. Comparing the OLS estimates for the returns to non-formal and formal learning with and without the correction confirms that, not correcting for sample selection, biases up the relationship between non-formal and formal training and hourly wages. The returns to non-formal training drop by about one percentage point when the correction is implemented. A similar reduction applies to the coefficient on formal training. Informal learning is mostly unaffected by the correction, associated with about 3% increase in hourly wages with or without the correction. Overall, qualitatively, the results are not affected by the correction in a major way. However, in the corrected model, the inclusion of informal

learning has a bigger impact on the relationship between non-formal training and wages, reducing it by about one percentage point (not shown).

Table 4.5. Returns to formal, non-formal, informal training, correcting for sample selection

OLS regression results, including a Heckman Correction term

	OLS without correction	OLS model with Heckman correction
Formal training	-0.031*	-0.045***
Non-formal training	0.125***	0.112***
Informal learning	0.033***	0.035***
Inverse Mills Ratio		-0.089**
Country dummies	Yes	Yes
Observations	83578	70956
R squared	0.5820	0.5795

Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. Proficiency in literacy is measured on a 500-point scale but is divided by 10 for presentational purposes. The same controls as Table 4.4 are included in the model but not shown. Significance levels as follows: * p < .1, ** p < .05, *** p < .01.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

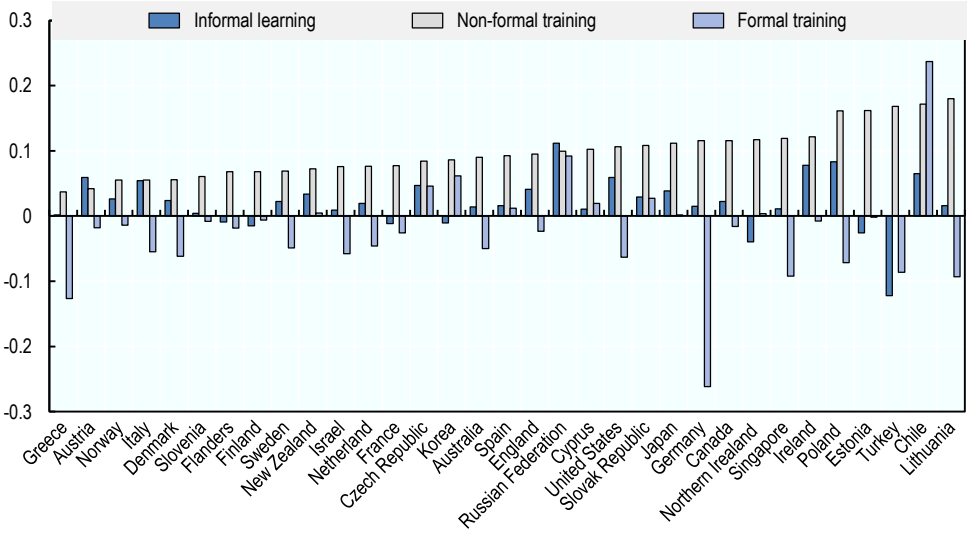
4.4. Heterogeneous returns to training

120. In this section, returns to formal, non-formal and informal training are compared across countries, and across key individual, job and firm characteristics. To do so, the model presented in section 4.3.3 is re-estimated by splitting the sample into the relevant groups.

121. Estimated returns to non-formal training are largest in Chile, Estonia, Ireland, Lithuania, Poland and Turkey and lowest in Greece and Austria (Figure 4.19). The picture is different for informal learning in the workplace: some of the lowest returns (negative) are found in countries where non-formal training has the highest returns internationally such as Turkey and Estonia; while countries with very low returns to non-formal training (notably, Italy and Austria) have relatively large returns to informal learning. In many countries, returns to formal training are negative, in line with the negative correlation overall.

Figure 4.19. Returns to training by country

OLS coefficients, from country-specific regressions



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. The same controls as Table 4.4 with the addition of a Heckman Correction term are included in the model.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

122. Returns to non-formal and informal learning are highest for tertiary-educated workers and this is also the case for the returns to formal training which are least negative for the highest educational attainment group (Figure 4.20). Returns to non-formal training are higher for female workers while returns to informal learning are highest for male workers (Figure 4.21). Splitting the sample by age group, older workers are those benefiting the most from informal learning, followed by prime-age workers and then youth. On the other hand, there is no difference in returns to non-formal training between older and prime-age workers while returns for youth are significantly lower (Figure 4.21).

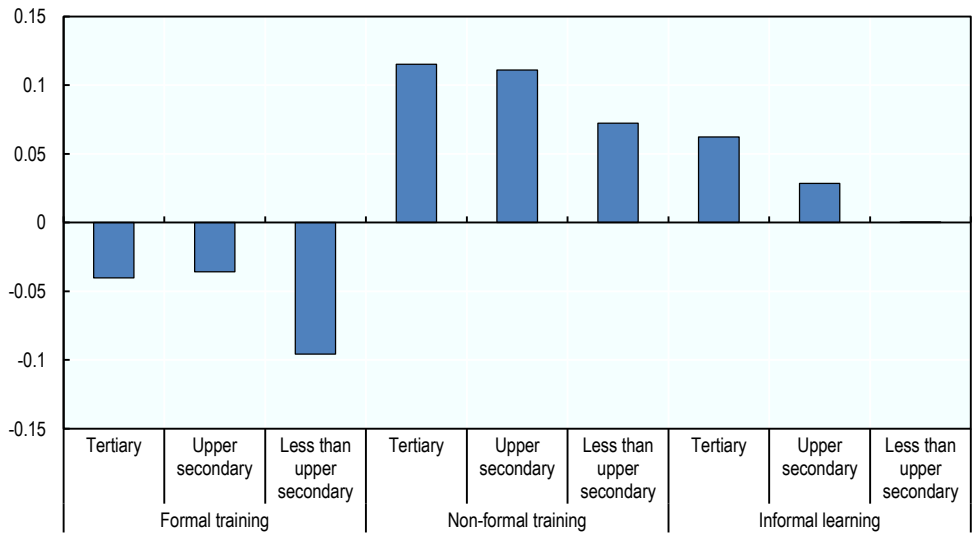
123. Returns by tenure are interesting because it could be argued that training is particularly needed – hence, valuable – for new hires. Returns to non-formal training decline with tenure past the first year in a new job. This is interesting when seen in conjunction with the incidence of non-formal training which, on the other hand, increases with tenure on the job (Figure 4.22). Returns to informal learning do not vary as much by tenure, falling from 7.5% among workers with 2-5 years of tenure to about 6% for workers with 11 or more years of tenure. [23] Hence, returns are the highest for low-tenured workers who are also those who learn the most informally.

124. Another interesting finding is that returns to informal learning are larger in environment where High Performance Work Practices are applied frequently (Figure 4.23), while the opposite is true for non-formal training. This suggests that HPWP may amplify the benefits of informal learning at work, either because of the type of learning that workers receive or because workers have more opportunities to turn what they learn into immediate use thanks the increased flexibility in organising their own work.

[23] Note that returns for workers with 0-1 and 6-10 years of tenure are not statistically significant.

Figure 4.20. Returns to training by educational attainment

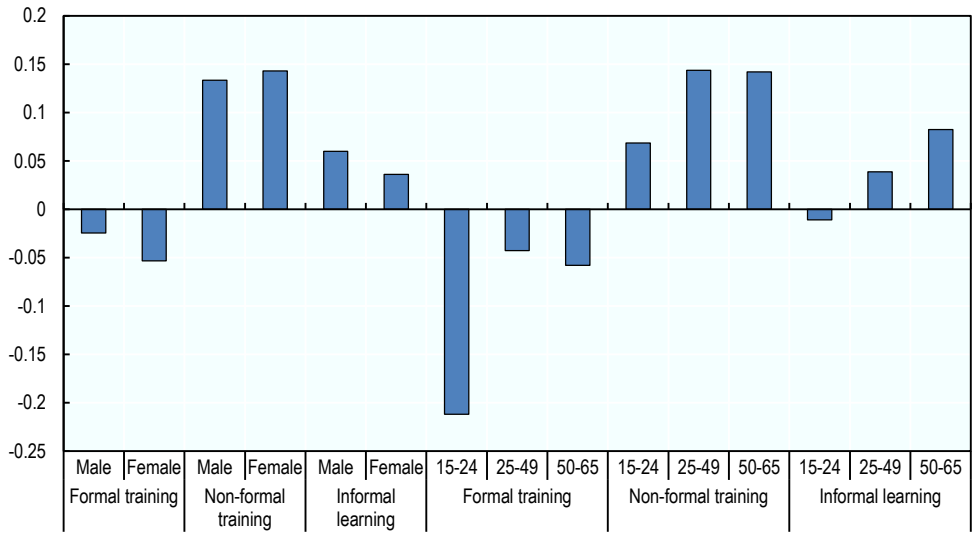
OLS coefficients, from separate regressions by educational attainment



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. The same controls as Table 4.4 with the addition of a Heckman Correction term are included in the model.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

Figure 4.21. Returns to training by gender and age

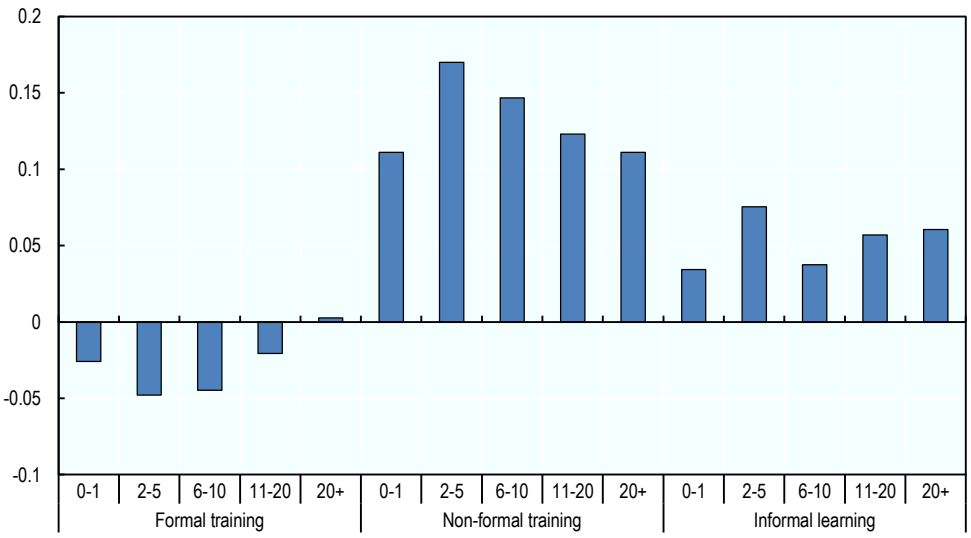
OLS coefficients, from separate regressions by gender and by age



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. The same controls as Table 4.4 with the addition of a Heckman Correction term are included in the model.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

Figure 4.22. Returns to training by job tenure

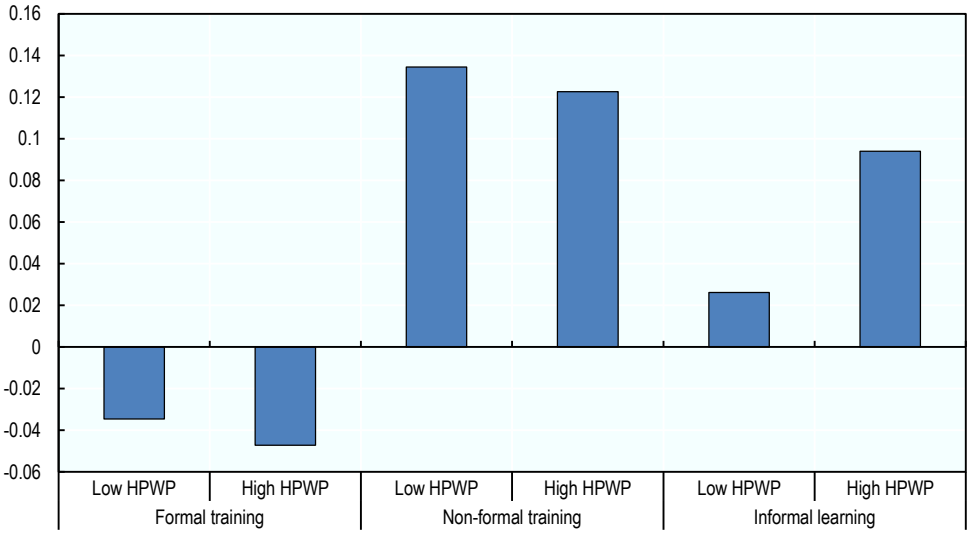
OLS coefficients, from separate regressions by job tenure



Note: Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. The same controls as Table 4.4 with the addition of a Heckman Correction term are included in the model.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

Figure 4.23. Returns to training, by High Performance Work Practices use

OLS coefficients, from separate regressions in jobs with frequent use of HPWP



Note: High frequency of HPWP refers to values of HPWP above the top 25th percentile of the pooled distribution. The remainder observations are labelled as low frequency HPWP. Job-related formal and non-formal training are computed based on workers who report that the latest training activity was job-related. The same controls as Table 4.4 with the addition of a Heckman Correction term are included in the model.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015).

5. The link between different types of training and labour productivity

125. The focus of this section is the impact of training participation on labour productivity at the sector level. For this purpose, labour productivity at the country-sector level (28 countries-14 sectors) is computed from the STAN database and merged with PIAAC data on training incidence and intensity. The wage analysis presented in the previous section is repeated using average wages at the sector level, as a benchmark for the productivity results.

126. As discussed in Section 2.2.2, returns to productivity are generally found to be higher than wage returns. For instance, learning informally might result in only modest wage increases (as it is hidden), but would yield higher productivity gains for those employers who foster it.

5.1. Descriptive analysis

127. From the STAN database, labour productivity is computed using value added per hour worked.[24] Hourly wages for each industry/country cell from PIAAC are also computed to allow comparing the wage and productivity returns to different forms of training. [25] The correlation between productivity and all forms of training is positive and significant, as is the case for the correlation between wages and training (Table 5.1 and Figure 5.1). The correlations are the strongest for non-formal training. Formal and non-formal training are more strongly correlated with wages than with productivity, but the opposite holds for informal learning.

Table 5.1. Correlation between productivity, wages and training incidence

Pairwise correlation coefficients

	Value added per hour worked (log)	Hourly wages (log)
Formal training	0.209***	0.381***
Non-formal training	0.452***	0.597***
Informal training	0.415***	0.373***

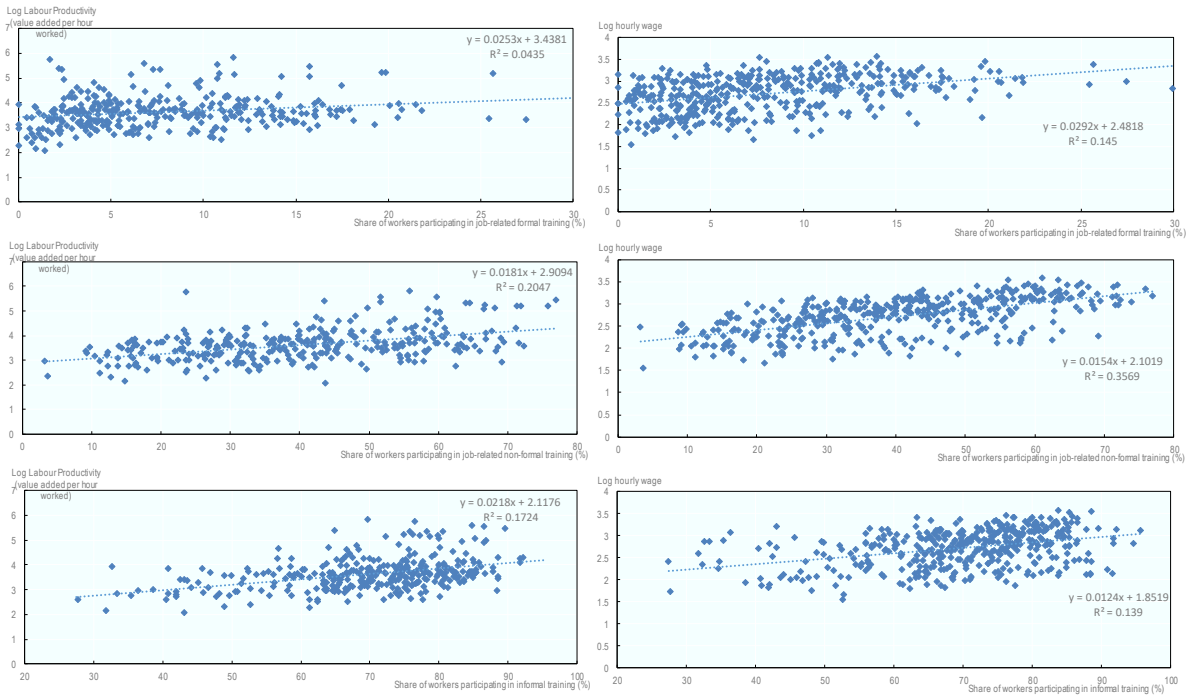
Note: All countries and industries for which valid information on productivity, wages and training is available are included in the correlation analysis. Significance levels as follows: * p < .1, ** p < .05, *** p < .01.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015) and the OECD STAN database.

[24] This choice is dictated by the need to compare hourly returns to hourly costs in the cost-benefit analysis carried out in the next section. However, similar results are obtained when using value-added per worker.

[25] The wage distribution is trimmed to exclude the top and bottom percentiles.

Figure 5.1. Productivity, wages and the incidence of formal, non-formal and informal training

Plotted observations refer to industry/country cells



Note: All countries and industries for which valid information on productivity, wages and training is available are included in the scatterplots.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015) and the OECD STAN database.

5.2. Multivariate analysis of the relationship between productivity and training

128. The simple correlations presented above fail to control for other factors affecting wages and value-added. To isolate the relationship between training participation, wages and value-added per hour worked, the following regression specification for country *c* and industry *i* is used:

$$ln(prod_{ci}) = \alpha + \beta_1 Formal_{ci} + \beta_2 Nonformal_{ci} + \beta_3 Informal_{ci} + \sum_j \rho_j X_{ci}^j + \gamma_c + \delta_i + \varepsilon_{ci}$$

The correlates of interest are the share of workers who have participated in training (formal, non-formal and informal) or, alternatively, the number of training hours (non-formal and informal). The control variables, X_{ci}^j, are: age groups (5), tenure groups (5), occupation groups (5), skill groups (3), education groups (3), share of women, share of SMEs, share of atypical contracts, share of private sector workers, share of workers in growing firms, log average hours per worker, log capital per worker.

129. OLS regression results in Table 5.2 confirm the positive relationship shown in Figure 5.1 between informal learning and productivity and wages. The correlation between informal learning and value-added per hour worked is much larger than for wages, both

when simply looking at participation in informal learning and when taking into account the intensity of learning. A 10 percentage point increase in the incidence of informal learning brings about a 5% rise in productivity and a 3% rise in wages. On the other hand, no relationship is found between formal or non-formal learning and productivity or wages once controls are included for workforce composition, firm characteristics, hours per worker and capital per worker.

Table 5.2. Relationship between productivity, wages and training

OLS coefficients

Share of workers in:	Value added per hour worked (log)	Value added per hour worked (log)	Value-added per hour worked (log)	Hourly wages (log)	Hourly wages (log)	Hourly wages (log)
Formal training	-0.001	-0.002	-0.004	0.001	0.000	-0.000
Non-formal training	-0.002	-0.003		0.000	-0.000	
Informal learning		0.005*			0.003***	
Hours of non-formal training			-0.001			0.000
Hours of informal learning			0.001**			0.000**
Ln hours/worker	-0.755**	-0.828***	-0.786***	-0.352***	-0.388***	-0.393***
Ln capital/worker	0.246***	0.241***	0.233***	0.021*	0.019	0.021*
Workforce composition	Yes	Yes	Yes	Yes	Yes	Yes
Firm and contract type	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.66	0.66	0.64	0.95	0.95	0.95
Observations	304	304	290	337	337	323

Note: Workforce composition controls include: the share of women and the share of workers in age groups, tenure groups, occupation groups, numeracy proficiency groups and educational attainment groups. Firm and contract type controls include: the share of SMEs, share of atypical contracts, share of private sector workers, and the share of workers in growing firms. Significance levels as follows: * p < .1, ** p < .05, *** p < .01.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015) and the OECD STAN database.

130. Productivity shocks can have an impact on training decisions, making participation in formal and non-formal training potentially endogenous. To correct for this, formal and non-formal training participation are instrumented using a similar set of variables to those used in the Heckman Correction Model for individual returns to training (attitudes to learning, the use of skills in everyday life, both averaged across individuals in each industry/country cells) as well as training requirements derived from the O*NET survey.[26] While attitudes to learning, skill use and training requirements of occupations can be expected to have a direct impact on training participation, they are likely to be uncorrelated with productivity and wages. Therefore, these variables can be used as instruments for training participation to deal with the endogeneity issue.

131. When informal learning participation is measured in hours of involvement, the instrumental variables (IV) results confirm a positive relationship between informal learning and value added of about twice the size as the relationship between informal learning and wages. On the other hand, when using the incidence of informal learning to measure participation, the effects of informal learning on productivity and wages are

[26] Experience requirements derived from O*NET are compiled using occupation-specific information on: "Need for on-the-job training", "Need for on-site training", "Health and safety requirements".

roughly the same. In these IV specifications, the magnitude of the non-formal learning association with productivity and wages is similar to that found in the literature, although not statistically significant. More generally, the relationship between training (of all forms) and productivity or wages appears to be positive once formal and non-formal learning are instrumented to correct for endogeneity but few coefficients are statistically significant.

Table 5.3. Relationship between productivity, wages and training, controlling for endogeneity

Instrumental Variable estimates

Share of workers in:	Value added per hour worked (log)	Value added per hour worked (log)	Value added per hour worked (log)	Hourly wages (log)	Hourly wages (log)	Hourly wages (log)
Formal training	0.039	0.041	0.047	0.018	0.017	0.021
Non-formal training	0.005	0.011		0.007	0.005	
Informal learning		0.001			0.001	
Hours of non-formal training			0.012			0.004
Hours of informal learning			0.001			0.000
Ln hours/worker	-0.829**	-0.933**	-0.727**	-0.434***	-0.429***	-0.332**
Ln capital/worker	0.246***	0.242***	0.247***	0.022	0.022	0.031**
Workforce composition	Yes	Yes	Yes	Yes	Yes	Yes
Firm and contract type	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.23	0.18	-0.07	0.08	0.16	-0.02
Observations	304	304	290	337	337	323

Note: Workforce composition controls include: the share of women and the share of workers in age groups, tenure groups, occupation groups, numeracy proficiency groups and educational attainment groups. Firm and contract type controls include: the share of SMEs, share of atypical contracts, share of private sector workers, and the share of workers in growing firms. Instruments include: average attitudes to learning, average use of skills in everyday life and average on-the-job and on-site training requirements and average health and safety requirements. Significance levels as follows: * $p < .1$, ** $p < .05$, *** $p < .01$. The F-statistics show that the instruments are strong for non-formal learning, but not for formal learning. The Sargan test shows that are over-identifying restrictions are valid.
Source: OECD Secretariat calculations based on the Survey of Adult Skills, PIAAC (2012, 2015) and the OECD STAN database.

132. Overall, the results from this productivity analysis confirm that training has a positive effect on productivity and that this effect is stronger than the effect on wages. Therefore, training does not only benefit workers through higher wages, but also the employers because of increased labour productivity. While the analysis at the sector level provides interesting preliminary results, ideally this analysis should be reproduced using firm-level data to better assess the link between firm-level productivity and the participation of employees in training activities. Unfortunately, firm-level datasets that have information on productivity as well as participation in different types of training are rare.

6. Linking returns to costs: A cost-benefit analysis

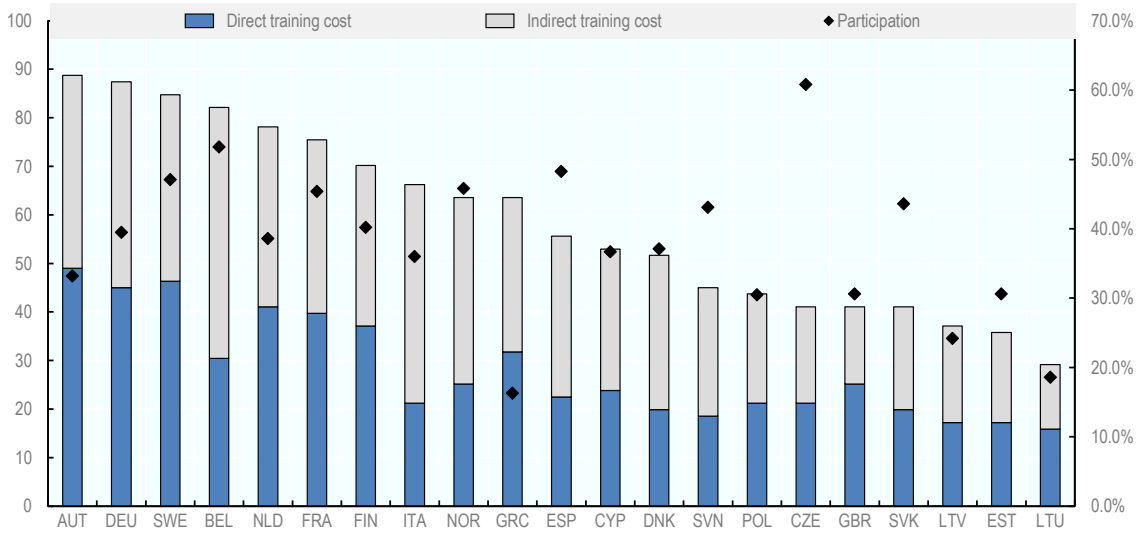
133. In this final section, the costs of training are compared to its returns in terms of productivity gains to assess incentives for firms to invest in training. Both non-formal and informal training are taken into account while the calculation is not possible for formal training for which data on costs is not available.

6.1. Summary statistics

134. Hourly training costs vary significantly across countries (Figure 6.1). This is the case for indirect costs, where the differences would reflect varying unit labour costs, and for direct training costs, which are likely more related to differences in the cost of living across countries, but potentially also differences in training quality. Overall training costs are highest in Austria, Germany, Sweden (but also Belgium and the Netherlands) – all countries with a long tradition of vocational training – and lowest in eastern European countries such as Estonia, Latvia and Lithuania. Overall, there does not seem to be any correlation between the cost of training provision and actual training participation.

Figure 6.1. Hourly training cost and training participation, by country

Training costs in USD PPP (left-hand scale) and CVT training participation (right-hand scale)

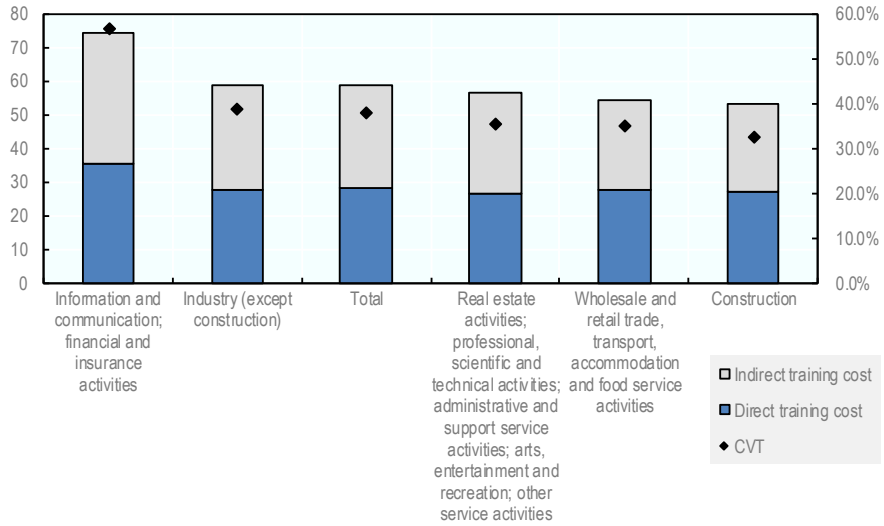


Source: EU-CVTS 2010.

135. On the other hand, there is not much variation in hourly training costs across four of the five sectors covered by EU-CVTS. Only in the ICT and finance sector, are costs and participation significantly higher than in the other sectors.

Figure 6.2. Training cost per hour of training and participation, by sector

Training costs in USD PPP (left-hand scale) and CVT training participation (right-hand scale).



Notes: Data refer to the unweighted average across countries
Source: EU-CVTS 2010.

6.2. Scatterplots and correlations

136. In addition to reflecting different price levels for training inputs across countries, higher direct costs per hour of training can also be seen a proxy for better training quality. This argument seems to be supported by the positive correlation between direct training cost and labour productivity (see Table 6.1 and Figure 6.3). A positive correlation is also observed between indirect costs on the one hand, and productivity on the other. This is likely to reflect some degree of endogeneity as the most productive workplaces would pay higher salaries. Finally, Table 6.1 and Figure 6.3 also show a positive correlation between participation in CVT courses and labour productivity, which is consistent with the evidence presented in section 5.

Table 6.1. Correlation between training costs, training participation and labour productivity

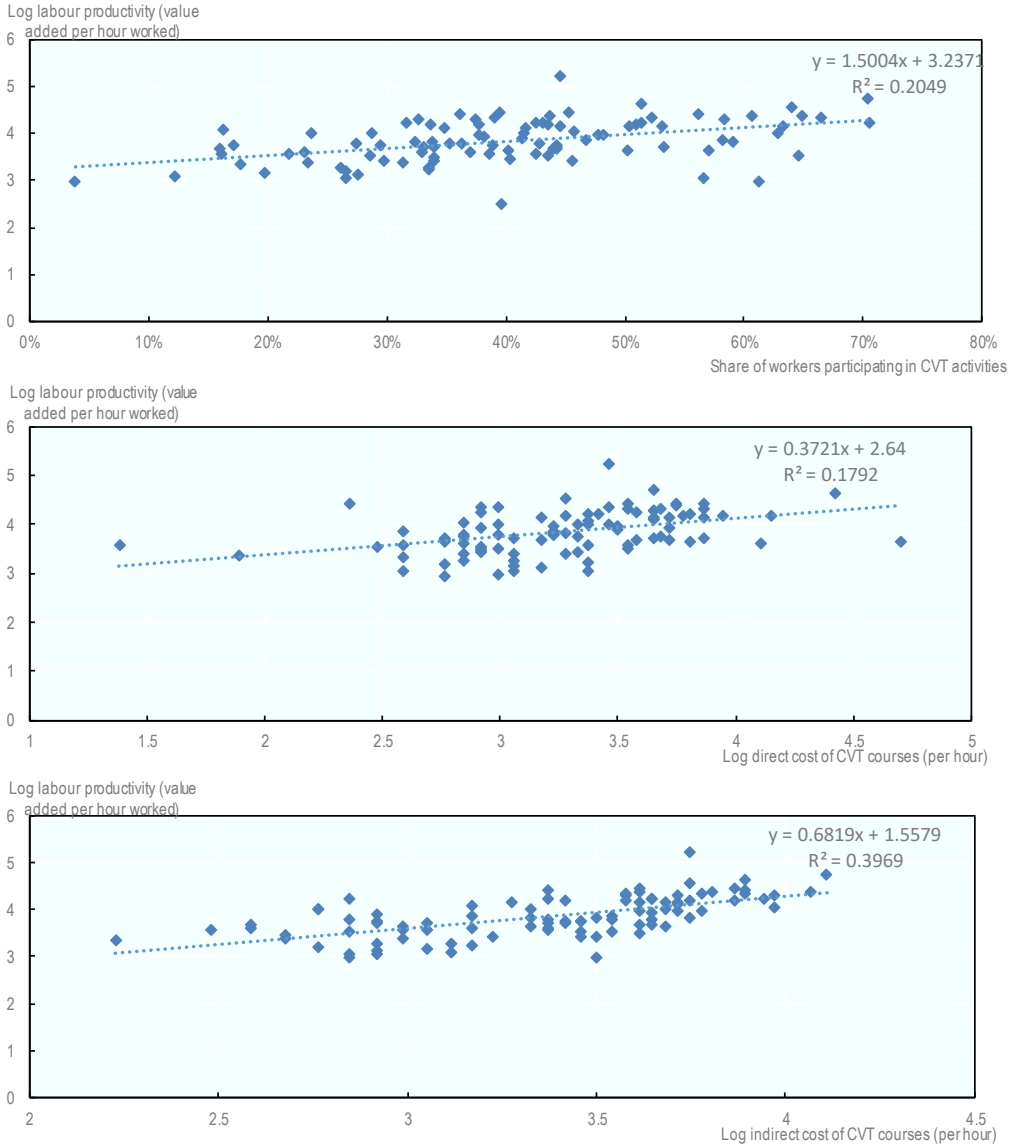
Pairwise correlations

	Value added per hour worked (log)	
Direct cost	0.423	***
Indirect costs	0.630	***
Direct and indirect cost	0.602	***
Share of workers participating in CVT activities	0.4723	***

Source: OECD STAN and EU-CVTS 2010.

Figure 6.3. Labour productivity, training participation and training costs

Logarithm of value added per hour worked, share of workers participating in CVT training, logarithm of cost per hour of training

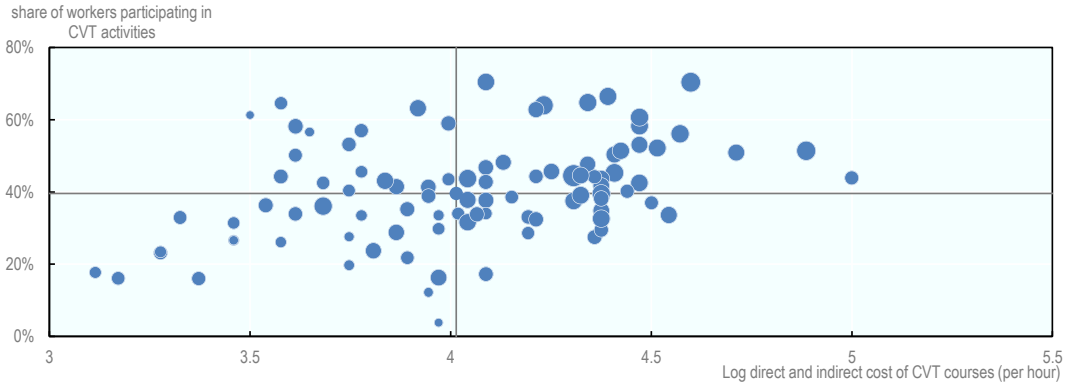


Source: OECD STAN and EU-CVTS 2010.

137. Further descriptive analysis shows how sector/countries that experience both high participation in CVT training and high spending on training per hour are generally the most productive ones (i.e. larger bubbles in Figure 6.4). However, these simple descriptive statistics do not allow drawing any causal conclusions.

Figure 6.4. The most productive sectors train more and spend more on training

Value added per hour worked (bubble size), share of workers participating in CVT training and logarithm of training cost per hour



Note: Each bubble represents a country-sector, and its size is proportional to the value added per hour. The horizontal and vertical lines represent the unweighted average participation and cost across country-sectors. Cost and productivity are expressed in PPPs.
Source: OECD STAN and EU-CVTS 2010.

6.3. Comparing costs and benefits of training

138. The monetary benefits to the firm of increase training participation are computed using the estimated returns of training on productivity presented above. These benefits are then compared to the average cost of training derived from EU-CVTS to gauge the net return to employers' investment in training.

6.3.1. Non-formal training

139. The total cost of one hour of CVT courses is derived from the EU-CVTS survey, as shown in Figure 6.1, to include both direct costs (e.g. fees and payments for CVT courses and training centres) and labour costs (i.e. the opportunity cost of training participation). The total cost of increasing the average hours of non-formal training by one equals the cost of one hour of training multiplied by the number of workers. However, for ease of interpretation, the cost is expressed per worker (by dividing by average employment).

140. The benefits of one extra hour of non-formal training are calculated using the estimated coefficient from the productivity regression presented in Table 5.3 (column 3). The variable of interest is the average number of hours of non-formal training. As indicated above, the analysis further includes controls for participation in formal training, hours of informal training, and additional controls for workforce composition, firm and contract type, as well as hours and capital per worker. The coefficient measures by how much (in percentage), the value added per hour worked increases following a one unit increase in hours of non-formal training. The total additional value added is calculated by multiplying the coefficient (β_2) with average value added per hour worked and average hours. For ease of interpretation, the benefit is expressed per worker (by dividing by average employment).

141. The comparison between costs and benefits per workers require some assumptions on how long the benefits of training are likely to last. Using *annual* value added per worker,

under the implicit assumption that the benefits will be felt throughout the year, yields benefits that largely surpass the costs. Every hour of training, at an average cost of 59 USD provides the employer with an increase in value added of just over 1% equivalent to a benefit of approximately 942 USD over one year of work. Using this unit cost and value-added return, employers would break even – the point where the cost of the additional hour of training equals the benefit it yields in increased value added – after just under 16 working days of improved performance.

6.3.2. Informal training

142. Given that informal learning is unorganised and happens while working, one could argue that there is no cost involved as the worker learns informally while performing his/her job. To use a conservative assumption, the cost of informal learning is set at half of the labour cost per hour derived from EU-CVTS, assuming that learning by doing slows workers down significantly.

143. The benefits of one extra hour of informal training are calculated using the estimated coefficient from the productivity regression presented in Table 5.3 (column 3). The coefficient on the informal learning variable measures by how much (in percentage) the value added per hour worked increases following a one unit increase in hours of informal training. The total additional value added is calculated by multiplying the coefficient (β_3) with average value added per hour worked and average hours. For ease of interpretation, the benefit is expressed per worker (by dividing by average employment).

144. As for non-formal learning, the comparison between costs and benefits per workers requires an assumption on how long the benefits of training are likely to last. Using *annual* value added per worker, the benefits largely surpass the costs but by less than it is case for non-formal learning. On average, across the countries included in the analysis, every hour of informal learning, at an average cost of 15.5 USD provides the employer with an increase in value added of just about 0.1% equivalent to a benefit of approximately 55 USD over one year of work. Under this conservative assumption that workers are significantly slow-down in their performance when learning informally, Employers would break even after just over 71 working days of improved performance. The net benefits of informal learning could be far higher than this if workers were assumed to be performing their task as normal while learning on the job.

6.3.3. Investment in training and productivity returns: a sectoral perspective

145. The key strength of EU-CVTS data stands in the information it provides on the incidence of training as well as the financial resources that firms invest in it. Squicciarini, Marcolin and Horvát (2015[49]) exploit this information to compute investment in CVT training by sector. This investment can be compared to returns at the sector level to get a sense of how the overall costs compare to benefits in terms of value-added per hour worked. To compute training returns to productivity at the sector level exploiting STAN data, sectors are aggregated into three categories: industry, low-skilled service sectors and high-skilled service sectors. The results are presented in Figure 6.5.

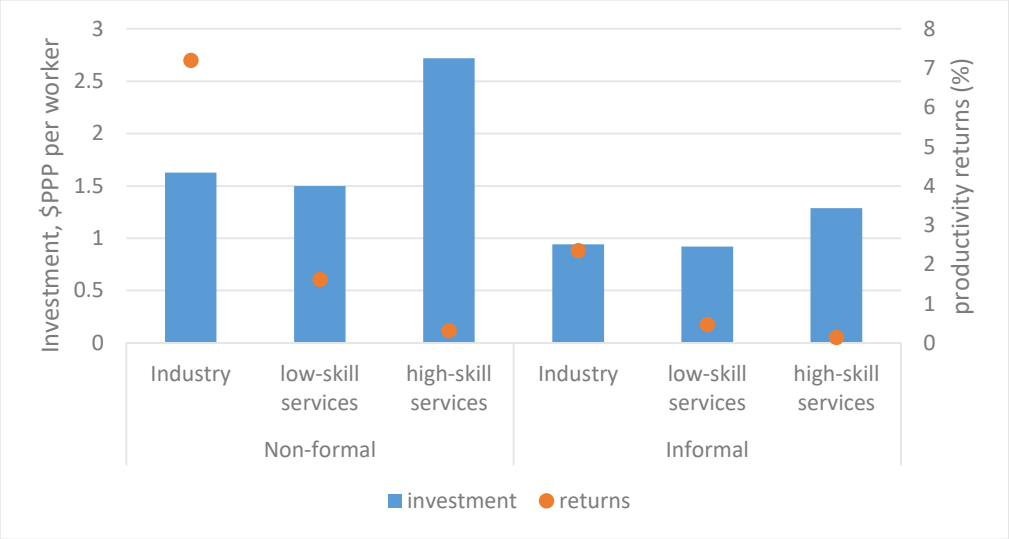
146. Investment in training is the highest in high-skilled services where returns are particularly small although not statistically significant.[27] On the other hand, firms in

[27] Lower productivity returns to training could be due to the difficulty of measuring productivity in the service sector.

industry and construction do not invest as much in training but reap significant returns from it. Both the patterns of returns and of investments at consistent for non-formal and informal learning. Using the same methodology as above to compute the costs and benefits of training yields a very large gain in industry and construction and a relatively large gain in low-skilled services. The gain is positive but smaller and not statistically significant for firms in high-skilled services.

Figure 6.5. Total investment in training and productivity returns, by sector

US Dollars (PPP) and percentage increase in wages for each training hour



Note: Productivity returns refer to the IV coefficient estimated similarly to column 3 of Table 4.5. Investment in training are adapted from Squicciarini, Marcolin and Horvát (2015[50]).
Source: OECD STAN and EU-CVTS 2010

7. Conclusions and policy implications

147. This study has exploited several data sources – notably PIAAC, OECD STAN, the EU-AES and the European EU-CVTS – to describe the incidence of and returns to formal, non-formal and informal learning. While formal training is found to be paid for by workers in the form of lower wages, both non-formal and informal learning yield significant returns, for individuals (in the form of higher wages) and for employers (in the form of higher labour productivity). Wage returns to participation in non-formal training are about 11% and participation in informal learning is associated with 3.5% higher wages. Returns in terms of labour productivity are over two times as large as returns on wages. Even accounting for the cost of providing training, the benefit to employers is extremely large compared to the cost.

148. Unfortunately, the type of workers that stand to benefit from informal learning are still the best educated, the young, those working in full-time job and in large and growing firms in the private sector. In other words, those who are also more likely to participate in non-formal learning. Some degree of "compensation" – i.e. participation in informal learning for workers who stand little chance of attending non-formal training – is found only for some groups, notably workers in non-standard forms of employment and workers with low-skills, ceteris paribus.

149. The findings in this paper on the magnitude and relevance of informal learning underscore the importance of improving the learning culture in the workplace as a means of fostering human capital development in firms. High performance work practices are shown to encourage informal learning and increase its returns, possibly through more opportunities to apply what has been learnt. This is in line with the economic literature on high-performance workplaces that suggests that delegating responsibility to autonomous problem-solving teams and creating jobs with a wide range of tasks and frequent job rotation can improve worker performance through informal learning and greater involvement in the firm.

150. Another approach would be to encourage informal learning by recognising the time and resources that firms invest in it. Proving workplace mentoring and support to learn by doing can be burdensome for firms, especially small ones, and some countries have acted to allow employers to use funding normally destined for formal and non-formal training to support informal learning efforts financially. This is the case for the "learning in a work setting" (*Formation en situation de travail*) in France which SMEs can fund using the training levy paid by employers for training provision more generally.

151. From the policy point of view, more could be done to foster this learning culture by encouraging innovative human resource management practices. Most initiatives in this area have focused on: *raising awareness* of the beneficial role that high performance work practices can play in fostering a learning culture and a better use of skills at work; *disseminating good practice* and creating opportunities for knowledge transfer and for sharing expert advice; and identifying *role models*. Because it is unrealistic to expect government to help every firm to improve their work organisation and job design, initiatives have often supported the development of high performance work practices in a limited number of businesses and then used these for *demonstration effects*. At the same time, countries can develop *diagnostic tools* to help companies identify bottlenecks and measures that will promote a better use of the skills of their workforce. When resources are

scarce, it is also important to make sure that interventions are well *targeted*. In particular, because smaller employers are less likely to implement these practices and may find it more difficult/costly to adopt them, it is important to target interventions on small and medium enterprises (SMEs) with growth potential. *Tax policy* can be leveraged to incentivise and support firms in adopting high performance work practices, especially considering that some firms may not have the incentive or financial capacity to promote workplace innovation.

152. A second policy implication of this work is that while employers reap significant benefits from their workers engagement in non-formal and informal learning, from a worker's perspective, a disadvantage of these forms of training is that the skills they help acquire or strengthen are less evident to other employers. This makes non-formal and informal learning less valuable in the labour market.

153. Formal certification could improve the visibility of workers' human capital gains in the labour market. Several countries have launched initiatives to recognise acquired competencies or to validate non-formal and informal learning. Such efforts are an attempt to increase labour market transparency with respect to workers' informally acquired skills by certifying competencies acquired through informal learning in the workplace.

154. However, formal recognition programmes are often very burdensome for the users. They could also make firms more hesitant to invest in the informal learning of their employees, because firms might lose the competitive advantage they gain from having more information on the productive skills of their employees than competing firms. Information is also crucial. While many countries have a system of recognition of prior learning (RPL) in place, it is often used relatively little. This is for example the case in Romania, where authorised evaluation centres are in charge of evaluating and certifying skills obtained to non-formal and informal learning. The service is free for job-seekers, but seems to be relatively unknown or unattractive, as only around 80 job-seekers participated in an RPL procedure in 2017.

155. To be effective, the recognition of prior learning must be transparent, streamlined and ensure the buy-in of all relevant stakeholders, including employers and education and training providers. The Portuguese Qualifica Programme includes the creation of a credit-based system for professional training in line with European frameworks; '*Passaporte Qualifica'*, an online tool for the recording of qualification and competences; and the establishment of a network of 300 Qualifica centres. Qualifica centres provide services related to information, guidance, as well as the recognition, validation and certification of skills free of charge. In France, the social partners have developed a system for the recognition of soft/basic skills, the so-called CLéA or Centificate of Professional Knowledge and Competences.

156. Finally, this work underscores the importance of collecting high-quality information on training participation by adults, training provision by firms and the respective costs and benefits. The unavailability of information on value-added per hours worked in conjunction with information on training investments is a particularly sore point. If measures of productivity were collected directly in the EU-CVTS or merged in from administrative sources, a more precise analysis of the importance of training for employers would be possible, yielding valuable insights for policy makers and employers themselves.

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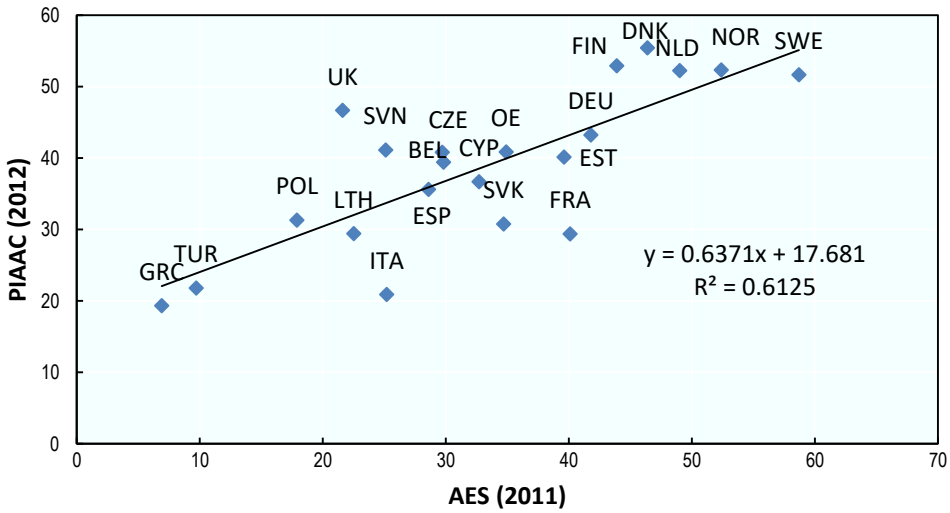
Annex A. Comparing PIAAC and AES adult learning measures

Figure A A.1. Correlation between AES (2011) and PIAAC (2012) incidence of job-related non-formal training

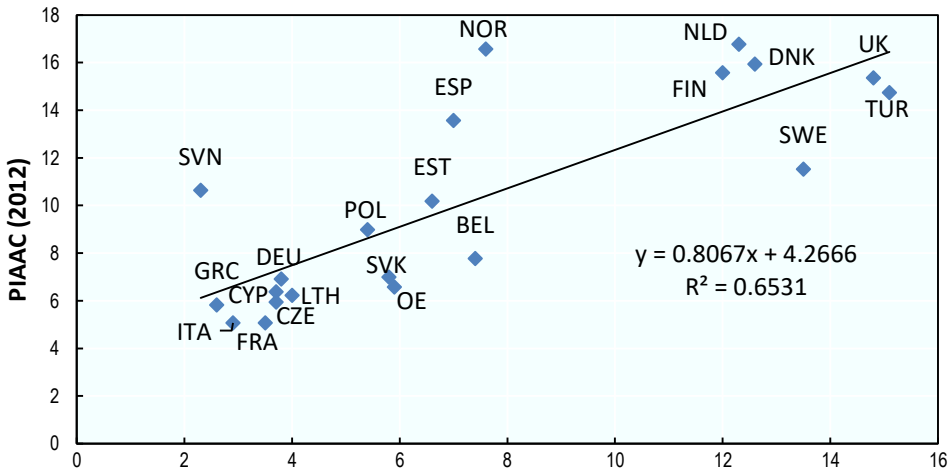
Incidence of job-related non-formal training



Note: The correlation is statistically significant at the 1% level.
Source: Adult Education Survey (2011) and Survey of Adult Skills (PIAAC) (2012).

Figure A A.2. Correlation between AES (2011) and PIAAC (2012) incidence of formal training

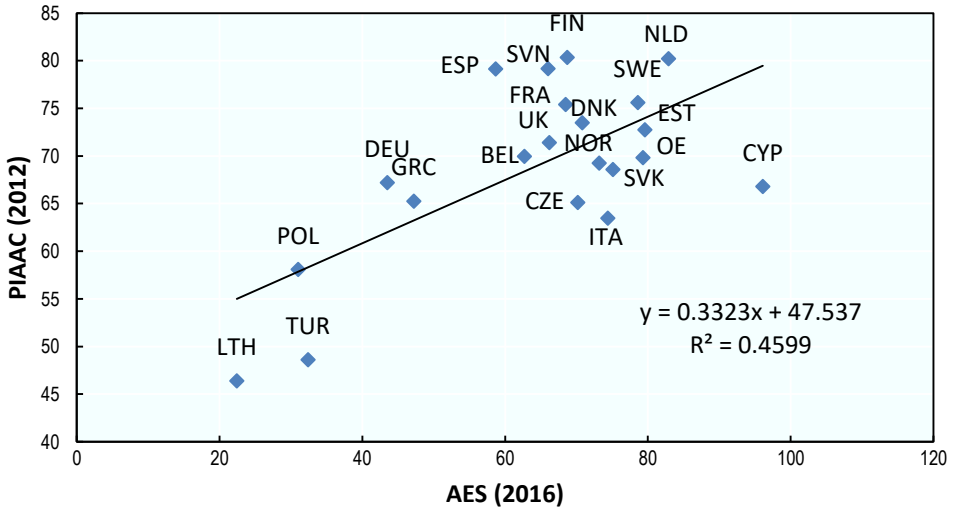
Incidence of formal training



Note: Data in the figure are not restricted to formal learning that is job related because job-relatedness is not assessed in AES for formal training. The correlation is statistically significant at the 1% level.
Source: Adult Education Survey (2011) and Survey of Adult Skills (PIAAC) (2012).

Figure A A.3. Correlation between AES (2016) and PIAAC (2012) incidence of informal learning

Incidence of informal learning



Note: Informal learning is measured differently in PIAAC (work related activities) and AES (everyday life activities). In addition, informal learning was not measured in 2011 so the 2016 incidence is used in the figure. The correlation is statistically significant at the 1% level.
Source: Adult Education Survey (2016) and Survey of Adult Skills (PIAAC) (2012).