

HOW DO FIRMS' AND INDIVIDUALS' INCENTIVE TO INVEST IN HUMAN CAPITAL VARY ACROSS GROUPS?

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Introduction

1. Education and training have a significant impact on output growth and individual welfare (OECD, 1994, 1999a, 2001). Although early childhood education must remain a policy priority to foster growth in the long-run, in 10-15 years from now, the bulk of the labour force will be still represented by individuals who are currently in the labour market. The education and training they receive after having started their working life is therefore crucial for output growth as well as individual career prospects.

2. There is a lively debate, however, concerning whether the current level of investment in training is adequate. Furthermore, past research has shown that training opportunities are unequally distributed across workers, with workers who are already in a better position in the labour market having more opportunities to acquire new skills. To remedy these problems, policy innovations – intended to improve training outcomes – have been experimented in OECD countries in recent years. Nevertheless, some implementation problems have sometimes accompanied the introduction of these innovations, usually because the factors behind inadequate training outcomes have not been addressed properly. The purpose of this paper is therefore twofold: a) to identify the reasons behind possible under-provision of training and inequality of outcomes; and b) to discuss policy approaches, by mapping each policy instrument into the potential problems it can address.

3. The empirical analysis of this paper focuses on employer-sponsored continuous vocational training (CVT) – *i.e.* that firms provide or pay for, at least partially. This is done for two reasons. On the one hand, CVT accounts for the largest share of education and training of the adult workforce in all OECD countries. On the other hand, CVT is closely related to the labour market and therefore must be analysed separately from the market for formal education.

4. The first section of the paper provides further evidence of inequality in training participation and intensity across different labour market groups. The second section looks at the evidence of under-provision of training, as well as at the determinants of uneven training incidence. It also presents econometric evidence of training supply and demand effects for different groups. The last section draws some final conclusions.

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1. Continuous vocational training in OECD countries: a closer look at the data.

5. According to the International Adult Literacy Survey (IALS),¹ there is substantial cross-country variation in the incidence and intensity of employer-sponsored CVT courses (that is formal CVT that firms provide or pay for, at least partially).² Training intensity and participation rates are greatest in the Nordic countries, the United Kingdom and New Zealand, and lowest in a number of European countries (Table 1). On average, 26% of employed persons participate in employer-sponsored CVT each year with an annual training intensity of 18 hours per employee, *i.e.* equivalent to two and a half working days. These figures imply that, on average, each participant receives about 68 hours of training per year, that is slightly less than nine working days. The country with the highest CVT intensity per employee (as well as the highest participation rate) is Denmark where employees receive on average 36 hours per year of employer-sponsored CVT, which translates into 81 hours per participant per year or about two working weeks.

6. Other studies have highlighted the fact that training provision is unequal across demographic and socio-economic groups (*e.g.* OECD, 1999b, and Ok and Tergeist, 2002). CVT may have the perverse effect of increasing inequalities between different worker groups if those already having greater earnings or employment security receive more training. Chart 1 shows the incidence and intensity of employer-sponsored CVT by gender and age. There does not appear to be any significant difference in participation rates by gender. Nevertheless there is a clear gender-training gap in terms of intensity, with women receiving on average 17% fewer hours of training than men.

7. The incidence of training tends to decline with age. In particular, the average training participation rate of workers aged 56 to 65 years is about three-quarter of that of prime-aged workers (aged 36 to 45 years). The participation profile is flatter at younger ages. However, the inverse correlation between age and training is more clear-cut when measured in terms of training intensity. On average, workers aged 56 to 65 years receive 12 hours of CVT courses per year, against 18 hours for workers aged 35 to 45 years and 21 hours for workers aged 26 to 35 years.

8. Likewise, training participation and intensity differ considerably across educational and occupational groups (Chart 2). Participation in low-skilled occupations (13%) is about one third of participation in high-skilled occupations (38%). A similar pattern is found between different educational groups (16% for workers with less than upper secondary education against 35% for those having a tertiary degree). The rise in training rates with skill-intensity and educational attainment is particularly steep in Belgium (Flanders), Poland, Hungary and Italy (see Annex 2).

9. The worker's position in the hierarchical ladder has an impact on his/her training opportunities. Chart 2 also shows that employees with a high degree of supervisory responsibility are twice as likely to participate in employer-sponsored training as are employees without any supervisory role. This pattern is more pronounced in terms of training intensity: on average, employees performing non-supervisory functions spend less than one-third as much time on training as employees with great supervisory role. Training incidence is also particularly low in the case of self-employed.

1. Unless otherwise specified, all the data in this paper are from the IALS. Data refer to 1994 for Canada, Ireland, the Netherlands, Poland, Switzerland (German and French-speaking regions), and the United States, to 1996 for Australia, Belgium (Flanders only), New Zealand and the United Kingdom and to 1998 for the Czech Republic, Denmark, Finland, Hungary, Italy, Norway and the Italian-speaking regions of Switzerland. Country rankings as well as discrepancies with the data reported in Table 2 for European countries can be partially ascribed to cross-country differences in the survey years and must be interpreted with great caution.

2. Due to the lack of cross-country comparable data on informal training, the analysis of this paper will focus on formal CVT only. A precise definition of the CVT concept used in this paper is provided in Annex 2.

10. As shown in Chart 2, immigrants are somewhat less likely to participate in employer-sponsored CVT than natives, but the difference is not large (about 5 percentage points).³ Immigrants also receive fewer hours of training on average (16 hours per employee per year, which corresponds to 86% of the training intensity of native workers). However, immigrants receive more employer-sponsored training than natives in Canada and Italy, as well as in the Netherlands (participation rates only) and Australia (training intensity only; see Annex 2).

11. Finally, data on training rates in large and small firms from the European Continuous Vocational Training Survey (CVTS) show that workers in small firms receive less employer-sponsored training than workers in large firms (Table 2).⁴ Except in a few countries (*e.g.* Ireland and the United Kingdom), this gap is even greater when training intensity is taken into account: workers in large firms receive almost twice as many hours of employer-sponsored training as workers in small firms.

12. Bivariate correlations cannot provide a full snapshot of employer-sponsored training provision across OECD countries. To the extent that certain characteristics are correlated (for instance, occupation, education and supervisory role), certain patterns of inequalities in training outcomes might be spurious. In order to correct for such biases, a multivariate analysis has been carried over. The resulting estimates (see Annex 2) seem to broadly confirm the qualitative patterns of inequality discussed above. For example, the probability of receiving employer-sponsored training is estimated to be on average 6 percentage points smaller for immigrants than for natives, and 9 percentage points smaller for workers with less than upper secondary education than for individuals with a tertiary qualification. Furthermore, the overall conclusion remains that important differences in training participation and intensity exist between OECD countries, even after adjusting for a considerable number of characteristics of both workers and their employers.

2. A closer look at the determinants of unequal access to training

13. The above section identifies patterns of unequal training provision across different worker groups. This section examines the source of the inequality and whether the observed patterns are optimal in terms of economic efficiency. More specifically, Section 2.A reviews the empirical evidence on the extent to which various market failures affect training outcomes. However, although their impact differs across worker groups, these market failures do not explain training gaps entirely. For instance, training provision might increase with educational attainment simply because it is more profitable for a firm to train high-educated workers or because high-educated workers are more ready to participate in training courses, due to greater rates of return. Anyway, the effectiveness of each policy instrument intended to improve training opportunities for disadvantaged groups will depend on the source of training inequalities – that is, whether training gaps are due to employers' or employees' behaviours. For this reason, the analysis carried over in Sections 2.B and 2.C tries to identify how employers' supply and employees' demand vary across worker groups. Implications for policy-making are then derived in the conclusions.

3. Note, however, that language courses are included in the CVT measure.

4. There are several reasons why data from the CVTS are more suitable than IALS data for the analysis of training incidence by firm size: (i) employers know better about firm size and employer-sponsored training than employees; (ii) employer-provided CVT courses are more precisely defined in the CVTS; and (iii) intensity figures from the CVTS are more precise (while the IALS is likely to underestimate training intensity, see Annex 2). IALS data are used, instead of the CVTS, in the other tables, because the latter provides no information on socio-economic and demographic characteristics of the recipients (except gender).

A. *Market failures affecting training outcomes*

14. In order to understand the incentives of individual workers and employers to invest in human capital, it is important to make a distinction between firm-specific and general training:

- In principle, the optimal amount of investment in *firm-specific* human capital – *i.e.* those skills that are valuable only at the firm providing them – can be obtained only if costs and returns can be shared by the worker and the firm (Becker, 1975, Hashimoto, 1981). Sharing is required for two reasons: i) this investment creates rents to continuing a relationship, which the parties can bargain over; and ii) although specific training is valued only at the firm that provides it – meaning that possible alternative job-offers for the worker are not increased by specific training – once training expenditures have been made, the firm incurs a greater loss if the worker quits. As a consequence, there is an incentive for the employer to increase post-training wages to prevent voluntary quits (see *e.g.* Parsons, 1986).
- In contrast, only the worker will pay for *general* training – that is training that raises productivity at other employers to the same extent as at the employer who provides it – under perfect competition in the labour market. This occurs because only the worker can reap the benefits from this type of training, since any alternative wage offer rises proportionately with his/her productivity. However, imperfections in other markets (*e.g.* the capital market) may prevent workers from choosing the optimal amount of human capital investment (Becker, 1975).

15. Chart 3 shows that most CVT courses are entirely paid by employers. With the exception of three countries (Ireland, Italy and Switzerland) where about one half of CVT courses are entirely paid by employers, firms fully pay for more than 70% of CVT courses.⁵ Does this mean that most of the recorded training is firm-specific? In fact, empirical evidence suggests that purely firm-specific skills are relatively rare (see *e.g.* Neal, 1995). Stevens (1994, 1999) argues that, in practice, most skills provided through training are likely to be neither fully general nor fully firm-specific and uses the term transferable skills for skills that are valuable at more than a firm but nonetheless are not valuable at all firms.

16. Few national surveys contain explicit information about the generality of skills provided through formal training. From those that do, it appears that most of the formal training provided is quite general and almost all is transferable⁶. Furthermore, it seems that off-site CVT courses (*i.e.* courses occurring

5. Even when employers alone are reported to pay for training, they may not bear the full cost because workers may indirectly pay for these services through wage adjustments and accepting to be trained outside normal working hours. This need not necessarily imply a wage cut since employers can lower or postpone wage increases in exchange for training. Similarly, newly-hired workers can be offered a contract with lower than usual starting pay combined with the promise of providing training and steeper than usual tenure-earnings profile. The empirical literature shows, however, little evidence that workers accept lower wages to co-finance training (Barron, Berger and Black, 1999a, Loewenstein and Spletzer, 1998, and Booth and Bryan, 2002), although there is some evidence that workers bear some of the opportunity cost of training by accepting to be trained outside normal working hours, at least under certain circumstances (Autor, 2001).

6. As regards to the United States, 76% of respondents in the Employer Opportunity Pilot Project (EOPP; employers) and 73% in the 1993 wave of the National Longitudinal Survey of Youth (NLSY; employees) believe that most of the skills acquired through training would be useful at other firms. Fewer than 8% of respondents reported that the skills gained through training would not be at all useful at other employers (Loewenstein and Spletzer, 1999). In the United Kingdom, 85% of training recipients in the 1998-2000 waves of the British Household Panel Survey (BHPS) view their training as general (Booth and Bryan, 2002). In Germany, 62% of training recipients in the 1989 wave of the German Socio-Economic Panel

outside the workplace) impart essentially general skills. By contrast, it is more difficult to establish the generality of workplace training (Loewenstein and Spletzer, 1999). Chart 4 shows that, even considering only CVT courses that are entirely employer-paid, on average, CVT occurring at work represent only 35% of total CVT in OECD countries. Even in the United Kingdom, the country for which the greatest share of workplace training is reported, more than 50% of reported training occurs outside the workplace. In other words, most of the employer-paid training reported in available cross-country data seems to be at least transferable, whereas, at least in theory, employee financing should take place.

17. This inconsistency between theory and evidence suggests that in fact labour markets are not perfectly competitive. This would explain why firms have an incentive to pay for a significant share of training courses, which are in fact general or transferable. For example, if firms have some degree of monopsony power over their trained personnel, employers may be able to recoup training costs by paying a trained worker less than his/her post-training marginal product, while still retaining the worker (see *e.g.* Acemoglu and Pischke, 1999*a*, Stevens, 1999). Stevens (1994, 2001) argues that these conditions are particularly likely to prevail for skills that cannot be useful at many other employers. But this also applies in the case of fully general training, due to asymmetric information and lack of certification (or lack of recognition of qualifications), frictions and search costs, wage-bargaining institutions and outcomes, adverse selection affecting quits and lay-offs, or complementarity with specific investments (Acemoglu and Pischke, 1999*b*).

18. Imperfect competition in the labour market, however, is likely to result in under-provision of training. Employers' monopsony power, by compressing the wage distribution, creates the conditions under which a significant share of general training costs is borne by the firm – since, under these conditions, firms are more able to reap the benefits of training. But under-investment is nevertheless likely to occur, because current employers cannot internalise the benefits from training that will accrue to future employers.⁷

19. Labour market imperfections, such as those described above, also reduce workers' incentives to invest in general training, insofar as they decrease workers' appropriability of its benefits. In particular, if pay scales do not reflect marginal productivity, workers cannot fully reap the benefits from general training and, therefore, are not able to internalise its lifetime benefits (in contrast with what they could do under perfect competition; Becker, 1975).

20. Empirical evidence shows that under-provision is likely to occur in all OECD countries. For example, Barron, Berger and Black (1999*a*) estimate that, in the United States, productivity gains after training are seven times larger than wage increases, suggesting that firms reap most of the returns from training. Furthermore, Loewenstein and Spletzer (1998, 1999) find that general training received at previous employers, at least if certified, has a greater effect on wages than training provided by the current employer, who can exploit its market power to recoup the costs of training – at least partially. Using the same dataset but a larger number of waves, Lengermann (1999) finds that the effect of general training received at current employers increases over time. Empirical studies for a number of European countries have obtained similar results (see *e.g.* Booth and Bryan, 2002, Ok and Tergeist, 2002, and Fougère, Goux and Maurin, 2001).

21. Are labour market imperfections, such as employers' partial monopsony power over their trained workforce, the only source of market failure affecting training outcomes? The theoretical literature

(GSOEP) state that they received a certificate from their training (58%, if only training during work hours is considered; see Pischke, 2001).

7. This externality is often associated with the phenomenon of “poaching” — that is, a firm can free ride other firms' investment by making better wage offers to their trained employees.

suggests that other market failures outside the labour markets – due to *e.g.* imperfections in the training and capital markets – may also be important (see Box 1).⁸

Box 1. Non-labour market sources of market failures: theoretical aspects

There are several sources of non-labour market failures that may affect training outcomes:

Training market imperfections: First, workers and employers may lack information on teaching quality and be unable to distinguish between different providers of educational services. Second, and perhaps more importantly, training might not be fully contractible: while the amount of training can be written down in a contract, its type and quality are less likely to be specified in a manner that is verifiable by third parties such as tribunals (Malcomson, 1997, 1999, Gibbons and Waldman, 1999). This may induce both the employee and the employer to behave non-co-operatively and invest in training separately without bargaining. In other words, the employee may refuse to treat the employer as a possible (and actually privileged) intermediary or provider of training services and, thus, refuse to share the costs of employer-provided training. It can be shown (Acemoglu and Pischke, 1999a) that, under these conditions, if the investments of the employer and the employee are perfect substitutes and returns to training are common knowledge, only one party will invest in general training (the one that benefits the most), and the amount of investment will depend on the marginal return to that party, being therefore not only sub-optimal but also lower than in the co-operative case wherein training contracts are enforceable. The non-contractibility of training might also exacerbate possible conflicts between employers and employees – the former preferring providing specific training and the latter receiving general skills that can be re-sold in the labour market (Stevens, 1994, Barron, Berger and Black, 1999b).

Capital market imperfections: Unlike physical capital, human capital cannot be used as collateral for borrowing (Becker, 1975). Moreover, individual human capital investment is often indivisible so that the risk associated to it cannot be diversified. Furthermore this risk can be insured only partially, at best: in practice, private insurance markets are unlikely to work in a proper way, due to the unobservability of the trainee's effort and the size of human capital investments (the level of individual liability required to avoid adverse selection would be too high, see *e.g.* Stevens, 1999). The employer can partially relax the employee's credit constraint to the extent that the employee accepts a lower wage during the training period. However, there is a limit to the extent to which small firms can borrow to finance training expenditures using physical capital as collateral. Furthermore, if workers cannot borrow at a competitive interest rate, the demand for training may remain below the social optimum, since in order to smooth consumption over time the employee cannot accept large wage cuts (see *e.g.* Acemoglu and Pischke, 1999a).

Co-ordination failures: When returns to training and returns to the adoption of new technologies are interdependent, both employers and workers may decide not to invest if each side expects low returns. A bad co-ordination equilibrium may therefore arise, leading to sub-optimal investment in training (Redding, 1996). The same argument can be applied to specialisation in high-tech industries. Workers and firms in low-tech industries have little incentive to invest in further training since the "upskilled" worker would not in fact perform an "upskilled" activity in the same firm and industry, while opportunities for the worker in other (high-tech) industries are small if the share of the latter in the national output is small (Crouch *et al.*, 1999).

22. In addition, labour market imperfections interact with capital and training market imperfections. In fact, if these imperfections are important, it can be shown from a theoretical point of view that the greater the wage compression, the greater the total investment in general or transferable training (Acemoglu and Pischke, 1999a). This occurs because, in the presence of firms' monopsony power, the wages of skilled workers may be below their productivity. In such a case, as said above, the employer has a greater incentive (and the employee has a lower incentive) to invest in training, the greater the difference between the productivity of trained workers and their wages. When workers are credit constrained, wage

8. The list of market failures in Box 1 is not exhaustive and is limited to those that are more frequently considered in the literature on general training. See *e.g.* Temple (2001) and Malcomson (1997) for discussions of additional sources of market failures that are not reviewed here.

compression increases the amount invested by the employer without significantly reducing that made by the employee, which is already low. A similar argument can be made if training is not contractible.⁹

23. Brunello (2003) finds evidence of such a negative relationship between training and wage dispersion in EU countries, which also appears to be stronger in the case of low educated workers.¹⁰ That analysis is extended here to examine differences in the effect of wage dispersion between gender and age classes as well as workers with different educational attainment.¹¹ First, simple probit models are considered where the probability of participating in total CVT (including non-sponsored training) is estimated as a function of standard individual and firm characteristics as well as wage dispersion. Total training participation is estimated to decrease significantly with wage dispersion only in the case of employees with less than upper secondary education (Table 3). For instance, Column 4 shows that a 10% decrease in the wage dispersion is estimated to increase the probability of being trained for male individuals with low educational attainment by approximately 2.5%. By contrast, the effect is less significant for workers with upper secondary education and above. Differences between gender and age appear to be limited.

24. Following Brunello (2002, 2003) a trinomial logit model is also estimated to study whether the association between wage dispersion and CVT participation differs between off-site and workplace training (Table 4).¹² Both off-site (general) and workplace (perhaps more specific) training are found to be negatively associated with wage dispersion in the case of low educated men (including older workers), although the relationship is less significant in the case of women. Conversely, no significant relationship is estimated for workers with upper secondary education and above.

25. The negative relationship between training and wage dispersion might be interpreted as indirect evidence that one of the following holds true: i) credit constraints (and wealth/income constraints) are greater for low-educated (low-income/low-wealth) workers; and/or ii) these workers find it more difficult to negotiate with their employers about the content and quality of training programmes. In such a situation, co-financing policies that increase incentives for firms to invest in training (such as corporate tax deductions) are likely to have a positive impact also on the amount of training received by low-educated workers. This is not the case, however, for women. A possible explanation for estimated gender differences is that women and men, with equal levels of qualification and experience, compete for the same opportunities within the firm. To the extent that employers do not wish to train and promote all interested workers, male employees might be disproportionately selected, due to pure or statistical discrimination

9. However, if the imperfections in the other markets are not too severe, the negative effect of labour market imperfections on workers' willingness to invest will dominate, resulting in aggregate under-investment, since workers can better internalise lifetime benefits from training than their employers (Stevens, 2001).

10. Brunello (2002, 2003) suggests to partition employees into clusters of relatively homogenous workers and compare training participation rates with wage distributions computed for each of these clusters. An alternative route consists in estimating the impact of minimum wage on training. Indeed, statutory or contractual minimum wages twist the lower tail of the wage distribution without necessarily affecting individual productivity. Recent empirical studies, which use direct information on training, has yielded contradictory findings about the impact of the minimum wage on CVT (see Grossberg and Sicilian, 1999, Neumark and Wascher, 2001, Acemoglu and Pischke, 2003, for the United States, and Arulampalam, Booth and Bryan, 2002, for the United Kingdom).

11. Wage dispersion is defined here as the logarithmic difference between the 90th and the 10th percentile of gross hourly wages of male wage and salary employees. To minimise endogeneity problems, wage dispersions are computed two years before and excluding workers who are still in training or education. Clusters with less than 30 observations are excluded from the analysis.

12. Only information on one CVT course, presumably the most important, is reported in the ECHP.

and/or to the fact that men are less time-constrained by family responsibilities (see OECD, 2002a and Section 2.C).

B. *Disentangling employers' supply from employees' demand*

26. The findings of Section 2.A suggest that market failures have an important impact on the level of training, with both employers' and employees' investment decisions being affected by institutional factors such as the degree of firms' monopsony power or the transferable nature of training. That analysis also suggests that these institutional factors affect training inequalities. From the point of view of policy making it is however essential to understand whether the source of under-investment is mainly affecting employers' or employees' behaviour. Furthermore, the inequality patterns discussed in Section 1 can be ascribed to market failures only partially and depend also on the variation of social returns to training across different worker groups. For instance, even in the absence of market failures certain workers may have a weak demand for training – due to low expected rates of returns, or weak motivation. Policy implications will depend on whether bottlenecks are on the supply or the demand side.

27. The market for CVT can be broken into *two sub-markets*: an upstream market, in which employers buy training services from a training provider; and a downstream market, in which employers re-sell these training services to their employees, with the price for training hidden in wages (the price of the latter transaction might be even zero when the employer bears all the cost). In the downstream training market, one can in principle distinguish between supply (by the employer) and demand (by the employee).¹³ Training outcomes can be analysed as the resulting equilibrium from the inter-reaction of supply and demand.

28. Most of the available datasets, however, lack sufficient information to identify training supply and demand. Consistently, analyses using these data are limited to the resulting equilibrium outcome. However the IALS allows the supply and demand factors underlying equilibrium outcomes to be identified (see Annex 1). This survey contains information on CVT courses that workers would have liked to have taken but could not, because they could not afford (or did not want) to pay for the implicit or explicit price required. Workers that responded positively to this question are called “constrained workers”, as in Oosterbeek (1998) and Leuven and Oosterbeek (1999), and can be assumed to have a positive training demand at least at zero cost borne by them.¹⁴ 26% of employed workers of OECD countries covered in the sample are “constrained” (Table 5). In all countries except Finland, workers who already receive some training are more frequently “constrained” than non-participants (31.5% versus 23%). Amongst training participants, workers who do not receive support from their employer report a particularly high incidence of constraints: on average, almost 40% of these workers would have liked to receive more training.¹⁵

13. In the upstream market, training supplier and demander might be the same institution in the case of internal CVT; in such a case the price of the upstream transaction is not observable and potentially ill-defined.

14. The phrasing of the question is as follows: “Since August (Year) was there any training or education that you wanted to take for career or job-related reasons but did not?”. In fact, this formulation is somewhat ambiguous, and it can be expected that workers declaring themselves constrained are those who expect positive returns from training even taking part of the (direct or opportunity) cost of training into account (e.g. part of the foregone income and leisure time, alternative investment opportunities, displeasure they associate with formal learning, due to bad pedagogical experiences, etc.). Indeed, it is difficult to imagine workers not being at least indifferent, with respect to being trained, in the absence of any implicit or explicit cost for them. Anyway, it can be shown that the identification strategy is still valid (see Annex 1).

15. The fact that people that received employer-sponsored training also tend to have a higher demand for additional training might reflect a number of economic factors (such as the interplay between credit or time constraints and factors affecting costs and benefits from training; see Section 2.C). However, non-

29. In the remainder of this section, relative patterns of demand (by employees) and supply (by employers) are analysed through the estimation of bivariate probit models of demand and equilibrium outcomes.¹⁶ These models are estimated subject to the assumption that, by threatening lay-offs and/or offering monetary compensation, an employer can always convince a worker to be trained (see Annex 1 for a detailed description of the identification issues involved).¹⁷ Although employers' supply cannot be directly estimated, information on it can be derived by comparing demand and equilibrium estimates (see Annex 1). For example, if training demand for, say, women is estimated to be significantly greater than training demand by men, but no significant difference is estimated for equilibrium outcomes, this can be interpreted as evidence that, for any given price of training, employers' supply is greater for men than for women.

30. Table 6 presents maximum likelihood estimation results for a pooled sample of 15 countries.¹⁸ In comparison to their male peers, women suffer from less satisfied training demands (demand is greater, and supply smaller, for women than for men).¹⁹ The same occurs for immigrants with respect to their native peers. These results possibly reflect lower expected returns by their employer (statistical discrimination), because of lower expected benefits (in the case of women, due to career breaks, maternity leave, etc.) or higher expected costs (in the case of immigrants, due to language reasons).

31. Training supply for very young workers (aged 16 to 25 years) appears to be smaller than that of prime-age employees, while the opposite occurs for older workers.²⁰ Age might in part capture the effect of

economic reasons may also be important for explaining why certain groups of individuals have higher or lower demand for training. OECD (2003a) identifies a number of non-economic factors affecting adults' demands for training such as access to information, motivational aspects, and lack of appropriate pedagogy.

16. Initially estimations are made for a limited number of individual characteristics (including, gender, age, education, country of birth, and occupation) and firm characteristics (firm size, sector), in order to maximise country coverage. Subsequently, over a limited country sample, the analysis is expanded to encompass the effects of literacy and parental background in order to provide a fuller analysis of the role of education as a source of inequality of access to training. Finally, type of contract and work status is also considered. The analysis will be limited to workers aged 16 to 65 years with at least some education who are employed by non-agricultural firms with more than 20 employees. The reference individual is a native male employee aged 36 to 45 years, with upper secondary education, who has changed job in the last 12 months and is working full-time as a clerk in a firm with 100 to 199 employees, located in an urban area and whose main business is in the mining, manufacturing or energy industry.

17. Another scenario, which assumes that employers cannot force their employees to be trained against their will (even at zero cost for the employees; see Annex 1), is also considered, but no significant difference in the estimates – reported in Annex 2 – appears between the two scenarios.

18. These countries are Australia, Belgium (Flanders only), Canada, the Czech Republic, Denmark, Finland, Hungary, Ireland, Italy, New Zealand, Norway, Poland, Switzerland, the United Kingdom, and the United States.

19. Estimation results presented here are robust to the simultaneous exclusion of transition economies and of those countries with a small number of observations (Belgium and Ireland, which have less than 800 observations each). Furthermore, if the remaining sample of 10 countries is split into two groups (continental European and English-speaking economies), the results are qualitatively the same and invariant across groups.

20. Both the probability of receiving training in equilibrium and of demanding training at zero cost are lower for older workers than for prime-age men. Nevertheless, the shift of the equilibrium outcome is much smaller than that of demand, leading to the conclusion that supply is greater for employees in this age class than for prime-age workers.

tenure, for which there are insufficient controls in the equation due to data limitations.²¹ Conversely, the result for older workers might reflect possible differences in pay-back periods between employers and employees.²² In equilibrium, pay-back periods for general training are likely to be longer for the employee than for the employer.²³ As a consequence, the age above which it is no longer profitable to pay for training (because the pay-back period is longer than the remaining number of years before retirement) is likely to be lower for the employee than for his/her employer.

32. The estimates also indicate that demand for training is relatively flat with respect to the type of occupation, while supply is estimated to increase with the degree of skill-intensity. By contrast, demand for training is estimated to be greater the higher the level of educational attainment, but this is not the case for supply.²⁴ These results might arise because of training market imperfections – e.g. as a result of imperfect information or contractibility – credit constraints and employers’ monopsony power, that appear to be greater, the lower the level of educational attainment (see Section 2.A).

33. Finally, training supply is estimated to be increasing with firm size while training demand is not. This pattern is consistent with the hypothesis that larger internal labour markets present greater opportunities to reap the benefits from training through internal promotion or re-assignment of trained workers.²⁵ Furthermore, in industries where product market competition is strong and the number of competitors large (such as construction, wholesale and retail trade, and community, social and personal services), employers’ market power over their skilled employees is likely to be relatively small. This may explain why, *ceteris paribus*, supply is estimated to be smaller (and demand greater) in these industries than in the other industries.²⁶

34. Demand and supply of training are likely to be influenced by individual histories preceding current job experience and entry in the labour market. These histories are not fully captured by educational attainment. For instance, literacy scores of those participating in employer-sponsored training are greater

21. This result might also reflect the fact that temporary jobs are not controlled for in these specifications, due to data limitations. However, on a smaller sample with only 8 countries, this result is robust to the inclusion of a dummy for temporary contracts (see Annex 2).

22. The pay-back period is defined as the number of years an investment needs to yield the expected revenue in order to be profitable.

23. The length of the pay-back period for human capital investments for both employers and employees is likely to depend mainly on individual characteristics that affects the cost of (and total potential benefits from) training. By contrast, the difference between employers’ and employees’ pay-back periods is likely to depend also on the wage structure and educational attainment, insofar as they affect the sharing of the benefits from training, but plausibly does not depend on age. In equilibrium — that is, given a certain division of costs and benefits from training — it is plausible that rate of returns from training are approximately equal for the employee and for the employer. As a consequence, pay-back periods for general training are likely to be longer for the employee than for the employer because the former retains his/her share of benefits upon quitting, while the latter does not. If this were not the case, workers (particularly when young) would find it profitable to increase the investment in training beyond the equilibrium amount.

24. The only statement that can be made about supply is that it does not increase with educational attainment, but it cannot be established whether it decreases or remains approximately constant. This is due to the fact that the estimated probabilities of demanding training at zero cost and of receiving training in equilibrium increase by approximately the same amount (see Annex 1).

25. Furthermore, small firms may invest less in training due to the fixed costs involved and the difficulty to replace a worker who temporarily leaves for training.

26. A similar argument can be extended to community size, explaining the resulting estimates.

than that of non-participants at any level of education (Chart 5). The average literacy score²⁷ of participants is 4% greater for workers with a tertiary qualification and 9% greater in the case of those with less than upper secondary education. Although the direction of causality is not clear-cut, there is some evidence that most literacy skills are developed by individuals at relatively young ages, typically before joining the labour market,²⁸ and that subsequent CVT spells do not modify the level of literacy in a significant way. Thus, Chart 5 suggests a causal relationship between literacy and training participation.

35. Instrumental variable (IV) techniques have to be used to confirm this statement.²⁹ The IV estimates of the impact of literacy and related variables on training supply and demand are shown in Table 7. The table shows that training demand is not significantly affected by literacy, while the equilibrium outcome is greater, the higher the literacy score. In other words, training supply is increasing with the level of literacy, suggesting that employers believe that learning ability increases (and therefore training costs decrease) with basic general skills, including literacy.

36. There is some evidence in the literature that in many OECD countries the incidence of employer-sponsored training is increasing with job-complexity (Barron, Berger, and Black, 1999*a,b*), and is lower for part-time (Leuven and Oosterbeek, 1999) and temporary workers (OECD 2002*a*). Table 8 shows estimation results for augmented versions of the specification reported in Table 6, which has been extended to include dummies for different types of contract (voluntary and involuntary part-time, temporary contract and supervisory role).³⁰

37. With respect to full-time employees, there is a strong evidence of much lower training supply for involuntary part-time workers, while demand is not significantly lower. The same applies to workers with temporary contracts compared with those with permanent contracts. Statistical discrimination, tenure effects and higher probability of quitting (voluntarily) can plausibly explain these findings.³¹ Similarly, employees working part-time for family or health reasons tend to be confronted with lower supply than full-time workers,³² although estimates are not always significant.³³

27. Simple average of the three literacy scores reported in the IALS that measure proficiency in prose, reading and quantitative skills on a 0-500 quantitative scale (see OECD and Statistics Canada, 2000).

28. In most countries, the mean performance of PISA students (at age 15) on the IALS literacy scale is greater than the mean performance of IALS individuals both in the whole sample and restricting the comparison to IALS individuals aged 26 to 35 years who completed secondary education (see OECD and Statistics Canada, 2000, and OECD, 2003b).

29. For five countries (Australia, Canada, Finland, Italy and the United States), the IALS contains a large set of information on parental background — namely, educational attainment of parents, father's occupation and a dummy for whether the mother has worked. The effect of parental background on training demand and supply is likely to occur essentially through literacy and education. Accordingly, these background variables can be used as instruments for literacy in a training regression.

30. These equations are estimated for varying country samples, depending on data availability.

31. The situation is very different for individuals working part-time voluntarily for reasons other than family or health problems or part-time education (demand at zero cost is particularly low for these workers while no clear statement on supply can be made).

32. In this case a different explanation of this result is more likely to be true. Family responsibilities is one of the main reasons for being “constrained” (see Section 2.C). Demand is identified at zero implicit or explicit costs for the worker, including day care for children and relatives. Part-time workers for family reasons are therefore likely to find certain types of training too expensive in terms of their associated day care costs.

33. Supply is also unambiguously greater for individuals with a great supervisory role compared with individuals with some supervisory responsibility, while demand is not significantly different. These

C. *Constrained workers*

38. There are several reasons why workers' demand (at zero cost) may not be satisfied. The incidence of different constraints affecting demand might affect the effectiveness of possible policy measures. For example, policy schemes allowing only relaxation of financial constraints (such as loan schemes or individual subsidies) will not help much when lack of time is the main constraint. In the latter case, more effective policy instruments might be provisions for training leaves and/or time accounts. The IALS provides some information on the reasons why workers are constrained.³⁴

39. Chart 6 shows the incidence of constrained workers by detailed reasons for both participants and non-participants in CVT. The most important constraint seems to be associated with the employee's shortage of available time for training. Around 15% of trained workers and 10% of non-trained workers claim that they could not take the desired training courses due to lack of time. Furthermore, a significant number of constrained workers declare that they could not take all the training they wanted either because they were too busy at work or because the time schedule was inappropriate or because of family responsibilities. Since multiple answers are allowed in the survey, these figures are not additive. Nevertheless, taking multiple answers into account, time is an issue for more than 60% of the workers who could not take the training they wanted. Though less important than time-related constraints, many employees report that they could not afford to pay for the cost of the training courses they wanted to take (about 7% of trained workers and 5% of non-trained workers).³⁵

40. Although time-related constraints emerge as the most important factor, its incidence varies across groups. Particularly, among "constrained" workers, the probability of being time-constrained is estimated to be 9 percentage points greater for managers and 10 percentage points lower for workers in elementary occupations than for clerks (Chart 7).³⁶ On the other hand, the probability of being constrained by financial reasons for managers is 4 percentage points lower than for clerical workers, while it is 7 percentage points higher for workers in elementary occupations. In other words, policy measures affecting costs (e.g. individual subsidies) may increase training participation of workers in low-skilled occupations even when they do not increase workers' time availability (*i.e.* even in the absence of time accounts or training leave schemes).

findings suggest that employers tend to sort more able employees into better career and training opportunities simultaneously. Conversely, workers with no supervisory role seem to have lower demand than individuals with more supervisory responsibility.

34. It must be noted at the outset, however, that this piece of information concerns only individuals with positive demand who, while not receiving enough employer-sponsored training, do not end up paying for the additional training they require themselves. Conversely, it cannot shed further light on the reasons why certain individuals demand little training (for example because of low returns due to low productivity, training market imperfections, interactions between age and pay-back periods, and to some extent credit market imperfections).

35. Given the ambiguity of the question on desired further training (see footnote 14) as well as of the definition of this constraint in the questionnaire ("too expensive/lack of money"), it is unlikely that all individuals that are credit-constrained reported that they suffer from this constraint. Plausibly, this constraint is likely to capture unaffordable course fees but not issues related to foregone income.

36. These figures refer to the estimated probability that a specific constraint binds conditional to the fact that there is at least one constraint that is binding, after controlling for all other characteristics. Probit estimates of the probability of reporting each constraint as a function of personal and job characteristics are reported in the Annex 2. However, the sample size is relatively small when the analysis is limited to constrained workers. Hence, results must be interpreted with caution.

41. Amongst “constrained” women working full-time, the estimated probability of being constrained because of either training cost or family responsibilities is 7 and 8 percentage points higher, respectively, than for men. This might be explained by two factors. On the one hand, women are more likely to be excluded by employer-sponsored training (see Sections 2.A and 2.B) and earn on average less than men — so that they might find training courses less affordable. On the other hand, women are less likely to exploit training opportunities available outside normal working hours, since these would make them stay away from home for even longer hours. The same argument applies to individuals working part-time because of health or family reasons. In particular, amongst “constrained” women working part-time, the estimated probabilities of the cost and family constraints are 13 and 31 percentage points higher, respectively, than in the case of men working full-time.

3. Conclusions

42. The preceding sections suggest that training opportunities are unevenly distributed across workers, and that training incidence falls short of socially desirable levels. Factors that affect the cost and benefits of CVT appear to contribute to both uneven distribution and under-provision of training. More precisely, Section 1 has shown that certain groups of individuals receive more employer-sponsored training than others. Section 2 has identified several sources of market failures (including labour, capital and training market imperfections) leading to under-provision of training, and shown that some of the inequalities in training access can be ascribed to these failures. Furthermore, Section 2 has decomposed the downstream training market³⁷ in order to trace the extent to which differences in the provision of employer-sponsored training across groups of workers are due to demand (by employees) or supply (by employers). The empirical results suggest that employers tend to exclude women, immigrants, young employees, involuntary part-time and temporary workers, workers in low-skilled occupations and workers with low literacy, when selecting which employees to train (Table 10). By contrast, lower demand appears to account for lower training participation of older and less educated workers. In the case of older workers, labour market imperfections affecting the distribution of training benefits and the length of employers’ and employees’ pay-back periods are likely to be behind this pattern. In the case of less educated workers, credit constraints and/or training market imperfections – due to lack of training information and contractibility between employers and employees – may partially explain this finding. However, non-economic factors, such as lesser motivation or bad pedagogical experiences, must also be taken into account. Finally, demand does not appear to vary with firm size or sector. However, supply rises with firm size, perhaps due to lower unit costs of training, larger benefits, and greater access to credit and information for large firms.

43. The first-best approach to overcoming market failures would be to eliminate market imperfections through structural reforms. However, some of these imperfections are “natural” characteristics of certain markets (*e.g.* the lower level of competition in the market for workers who have acquired transferable skills, which are not valuable at every firm) and effective reforms to overcome them have not been proposed yet. Furthermore, other imperfections are induced by institutions and policies that do not concern primarily training outcomes (*e.g.* those affecting the distribution of earnings such as minimum wages), whose reform cannot be undertaken without a careful evaluation of all other relevant trade-offs. A second-best approach to improving training outcomes is to increase the economic incentives to demand and supply training through fiscal policy and institutional arrangements favouring cost-sharing among private parties. This second-best approach can also target disadvantaged groups more easily, given

37. It has been noticed in Section 2 that the market for CVT is particularly complex when training within the firm is considered. In that case, it can be disaggregated into two sub-markets: upstream, employers buy training services from a training provider; downstream employers re-sell these training services to their employees, with the price for training hidden in wages.

that not all the training gaps are due to market failures (as discussed in Section 2.B). However, policy design is crucial, since some of the identified sources of market failure (e.g. lack of contractibility of training quality) can equally lead to policy failures, with the risk of large deadweight losses and heavy burdens for the public budget. For the same reason, a comprehensive policy strategy is more likely to be effective in reducing both under-provision and inequalities.

44. This section reviews the experience of OECD member countries with various second-best approaches to surmount financial and economic barriers to the provision of and participation in CVT. It must be stressed at the outset that the analysis is essentially based on deductive arguments derived from the empirical results of the previous sections. In fact, there are only few empirical evaluations of existing schemes, in part due to the novelty of most of them. Furthermore, with few exceptions, available evaluations are limited to descriptive statistics and do not build up counterfactuals, against which a rigorous assessment could be made. For these reasons, for each specific policy, it is only possible to identify the problem it can address and whether it has been implemented in a consistent way but not whether each intervention has been excessive, insufficient or just right to attain its target.³⁸

45. Since the 1960s, policies in this area were formulated to address, first and foremost, perceived rigidities on the supply side that interfered with adult education and training. The underlying assumption was one of substantial economic and social demand for adults to return to formal education. Thus, the objective of *recurrent education* was to improve learning opportunities for individuals by enhancing the capacity of the formal education sector to accommodate those wishing to return to education, whether to overcome deficiencies due to early school leaving, or to update and further upgrade qualifications. However, recurrent education never emerged as an enduring widespread practice, in part because its associated costs were never adequately funded.

46. More recently, improving CVT has emerged as a distinct policy issue from facilitating adult participation in *recurrent education* and *active labour market policy* (in which those at risk in the labour market engage in short-term training to compensate for skill deficiencies). This distinction has brought about a shift in the target of public policy from providers and systems geared to provision of education and training with relatively homogeneous content to the demand of individuals and employers for more heterogeneous learning outcomes. In other words, in contrast to children in initial education, learning objectives of individual adults are ever changing and highly heterogeneous so that such needs could be met only through a more differentiated arrangement of providers and courses than the delivery mode characterising initial education. As a consequence, policy strategies to improve training outcomes have shifted from direct subsidisation of external (public or private) providers of training services to co-financing schemes intended to increase incentives for employers and/or individuals to invest in training. The shift towards this policy approach is based on three general principles:

- in most societies, because of the budget constraint, public authorities alone cannot provide the necessary financial resources for lifelong learning;
- as lifelong learning generates considerable private returns, employers and employees should finance most of its costs; and

38. Due to the methodological complexity of *ex-post* assessment, evaluation mechanisms should be included into policy design to ensure timely corrections of policy mistakes. It is true that most policy innovation are usually tried and evaluated as pilot programs first. However, certain experiences (such as with the British individual learning accounts) show that not all the possible implementation problems of mass-scale programs can be anticipated on the basis of small pilot experiments.

- greater reliance on market forces could strengthen the incentives both for learners to seek more efficient learning options and for providers to achieve higher levels of efficiency.

47. Co-financing mechanisms – *i.e.* schemes that channel resources from at least two parties among employers, employees and governments – can be designed to increase training incentives for employers, for individuals or for both. Since the primary reason for which employers may invest in training less than the socially optimal amount is that current employers cannot internalise benefits from training that will accrue to future employers (as discussed in Section 2.A), *tax arrangements* or *grant schemes* for enterprises can be used to tackle aggregate under-investment. By modifying the marginal cost of training these schemes may raise employers' supply towards the socially optimal level. Also, these schemes can be complemented by policies favouring cost-sharing between employers and employees, such as regulatory provisions for *pay-back clauses* and *time accounts*, to the extent that training market imperfections are not too strong. In fact, as discussed in Section 2.A, cost-sharing is unlikely to occur if the content and quality of training are not contractible. Moreover, transparent accounting and disclosure practices can have an important role in channelling resources from the stock market towards training firms, thereby increasing their incentives to train (OECD and Ernst & Young, 1997).

48. It can be inferred from the analysis of Section 2 that co-financing incentives directed to employers (such as tax arrangements and grant schemes) might help to foster training participation of prime-age skilled men and of those with little demand, whose training is nonetheless profitable for firms, such as older workers and the low educated (see Table 10). For the same reason, policies of this kind are also likely to benefit workers in large firms, high-tech industries and industries wherein the number of competitors is relatively small. If targeted, these policies might improve the position also of other groups, particularly workers in small firms, but there is only limited evidence of success stories of this kind.³⁹

49. For workers who have less frequent opportunities to receive employer-sponsored training – namely women, immigrants, involuntary part-time and temporary workers, workers in small firms, in low-skilled occupations, in low-tech industries and/or workers with low literacy within each educational attainment class –, it is likely to be difficult to target policies focussing on employers' incentives in an efficient way (Table 10). Individual-based demand-side policies (such as *loan* and *subsidy schemes*), by relaxing individual borrowing constraints and increasing expected rates of return, can thus play a complementary role. Furthermore, some of these policies (*e.g.* certain subsidy schemes such as *individual learning accounts*) address both economic and non-economic barriers to training. However, they require the diffusion of information that workers often do not have. In addition, portability and certification of skills must be assured. As a consequence, financial incentives must be accompanied by adequate framework conditions. Even in this case it might be difficult to target with precision certain workers (such as the under-literate workers within the low-educated). Strengthening delivery of formal education emerges therefore as a complementary policy instrument (see OECD, 2002b).

39. A special case can be made for young workers. Certain schemes, although untargeted in principle, may be designed in such a way that they make training newly hired young workers comparatively less costly than training more mature and experienced workers. This is the case, for instance, of tax arrangements that do not allow deduction of employers' opportunity costs such as foregone productivity which can be expected to be larger in the case of the latter compared with the former.

IDENTIFICATION AND ESTIMATION OF TRAINING DEMAND AND SUPPLY

50. Information on constrained workers can be used to identify the demand for training of employed persons. Workers declaring that they are “constrained” clearly believe that their return from training is non-negative, at least if they do not have to pay for it. It can be said that an individual has a positive demand (at zero cost for the individual) if he/she declares to have taken non-sponsored training courses and/or to desire further training.⁴⁰ From this information the probability of demanding training can be estimated as a function of personal and job characteristics. Taking two different groups of individuals and assuming that demand curves are downward sloped (with respect to the implicit or explicit price of training) and do not cross each other, it is therefore possible to estimate whether one group has greater demand than another by estimating their respective probabilities of desiring further training at zero cost (points A and A’ in Chart A1.1).

51. Rigorously speaking, without additional assumptions on employers’ behaviour, the demand-identification strategy described above is valid only for employees not receiving employer-sponsored training. Indeed, workers who receive employer-sponsored training may or may not have a positive demand for training, depending on employers’ behaviour and training bargaining outcomes. Two extreme alternative assumptions can be selected:

- *Hypothesis A*: as assumed by Oosterbeek (1998) in a similar analysis for the Netherlands, employers cannot force their employees to be trained against their will (even at zero cost for the employees), therefore training takes place only if the worker’s demand is non-negative; or
- *Hypothesis B*: by threatening lay-offs and/or offering monetary compensation, an employer can always force a worker to be trained, therefore demand at zero cost for workers receiving employer-sponsored CVT might not be positive and its sign is unobservable.

52. Hypothesis A allows the identification of demand on the whole sample while, under Hypothesis B, demand can be consistently estimated only on the subsample of those non-receiving employer-sponsored training (see Table A1.1). Furthermore, these additional assumptions on employers’ behaviour

40. The exact phrasing of the question is as follows: “Since August (Year) was there any training or education that you wanted to take for career or job-related reasons but did not?”. As already noted, the phrasing of the question is somewhat ambiguous, and it can be expected that workers declaring themselves constrained are those who expect positive returns from training even taking part of the cost of training into account. Indeed, it is difficult to imagine workers not being at least indifferent, with respect to being trained, in the absence of any implicit or explicit cost for them. Anyway, except when otherwise mentioned, the identification strategy is still valid if additional hypotheses are made to take into account this issue — namely that i) individuals interpret this question as asking whether they would like to receive further training for a fixed implicit or explicit cost supported by them; and ii) that this perceived cost (or price) threshold does not depend on observable individual characteristics and can be modelled as a constant plus a standard error term. Simply, demand will be identified at this price threshold — that is perceived as implicit in the question —, rather than being identified at zero cost borne by the employee.

and bargaining outcomes allow deriving the relative positions of supply schedules from the simultaneous estimation of demand and equilibrium outcomes (the point of intersection between supply and demand, B and B' in Chart A1.1).

53. In practice, under both hypotheses, the final econometric model jointly estimates the probability of receiving employer-sponsored training in equilibrium and the probability of demanding training at zero cost as a function of personal and firm characteristics (in a bivariate probit framework).⁴¹ To do so, for the equilibrium outcome, the dependent variable takes value one if the worker has received employer-sponsored training and zero otherwise while, for demand, it takes value one if the worker has received training or is "constrained" and zero otherwise. Under Hypothesis B, the latter is estimated only conditional on the fact that the worker has not received any employer-sponsored training, which, under this hypothesis, when it has taken place, prevents the observation of demand. By contrast the equilibrium outcome is estimated on the whole sample. Symmetrically, under Hypothesis A, the equilibrium outcome is estimated only conditional on the worker having received training or being willing to be trained at zero individual cost, while demand is estimated on the whole sample. Under this hypothesis demand can be identified on the whole sample. Hence, not using the information concerning recipients of employer-sponsored training would be inefficient. In principle, the correlation between the error terms of the demand and equilibrium outcome equations must be taken into account (to avoid selection bias). However, since Oosterbeek (1998), in a similar analysis for the Netherlands, does not find this correlation to be significant, for computational reasons the equations are estimated as if the residuals were uncorrelated.

54. Under both hypotheses, information on the relative position of employers' supply for different groups can then be derived by comparing demand and equilibrium outcomes, on the basis of the assumption that supply curves are upward sloped and do not cross each other. Only the relative positions of supply and demand for different groups of workers can be identified. In other words it is possible to estimate whether employers' supply for one group is greater than that for another group, but not the whole supply schedules. The same limitation holds as regards to the demand schedules. Table A1.2 summarises all possible combinations of demand and equilibrium estimates and their implications for employers' supply. For example, if training demand for, say, women is estimated to be significantly greater than training demand by men, but no significant difference is estimated for equilibrium outcomes (first row in the table), this can be interpreted as evidence that for any given price of training, employers' supply is greater for men than for women. Equivalently, the supply curve for women is above that for men (compare S and S' with D and D' in the Chart A1.1). To the extent that results are consistent under both hypotheses A and B, some statements on supply and demand can be derived with some confidence. Tables 7 to 9 are based only on estimates under Hypothesis B. However, results, reported in details in Annex 2, are similar when estimations are carried over under Hypothesis A.

41. Under Hypothesis B, demand and equilibrium outcome can be consistently estimated using also the additional hypotheses discussed in the previous footnote that allow for a more plausible interpretation of respondents' reaction to the question on further training. Simply, the probability of demanding training is estimated at the price threshold that is perceived to be implicit in the question on further training, rather than being identified at zero cost supported by the respondent. By contrast, subject to Hypothesis A, in order for the estimation procedure to be consistent with the hypotheses of the previous footnote, training must take place only if workers' demand is non-negative *at the perceived price threshold*. This would imply that training occurs only if employees would have responded "yes" to the question on desired further training if they had not received any training. In other words, it would imply assuming under Hypothesis A that there are always some implicit training cost for the employee (such as displeasure from learning, temporary change of colleagues, etc...) that the employer cannot eliminate, even with monetary compensation.

DATA DEFINITIONS AND DETAILED ESTIMATION RESULTS

A. *Data sources and definitions*

Data sources

55. The quantitative analysis contained in this paper is based on data from the following three sources:

a) International Adult Literacy Survey (OECD and Statistics Canada)

The *International Adult Literacy Survey* (IALS) is an individual survey using a common questionnaire. The survey asks whether the workers have received any training or education during the 12 months prior to the survey, but it includes details only about the three most recent courses (purpose, financing, training institution, duration etc.). For this reason the number of hours of training is underestimated in the case of workers having taken more than three courses. Data refer to 1994 for Canada, Ireland, the Netherlands, Poland, Switzerland (German and French-speaking regions), and the United States, to 1996 for Australia, Belgium (Flanders only), New Zealand and the United Kingdom and to 1998 for the Czech Republic, Denmark, Finland, Hungary, Italy, Norway and the Italian-speaking regions of Switzerland. See Leuven and Oosterbeek (1999) and OECD and Statistics Canada (2000) for evaluations of the data quality of this survey.

b) European Community Household Survey (EUROSTAT)

The *European Community Household Survey* (ECHP) is designed for longitudinal analysis of the economic and social position of individuals in the European Union countries. This survey provides rich information regarding work status, income, education etc. Since the statistical work on these data was carried over before the December 2002 release, estimates presented in this paper are based on data released in December 2001, which contain 5 waves from 1994 to 1998. The survey includes the 15 European Union member countries. The data used in this paper refer to 1996 (wave 3) for Belgium, Denmark, France, Germany, Ireland, Italy and the United Kingdom, to 1997 (wave 4) for Austria, Greece and Spain and to 1998 (wave 5) for Portugal. Other EU countries are excluded because of lack of data on training and/or sample size. The choice of the wave has been made in such a way to maximise sample size in the regression analysis. As regards to CVT, the survey asks whether the worker has participated in any CVT during the year prior to the survey. Training participants are asked to report details (location, purpose, financing and duration) on only one CVT course. See Peracchi (2002) for an evaluation of the data quality of this survey.

c) The second Continuing Vocational Training Survey 2 (EUROSTAT)

The second *Continuing Vocational Training Survey* (CVTS2) was carried out by EUROSTAT in 2000 in EU Member states, Norway and 9 EU candidate countries. This is an enterprise survey covering establishments with at least 10 employees. It provides information on employer-sponsored training, which was taken during the year 1999, for employed persons, excluding apprentices and trainees. The survey provides a large set of characteristics for the enterprises, but only gender, training participation and total training hours for the employee. No evaluation of data quality is available. For more details on the survey, see Eurostat (2000a).

Data definitions

56. CVT may entail the following forms of training (See *e.g.* Eurostat, 2000a):

- a) Courses which take place away from the place of work, *i.e.* in a classroom or training centre, at which a group of people receive instruction from teachers/tutors/lecturers for a period of time specified in advance by those organising the course.
- b) Planned periods of training, instruction or practical experience, using the normal tools of work, either at the immediate place of work or in the work situation.
- c) Planned learning through job rotation, exchanges or secondments.
- d) Attendance at learning/quality circles.
- e) Self-learning through open and distance learning, (methods used in this type of learning can include using video/audio tapes, correspondence courses, computer based methods or the use of a Learning Resources Centre).
- f) Instruction at conferences, workshops, lectures and seminars.

57. In practice, the definition of CVT in different surveys varies and thereby the coverage of the different forms of training is not the same across surveys. In the CVTS2, the definition of CVT conforms strictly with item a above, including post-graduate education but excluding initial training – *i.e.* training received by a person when hired in order to make his/her competencies suited to his/her job assignment. In the ECHP, all education and language courses are excluded from the definition of training. Vocational training is defined on the basis of country-specific categories used in the Labour Force Survey. A mapping of these categories into ECHP variables is provided by Eurostat (2000b). In the IALS, there is a distinction between job- or career-related training and training for other purposes. Furthermore, education and training courses are divided into seven mutually exclusive categories: i) leading to a university degree/diploma/certificate; ii) leading to a college diploma/certificate; iii) leading to a trade-vocational diploma/certificate; iv) leading to an apprenticeship certificate; v) leading to an elementary or secondary school diploma; vi) leading to professional or career upgrading; and vii) other. For the purpose of this paper, only job- or career-related training has been considered in the analysis. Moreover, in order to thoroughly exclude formal education courses, only items iv, vi, and vii have been retained in the definition of CVT courses, while items i, ii, iii and v are subsumed into the category of other education and training (cf. Table 1). According to this definition, Tables A2.1 and A.2 show CVT incidence in each country by gender and age and socio-economic characteristics. Charts 1 and 2 in the main text are based on the data shown in these tables.

58. The occupation classification used in this paper corresponds approximately to the 1-digit level of the International Standard Classification of Occupations (ISCO-88). In Chart 2 and Table A2.2 data have been grouped as follows: high-skilled occupations corresponding to managers, professional technicians and associate professional (ISCO-88 codes 1 to 3); medium-skilled occupations corresponding to clerks, service and sales workers, craft and related trade workers, plant and machine operators and assemblers (ISCO-88 codes 4 to 8); and low-skilled occupation corresponding to elementary occupations (ISCO-88 code 9).

59. Hourly earnings used to calculate wage dispersion are computed from gross monthly earnings in the main job, by dividing them by 52/12 and by usual weekly hours of work for employees working for at least 15 hours a week. Overtime pay and hours are included. Only employees working from 30 to 70 hours per week and that are not in education or training are considered. ECHP personal weights have been used in the computation of the wage dispersion but not in the regression analysis.

B. Detailed estimation results

Tobit and probit models of the determinants of employer-sponsored training

60. Maximum likelihood estimations of a probit model for training participation and a tobit model for training hours have been carried over on a pooled sample of fifteen countries to provide further evidence on the training gaps discussed in Section 1 on the basis of a bivariate analysis. Estimates based on these models are reported in Table A2.3. Probit regressions are standard when the dependent variable is a dummy variable. Conversely, Tobit regressions are standard when the dependent variable is continuous but censored. In the probit model, the dependent variable takes value one if the individual participated in at least one employer-sponsored CVT course in the twelve months preceding the survey and zero otherwise. The table reports in this case the estimated change in the probability of receiving training associated with each specific characteristic for an individual otherwise identical to the reference individual. The tobit model estimates the association of training hours with the characteristics reported in the table, correcting for the sample selection bias due to the fact that individuals with different characteristics have different probability of participating in training. The dependent variable in this model is the logarithm of one plus training hours received by the individual. This logarithmic form is chosen to eliminate exponential heteroskedasticity. The argument of the logarithm is augmented by one because otherwise observations for non-participants would be eliminated from the sample. Coefficients can be interpreted as in a standard linear regression.

61. The reference individual is indicated in the table. Estimations are carried over for a limited number of individual characteristics (including, gender, age, education, country of birth, and occupation) and firm characteristics (firm size, sector), in order to maximise country coverage. Supervisory role and the distinction between self-employed and employees are not taken into account (the inclusion of these variables would have limited the analysis to only ten countries). As a consequence, the analysis is also restricted to employees of firms with more than twenty employees to eliminate as much as possible self-employment. Moreover, the sample is limited to employees with at least some education (since those without education are rather an exception and are concentrated in few countries) and not working in the agricultural sector (because of the special character of the agricultural labour market). As for the analysis of Section 2.B the sample include individuals aged 16 to 65 years. This is done for comparison with the empirical results that are presented in that section where young individuals are added to preserve a sufficiently large sample size. All the results presented in this paper are however robust to the elimination of this age class.

Demand and supply of training

62. For five countries (Australia, Canada, Finland, Italy and the United States), the IALS contains a large set of information on parental background – namely, educational attainment of parents, father’s occupation and a dummy for whether the mother has worked. The effect of parental background on training demand and supply is likely to occur essentially through literacy and education. Accordingly, these background variables can be used as instruments for literacy in a training regression. To instrument literacy, the literacy score is therefore regressed on parental background variables, education and other available characteristics (such as gender, age, community size, country of birth, and country dummies) that are relatively unlikely to be determined by the level of literacy. To avoid reverse-causality bias, other characteristics such as part-time status, industry, occupation, firm size and number of employers are excluded from the instrumental regression. Mother’s work status is included separately in the final IV regressions estimating the effect of literacy on demand and equilibrium. In fact, mother’s work status might be weakly endogenous, to the extent that it affects individual motivation and work attachment, particularly of women. This intuition is confirmed by the fact that this is the only parental background variable that is found to be significant when included in demand and equilibrium equations (both with and without the additional inclusion of literacy). Complete estimation results under both hypotheses A and B (see Annex 1) are reported in Table A2.4, while only the coefficients of literacy estimated under hypothesis B are included in Table 7 in the main text.

63. Table A2.5 reports complete estimation results, under both hypotheses, from different specifications including type of contract variables (cf. Table 8 in the main text). Three sets of estimates are considered. The first specification, which distinguishes between voluntary and involuntary part-time, is estimated on the full set of fifteen countries. By contrast, due to data availability, the second and third specifications (including also supervisory role and temporary contract, respectively) are estimated on smaller sets of countries – including Canada, Belgium, Czech Republic, Finland, Hungary, Italy, Poland, Switzerland, the United Kingdom and the United States, in the case of the second (supervisory role), and Canada, Finland, Hungary, Italy, Poland, Switzerland, the United Kingdom and the United States, in the case of the third (temporary contract).

Constrained workers

64. Table A2.6 reports complete results obtained from the estimation of probit models of the determinants of each barrier to training reported by constrained workers. Chart 7 in the main text is based on these estimates. The dependent variable takes value one if the individual reported a given specific constraint and zero if he/she reported to be constrained but did not report that specific constraint. Conditional on being constrained, the table reports the estimated change in the probability of being constrained by a given specific constraint associated with each characteristic for an individual otherwise identical to the reference individual. The equations are estimated only for those countries where sample size is greater than 200 observations (Australia, Canada, Denmark, Finland, Italy, New Zealand, Norway, Switzerland, the United Kingdom and the United States).

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Table 1. **Cross-country variation of training outcomes is large**

Employer-sponsored education and training^a

	Participation rate (%)			Annual intensity (hours per employee)		
	Total job-related education and training	<i>of which:</i>		Total job-related education and training	<i>of which:</i>	
		CVT ^b courses	Other types of job-related education and training		CVT ^b courses	Other types of job-related education and training
Australia	27	24	5	22	15	7
Belgium ^c	13	13	0	10	10	0
Canada	31	28	3	21	17	3
Czech Republic	20	16	5	18	13	5
Denmark	45	45	1	39	36	2
Finland	42	42	1	23	23	1
Hungary	15	14	2	15	13	2
Ireland	12	10	2	14	9	6
Italy	14	14	0	8	8	0
Netherlands	27	24	3	30	21	8
New Zealand	36	34	4	30	23	7
Norway	46	45	1	38	35	3
Poland	12	11	2	10	8	2
Switzerland	15	14	0	9	9	1
United Kingdom	45	44	3	30	22	8
United States	35	33	3	22	18	3
Unweighted average	27	26	2	21	18	4

a) Data refer to job-related training that employers provided (or partially paid) for employees aged 26 to 65 years in 1994 for Canada, Ireland, the Netherlands, Poland, Switzerland (German and French-speaking regions), and the United States, in 1996 for Australia, Belgium (Flanders only), New Zealand and the United Kingdom and in 1998 for the Czech Republic, Denmark, Finland, Hungary, Italy, Norway and the Italian-speaking regions of Switzerland.

b) Continuous vocational training.

c) Flanders only.

Source: IALS.

Table 2. **Workers in small firms receive relatively little training**

Employer-sponsored CVT by firm size, 1999^a

Number of employees in the firm	Participation rate (%)			Annual intensity (hours per employee)		
	10-49	>1000	All ^b	10-49	>1000	All ^b
Austria	24	43	31	7	14	9
Belgium	20	66	41	7	21	13
Czech Republic	24	55	42	6	12	10
Denmark	48	56	53	18	24	22
Finland	38	62	50	16	20	18
France	23	62	46	8	25	17
Germany	25	38	32	6	10	9
Greece	3	33	15	1	12	6
Hungary	7	26	12	3	10	5
Ireland	28	52	41	13	14	17
Italy	11	52	26	4	16	8
Luxembourg	19	59	36	8	20	14
Netherlands	36	42	41	11	19	15
Norway	12	22	16
Poland	8	46	16	3	11	4
Portugal	4	43	17	2	14	7
Spain	10	46	25	6	18	11
Sweden	51	68	61	15	22	18
United Kingdom	35	52	49	12	10	13
Unweighted average	23	50	35	8	17	12

a) Initial vocational training is not included. For this reason figures for Austria and Germany, where initial training plays a major role because of the dual educational system, are not fully comparable with those for the other countries.

b) All firms with at least 10 employees.

Source: CVTS2, New Cronos.

Table 3. Less-educated workers receive more training when wages are compressed

Probit-model estimates of the change in training probability associated with each factor^a

	Men aged 20-55 years	Men & women aged 20-55 years	Men aged 20-65 years	Men aged 20-55 years	Men & women aged 20-55 years	Men aged 20-65 years
	Employees with upper secondary education and above			Employees with less than upper secondary education		
Male*<i>D91</i>^b	-0.099	-0.092	-0.035	-0.256 *	-0.305 *	-0.237 *
Older^c*<i>D91</i>^b	-	-	0.033	-	-	-0.236 **
Female*<i>D91</i>^b	-	-0.055	-	-	-0.201 *	-
Age	-0.007 *	-0.005 *	-0.006 *	-0.007 *	-0.007 *	-0.006 *
Job tenure (0 and 1 year)	-0.007	0.033	0.008	0.026	0.034	0.064
Job tenure (2 to 5 years)	-0.014	-0.020	-0.007	-0.004	-0.002	0.030
Job tenure (10 to 14 years)	0.028	0.030	0.060 **	0.039	0.000	0.043
Job tenure (15 years or more)	0.001	-0.026	0.009	0.025	0.034	0.045
Firm size (more than 500 employees)	0.138 *	0.107 *	0.140 *	0.152 *	0.137 *	0.178 *
Tertiary education	0.065 *	0.066 *	0.044 ***	-	-	-
Prior long term unemployment spell	-0.084 *	-0.073 *	-0.081 **	-0.053	-0.084 *	-0.094 *
Female	-	-0.053	-	-	-0.108	-
Older workers ^c	-	-	-0.117	-	-	-0.048
Log Likelihood	-3047	-4967	-3128	-898	-1404	-898
Number of observations	6852	10990	7075	4915	7661	5314
Pseudo-R²	0.152	0.138	0.150	0.238	0.219	0.244
Number of countries	12	12	12	12	12	12

*, **, *** Statistically significant respectively at 1%, 5% and 10% levels, standard errors adjusted for cluster level effects.

- a) Estimated change in the probability of receiving training with respect to the reference individual. For continuous variables, marginal changes evaluated at the sample mean are reported. Each equation also includes 8 occupation dummies, 13 sector dummies and 12 country dummies. The sample is wage and salary employees in the private sector who are no longer in education, and not in the agricultural sector. The dependent variable takes value 1 for workers participating in training and 0 otherwise. The reference individual is male with less than tertiary education, aged 20 to 49 years, with 6 to 9 years of tenure, no prior history of long term unemployment and working in a firm with no more than 500 employees.
- b) Logarithm of the ratio of the 90th to 10th percentile of the cluster-specific distribution of gross hourly wages of male employees aged 20 to 55 years and not in education or training. Clusters are defined over 12 countries, 2 occupations, 2 sectors, 3 education levels and 2 age classes.
- c) Individuals aged 50 to 65 years.

Source: ECHP.

Table 4. Wage compression has an impact on both general and specific training

Multinomial logit estimates of the propensity to receive CVT ^a

	Men aged 20-55 only years	Men & women aged 20-55 years	Men aged 20-65 only years	Men aged 20-55 only years	Men & women aged 20-55 years	Men aged 20-65 only years
	Employees with upper secondary education and above			Employees with less than upper secondary education		
Off-site CVT						
Male*D91 ^b	-0.268	-0.408	0.037	-1.926 **	-2.067 **	-1.653 **
Older workers ^c *D91 ^b	-	-	-0.076	-	-	-5.067 **
Female*D91 ^b	-	0.075	-	-	-1.993 ***	-
Age	-0.035 *	-0.028 *	-0.044 *	-0.051 *	-0.058 *	-0.050 *
Job tenure (0 and 1 year)	0.334	0.568 *	0.387 **	0.607	0.669 **	0.958 **
Job tenure (2 to 5 years)	0.031	0.013	-0.029	-0.122	0.046	0.203
Job tenure (10 to 14 years)	0.080	0.083	0.176	0.125	0.067	0.271
Job tenure (15 years or more)	0.076	-0.160	0.077	0.109	0.137	0.243
Firm size (more than 500 employees)	0.415 *	0.221 **	0.447 *	0.453 ***	0.441 **	0.780 *
Tertiary education	0.365 **	0.270 **	0.097	-	-	-
Long term unemployment spell	-0.350	-0.383 **	-0.392	-0.793 *	-0.761 *	-1.352 **
Female	-	-0.459	-	-	0.137	-
Older workers ^c	-	-	0.091	-	-	1.947
Workplace CVT						
Male*D91 ^b	-0.665	-0.337	-0.206	-2.108 *	-1.919 *	-2.457 *
Older workers ^c *D91 ^b	-	-	0.611	-	-	-2.881 *
Female*D91 ^b	-	-0.073	-	-	-0.745	-
Age	-0.028 *	-0.020 *	-0.022 **	-0.018	-0.018 **	-0.014
Job tenure (0 and 1 year)	-0.302	-0.348 **	-0.251	-0.463	-0.147	-0.347
Job tenure (2 to 5 years)	-0.210	-0.275 ***	-0.150	0.389	0.067	0.528
Job tenure (10 to 14 years)	0.064	0.167	0.240	0.509	0.364	0.625 ***
Job tenure (15 years or more)	0.040	-0.090	0.083	0.191	0.359	0.387
Firm size (more than 500 employees)	0.728 *	0.605 *	0.690 *	1.079 *	1.193 *	1.261 *
Tertiary education	0.434 **	0.391 *	0.372 **	-	-	-
Long term unemployment spell	-0.602 *	-0.416 ***	-0.442	-0.290	-0.399	-0.551
Female	-	-0.517	-	-	-1.662 **	-
Older workers ^c	-	-	-1.343	-	-	-0.018
Log Likelihood	-2629	-4387	-2710	-721	-1130	-716
Number of observations	5092	8413	5295	4506	7007	4891
Pseudo-R²	0.139	0.133	0.136	0.211	0.206	0.230
Number of countries	10	10	10	10	10	10

*, **, *** Statistically significant respectively at 1%, 5% and 10% levels, standard errors adjusted for cluster level effects.

- The reported coefficients show the linear effect of each variable on the unobserved propensity to receive training. A positive sign for a given variable indicates that the probability of receiving training is larger the greater that variable. Each equation also includes 8 occupation dummies, 13 sector dummies and 12 country dummies. The sample is wage and salary employees in the private sector who are no longer in education, and not in the agricultural sector. The dependent variable takes value 1 for workers participating in training and 0 otherwise. The reference individual is male with less than tertiary education, aged 20 to 49 years, with 6 to 9 years of tenure, no prior history of long term unemployment and working in a firm with no more than 500 employees.
- Logarithm of the ratio of the 90th to 10th percentile of the cluster-specific distribution of gross hourly wages of male employees aged 20 to 55 years and not in education or training. Clusters are defined over 12 countries, 2 occupations, 2 sectors, 3 education levels and 2 age classes.
- Individuals aged 50 to 65 years.

Source: ECHP.

Table 5. **A quarter of all workers would like more training**

Percentage of workers reporting that they wanted to take further training, but did not

	All ^a	Not trained ^a	Trained ^b		
			All trained	<i>Of which:</i>	
				Not employer sponsored	Employer-sponsored
Austria	26.9	25.2	31.2	34.5	30.3
Belgium ^c	19.2	17.2	30.8	38.9	28.9
Canada	33.6	30.2	41.4	64.3	37.4
Czech Republic	15.4	14.7	19.1	26.1	18.5
Denmark	33.3	31.1	35.4	39.1	34.6
Finland	38.1	38.9	37.2	38.6	37.0
Hungary	15.4	14.5	20.0	24.9	18.7
Ireland	19.2	17.5	29.0	29.2	29.0
Italy	24.1	21.1	34.0	36.4	32.2
Netherlands	22.5	21.7	24.6	23.9	24.7
New Zealand	33.0	28.2	40.3	48.6	38.5
Norway	34.4	29.4	39.9	30.6	41.0
Poland	16.0	14.6	25.5	36.8	22.8
Switzerland	27.2	26.6	29.7	25.3	31.4
United Kingdom	25.4	20.1	31.2	47.1	29.3
United States	26.1	21.9	34.6	43.1	33.6
Unweighted average	25.6	23.3	31.5	36.7	30.5

Note: Data refer to 1994 for Canada, Ireland, the Netherlands, Poland, Switzerland (German and French-speaking regions), and the United States, to 1996 for Australia, Belgium (Flanders only), New Zealand and the United Kingdom and to 1998 for the Czech Republic, Denmark, Finland, Hungary, Italy, Norway and the Italian-speaking regions of Switzerland.

a) Employed persons aged 25 to 65 years who did not receive training for professional or career-related purposes.

b) Employed persons aged 25 to 65 years who received training for professional or career-related purposes.

c) Flanders only.

Source: IALS.

Table 6. Training supply and demand vary across firms and individuals

Bivariate probit model estimates of the change in the probability associated with each factor^{a,b}

	Demand	Equilibrium outcome	Supply ^c
Gender			
(reference: Men)			
Women	2.3 **	-1.1	+
Age groups			
(reference: aged 36-45)			
Aged 16-25	1.7	-7.5 *	-
Aged 26-35	1.7	-1.0	0
Aged 46-55	-7.1 *	-2.2 **	+
Aged 56-65	-15.2 *	-6.5 *	+
Educational attainment			
(reference: upper secondary)			
Less than upper secondary	-4.9 *	-4.0 *	0(?)
Tertiary	5.5 *	5.2 *	0(?)
Community size			
(reference: Urban)			
Rural	-3.2 *	-0.1	+
Full-time/part-time			
(reference: Full-time)			
Part-time workers	-2.2 ***	-12.4 *	-
Country of birth			
(reference: born in country of interview)			
Immigrants	2.4	-5.5 *	-
Number of employers (last 12 months)			
(references: more than one employer)			
One employer only	-9.2 *	1.6	+
Firm size			
(reference: 100 to 199 employees)			
20 to 99 employees	1.2	-2.4 ***	-
200 to 499 employees	-0.1	5.4 *	+
500 & more employees	1.0	9.9 *	+
Industry			
(reference: manufacturing, mining & energy)			
Construction	5.9 **	-3.9 ***	-
Wholesale & retail trade	2.5	-5.1 *	-
Transport, storage & communications	0.9	2.7 ***	+
Financing, Ins. Real estate & Bus. Services	-0.9	4.8 *	+
Community, social & personal services	5.4 *	-0.6	-
Occupation			
(reference: Clerks)			
Legislators, senior officials & managers	1.3	11.0 *	+
Professionals	5.8 *	5.2 *	?
Technicians & associate professionals	3.6 **	5.6 *	?
Service workers & shop & market sales workers	-1.6	-3.3 **	-
Craft & related trades workers	-2.6	-6.0 *	-
Plant & machine operators & assemblers	-2.5	-11.4 *	-
Elementary occupations	-7.9 *	-17.6 *	-
Predicted at vector 0	34.4	34.6	
Log likelihood	-6912	-11129	
Number of observations	11929	19036	
Number of countries	15	15	
Pseudo R2	0.065	0.115	

*, **, *** statistically significant at 1%, 5% and 10% levels, respectively.

- a) The estimation is based on the hypothesis that employees cannot refuse to be trained. Subject to this hypothesis, the demand equation is estimated only on the sub-sample of those who did not receive employer-sponsored training.
- b) Estimated percentage change in the probability of demanding training (receiving training in equilibrium) with respect to the reference individual. Equations are estimated by maximum likelihood assuming no correlation between residuals. The sample population is employees of firms with more than 20 employees, with at least some education, aged 16 to 65 years and not working in the agricultural sector. The reference individual is indicated in the table. The dependent variable for demand takes value 1 if the individual received training or wished to be trained. For the equilibrium outcome the dependent variable takes value 1 if the individual received employer-sponsored training. All equations include 15 country dummies.
- c) +, - and 0 mean that, with respect to the reference individual, a given characteristic is estimated to increase supply, reduce supply, leave supply unchanged. The sign ? implies that nothing can be said on the supply shift. See Annex 1 for a detailed description.

Source: OECD estimates based on IALS.

Table 7. Literacy has no impact on training demand

Supply and demand: the effect of literacy

Bivariate probit estimates ^{a, b}

	Demand	Equilibrium outcome	Supply ^c
Literacy	0.5	5.0 **	+
Number of countries	5	5	

^{*}, ^{**}, ^{***} statistically significant at 1%, 5% and 10% levels, respectively .

- a) The estimation is based on the hypothesis that employees cannot refuse to be trained. Subject to this hypothesis, the demand equation is estimated only on the sub-sample of those who did not receive employer-sponsored training.
- b) Estimated percentage change in the probability of demanding training (receiving training in equilibrium) with respect to the reference individual. For literacy, which is a continuous variable, the effect of a 10% increase in the literacy score from the sample average is reported. Equations are estimated by maximum likelihood assuming no correlation between residuals. Literacy, being potentially endogenous, has been instrumented using parental background characteristics, education, gender, age, community size, country of birth and country dummies. The sample are employees of firms with more than 20 employees, with at least some education, aged 16 to 65 years and not working in the agricultural sector. The reference individual is a native male employee aged 36 to 45, with upper secondary education, who has changed job in the last 12 months and is working full-time as a clerk in a firm with 100 to 199 employees, located in an urban area and whose main business is in the mining, manufacturing or energy industry. The dependent variable for demand takes 1 if the individual received training or wished to be trained. For the equilibrium outcome the dependent variable takes value 1 if the individual received employer-sponsored training. All equations include dummies for gender, educational attainment, age classes, community size, part-time status, country of birth, number of employees, firm size classes, industries, occupations and countries.
- c) +, - and 0 mean that, with respect to the reference individual, a given characteristic is estimated to increase supply, reduce supply, leave supply unchanged. The sign ? implies that nothing can be said on the supply shift. See Annex 1 for a detailed description.

Source: OECD estimates based on IALS.

Table 8. The type of contract has an impact on training demand and supply

	Bivariate probit estimates ^{a,b}								
	Demand	Equilibrium outcome	Supply ^c	Demand	Equilibrium outcome	Supply ^c	Demand	Equilibrium outcome	Supply ^c
Part-time									
(reference: full-time)									
-family and health problems	-1.7	-9.7 *	-	-3.9	-6.2 *	-	-6.2 ***	-5.8 **	?
-still in education	-7.5 *	-19.9 *	-	-10.2 **	-17.3 *	-(?)	-12.1 *	-16.4 *	?
-voluntary part-time for other reasons	-12.1 *	-8.6 *	?	-11.3 *	-7.9 **	?	-12.2 *	-7.3 **	?
-involuntary part-time	8.5 *	-13.3 *	-	1.1	-12.1 *	-	-0.6	-9.0 *	-
Supervisory role									
(reference: some supervisory role)									
No supervisory				-6.6 *	-8.5 *	?	-6.5 *	-7.5 *	?
Great supervisory				-4.3 ***	4.7 *	+	-3.4	5.0 *	+
Temporary contract									
(reference: permanent)									
Temporary contract							7.8 *	-12.7 *	-
Number of countries	15	15		10	10		8	8	

*, **, *** statistically significant at 1%, 5% and 10% levels, respectively.

- a) The estimation is based on the hypothesis that employees cannot refuse to be trained. Subject to this hypothesis, the demand equation is estimated only on the sub-sample of those who did not receive employer-sponsored training.
- b) Estimated percentage change in the probability of demanding training (receiving training in equilibrium) with respect to the reference individual. Equations are estimated by maximum likelihood assuming no correlation between residuals. The sample are employees of firms with more than 20 employees, with at least some education, aged 16 to 65 years and not working in the agricultural sector. The reference individual is a native male employee aged 36 to 45, with upper secondary education, who has changed job in the last 12 months and is working full-time as a clerk in a firm with 100 to 199 employees, located in an urban area and whose main business is in the mining, manufacturing or energy industry. Additional characteristics of the reference individual are indicated in the table. The dependent variable for demand takes value 1 if the individual received training or wished to be trained. For the equilibrium outcome the dependent variable takes value 1 if the individual received employer-sponsored training. All equations include dummies for gender, age classes, community size, part-time status, country of birth, number of employees, firm size classes, industries, occupations and countries.
- c) +, - and 0 mean that, with respect to the reference individual, a given characteristic is estimated to increase supply, reduce supply, leave supply unchanged. The sign ? implies that nothing can be said on the supply shift. See Annex 1 for a detailed description.

Source: OECD estimates based on IALS.

Table 9. From evidence to policy

Main co-financing policy options likely to improve training outcomes for specific disadvantaged groups

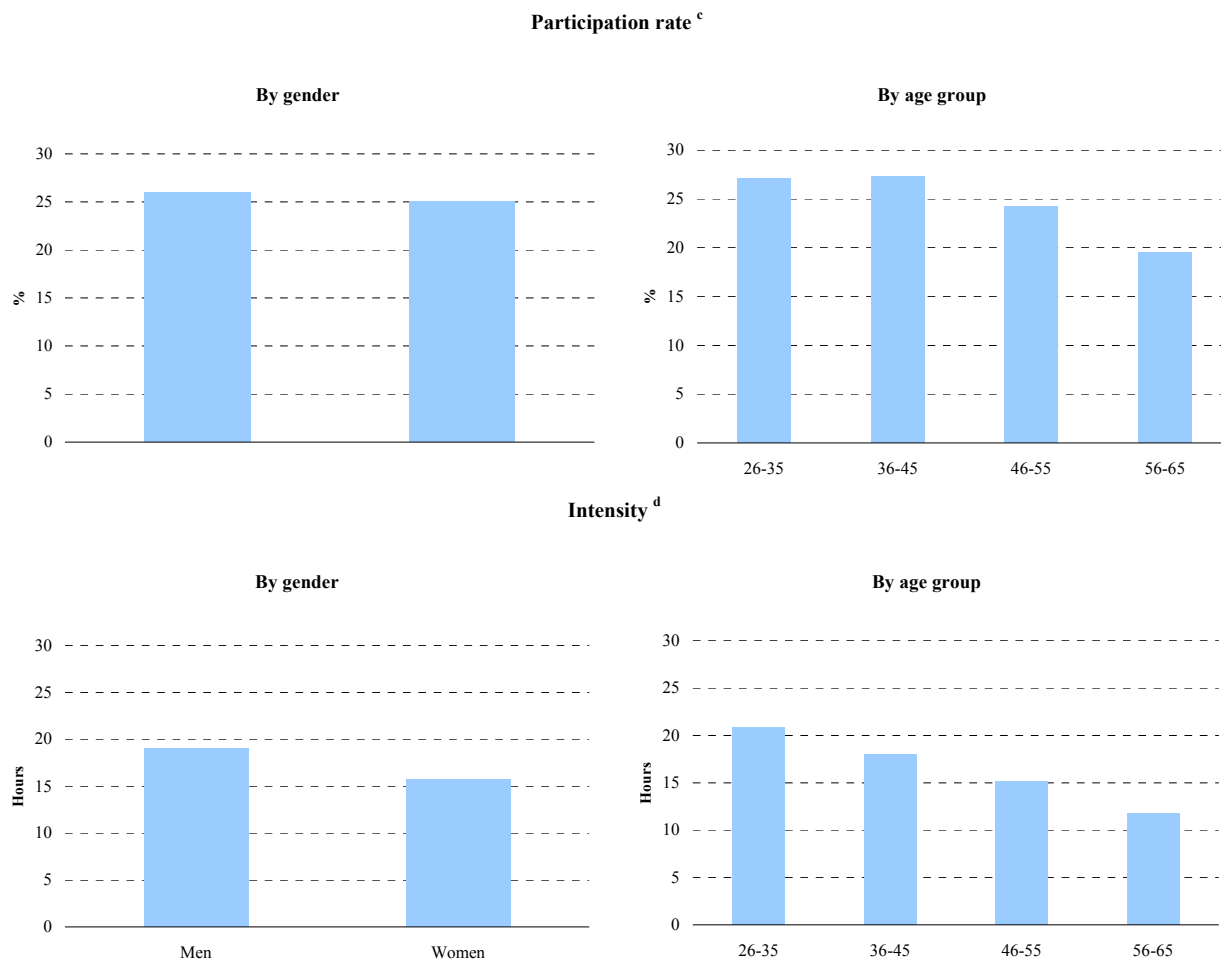
Disadvantaged group	Main barrier to training ^a		Co-financing schemes
Older workers, low-educated workers	Weak demand with equal or higher employers' supply		- Incentives for employers (corporate tax deductions, pay-back clauses)
Women, immigrants, workers with low literacy, involuntary part-time workers, temporary workers, non-supervisory workers	Low employers' supply with equal or higher demand	Low supply due to individual characteristics	- Reducing individual credit constraints (loan schemes, ILAs, pay-back clauses) - Reducing individual time constraints (time accounts, training leave) - Improving cost-sharing (pay-back clauses)
Workers in small firms, workers in low-tech industries and/or industry with many firms		Low supply due to firm characteristics	- Reducing individual credit constraints (loan schemes, ILAs, pay-back clauses) - Incentives for employers (targeted tax deductions, pay-back clauses)
Low literacy workers with low qualifications	Low demand and low employers' supply		"Empowering" schemes (ILAs)

a) Barriers to training refer to the main reasons for the weak participation in employer-sponsored CVT of a particular worker group relative to the reference group, namely native, high-skilled, full-time, prime-age male employees in large high-tech firms.

Source: OECD estimates based on IALS.

Chart 1. Older workers and women receive less training

Employer-sponsored CVT courses by gender and age^{a,b}

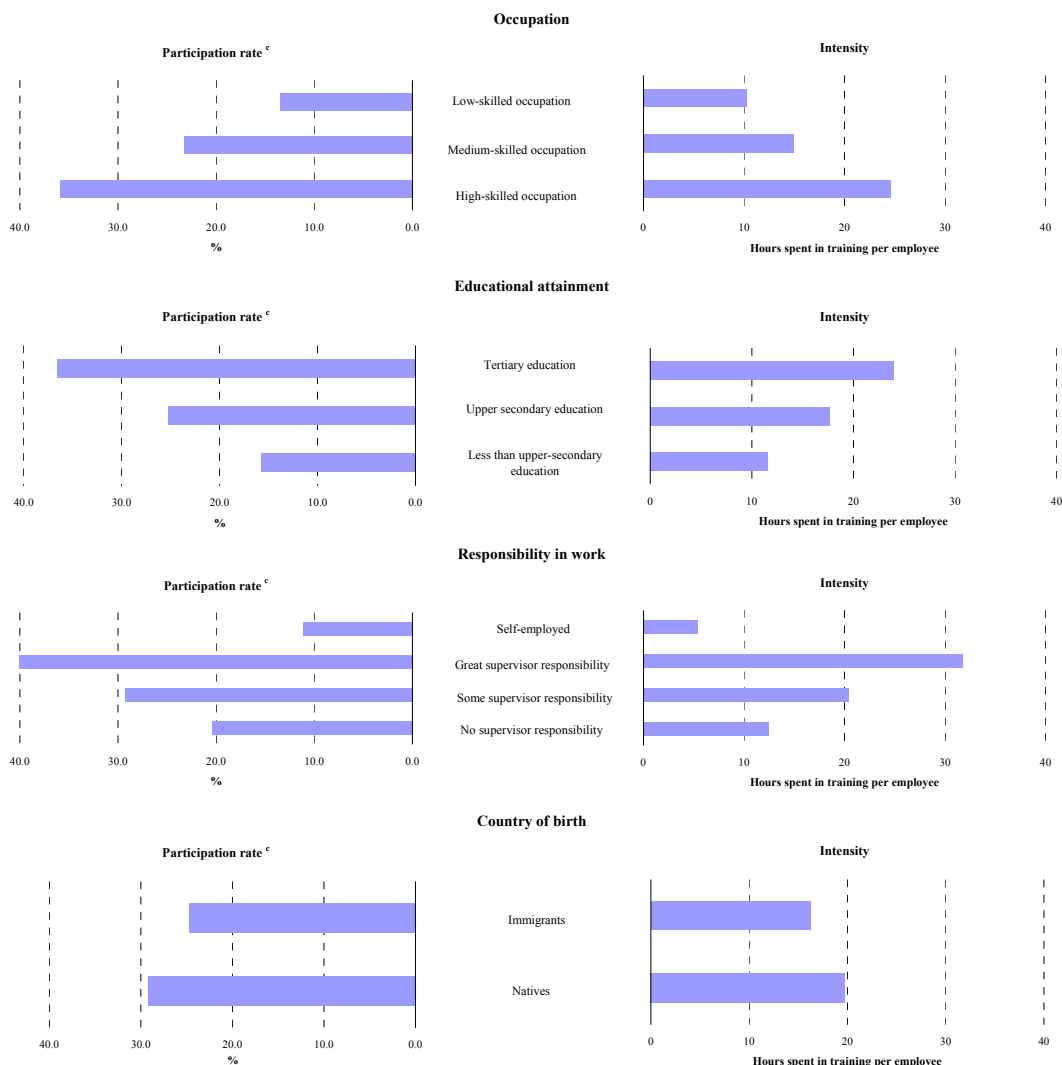


- a) Data refer to employed persons aged 26 to 65 years.
- b) Unweighted average of Australia, Belgium (Flanders only), Canada, the Czech Republic, Denmark, Finland, Hungary, Ireland, Italy, the Netherlands, New Zealand, Norway, Poland, Switzerland, the United Kingdom and the United States.
- c) Ratio of employees participating in training to total employees (in %).
- d) Hours spent in CVT courses per employee.

Source: IALS.

Chart 2. Native and skilled workers receive more training

Employer-sponsored CVT courses by socio-economic characteristics ^{a,b}



a) Data refer to employed persons aged 26 to 65 years.

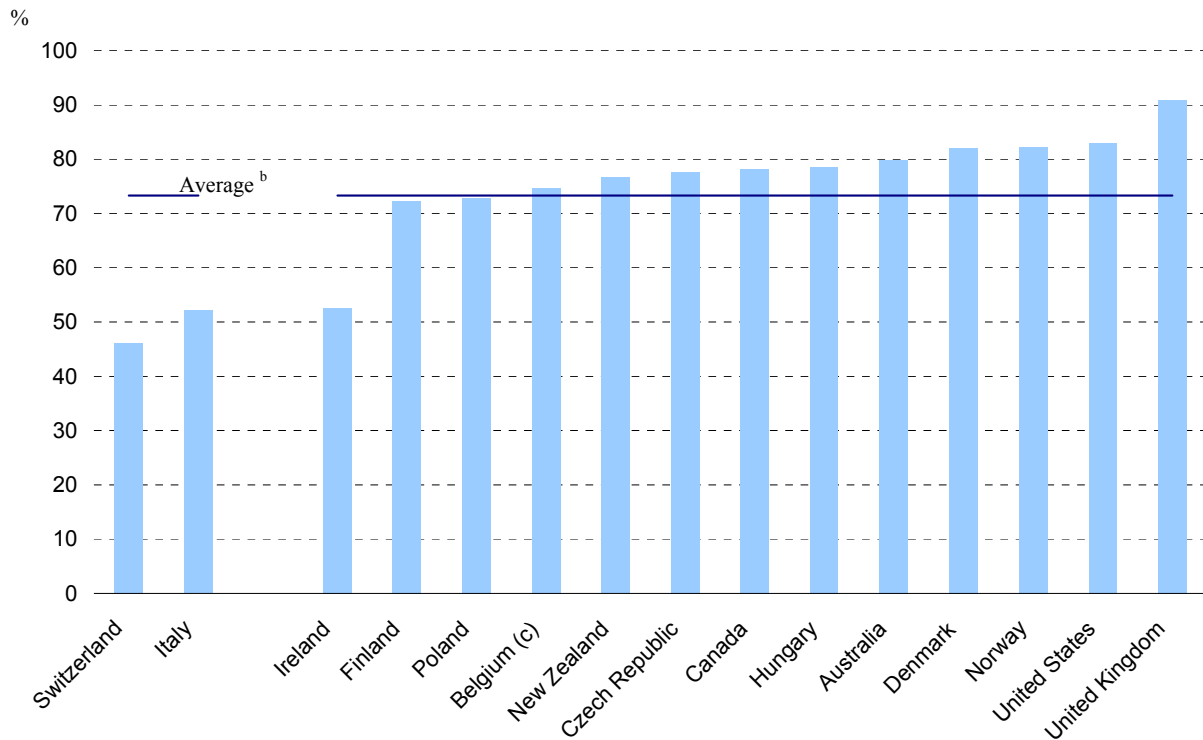
b) Unweighted average of Australia, Belgium (Flanders only), Canada, the Czech Republic, Denmark, Finland, Hungary, Ireland, Italy, the Netherlands, New Zealand, Norway, Poland, Switzerland, the United Kingdom and the United States. Belgium is excluded from 'Occupation'; Australia, Denmark, Ireland, New Zealand and Norway are excluded from 'Responsibility in work' due to missing data; Belgium, the Czech Republic, Finland, Hungary and Poland are excluded from 'Country of birth'.

c) Ratio of employees participating in training to total employees (in %).

Source: IALS.

Chart 3. Most training is entirely paid by employers

Percentage of CVT courses entirely paid by employers^a



a) Data refer to all CVT courses (both employer-sponsored and non-employer-sponsored) received by employed persons aged 26 to 65 years and to 1994 for Canada, Ireland, Poland, Switzerland (German and French-speaking regions), and the United States, to 1996 for Australia, Belgium (Flanders only), New Zealand and the United Kingdom and to 1998 for the Czech Republic, Denmark, Finland, Hungary, Italy, Norway and the Italian-speaking regions of Switzerland.

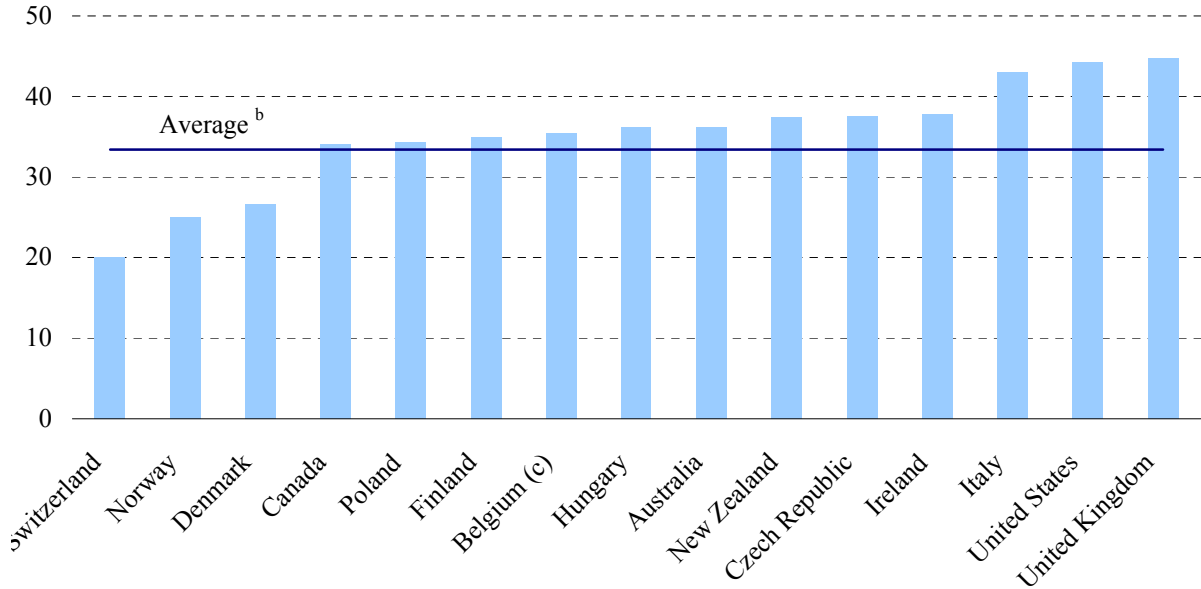
b) Unweighted average of countries shown.

c) Flanders only.

Source: IALS.

Chart 4. **Employer-paid CVT less frequently impart firm-specific skills**

Percentage of employer-paid CVT courses taking place at work^a



a) Data refer to CVT courses that are entirely employer-paid and provided to employed persons aged 26 to 65 years. Also, they refer to 1994 for Canada, Ireland, Poland, Switzerland (German and French-speaking regions), and the United States, to 1996 for Australia, Belgium (Flanders only), New Zealand and the United Kingdom and to 1998 for the Czech Republic, Denmark, Finland, Hungary, Italy, Norway and the Italian-speaking regions of Switzerland.

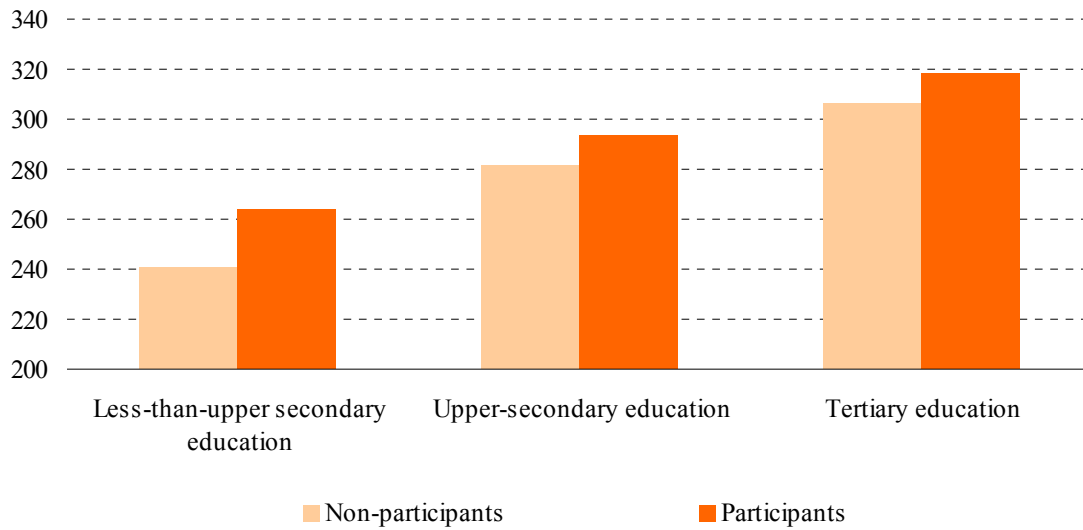
b) Unweighted average of countries shown.

c) Flanders only.

Source: IALS.

Chart 5. Workers with better literacy skills receive more training

Literacy and employer-sponsored CVT, by educational attainment^{a,b}



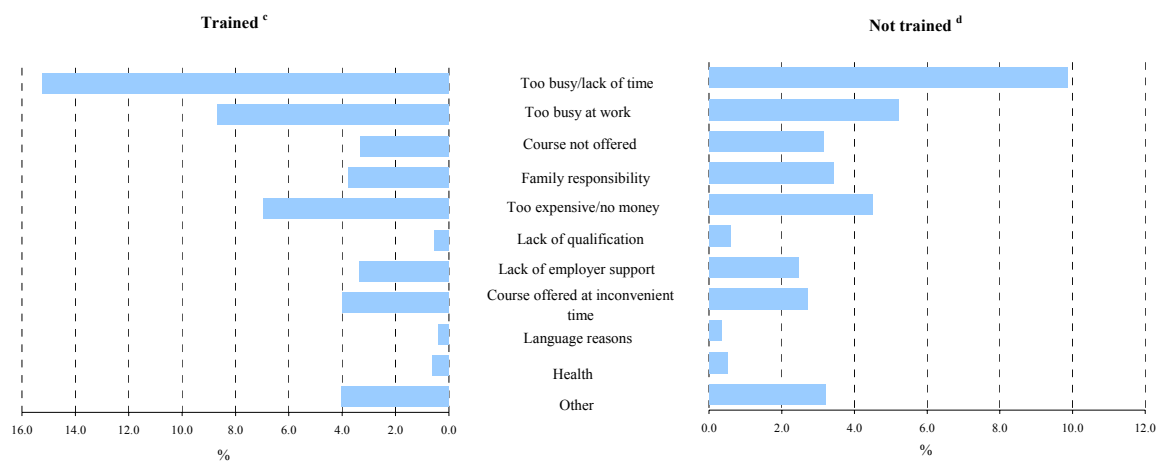
a) Data refer to employed persons aged 26 to 65 years.

b) Unweighted average of Australia, Belgium (Flanders only), Canada, the Czech Republic, Denmark, Finland, Hungary, Ireland, Italy, the Netherlands, New Zealand, Norway, Poland, Switzerland, the United Kingdom and the United States. The literacy levels are calculated as an average over the three types of literacy skills reported in the IALS, namely prose, documentation and quantitative skills.

Source: IALS.

Chart 6. Time is the most common constraint

Percentage of constrained workers, by reason ^{a, b}



a) Employed persons aged 26 to 65 years.

b) Unweighted average of Australia, Belgium (Flanders only), Canada, the Czech Republic, Denmark, Finland, Hungary, Ireland, Italy, the Netherlands, New Zealand, Norway, Poland, the United Kingdom, and the United States.

c) Individuals who received training for professional or career-related purposes.

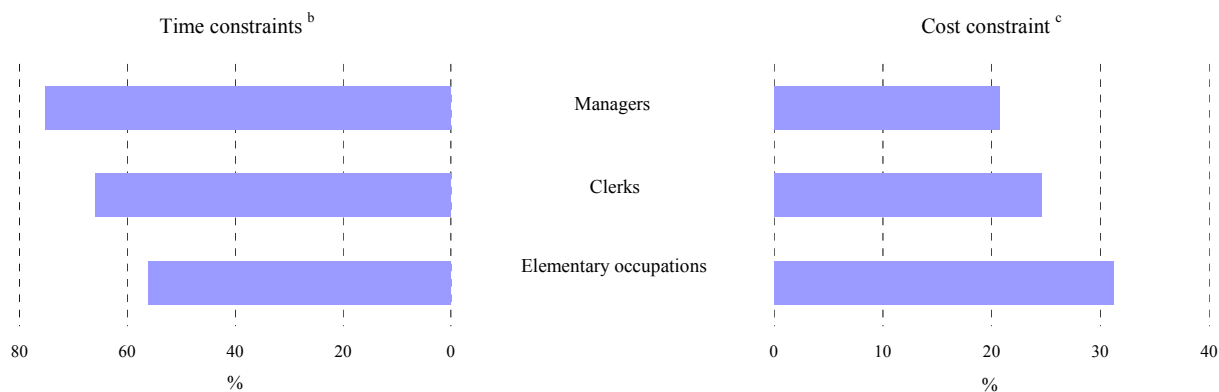
d) Individuals who did not receive training for professional or career-related purposes.

Source: IALS.

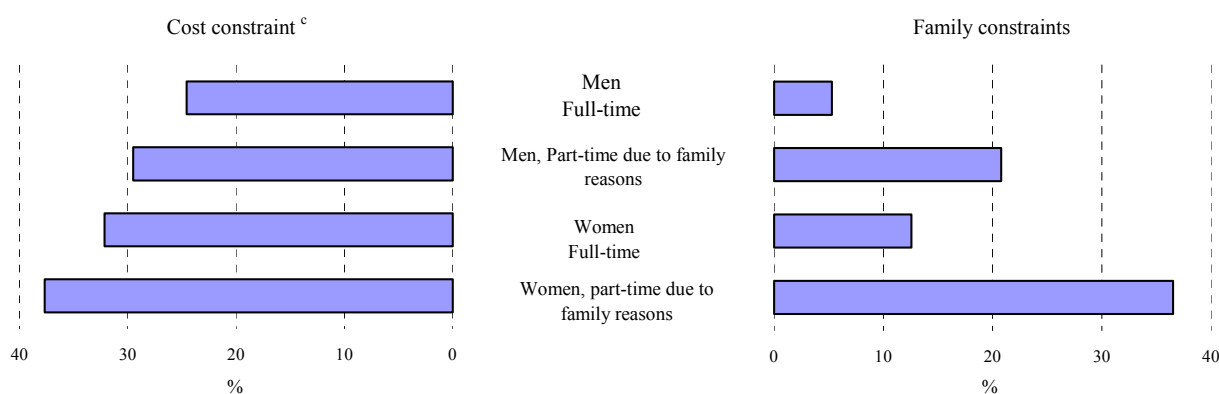
Chart 7. Constraints vary across worker groups

Probability of reporting a specific constraint, conditional to being "constrained"^a

Managers versus elementary occupations



Gender and part-time



- a) See Annex 2 for full estimation results.
- b) Too busy/lack of time, too busy at work, family responsibilities, course offered at inconvenient time.
- c) Course too expensive/no money.

Source: OECD estimates based on IALS

Table A1.1. **Samples and dependent variables**

	Demand	Equilibrium Outcome
	Dependent variable: 1 for participants in sponsored and non-sponsored CVT or constrained workers, and 0 for the others	Dependent variable: 1 for participants in sponsored CVT only, and 0 for the others
Hypothesis A: Employers cannot force their employees to be trained against their will	Whole sample	Participants in sponsored and non-sponsored CVT or constrained workers
Hypothesis B: Employers can always force a worker to be trained through monetary compensation or lay-off threats	Non-participants in sponsored CVT	Whole sample

Table A1.2. Estimating supply differences across groups from demand and equilibrium estimates^a

Demand	Equilibrium outcome	Supply
+	0	-
+	-	-
0	-	-
0	0	0
-	+	+
-	0	+
0	+	+
+	+	depends on the relative size of differences
-	-	depends on the relative size of differences

- a) +, - and 0 mean that, with respect to the reference individual, a given characteristic is estimated to shift the corresponding curve rightward, leftward and in no significant way, respectively. For example, the first line of the table means that if demand is estimated to shift rightward and no significant shift is estimated for the equilibrium outcome, then the derived supply schedule is estimated to shift leftward.

Table A2.1. Training incidence by gender and age^a

	Participation in employer-sponsored training (%)							Hours spent in employer-sponsored training per employee						
	Gender			Age group				Gender			Age group			
	Both sexes	Men	Women	26-35	36-45	46-55	56-65	Both sexes	Men	Women	26-35	36-45	46-55	56-65
Australia	24.4	25.8	22.4	24.8	27.8	21.9	17.5	15.4	19.5	9.9	19.0	14.8	14.1	8.6
Belgium ^b	13.2	14.7	10.7	12.0	11.3	17.1	18.2	9.7	12.0	6.1	11.7	6.8	8.7	20.9
Canada	28.3	28.8	27.6	27.3	29.2	29.9	23.4	17.3	21.8	11.5	15.3	19.2	19.1	13.4
Czech Republic	15.9	19.3	12.0	19.1	15.1	14.8	14.4	13.3	15.9	10.3	18.3	10.3	13.6	10.8
Denmark	44.8	43.3	46.6	46.6	49.9	42.8	32.2	36.4	34.0	39.3	35.7	37.7	39.6	26.4
Finland	41.7	41.7	41.9	44.7	44.3	38.1	33.5	22.6	22.7	22.6	28.0	25.8	16.4	13.5
Hungary	13.6	13.0	14.4	15.2	14.0	12.2	9.0	13.0	12.3	13.8	15.1	14.4	9.8	7.4
Ireland	10.2	8.7	12.9	13.1	10.1	7.4	4.9	8.7	4.6	16.4	13.1	8.7	3.5	2.6
Italy	14.0	16.4	9.7	14.8	15.1	11.6	12.9	7.7	8.1	7.0	10.6	7.3	5.4	4.2
Netherlands	24.1	26.9	19.4	25.2	27.0	21.3	14.6	21.4	25.0	15.3	29.4	19.6	15.3	10.2
New Zealand	33.7	34.3	33.0	33.9	36.5	35.8	19.3	23.2	28.0	17.5	26.4	22.4	22.5	17.7
Norway	44.9	42.3	48.1	48.0	46.7	45.0	30.5	35.0	34.8	35.1	38.9	37.4	31.4	25.1
Poland	10.6	9.5	12.1	10.3	11.8	9.1	9.5	8.0	7.3	8.9	10.1	7.1	7.1	4.9
Switzerland	14.5	15.7	12.6	16.8	14.6	12.3	12.7	8.8	10.8	5.9	12.9	10.0	5.2	3.5
United Kingdom	43.5	43.3	43.8	48.1	48.8	37.3	30.0	21.8	24.5	18.4	27.1	24.1	18.5	7.8
United States	32.7	31.7	33.7	32.9	34.5	31.8	29.1	18.3	22.2	14.0	21.8	22.1	13.0	10.8

a) Data refer to employed persons aged 26 to 65 years and to 1994 for Canada, Ireland, the Netherlands, Poland, Switzerland (German and French-speaking regions), and the United States, to 1996 for Australia, Belgium (Flanders only), New Zealand and the United Kingdom and to 1998 for the Czech Republic, Denmark, Finland, Hungary, Italy, Norway and the Italian-speaking regions of Switzerland.

b) Flanders only.

Source: IALS.

Table A2.2. Training incidence by socio-economic characteristics^a

	Participation in employer-sponsored training (%)								
	Occupation			Educational attainment			Country of birth		Employee (no supervisory)
	High-skilled occupation	Medium-skilled occupation	Low-skilled occupation	Less than upper- secondary	Upper secondary	Tertiary	Natives	Immigrants	
Australia	34.1	21.2	13.6	18.2	23.0	32.9	26.3	19.6	..
Belgium ^b	33.7	11.5	..	5.5	13.6	22.1	13.2	..	9.2
Canada	37.6	24.8	14.9	16.3	23.5	38.2	28.0	29.4	21.2
Czech Republic	22.3	12.8	10.0	11.2	19.5	26.2	16.0	..	13.8
Denmark	58.9	38.9	21.6	27.5	42.2	59.4	45.0	34.0	..
Finland	52.6	38.0	20.1	28.6	39.7	57.3	41.9	..	42.6
Hungary	23.2	10.0	5.7	8.4	9.6	26.3	13.7	..	12.7
Ireland	15.2	10.3	4.7	6.3	13.4	13.8	10.3	8.1	..
Italy	23.4	12.1	4.9	7.3	19.5	23.0	13.9	16.6	12.4
Netherlands	28.7	20.2	13.3	15.0	23.9	37.3	23.9	27.4	21.2
New Zealand	45.8	30.8	20.8	27.9	30.5	44.6	35.0	28.7	..
Norway	55.5	40.7	24.9	27.2	42.0	56.1	45.2	39.5	..
Poland	20.6	9.4	3.1	4.7	16.0	20.3	10.7	..	9.7
Switzerland	19.9	12.0	6.1	4.6	15.6	22.7	16.0	8.7	11.9
United Kingdom	55.7	38.0	27.7	35.2	48.2	58.0	43.8	39.8	41.5
United States	45.0	29.5	11.1	9.0	24.4	46.8	34.5	20.1	28.0

	Hours spent in employer-sponsored training per employee								
	Occupation			Educational attainment			Country of birth		Employee (no supervisory)
	High-skilled occupation	Medium-skilled occupation	Low-skilled occupation	Less than upper- secondary	Upper secondary	Tertiary	Natives	Immigrants	
Australia	18.0	13.8	10.1	11.4	15.3	20.1	15.3	15.6	..
Belgium	21.9	7.8	..	3.0	13.1	14.2	9.9	..	6.0
Canada	19.5	15.9	15.1	12.0	13.1	23.8	17.1	18.3	10.6
Czech Republic	19.6	10.3	6.9	8.0	16.4	27.2	13.5	..	11.9
Denmark	48.8	31.0	19.9	29.4	32.2	47.3	36.7	22.7	..
Finland	30.8	18.2	6.9	13.1	21.9	32.4	22.7	..	21.7
Hungary	28.6	6.5	2.2	4.5	10.0	26.9	13.1	..	11.6
Ireland	13.0	10.7	1.7	7.8	10.9	6.5	9.0	2.5	..
Italy	15.5	5.3	1.8	2.8	12.5	12.5	7.7	9.4	5.2
Netherlands	26.6	13.9	14.3	14.4	23.4	28.3	21.1	26.6	19.6
New Zealand	32.1	17.4	18.6	24.4	20.3	23.3	23.7	21.1	..
Norway	43.9	25.4	28.5	21.6	34.6	39.7	35.6	24.2	..
Poland	11.5	10.9	2.0	5.3	8.6	14.7	8.0	..	7.5
Switzerland	11.8	9.1	2.0	1.4	10.2	13.9	10.3	3.5	7.2
United Kingdom	27.5	19.6	12.9	18.0	27.2	25.7	21.9	20.7	22.9
United States	22.7	17.1	10.9	7.6	12.8	26.5	18.9	13.8	12.6

.. Data not available or cells with less than 30 observations.

a) Data refer to employed persons aged 26 to 65 years and to 1994 for Canada, Ireland, the Netherlands, Poland, Switzerland (German and French-speaking regions), and the United States, to 1996 for Australia, Belgium (Flanders only), New Zealand and the United Kingdom and to 1998 for the Czech Republic, Denmark, Finland, Hungary, Italy, Norway and the Italian-speaking regions of Switzerland.

b) Flanders only.

Source: IALS.

Table A2.3. Probit and tobit estimates of the determinants of training

	Training participation		Average hours spent in training	
	Probit ^a		Tobit ^b	
Gender (reference: Men)				
Women	-0.011		-0.205	*
Age groups (reference: aged 36-45)				
Aged 16-25	-0.076	*	-0.683	*
Aged 26-35	-0.010		-0.070	
Aged 46-55	-0.022	**	-0.231	**
Aged 56-65	-0.065	*	-0.711	*
Educational attainment (reference: upper secondary)				
Less than upper secondary	-0.040	*	-0.389	*
Tertiary	0.052	*	0.411	*
Community size (reference: Urban)				
Rural	-0.001		0.012	
Full-time/part-time (reference: Full-time worker)				
Part-time workers	-0.124	*	-1.414	*
Country of birth (reference: born in country of interview)				
Immigrants	-0.055	*	-0.500	*
Number of employers (last 12 months) (references: more than one employee)				
One employer only	0.016		0.092	
Firm size (reference: 100 to 199 employees)				
20 to 99 employees	-0.024	***	-0.335	**
200 to 499 employees	0.053	*	0.433	*
500 & more employees	0.099	*	0.847	*
Industry (reference: manufacturing, mining & electricity)				
Construction	-0.039	***	-0.488	**
Wholesale & retail trade	-0.051	*	-0.572	*
Transport, storage & communications	0.027	***	0.283	**
Financing, Ins. Real estate & Bus. Services	0.048	*	0.341	*
Community, social & personal services	-0.006		-0.104	
Occupation (reference: Clerks)				
Legislators, senior officials & managers	0.110	*	1.059	*
Professionals	0.053	*	0.529	*
Technicians & associate professionals	0.056	*	0.549	*
Service workers & shop & market sales workers	-0.033	**	-0.299	
Craft & related trades workers	-0.059	*	-0.501	*
Plant & machine operators & assemblers	-0.113	*	-1.181	*
Elementary occupations	-0.176	*	-2.067	*

Table A2.3. Probit and tobit estimates of the determinants of training *(cont.)*

Country	Training participation		Average hours spent in	
	Probit ^a		Tobit ^b	
(reference: Australia)				
Belgium ^c	-0.162	*	-2.418	*
Canada	-0.035	**	-0.366	**
Czech Republic	-0.180	*	-2.063	*
Denmark	0.180	*	1.591	*
Finland	0.132	*	0.990	*
Hungary	-0.197	*	-2.454	*
Ireland	-0.202	*	-2.907	*
Italy	-0.166	*	-1.888	*
New Zealand	0.137	*	1.056	*
Norway	0.128	*	1.113	*
Poland	-0.189	*	-2.889	*
Switzerland	-0.112	*	-1.194	*
United Kingdom	0.148	*	1.048	*
United States	-0.017		-0.262	
Predicted at vector 0	0.345		-0.830	
Log likelihood	-11138		3043	
Number of observations	19062		18853	
Number of countries	15		15	
Pseudo R2	0.115		0.057	

*, **, ***, statistically significant at 1%, 5% and 10% levels respectively.

- a) Estimated change in the probability of training participation with respect to the reference individual. The sample population is employees of firms with more than 20 employees, with at least some education, aged 16 to 65 years and not working in the agricultural sector. The reference individual is indicated in the table.
- b) The dependent variable is equal to $\log(1+T)$ where T stands for hours of training.
- c) Flanders only.

Source: OECD estimates based on the IALS.

Table A2.4. Training supply and demand: the effect of literacy

Bivariate probit model estimates of the change in the probability associated with each factor ^a

	Hypothesis A ^b		Hypothesis B ^c	
	Demand	Equilibrium outcome	Demand	Equilibrium outcome
Literacy	3.7	4.0	0.5	5.0 **
Mother has worked	6.6 *	-0.5	5.2 **	3.4 ***
Gender (reference: Men)				
Women	-0.3	-5.1 *	1.8	-3.1 **
Age groups (reference: aged 36-45)				
Aged 16-25	-6.7 *	-9.7 *	-0.4	-9.6 *
Aged 26-35	-0.5	-3.7 **	1.9	-2.8 ***
Aged 46-55	-6.9 *	3.7 ***	-6.2 *	-2.2
Aged 56-65	-9.5 *	8.7 **	-10.2 *	-0.6
Educational attainment (reference: upper secondary)				
Less than upper secondary	-2.7	1.6	-3.4	0.1
Tertiary	3.2	-5.1 ***	5.5 **	-1.6
Community size (reference: Urban)				
Rural	-0.2	0.4	-0.9	0.6
Full-time/part-time (reference: Full-time)				
Part-time workers	-8.8 *	-15.8 *	-0.5	-13.2 *
Country of birth (reference: born in country of interview)				
Immigrants	1.6	-3.0	3.0	-0.6
Number of employers (last 12 months) (references: more than one employer)				
One employer only	-5.4 *	5.3 *	-6.7 *	1.6
Firm size (reference: 100 to 199 employees)				
20 to 99 employees	3.3	-3.6	3.6	-0.1
200 to 499 employees	4.6	8.4 *	-1.8	9.7 *
500 & more employees	10.3 *	7.0 *	3.1	12.2 *
Industry (reference: manufacturing, mining & electricity)				
Construction	-0.3	-14.0 *	6.5 ***	-8.2 **
Wholesale & retail trade	0.0	-9.5 *	5.2 **	-5.7 **
Transport, storage & communications	4.0	2.0	2.6	2.9
Financing, Ins. Real estate & Bus. Services	3.8	-0.7	3.3	1.9
Community, social & personal services	4.6 **	-7.6 *	7.6 *	-1.9
Occupation (reference: Clerks)				
Legislators, senior officials & managers	5.8 **	4.2	1.8	6.1 **
Professionals	5.6 **	1.7	3.4	4.3 **
Technicians & associate professionals	6.1 *	-0.5	5.8 **	2.7
Service workers & shop & market sales workers	-3.4	-7.3 **	0.7	-6.2 *
Craft & related trades workers	0.2	-12.7 *	5.5 ***	-6.9 *
Plant & machine operators & assemblers	-10.5 *	-16.1 *	-0.3	-14.1 *
Elementary occupations	-14.0 *	-20.4 *	-2.6	-17.8 *
Predicted value at the average literacy score ^d	48.3	72.3	22.5	34.0
Average literacy score	294.4	298.0	291.3	294.4
Number of observations	6973	4141	4437	6973
Log likelihood	-4407.6054	-2530.0355	-2759.9307	-4185.3041
Number of countries	5	5	5	5
Pseudo-R²	0.0641	0.0849	0.0495	0.0844

*, **, *** statistically significant at 1%, 5% and 10% levels, respectively.

- a) Estimated change in the probability of demanding training (receiving training in equilibrium) with respect to the reference individual. For literacy, which is a continuous variable, the effect of a 10% increase in the literacy score from the sample average is reported. Equations are estimated by maximum likelihood assuming no correlation between residuals. Literacy, being potentially endogenous, has been instrumented using parental background characteristics, education, gender, age, community size, country of birth and country dummies. The sample population is employees of firms with more than 20 employees, with at least some education, aged 16 to 65 years and not working in the agricultural sector. The reference individual is indicated in the table. The dependent variable for demand takes value 1 if the individual received training or wished to be trained. For the equilibrium outcome the dependent variable takes value 1 if the individual received employer-sponsored training. All equations include 15 country dummies.
- b) Employees can refuse to be trained. Subject to this hypothesis, the equilibrium outcome equation is estimated only on the sub-sample of those wishing to receive training.
- c) Employees cannot refuse to be trained. Subject to this hypothesis, the demand equation is estimated only on the sub-sample of those who did not receive employer-sponsored training.
- d) Predicted probability at the average literacy score for the reference individual.

Source: OECD estimates based on the IALS.

Table A2.5. Training demand and supply according to the type of contract

Bivariate probit estimates^a

Part-time contracts

	Hypothesis A ^b		Hypothesis B ^c	
	Demand	Supply	Demand	Supply
Part-time (reference: Full-time worker)				
Family and health reasons	-8.68 *	-10.12 *	-1.74	-9.65 *
Still in education	-19.20 *	-24.50 *	-7.46 *	-19.92 *
Voluntary part-time for other reasons	-14.45 *	-0.17	-12.05 *	-8.55 *
Involuntary part-times	-2.17	-22.52 *	8.45 *	-13.30
Gender (reference: Men)				
Women	0.49	-4.32 *	2.53 **	-1.65 **
Age groups (reference: aged 36-45)				
Aged 16-25	-2.01	-8.66 *	2.73	-5.49 *
Aged 26-35	0.61	-1.93	1.71	-0.74
Aged 46-55	-5.75 *	3.13 **	-7.13 *	-2.12 **
Aged 56-65	-13.79 *	4.32 **	-15.16 *	-6.48 *
Educational attainment (reference: upper secondary)				
Less than upper secondary	-5.92 *	-0.79	-4.91 *	-4.07 *
Tertiary	6.55 *	2.06	5.38 *	5.16 *
Community size (reference: Urban)				
Rural	-2.26 **	2.35 ***	-3.66 *	-0.18
Country of birth (reference: born in country of interview)				
Immigrants	-2.43 ***	-7.83 *	2.25	-5.29 *
Number of employers (last 12 months) (reference: more than one employee)				
One employer only	-5.35 *	6.92 *	-9.62 *	1.29
Firm size (reference: 100 to 199 employees)				
20 to 99 employees	-0.59	-3.69 ***	1.83	-2.46 ***
200 to 499 employees	4.05 **	5.55 **	0.76	5.57 *
500 & more employees	7.51 *	8.79 *	1.80	9.89 *
Industry (reference: manufacturing, mining & electricity)				
Construction	1.33	-8.97 *	6.42 **	-3.84 ***
Wholesale & retail trade	-1.64	-5.91 *	2.84	-4.31 *
Transport, storage & communications	2.08	3.41 **	0.80	2.52 ***
Financing, Ins. Real estate & Bus. Services	2.42	5.54 *	-1.18	4.39 *
Community, social & personal services	2.76 **	-4.21 **	5.33 *	-0.57
Occupation (reference: Clerks)				
Legislators, senior officials & managers	8.49 *	9.57 *	1.24	10.74 *
Professionals	7.08 *	1.62	6.43 *	5.11 *
Technicians & associate professionals	5.55 *	3.62 ***	3.72 **	5.24 *
Service workers & shop & market sales workers	-3.23 **	-2.00	-1.95	-2.92 **
Craft & related trades workers	-5.53 *	-5.10 **	-2.88	-5.82 *
Plant & machine operators & assemblers	-9.96 *	-12.56 *	-3.03	-10.99 *
Elementary occupations	-18.12 *	-16.00 *	-8.75 *	-16.52 *
Predicted at vector 0	58.75	55.10	39.91	31.48
Log likelihood	-11591	-6200	-6799	-10990
Number of observations	18811	10709	11763	18811
Number of countries	15	15	15	15
Pseudo R²	0.099	0.099	0.068	0.117

Table A2.5. Training demand and supply according to the type of contract *(cont.)*

Bivariate probit estimates ^a

	Supervisory role							
	Hypothesis A ^b				Hypothesis B ^c			
	Demand		Supply		Demand		Supply	
Part-time (reference: Full-time worker)								
Family and health reasons	-6.94	*	-3.42		-3.95		-6.22	*
Still in education	-17.19	*	-17.74	*	-10.21	**	-17.30	*
Voluntary part-time for other reasons	-12.36	*	-0.24		-11.33	*	-7.86	**
Involuntary part-times	-4.83		-17.14	*	1.14		-12.08	*
Supervisory role (reference: some supervisory role)								
No supervisory	-9.20	*	-5.81	*	-6.63	*	-8.52	*
Great supervisory	1.28		5.98	**	-4.29	***	4.75	*
Gender (reference: Men)								
Women	0.67		-5.22	*	2.85	***	-2.00	***
Age groups (reference: aged 36-45)								
Aged 16-25	-1.38		-6.20	**	2.04		-4.17	**
Aged 26-35	1.61		-1.25		2.20		0.22	
Aged 46-55	-5.14	*	2.78		-6.80	*	-2.40	***
Aged 56-65	-10.41	*	6.17	***	-14.87	*	-4.23	**
Educational attainment (reference: upper secondary)								
Less than upper secondary	-6.21	*	-1.40		-5.10	*	-5.29	*
Tertiary	6.64	*	-0.38		7.48	*	4.34	*
Community size (reference: Urban)								
Rural	-1.10		1.16		-1.59		-0.28	
Country of birth (reference: born in country of interview)								
Immigrants	-3.01		-6.80	**	0.10		-5.58	*
Number of employers (last 12 months) (reference: more than one employee)								
One employer only	-7.61	*	7.74	*	-12.74	*	0.23	
Firm size (reference: 100 to 199 employees)								
20 to 99 employees	0.77		-3.98		3.23		-1.77	
200 to 499 employees	3.13		8.16	*	-0.65		6.93	*
500 & more employees	8.01	*	9.79	*	2.58		11.93	*
Industry (reference: manufacturing, mining & electricity)								
Construction	2.01		-4.18		5.02		-1.51	
Wholesale & retail trade	-1.38		-7.16	**	4.22		-5.17	*
Transport, storage & communications	4.85	**	6.97	**	1.96		6.77	*
Financing, Ins. Real estate & Bus. Services	5.52	*	3.55		4.28		5.81	*
Community, social & personal services	2.65	***	-6.13	*	6.83	*	-1.79	
Occupation (reference: Clerks)								
Legislators, senior officials & managers	1.97		3.81		-1.07		3.26	
Professionals	6.36	*	0.00		7.81	*	4.02	**
Technicians & associate professionals	4.48	*	0.74		5.09	**	3.15	***
Service workers & shop & market sales workers	-5.87	*	-1.54		-4.39	***	-5.12	*
Craft & related trades workers	-8.20	*	-6.31	**	-5.29	***	-8.70	*
Plant & machine operators & assemblers	-11.84	*	-9.39	*	-7.05	**	-11.91	*
Elementary occupations	-18.98	*	-15.97	*	-10.27	*	-18.54	*
Predicted at vector 0	65.43		57.92		45.77		36.96	
Log likelihood	-6730		-3409		-3943		-6197	
Number of observations	11043		5909		7228		11043	
Number of countries	10		10		10		10	
Pseudo R²	0.118		0.113		0.094		0.129	

Table A2.5. Training demand and supply according to the type of contract *(cont.)*

	Bivariate probit estimates ^a							
	Temporary contracts							
	Hypothesis A ^b		Hypothesis B ^c		Hypothesis A ^b		Hypothesis B ^c	
	Demand	Supply		Demand	Supply	Demand	Supply	
Part-time (reference: Full-time worker)								
Family and health reasons	-8.38 *	-1.91		-6.16 ***	-5.75 **			
Still in education	-18.27 *	-16.77 *		-12.10 *	-16.37 *			
Voluntary part-time for other reasons	-13.31 *	0.27		-12.16 *	-7.27 **			
Involuntary part-times	-4.34	-12.86 *		-0.61	-8.98 *			
Supervisory role (reference: some supervisory role)								
No supervisory	-8.85 *	-4.88 **		-6.47 *	-7.51 *			
Great supervisory	2.05	5.91 **		-3.45	5.00 *			
Temporary contract (reference: permanent)								
Temporary contract	-1.95	-18.64 *		7.85 *	-12.67 *			
Gender (reference: Men)								
Women	1.62	-4.60 *		3.49 **	-1.22			
Age groups (reference: aged 36-45)								
Aged 16-25	-0.30	-4.10		2.11	-2.14			
Aged 26-35	1.60	-1.29		2.28	0.08			
Aged 46-55	-6.68 *	1.01		-7.00 *	-4.01 *			
Aged 56-65	-10.09 *	4.75		-13.46 *	-4.27 ***			
Educational attainment (reference: upper secondary)								
Less than upper secondary	-6.25 *	-1.46		-4.93 **	-5.09 *			
Tertiary	6.66 *	-0.21		7.05 *	4.16 *			
Community size (reference: Urban)								
Rural	-1.71	1.26		-2.67 ***	-0.27			
Country of birth (reference: born in country of interview)								
Immigrants	-2.90	-6.17 **		0.17	-4.96 **			
Number of employers (last 12 months) (reference: more than one employee)								
One employer only	-7.42 *	5.49 **		-11.27 *	-1.07			
Firm size (reference: 100 to 199 employees)								
20 to 99 employees	2.20	-2.37		3.56	0.06			
200 to 499 employees	4.71 **	8.21 **		1.04	7.99 *			
500 & more employees	9.67 *	11.73 *		2.72	14.07 *			
Industry (reference: manufacturing, mining & electricity)								
Construction	1.80	-3.15		3.97	-1.55			
Wholesale & retail trade	-0.44	-5.50 ***		4.03	-3.72 ***			
Transport, storage & communications	4.98 **	7.44 **		1.85	6.77 *			
Financing, Ins. Real estate & Bus. Services	7.67 *	5.31 ***		5.16 ***	8.00 *			
Community, social & personal services	4.14 *	-4.27 ***		7.12 *	0.04			
Occupation (reference: Clerks)								
Legislators, senior officials & managers	1.52	4.66		-2.76	3.50			
Professionals	6.93 *	1.71		6.61 **	5.35 *			
Technicians & associate professionals	4.74 *	0.02		5.72 **	2.71			
Service workers & shop & market sales workers	-6.01 *	-2.76		-3.98	-5.39 *			
Craft & related trades workers	-7.71 *	-5.51		-5.57 ***	-7.51 *			
Plant & machine operators & assemblers	-11.10 *	-9.55 *		-6.50 **	-10.83 *			
Elementary occupations	-18.41 *	-15.05 *		-10.19 *	-17.31 *			
Predicted at vector 0	62.24	56.97		43.65	34.61			
Log likelihood	-5861	-3062		-3432	-5491			
Number of observations	9623	5412		6099	9623			
Number of countries	8	8		8	8			
Pseudo R²	0.111	0.125		0.091	0.131			

*, **, ***, statistically significant at 1%, 5% and 10% levels respectively.

- a) Estimated change in the probability of demanding training (receiving training in equilibrium) with respect to the reference individual. Equations are estimated by maximum likelihood assuming no correlation between residuals. The sample are employees of firms with more than 20 employees, with at least some education, aged 16 to 65 years and not working in the agricultural sector. The reference individual is indicated in the table. Additional characteristics of the reference individual are indicated in the table. The dependent variable for demand takes value 1 if the individual received training or wished to be trained. For the equilibrium outcome the dependent variable takes value 1 if the individual received employer-sponsored training. All equations include country dummies.
- b) Employees can refuse to be trained. Subject to this hypothesis, the equilibrium outcome equation is estimated only on the sub-sample of those wishing to receive training.
- c) Employees cannot refuse to be trained. Subject to this hypothesis, the demand equation is estimated only on the sub-sample of those who did not receive employer-sponsored training.

Source: OECD estimates based on the IALS.

Table A2.6. Probability of selected barriers to training conditional on being constrained

	Probit estimates ^a		
	Time constraints ^b	Cost constraints ^c	Family constraints
Training participation (reference: non-trained)			
Trained without employer-sponsoring	4.67	-5.44	-3.03
Trained with employer-sponsoring	-2.89	0.30	-0.54
Training intensity (reference: average level)			
1+log of time spent in training courses (not employer-sponsored)	-1.00	3.58 **	0.96
1+log of time spent in training courses (employer-sponsored)	1.13	0.09	-0.14
Part-time (reference: Full-time worker)			
Family and health reasons	5.73 **	4.95 ***	15.49 *
Voluntary part-time for other reasons	-2.76	-3.86	-1.51
Involuntary part-time	-15.65 *	7.22 **	-2.66 **
Gender (reference: Men)			
Women	0.94	7.58 *	7.27 *
Age groups (reference: aged 36-45)			
Aged 16-25	-5.32 **	1.40	-3.97 *
Aged 26-35	2.64	0.66	2.07 *
Aged 46-55	0.28	-5.34 *	-2.68 *
Aged 56-65	-7.00 **	-4.53	-3.90 *
Educational attainment (reference: upper secondary)			
Less than upper secondary	0.37	-2.60	-0.72
Tertiary	4.05 **	1.62	-0.77
Community size (reference: Urban)			
Rural	3.71 **	-2.38	0.80
Country of birth (reference: born in country of interview)			
Immigrants	5.03 **	-0.64	1.08
Number of employers (last 12 months) (reference: more than one employee)			
One employer only	3.84 **	-7.69 *	0.49
Firm size (reference: 100 to 199 employees)			
20 to 99 employees	-5.63 **	-0.08	-1.41
200 to 499 employees	-5.80 ***	-0.79	-0.82
500 & more employees	-9.20 *	-3.76 ***	-1.29
Industry (reference: manufacturing, mining & electricity)			
Construction	1.49	-1.63	-2.30
Wholesale & retail trade	1.15	7.81 *	1.85
Transport, storage & communications	-4.93	1.33	-0.21
Financing, Ins. Real estate & Bus. Services	-1.37	0.15	0.54
Community, social & personal services	-9.77 *	8.10 *	0.27
Occupation (reference: Clerks)			
Legislators, senior officials & managers	9.29 *	-3.83	-2.21 **
Professionals	6.35 *	2.80	1.01
Technicians & associate professionals	0.29	1.22	-1.25
Service workers & shop & market sales workers	-2.01	-0.30	0.22
Craft & related trades workers	-10.15 *	-3.09	1.39
Plant & machine operators & assemblers	-7.59 **	0.38	1.62
Elementary occupations	-9.72 **	6.66 ***	1.02 *

Table A2.6. Probability of selected barriers to training conditional on being constrained (cont.)

Country (reference: Australia)	Probit estimates ^a					
	Time constraints ^b		Cost constraints ^c		Family constraints	
Canada	6.47	**	1.32		7.16	*
Denmark	-11.34	*	-14.25	*	-1.66	
Finland	-3.71		-6.09	**	1.29	
Italy	9.95	*	-11.18	*	9.16	*
New Zealand	11.97	*	9.71	*	17.14	*
Norway	-5.00	***	-9.02	*	1.11	
Switzerland	1.82		-12.52	*	0.23	
United Kingdom	-4.17		-1.94		2.42	***
United States	8.37	**	10.44	*	8.44	*
Log likelihood	-3091		-2340		-1515	
Number of observations	4866		4868		4867	
Number of countries	10		10		10	
Pseudo R²	0.048		0.075		0.154	

*, **, ***, statistically significant at 1%, 5% and 10% levels respectively.

a) "Estimated change in the probability of being affected by the particular type of constraint conditional to being ""constrained"" with respect to the reference individual. For continuous variables, marginal changes evaluated at the sample mean are reported. The sample are ""constrained"" employees of firms with more than 20 employees, with at least some education, aged 16 to 65 years and not working in agricultural sector. The reference individual is indicated in the table. Due to the small number of observations for some countries, only 10 countries are included in the sample. "

b) Too busy/lack of time, too busy at work, family responsibilities, course offered at inconvenient time.

c) Course too expensive/no money.

Source: OECD estimates based on the IALS.

Chart A1.1. Demand and supply of training: solving the identification problem

