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The Provision and Effects of Company Training: A Brief Review of the Literature

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This paper reviews recent empirical research on economic benefits of company-provided training in search for answers to questions such as: What kinds of training do companies provide? Who is trained? How intensively? For what reason? Do trained employees experience an earnings advantage over non-trained? Does training enhance employability, mobility, and promotion? Do companies, and the society at large, benefit from these investments? Despite growing interest in these questions, our current knowledge on the economic role of company-provided training demands great cautiousness in drawing policy implications concerning the crucial questions of inequality of access to company training and training market failures, among others.
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"…the traditional schooling system is not an option that many incumbent workers or firms use when facing the need to upgrade their skills. As a result, the provision (or non-provision) of employer-provided training is a key factor determining how much and what kind of skill upgrading occurs within firms and across workers."
– Lynch and Black (1998: 65)

This paper explores the most recent research on the economic benefits arising from company-provided training. More precisely, it reviews the empirical literature in its search for answers to the following policy-relevant questions: What kinds of training do companies provide? Who is trained, to what extent, and for which reasons? Do trained employees experience an earnings advantage over the non-trained? Does training enhance employability, job mobility, and promotion? Does the company benefit from its training investments in terms of improved productivity, competitiveness, and profitability? Does the economy and society at large benefit from

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companies' efforts to develop the skills of their labour?

This non-technical review is far from comprehensive. It may rather be described as the tip of the iceberg, with an emphasis on some of the most recent empirical research on company-provided training and its economic implications for employees, the company, and society.[1] Since the primary focus is on hard empirical evidence, theoretical and methodological aspects are only briefly mentioned.[2] Moreover, although the review focuses on company training, it nevertheless mostly ignores the existing literature on apprenticeship training. It also omits, for the most part, the complex issue of training those with only low-level skills.[3] Also, this review does not provide descriptive statistics across countries. Such information has been extensively surveyed by Nestler and Kailis (2002a,b,c,d,e) and the OECD (1994, 1999, 2003), among others.

The first training decision that a company has to make is not necessarily concerned with whom to train. Instead, the company needs to start by considering whether to buy the new skills they require in the labour market by hiring properly skilled labour, or whether it is preferable to acquire the new skills by training the company's present staff. If the company decides to invest in its current personnel, then it is faced with a multitude of highly interrelated questions: Who are to be trained? What kind of training is needed? How extensive is the training to be? Is there a big risk that employees will be lured away by competitors once trained? Of these questions, the empirical literature has paid considerable attention to trying to unravel which personal and company characteristics most strongly influence the probability that an employee will participate in employer-provided training (the incidence of training). Considerably less is known about the determinants of the extent of the training (the intensity of training).

After the training investment has been made, logically the focus turns to the effects of the training. As will become evident in the following discussion, there has been very little research to date on the impact of training on the trained employees and their non-trained colleagues, on the performance of the training company, and, in the last resort, on social welfare. Moreover, the vast majority of existing research has been restricted to the UK or the USA.

General versus specific company training

The confusion about definitions which characterises the literature on company training also extends to the traditional division of company training into general and specific training.[4] Moreover, this topic has received considerable attention in recent years.

1. For comprehensive reviews of previous evidence, see e.g. Lynch (1994a,b), Ashenfelter and Lalonde (1996), Booth and Snower (1996), Bishop (1997). More recent work has been reviewed by e.g. Asplund and Pereira (1999), Blundell et al. (1999) and Ok and Tergeist (2003). Also noteworthy is the critical contribution by Ashton and Green (1996).
2. For a recent survey of the theoretical training literature, see Leuven (2004).
3. This issue was recently covered in a special issue of *The International Journal of Manpower* (Asplund and Salverda, 2004).
4. General training enhances productivity at the company providing the training, as well as at (some) other companies. Specific training, at the other extreme, raises the productivity of the trainee at the current employer only.

The theoretical literature on training has departed from the pioneering contributions by Becker (1964) and Mincer (1974), who drew a basic line between general and firm-specific training. While employees themselves need to pay for their general training, companies are usually willing to share both the costs and the benefits arising from investments in firm-specific training with their employees. When sharing is optimal, the firm-specific investments of the two parties are also optimal, while at the same time, the risks of human capital losses due to quits or layoffs are reduced (Hashimoto, 1981).

However, recent research does not lend support for this traditional theoretical view. A growing number of studies suggest that companies provide their employees with a considerable amount of general training, and also pay for this training. Using US data on youth, Loewenstein and Spletzer (1998, 1999) found that employers pay for nearly all off-the-job company training, of which a large portion appears to be essentially general. Data from the International Adult Literacy Survey (IALS) indicate that company training received off-the-job imparts mainly general skills but is, nevertheless, mostly paid for by the employer (OECD, 2003). Likewise, European Community Household Panel (ECHP) data reveal that European employers tend to pay for training that can be considered to generate skills of a more general nature (Booth and Bryan, 2002).

A rapidly expanding theoretical literature is attempting to identify the conditions under which companies are willing to sponsor general training, while empirical evidence in support of the predictions derived from these theoretical models is only just starting to emerge. A few recent contributions are referenced below, all of which contain reviews of the previous literature in the field of employer-supported general training.[5] But before turning to these studies, the question has been put forward whether it is meaningful to distinguish between general and specific company training. Lazear (2003) argued that there is no firm-specific training. Instead, all skills can be seen to be essentially general in the sense that they are used by other companies as well. It is only the composition of the skills in a company and the weights that this particular company attaches to each skill that generate specificity. He also provided empirical support for this 'skill-weights' view.[6]

Acemoglu and Pischke (1998) developed a theoretical model that departs from the assumption that a company has superior information about the abilities of its employees and, consequently, ex-post-informational monopsony power relative to other potential employers.[7] Their adverse selection-based model results in multiple equilibria where, at the one extreme, the employer provides and pays for considerable amounts of general training due to a low quitting rate. At the other extreme, employee turnover is endogenously high and, accordingly, the company's monopsony power is low, as well as its willingness to train. Moreover, their predictions of there being adverse selection among those receiving company-provided training, as well as of companies having

5. Also see e.g. Barron, Berger and Black (1999) as well as Booth and Bryan (2002).
6. For other relevant theoretical contributions on general versus specific investments in company training, see e.g. Oosterbeek, Sloof and Sonnemans (2001) and Kessler and Lülfesmann (2002).
7. Previous theoretical work relied on the assumption of asymmetric information about the amount of the training investment (e.g. Katz and Ziderman, 1990; Chang and Wang, 1996).

monopsony power over those who stay, receive support from wage comparisons between German large-company apprentices who differ in their quitting behaviour.

Building on the imperfect information argument, Booth and Zoega (2000) put forth a further rationale for companies to invest in the general skills of their workforce. In particular, they argued that if the productivity of an employee depends on the quality of his or her colleagues, then this particular ability of the company to stimulate the productivity of its employees beyond what they could perform elsewhere will provide the company with some monopsony power in the labour market. When enjoying such monopsony power, the company is also willing to invest in the general training of its workforce. This monopsony power is shown to increase in the average quality of the company's labour as measured by its capacity to undertake complex working tasks, implying that the company's incentive to invest in training that is general to the industry increases with its task complexity. Hence, the more stimulating the working environment is, the more sophisticated are the working tasks undertaken, the stronger is the employee's loyalty to the present employer, and the higher are the employer's profits, since the marginal effect of the training investment on productivity exceeds that on wages. In other words, the company benefits more from the investment than the trained employee.

Booth and Zoega (2000) noted that their model receives support from empirical studies in the USA. In particular, they referred to Lynch and Black (1998), who showed that the incidence of computer skills and teamwork training in US establishments is positively associated with the average educational level of the establishment, as well as with its use of high-performance work practices. The Lynch–Black study is also interesting in that these more general types of training programmes are found to be more likely in large establishments and in those with low employee turnover. These conclusions agree with those drawn by Acemoglu and Pischke (1998) concerning apprenticeship programmes in large German companies.

A situation of asymmetric information also underlies the model proposed and tested by Autor (2001). More specifically, he addressed the question of why a majority of US temporary help supply companies offer – in sharp contradiction with the competitive model of training – nominally free and unrestricted computer skills training to their employees. His model predicts, and the empirical data confirm, that general training is provided to induce self-selection among applicants (attract employees of higher unobserved ability), as well as to screen the ability of the employees that are trained. In addition to providing spot market labour, temporary help supply companies thus also sell information to their clients about the quality of the temporary help employees. The author concluded that the rapid growth of temporary help supply employment is suggestive of increasing demand for arrangements to screen employees for permanent employment.

Gersbach and Schmutzler (2003), on the other hand, deviated entirely from the asymmetric information condition and relied instead on the requirement of imperfect product market competition as a generator of company-sponsored general training in an economy with endogenous turnover. Since the most important conditions of their model relate to the training technology and the toughness of product market competition, multiple equilibria may emerge also in their modelling framework. In particular, the

authors hypothesised that the probability of general training in an industry increases if the concentration is high (or competition sufficiently soft), the returns on training decrease fast enough for labour turnover to be avoided, and the differentiation in products is sufficiently strong. Because of the existence of multiple equilibria, government intervention may be socially desirable, they concluded.

Apart from the asymmetric information rationale, mainly linked to young people, Acemoglu and Pischke (1999a, 1999b) developed also another line of reasoning for companies to invest in the more general skills of their employees. In particular, they explored the bilateral monopoly situation in wage determination that is likely to arise due to labour market frictions such as transaction costs and imperfect information on employee ability and/or effort. This bargaining will compress the wage structure relative to productivity and thus induces the company to also pay for skills that are portable across employers. The lower the wages of the employees compared to their productivity and the slower the increase in wages compared to rises in productivity, the higher is the incentive of companies to invest in and also pay for the general training of their employees. The two authors provided a comprehensive review of the relevant empirical literature, especially for Germany and the USA, in the search for evidence in support of the predictions of their non-competitive theoretical model.

More formally and simplified, the Acemoglu–Pischke model can be outlined as follows, using a simple two-period model and with the focus on general training. At time $t = 0$, with an initial production normalised to y_0, the employer or the employee decides independently about the amount to invest in the employee's general skills, τ. The corresponding costs of the training are $c(\tau) = c_{employer} + c_{employee}$. At time $t = 1$, the employee either stays with the employer or quits. If the employee stays, (s)he will produce output $y_1 = f(\tau)$ at a wage rate $w(\tau)$.[8] If (s)he quits, (s)he will receive an outside wage equal to $v(\tau)$. The existence of labour market frictions results in a situation where the employee's outside wage option is lower than his or her marginal product at the current employer, that is, $v(\tau) < f(\tau)$. The consequent surplus, $f(\tau) - v(\tau)$, can be shared between the employer and the employee. The outcome of this sharing depends on the bargaining power of the employee ($\beta \in [0,1]$), and will affect his or her actual wage at the current employer in the second period. Assuming Nash bargaining, the equilibrium wage of the second period will be:

$$(1) \qquad w(\tau) = v(\tau) + \beta\,[f(\tau) - v(\tau)],$$

which reveals the critical role of the outside wage option.

The employer's interest in providing and paying for the general training of its employees is determined by the economic benefits that it can reap from the investment. Accordingly, the employer chooses τ in order to maximise its profits, π,

$$(2) \qquad \pi(\tau) = [f(\tau) - w(\tau)] - c(\tau) = (1 - \beta)[f(\tau) - v(\tau)] - c(\tau).$$

The first-order conditions of equation (2) are:

$$(3) \qquad (1 - \beta)[f'(\tau) - v'(\tau)] - c'(\tau) = 0.$$

8. The training technology is assumed to be general, implying that $f(\tau)$ is the same for all employers.

This model reduces to the case of a perfectly competitive labour market if $f'(\tau) - v'(\tau) = 0$. Put differently, $f(\tau) = w(\tau) = v(\tau)$, implying that the employer will not bear any of the costs arising from investments in the general training of employees. As noted above, a precondition for the employer to contribute to such investments is that the initial wage of the employee is lower than his or her productivity, and that this gain of the employer increases with training. This surplus condition with respect to outside wages, $f'(\tau) - v'(\tau) > 0$, generates external wage compression, which translates into internal wage compression, $f'(\tau) - w'(\tau) > 0$, as well. One crucial implication of the presence of labour market frictions is that investment in general training will be lower than the socially optimal level, which Becker (1964) showed could be achieved in a perfectly competitive labour market. In other words, labour market imperfections cause τ to be lower than τ^*.

Bassanini and Brunello (2003) proposed and undertook an alternative test of the Acemoglu–Pischke hypothesis that wage compression encourages employer provision and sponsoring of general training. More specifically, they suggested that employees be partitioned into relatively homogeneous clusters, for which the training incidence and the training wage premium are calculated. Based on training data from the 1996 wave of the ECHP for seven countries, restricted to male employees aged 30 to 60 working full-time in the non-agricultural private sector, they found the correlation between training incidence and training wage premiums to be significantly negative, although rather small in size. In other words, their results lent support to the hypothesis that higher wage compression induces employers to provide and pay for general training. Peraita (2001), in contrast, obtained no support for the Acemoglu–Pischke model when testing it in Spain using 1994 ECHP data. His conclusion was essentially based on the following reasoning: Although Spain is top-ranked when it comes to regulated labour markets, and is characterised by a highly-compressed wage structure, the country's figures for company-sponsored training are poor, especially for the unskilled and the less educated workforce.

In this context, a conceptual aspect deserves attention. More specifically, in an extension of the Acemoglu and Pischke (1999a, 1999b) approach, Booth and Zoega (2001) showed that wage compression – as commonly understood in the literature – does not constitute a necessary condition for companies to provide general training, while the Acemoglu–Pischke definition of wage compression does. They argued that companies can also gain from sponsoring general training for their employees in the absence of (relative) wage compression, as measured by the ratio of productivity to wages, as long as the (absolute) gains in wages are below the (absolute) gains in productivity. Hence, Booth and Zoega (2001) chose to call the wage compression of Acemoglu and Pischke (1999a, 1999b) 'absolute wage compression' in order to distinguish it from 'normal' (relative) wage compression. More formally, while absolute wage compression occurs when the profits per employee in absolute terms are increasing in training, that is, $f'(\tau) - w'(\tau) > 0$, relative wage compression occurs when the ratio of output to wages is increasing in training. Booth and Zoega (2001) noted, though, that although not being a necessary condition, (relative) wage compression induced by labour market institutions may nevertheless make companies more willing to pay for general training, thus raising the overall level of company-sponsored general training. A similar point was made by Brunello and Medio (2001),

who developed a simple search equilibrium model in an attempt to explain the stylised differences in education and workplace training prevailing between Germany, Japan, and the USA.

Various labour market institutions, especially minimum wages and trade unions, have been shown to give rise to similar situations as that produced by the non-competitive wage compression argument, but with the additional feature of improving the general company training position also for low-wage employees. Acemoglu and Pischke (2003) empirically analysed the impact of state and federal increases in the minimum wage in the USA between 1987 and 1992 on the company-sponsored training of low-wage employees. Their results suggested that the employees that were affected by the minimum wage increase received the same or even slightly more training. Since they obtained no support for the idea of minimum wages reducing the level of company-sponsored training, they concluded that this finding may provide part of the explanation for why European countries, with a variety of legal and union-imposed wage floors, tend to have more well-trained workforces than the USA.[9] However, one shortcoming of the analysis, also noted by the authors themselves, is that it focused on formal training, whereas informal training might be much more important in low-wage jobs. Moreover, a closer look at other recent evidence on the impact of minimum wages on training incidence reveals that the available evidence is highly contradictory[10]. Bassanini and Brunello (2003), for instance, hypothesise that this is due to difficulties related to a proper definition of the treatment versus control groups, as well as of the time horizon. Cross-country differences in the degree of labour market imperfections are also seen to add to the ambiguity of the existing results.

In a similar vein, Booth, Francesconi and Zoega (2003) found for a panel of British full-time male employees, that trade unions enhance both the incidence and the intensity of general training for union-covered compared to non-union-covered employees. On the other hand, they also noted that their data was biased towards more formal training, and that informal training may affect non-union employees differently from unionised employees. A more adequate data coverage of company-sponsored training might, accordingly, weaken the advantageous position found for unionised relative to non-unionised employees.

All in all, the predictions of the standard theory seem to be at odds with reality. As indicated above, a number of recent empirical analyses have lent support to the hypothesis that labour market imperfections restricting the mobility of workers in combination with the possibility for employers to earn rents on their trained employees make companies willing to invest also in the more general skills of their workforce. The existing empirical evidence suggests that companies do – and should – provide and pay for general training. This seems to support the hypothesis that due to more compressed wages, European companies seem to be more willing to bear the costs for general training than US companies.

9. In a recent paper, Pischke (2004) used this outcome as part of an explanation for rising wage inequality in the USA, but relatively stable wage structures in Europe in the 1980s.
10. See e.g. Arulampalam, Booth and Bryan (2004a) for the UK; Grossberg and Sicilian (1999) and Neumark and Wascher (2001) for the USA.

Incidence and intensity of company training[11]

A widely established contention, supported by aggregate statistics, is that the probability of receiving employer-provided training increases substantially with the individual employee's level of education. This positive association between the acquired formal education and subsequent training has also received strong support in empirical analyses based on individual-level as well as employer-level data. Moreover, a recent study of ten EU countries (Arulampalam, Booth and Bryan, 2003a) showed that this complementarity between training and education holds for both men and women. The strong positive association between education and training inclined Bartel and Sicherman (1995) to argue that one way of dampening the effect would be to make the process of learning new skills simpler, since this could create a relative increase in the value of time spent in training for the less-educated.

On the other hand, Oosterbeek (1998), argued that the positive correlation between formal education and company training is simply due to the omission of ability and self-selection problems in the undertaken analyses; better-educated individuals reap a higher return on their investments in training and have, as a consequence, a stronger preference for training than less-educated individuals. His results point to no significant correlation between education and training on the employers' side. In other words, for the company, it is irrelevant whether it trains its better- or less-educated employees. Similar findings were reported by the OECD (2003) in the sense that the lower incidence and intensity of company training of less-educated employees as compared to their more educated counterparts seem demand- rather than supply-driven. More specifically, while the supply of training (by employers) shows no variation with the educational level of employees, the less-educated reveal a much lower demand for training than the better-educated.

A characteristic closely related to employees' formal education is their occupational and/or hierarchical status. A broad-based generalisation of the existing evidence is that both the incidence and the intensity of company-sponsored formal training vary considerably across occupations, and typically increase when moving up the hierarchical ladder.[12] The empirical evidence offers few, if any, explanations for these differences. One potential reason is that training needs are very different in different occupations and at different hierarchical levels. Alternatively, the need to supplement skills learned in school may differ across occupations and hierarchical levels, a reasoning that might also apply across industries.

There is, however, empirical evidence that contrasts sharply with these contentions. Using data on young males in US manufacturing industries, Bartel and Sicherman (1998) found no occupational differences in training incidence across production workers employed in manufacturing industries with very low levels of technological change. At

11. Apart from the studies mentioned in this section, further evidence on the incidence and intensity of company training can be found in, among others, the following contributions: Blundell, Dearden and Meghir (1996), Barron, Berger and Black (1997), Pannenberg (1997), Arulampalam and Booth (1998), Lynch and Black (1998), Frazis, Gittleman and Joyce (2000), Goux and Maurin (2000), Brunello (2001), Pischke (2001) and Kuckulenz and Zwick (2003).
12. See e.g. Pischke (2001) for an illustrative example on Germany.

higher levels of technological change, on the other hand, craftsmen received significantly more formal training than other production workers. Among non-production workers, in contrast, clerical and unskilled workers received the least training in industries with low levels of technological change, but the most training in industries characterised by high rates of technological change. Since the category of clerical workers covers occupations heavily affected by the introduction of computers, these findings can be interpreted as providing indirect evidence that companies experiencing rapid technological change also pay for investment in the more general skills of their workforce, including the low-skilled. The OECD (2003), in contrast, reported that the training supplied by employers' fell well short of employee demands, especially in the case of employees in low-skilled occupations and employees with low literacy. However, the report did not discuss how these outcomes link to the aforementioned OECD conclusion that there is no bias against the low-educated when it comes to employer-provided training.

Since men and women are typically investigated separately when it comes to training, there is notably more information on gender differences in training participation rates than on gender *per se* as a determinant of the incidence and intensity of training. The OECD (2003) found no significant differences in training participation rates between male and female employees.[13] A similar finding was reported by Arulampalam, Booth and Bryan (2003a) for six out of the ten EU countries analysed based on ECHP data. For four of the countries, women were found to be more likely than men to participate in training.

However, when exploring what determines participation in training, the outcome typically looks quite different. Country-specific studies often indicate that being a woman means a significantly lower probability of receiving company training and, if participating, the length of training is likely to be significantly shorter than that for men. Moreover, when decomposing the likelihood of training participation for men and women, Arulampalam, Booth and Bryan (2003a) noted that similarity in the overall training incidence across the two sexes commonly hides opposing effects of characteristics and returns to these characteristics. Gender gaps in the probability of participation in training, in turn, appear to be variably due to different characteristics of men and women, on the one hand, and to differing returns to similar characteristics, on the other hand.

The Arulampalam, Booth and Bryan (2003a) study revealed, in effect, several interesting training similarities and dissimilarities between European men and women aged 25 to 54 in non-agricultural employment. First, there seems to be a strong negative correlation between age and the probability of receiving formal work-related training for men, but not for women. The authors interpreted this result as evidence that women have a higher probability of experiencing lifelong learning over their entire working career. Second, fixed-term employment contracts tend to induce a lower training probability for men in five of the ten EU countries under study, but for women in

13. There is a clear gender gap in the intensity of training, though.
14. As shown in a recent study for Sweden (Wallette, 2004), the training outcome may, however, vary quite substantially depending on the type of temporary job held. A distinction between five types of temporary jobs (probationary, project, replacement, on-call, and other temporary jobs) reveals that, while the incidence of

continue

only two of the countries.[14] The authors drew attention especially to the results for Finland, which point to a significantly negative association between fixed-term contracts and training for both men and women. Moreover, the Finnish results also point to a significantly negative relationship between part-time work and training, although for Finnish men only.[15] Thus, the authors argued, in Finland there are clear signs of a mechanism at work that may affect the country's human capital acquisition. Third, both men and women are, on average, more likely to receive training if employed in the public sector. Finally, as already noted above, the positive correlation between training and education is strong for both genders across Europe.

Oosterbeek (1998) argued that the observed bias towards men might well be explained by the higher probability that women will experience career interruption, which makes training investment in women more risky from the company's point-of-view. Lynch and Black (1998), on the other hand, stated that the documented gender differences may be largely driven by the analyses overlooking the fact that gender composition is likely to vary with the characteristics of the employer. They found, for instance, that the larger the proportion of female employees in US manufacturing establishments, the greater the proportion of employees trained.

Theoretically, unions may encourage either more or less training. The existing evidence, mostly for the UK and the USA, seems to be equally inconclusive. While a number of British studies suggest that union-covered employees have both a higher incidence and a higher intensity of training than their non-union counterparts[16], a recent study by Addison and Belfield (2004:16) found no "…simple effect of unions on training incidence, duration, or coverage". Frazis, Gittleman and Joyce (2000), in contrast, reported non-unionised US establishments to be more likely to provide their employees with training than their unionised counterparts.

Larger companies are much more likely to provide their employees with formal training than are smaller companies. In addition, the extent of training tends to be positively related to the size of the employer. Several potential explanations for this divergence in training provision between differently-sized employers have been put forth in the literature, but none of them has been subject to rigorous empirical tests. Among these explanations are higher training-related fixed costs in smaller companies, and more concern among smaller employers about trained employees being hired away by competitors. However, opposite results have been reported as well. When distinguishing between manufacturing and non-manufacturing US establishments, Lynch and Black (1998) obtained an inverse relationship between employer size and the proportion of employees being trained in the non-manufacturing sector; that is, smaller non-manufacturing establishments were found to train a greater proportion of their workforce than were the sector's larger establishments.

training is typically lower for temporary employees, the amount of training received, once trained, is not automatically lower than for permanently employed colleagues.

15. In a majority of the investigated EU countries, part-timers and full-timers have been found to be equally likely to start training.
16. For a positive union effect, see e.g. Green, Machin and Wilkinson (1999), Booth, Francesconi and Zoega (2003), and Böheim and Booth (2004).

Substantial differences in the provision of formal training programmes are also evident across single industries. A conspicuous feature here is the markedly lower incidence of company-provided training in low-skill/low-pay industries in both manufacturing (e.g. textiles) and services (e.g., wholesale and retail trade, hotels and restaurants), even after controlling for a broad set of personal and employer characteristics.[17]

Few studies have been able to cover other characteristics of the employers. For UK and US companies and establishments there is some evidence of the use of high-performance work systems and a high degree of capital intensity exerting a positive influence on the existence of formal training programmes.[18] Large investments in physical capital and R&D, as well as the adoption of new forms of work organisation also tend to encourage higher percentages of employees to be given formal training.

Furthermore, despite the theoretically asserted crucial association between technological progress and training (e.g. in Acemoglu 1997), few studies have explored this link empirically. Empirical research on this issue is all the more important, as no clear prediction on the sign of the relationship between technological change and investment in training can be derived from economic theory.[19] According to a study by Bartel and Sicherman (1998) using US data on young males employed in manufacturing, production workers in manufacturing industries with a high rate of technological change are more likely to receive formal company training than are their colleagues employed in manufacturing industries characterised by low levels of technological change.[20] The corresponding results for non-production young males point to no significant overall differences in formal company training across industries differing in their rate of technological change. Their results further indicate that, although the more educated have a higher probability of being trained, the training gap between less- and better-educated workers tends to narrow at higher levels of technological change, a finding that holds true for both production and non-production workers. This situation is explained to emerge because of the substitutability between a higher education and training is stronger than their complementarity, which favours more training for the less skilled. In other words, the more educated are seen to be more adaptable to new technologies than their less-educated counterparts[21], who accordingly need more training. The results of Bartel and Sicherman (1998) also suggest that higher rates of technological change increase the pool of trainees; that is, companies are more likely to train those who did not receive training in the previous period. Technological change does not, however, seem to increase the number of hours spent in training (Bartel and Sicherman 1995).

As a final remark concerning the incidence and intensity of company training, it may be noted that few studies have attempted to link companies' decisions to

17. For recent evidence on the training situation of the low skilled employed in the service sector, as well as a brief overview of the current state-of-knowledge on this issue, see e.g. Asplund and Salverda (2004).
18. For the UK, see Addison and Belfield (2004), and for the USA, e.g. Lynch and Black (1998) and the references therein.
19. For a brief discussion of the theory aspect, see e.g. Bartel and Sicherman (1998).
20. It may be noted that the role of the rate of technological change is maintained when controlling for differences in the *level* of technology across manufacturing industries.
21. Evidence in support of this contention was provided already in 1987 by Bartel and Lichtenberg.

invest in training to explicit reasons or objectives for undertaking these investments, such as new technology or workplace re-organisation. Information on the major reasons underlying companies' investment in their employees has so far been mostly obtained indirectly, through the inclusion of company-specific characteristics as determinants of training incidence and intensity. One attempt in this vein is a recent study by Bresnahan, Brynjolfsson and Hitt (2002) based on, *inter alia*, a survey of organisational practices and labour force characteristics conducted in 1995 and 1996 among senior human resource managers in large US companies. One finding was that companies with high levels of information technology and workplace organisation invest highly in training irrespective of whether or not they have already invested heavily in human capital. Moreover, this complementarity between new technology and human capital investment policies seems to be a within-sector effect rather than one arising merely from cross-sector differences in production processes.

Turnover effects of and on company training

Both human capital and internal labour market theories predict a negative relationship between specific training and turnover.[22] According to the human capital model (Becker 1964), both the employee and the employer have an incentive to maintain a long-term employment relationship in order to realise a return on their shared investment. Since the period available to recoup such an investment lengthens if the employee is trained earlier, specific training can be expected to be negatively associated with tenure on the job. The internal labour market theory, developed by Doeringer and Piore (1985), in turn advocates that the higher the company's need of specific skills and, accordingly, its training costs, the more motivated the company is to structure its internal labour market to discourage turnover among its employees. In a similar vein, more recent theories focussing on the re-organisation of production, work and companies, with the ultimate goal of improving the capability to respond to new technology and increased competitive pressures, emphasise the role of training as well as of other strategies to increase commitment to the workplace and, hence, to discourage turnover.[23]

A common feature of these theoretical strands is that the company's efforts to reduce turnover are taken to be driven by its need to impart specific skills. However, this presumed negative association between company-provided training and turnover has recently been given an alternative interpretation: it should rather be seen as reflecting the relationship between general training and turnover in a non-competitive labour market setting characterised by limited mobility (e.g.

22. In a competitive labour market, there is no specific relationship between general training and turnover, since the employee bears all the costs of the training and decides whether to remain or quit without incurring any costs in the process of going to work for another company.
23. For a brief review of the theoretical literature on work organisation mechanisms and human resource management practices, see e.g. Asplund and Oksanen (2003).
24. Finally, a recent paper by Diaz-Vazquez and Snower (2003) may also be mentioned in this context. They derive a theoretical model showing how company-based specific on-the-job training changes the effects of firing costs on employment. Their model predicts that the effect of such training causes firing costs to have a contractionary influence on average employment, when looking over the whole business cycle. The authors argue that

Chang and Wang 1996).[24] Existing empirical evidence on the association between the provision of training and subsequent turnover is mixed in the sense that some results point to a significantly negative relationship (e.g. Parent 1999) while others indicate that the relationship is negative but non-significant (e.g. Krueger and Rouse 1998).

When it comes to the impact of turnover on training, the relationship is, in theory, ambiguous (e.g. Frazis, Gittleman and Joyce, 2000). Thus, employees who are perceived to have a high probability of leaving the company are less likely to receive employer-provided training. Simultaneously, as noted above, the benefits from training are expected to be highest in the case of employees with short tenure on the job. Additionally, training might increase an employee's probability of leaving the employer. In other words, the company faces an obvious risk of having its trained employees hired away – 'poached' – by other companies that also value the new skills that these trained employees have acquired through their current employer's investment in them. Indeed, using US establishment-level data, Frazis, Gittleman and Joyce (2000) found turnover to have a negative effect on some but not all their measures of training. Booth, Francesconi and Zoega (2003), in turn, showed that the higher the average quit rate in a UK industry, the less likely is a full-time male employed in the industry to receive general training, and the fewer are the training days, if trained. However, they also found that unionised full-time male employees have a lower quit rate than non-unionised colleagues, which is seen to be due to unions raising the relative wages of their members. This, in turn, induces the company to provide more training in the general skills of its employees as well.

Additionally, an earlier UK study of the link between training and job-to-job mobility (Dearden et al., 1997) showed that training-sponsoring employers typically face a lower-than-average probability of losing their trained employees in the next year compared to employers who do not provide their employees with training. The authors interpreted this finding to indicate that employers are inclined to train the employees they wish to retain. Previous job mobility seems to leave the probability of receiving training roughly unaffected. The exception to this is a very recent job move, which tends to induce a higher training probability, probably mainly due to induction training. These findings hold for both men and women. Also in the UK, Green et al. (2000) found that mobility tends to decline with the degree of firm-specificity of the acquired skills, the extent of company sponsorship of the training, and training aimed at raising the employee's commitment to the company. But for the majority of cases, the two mobility-expectations-of-training measuring surveys used in the analysis point to training having no significant impact on mobility.

A higher turnover of labour has occasionally been put forth as an explanation to why the US economy generates less training than many other OECD economies (e.g. Blinder and Krueger 1996). This contention of a negative relation between turnover and the level of training is, however, refuted by Acemoglu and Pischke (1998). In particular, they argued that if companies provide and pay for

the stated interdependence between companies' hiring and firing decisions can attribute the relatively weak job creation experienced in many OECD countries to skill-biased technological change occurring in combination with restrictive job security legislation.

skills of a more general nature (as was earlier shown to be the case), then the differing amounts of general training across countries cannot be explained by exogenous differences in turnover alone.

Wage effects of company training

As already noted, the standard human capital model distinguishes between general and specific training. Companies bear none of the costs of general training; the employees entirely finance their accumulation of general skills themselves by accepting a lower wage during the training period, but also collect all the returns on their training investment through higher post-training wage growth. Simultaneously, the economy achieves a socially optimal level of training. If the employees face imperfections in the form of, for instance, credit constraints, the training investment level will, due to the absence of company financing, fall short of the social optimum. This classical situation changes, however, if the training is in some part specific to the company, or if there are frictions in the labour market that provide the company with incentives to share the cost of general training.[25] In that case, the obtained return on training will underestimate the wage effect of the investment in terms of productivity (see further e.g. Frazis and Loewenstein, 2003).

A broad number of studies report participation in employer-provided training to have a significantly positive impact on the wages of the trained employees, while much less is still known about the wage effects of the intensity of the training.[26,27] Since not all employees are equally likely to obtain training, employer-provided training thus stands out as a potentially key contributor to wage and earnings inequality, further boosted by the complementarity between education and training posited earlier.[28] Conversely, training offers one key tool when trying to combat rising wage inequality in general, and improve the labour market situation of the low-skilled in particular. But, as emphasised by Lynch (1995:57): "Training for training's sake will not eliminate the wage gap."

In recent years, however, the existing evidence of a strong positive association between company-provided training and the subsequent wages of the trainees has been questioned due to the obvious problem that training is not necessarily randomly distributed to employees. More specifically, standard Mincer-type wage equations to which a dummy indicator for participation in training is added as an explanatory variable are seen to generate biased estimates of the wage effects of training whenever the employee's and/or the employer's decision affects who is getting trained, and who is not.[29] The literature contains a few examples,

25. See the discussion above in the section on general versus specific training.
26. For overviews of previous evidence on the wage effects of company training, see e.g. Bishop (1997), Barrett et al. (1998) and Cohn and Addison (1998).
27. Studies approximating returns to general human capital by labour market experience and returns to specific human capital by tenure have been overlooked in this context.
28. See further e.g. Groot and Maassen Van den Brink (2003). Arulampalam, Booth and Bryan (2003b), in turn, argued that at least some of the documented differences in wage inequality across EU countries could be explained by the complementarity between education and training *systems*.
29. See e.g. Frazis and Loewenstein (2003) and Schøne (2004) for a comprehensive discussion of potential econometric problems when estimating the wage effects of training investments. These problems include unobserved heterogeneity in wage levels as well as in wage growth, unobserved heterogeneity in returns to training, and measurement errors, among others.

where attempts have been made to account for the unobserved heterogeneity between individuals that underlies this selectivity bias, using standard techniques – Heckman-type selection models, instrumental variable methods, and fixed-effects estimators.[30] Frazis and Loewenstein (2003) were left with a return on training in the USA that is several times the return on formal schooling even after correcting for unobserved heterogeneity as well as a set of other confounding factors. However, their results also indicate that the return on training declines substantially with the quantity of training; that is, the highest returns are reaped from relatively short spells of training. Booth and Bryan (2002), controlling for time-invariant heterogeneity using fixed effects techniques, found the wage gains from participation in company training in the UK to be positive and persistent. For France, in contrast, controlling for time-invariant heterogeneity generates statistically non-significant wage effects from company training (Goux and Maurin 2000). Evidence for Norway indicates that controlling for unobserved heterogeneity reduces the estimated wage effect to the still significant but minor magnitude of approximately one per cent (Schøne 2004).[31] The existing evidence for Germany is inconclusive; while Pischke (2001) found no evidence of work-related training leading to higher wages in Germany[32], Kuckulenz and Zwick (2003) reported the wage effects of participation in company training to be positive even after correction for the endogeneity of training.

Still another technique has been suggested by Leuven and Oosterbeek (2002), the basic idea of which is to narrow down the typical comparison group of all non-participants to those who were to participate in training, but were not able to do so due to some random event. This approach leads to an estimated wage return on participation in company-provided formal training in the Netherlands that is close to zero. The authors noted that this finding of no wage effects whatsoever from participation in company training is in line with previous results of theirs based on instrumental variable methods (Leuven and Oosterbeek 2001). They concluded by arguing that what is interpreted as returns to training seems, for the most part, to be a return to unobservable characteristics.

Considerably more conformity in reported results seems to characterise the wage effects of company training received at previous employers. Thus Booth and Bryan (2002) found for the UK that employer-financed training increases wages both at the current employer and at future employers, with the wage premium being substantially higher at future employers, especially for accredited training.[33] They note that these results are well in line with previous findings for the UK. Furthermore, they found a similar pattern of effects for the time spent in training. Loewenstein and Spletzer (1998, 1999) also found company-provided training received at previous employers to exert a positive and persistent influence on wages in the

20. For a brief review of these studies, see e.g. Leuven and Oosterbeek (2002).
31. Schøne (2004), however, found even this size of the wage effect to be relatively high in view of the typically short duration of training in Norway (an average number of training days among participants of approximately 11 days). Furthermore, he estimated a doubling (an increase of 100 per cent) of the number of training days to increase hourly wages by 1.1 per cent. When applying fixed-effects estimation techniques, the wage effect of the number of training days drops considerably and, while significant, is only slightly more than zero.
32. Instead Pischke (2001) found training during leisure time to exert a significantly positive effect on wages.
33. Indeed, non-accredited training was found to exert no impact whatsoever on wages in future jobs.

USA. In contrast to the UK findings, however, they obtained no, or only weak, evidence in support of general company training raising wages also at the employer providing the training, although this effect reveals a tendency to strengthen over time, according to results by Lengermann (1999). Negligible returns on general training provided by the training company, but large returns when changing employers, are results that seem to also hold true for full-time Swiss males employed in large companies (Gerfin 2004). For those employed in small companies, on the other hand, there is no notable difference between the return on general training reaped by those who stay in the company providing the training and those who move to work in another company. These findings of the return on training being typically larger at future employers are well in line with the predictions of the new theoretical models of training in frictional labour markets.

Another aspect related to the wage effects of company-sponsored training, receiving growing attention in the empirical training literature, is the question of whether the return on training investment stays the same across the whole of the wage distribution, as assumed in standard wage regressions. Arulampalam, Booth and Bryan (2004b) used ECHP data for non-agricultural private-sector men aged 25 to 54 in ten EU countries to test the validity of this assumption. Their major finding was that in the vast majority of the investigated countries, the return on company training does not change significantly across the conditional wage distribution. Belgium stands out as the only notable exception in this respect. This similarity in results across the EU countries does not extend to mean wage returns on training, though. On the contrary, the mean returns vary considerably across the ten EU countries in the study. In particular, the highest average return was in Ireland, and the lowest, or zero, in Italy and the Netherlands, with the Dutch result thus being well in line with the aforementioned findings of Leuven and Oosterbeek (2001, 2002). Comparatively low average returns were also apparent for the countries with the highest incidence of company training – Britain, Denmark and Finland.

Surprisingly minor attention has been paid to the question whether, and how, the wage effects of investments in company training vary with the characteristics of the trained employees. Recent contributions by Regnér (2002) for Sweden and by Kuckulenz and Zwick (2003) for Germany shed some further light on these issues.[34] Their findings confirm, by and large, *a priori* expectations while simultaneously offering insight on additional dimensions. The Swedish findings reveal that the wage effects are larger for employees in jobs that require long training, for the recently hired, and for those receiving general as opposed to specific training, but only if employed in the private sector. Indeed, specific training caused significant wage effects for public-sector employees only, which contrasts sharply with the Norwegian results, which showed no significant difference in the return on general and specific training in the private sector (Barth 1997).

The German results suggest that highly-skilled employees reap greater benefits from training than their low-skilled colleagues, the return on training is higher for job entrants

34. For other similar studies, see e.g. Lynch (1992) for the USA, Blundell, Dearden and Meghir (1996) for the UK, and Pannenberg (1997) for Germany.

than for tenured employees, and employees with a permanent job contract get higher returns from training than those employed on a temporary basis. In contrast to these German results, Ok and Tergeist (2003) obtained no evidence from ECHP data in support of the impact of training on wages being significantly different between low-educated and high-educated employees. Evidence from the UK, in turn, indicates that unionised employees tend to gain more from investments in company-sponsored (general) training than their non-unionised counterparts (Booth, Francesconi and Zoega, 2003). Moreover, this advantage of unionised over non-unionised employees also extends to the duration of the training, although the overall wage effect of training duration is small.[35]

A cautious generalisation about formal versus informal training would be that individuals tend to gain a positive private return from off-the-job training. Recent evidence from Germany, reported by Kuckulenz and Zwick (2003), indicates that participation in 'external' training has a significantly positive effect on wages, while the wage return on participation in 'internal' training is non-significant. These findings are in line with those reported by e.g. Barron, Berger and Black (1997) for the impact of 'off-site' versus 'on-site' company training on starting wages in the USA. On the other hand, when comparing youth training in Australia, the UK and the USA, Tan et al. (1992) found that in all three countries, training provided within the company offered larger returns than training provided outside the company (i.e., off-the-job).

Productivity effects of company training

The effects of employer-provided training on company productivity have typically been evaluated indirectly by means of its impact on wages. A major shortcoming of such an approach, however, is that wages are suitable as a direct measure of productivity only in a traditional neoclassical labour market; that is, in a labour market with perfectly competitive wages. As noted in the previous section, in situations where both the costs and the benefits of the training investment are shared by the employee and the employer, the result is an underestimation of the wage effect in terms of productivity. Often the estimated return on training is then interpreted as a lower-bound estimate of the wage effect.

A slowly growing literature attempts to measure the productivity effects of company training directly, typically through the use of standard Cobb–Douglas production functions. A common feature of earlier studies in this field is rather weak evidence in support of the existence of a clear-cut, non-negligible positive association between company training and productivity.[36] Just as in the case of effects on wages from training, one reason for this ambiguous outcome is that the estimated positive productivity impacts tend to disappear once the endogeneity of training is

35. It is also noteworthy that recent evidence for UK establishments, as reported by Forth and Millward (2004), suggests that the wage effects of the duration of training are non-linear. More specifically, they find that the positive relation between training duration and wages is associated with certain training durations (one to two days, and two to five days) when compared to a situation of no training.
36. Previous studies of the productivity effects of employer-provided training are mostly based on various performance measures (subjective as well as more objective ones) for rather specific samples of companies. Moreover, a majority of the studies concern the USA. See e.g. Dearden, Reed and Van Reenen (2000).

corrected for. The last few years, however, have seen several interesting contributions to this emerging research field.[37]

A study by Dearden, Reed and Van Reenen (2000) based on a panel of British industries covering the years 1983 to 1996 reported that training significantly boosts productivity and, moreover, to a much larger degree than indicated in previous studies focusing entirely on the wage effects of training. The underestimation of the productivity effects of company training is argued to be due to two major circumstances. Firstly, companies usually make training decisions for some particular reason(s), such as negative demand shocks or low productivity, implying that training should be treated as an endogenous factor instead of being taken as exogenously determined. Secondly, their estimated wage effects of training are found to be only about half of those on industrial productivity.[38] Addison and Belfield (2004) reported a positive impact from (instrumented) training on both labour productivity and financial performance in British private-sector establishments with at least 10 employees. An advantage of their study is that they explore the impact not only of the incidence of training but also of the duration and coverage of training. A disadvantage is that they are restricted to the use of subjective measures of labour productivity and financial performance obtained from management questionnaires.

Hempell (2003) recently reported a positive productivity effect of training for the service sector in Germany based on data covering the period from 1994 to 1998. Positive, albeit rather modest, productivity effects were noted in the Swedish machine tool industry in a study by Kazamaki Ottersten, Lindh and Mellander (1999). They explain the small productivity impacts of company-sponsored training by second-order effects compared to the estimated first-order effects of company training expenditures yielding substantial cost savings in the long run. Black and Lynch (1996), finally, found no impact of training on sales in private US establishments with more than 20 employees, but noted that their measures of training (number of employees involved in training in, respectively, 1990 and 1993) obviously underestimate the true return. When they accounted for other dimensions of training, their evidence becomes more compelling. More specifically, the productivity effect appears to be strongly dependent on the proportion of time spent in formal off-the-job training (for manufacturing) and also on the content of the training programmes (for non-manufacturing). All in all, focusing merely on the wage effects of training overlooks the fact that companies profit substantially from the training they provide their employees.

A limited number of mostly US studies have tried to move one step further, in the direction of evaluating the employer's internal rate of return on investment (ROI) in formal company training. These studies were recently reviewed by Bartel (2000:522), who concluded that the ROI in training might be "much higher than previously believed".

37. For an informative summary table of recent contributions to the 'training-in-the-production-function' literature, see Addison and Belfield (2004, Appendix Table 1).
38. A roughly 50–50 split of the benefits of training between employees and employers was also reported by Barron, Black and Loewenstein (1989) based on company-level data for the USA. In a more recent study of US employer-reported data, however, Barron, Berger and Black (1997) found the estimated effect on productivity growth to be approximately ten times the effect on wage growth.

Nevertheless, the existing evidence provides neither companies nor policy-makers with much guidance on the magnitude of the employer's rate of ROI in training. She emphasises that, especially in case of under-investment problems, the ROI in training could guide companies in their investment decisions, and policy makers in their decisions on subsidies to company training. A major reason for the limited information on employers' ROI in training is lack of data on the employers' training costs in company-level and establishment-level data sets. This explains why the focus has usually been limited to productivity effects.

Finally, Collier et al. (2003) took an indirect approach to assessing the impact of training investment on company performance by exploiting the link between training and commercial survival, using panel data on nine occupational groups within British establishments. Their results suggested that, while no occupational group reveals a negative association between training and survival, certain occupational groups do stand out in the sense that increasing their training improves substantially the establishment's chances of survival. The picture is, however, complicated by the fact that these occupational groups are not the same across establishments, but differ notably between larger and smaller establishments.

Finally, while the existing evidence points to significantly positive productivity effects from external or general training, the effects of internal or specific training are typically estimated to be negligible. Results pointing in these directions have been obtained by Dearden, Reed and Van Reenen (2000) for the UK, Barrett and O'Connell (2001) for Ireland and Zwick (2002) for Germany. It is hypothesised that this outcome is due to more formal company training having a more lasting impact on productivity.

Societal effects of company-provided training

Empirical evidence in support of the existence of noteworthy positive external effects from investment in human capital is weak. While there is an emerging literature focusing on spillovers from investments in formal education[39], few studies can say something concrete about training spillovers. Since the Dearden, Reed and Van Reenen (2000) study focuses on the effects of training on industry productivity, the results appear to capture at least some of the externalities that can be expected to arise from company-provided training. According to the authors, such positive externalities may offer an explanation for the comparatively large effects of training that they obtained from data on British industries.

Another strand of research departs from the predictions of standard economic theory, according to which employers will not invest in general training and will under-invest in specific training, unless appropriate policy measures are taken. This negative impact on the training behaviour of companies is caused by the obvious risk of competitors hiring away (poaching) the trained employees. The overall consequence is underinvestment in company training, as too few employees are trained and the intensity of the provided training is too low. These market failures, which are taken to be present especially in the case of more general training, are thus due to the companies' discount rate exceeding the social discount rate. In their theoretical

39. See e.g. Sianesi and Van Reenen (2003), and Asplund (2004).

model focusing on investment in general human capital on-the-job in an imperfectly competitive labour market, Booth, Zoega and Francesconi (1999) showed that trade unions may affect this 'quitting externality' by increasing the training intensity, but at the expense of a lower number of employees being trained. Hence, there is both a positive and a negative effect on social welfare. Moreover, they obtain support for the predictions of their model from the analysis of full-time male employees using British panel data for the years 1991 to 1996.

The need for government subsidies arising from poaching externalities and underinvestment in general company training has also been analysed in a theoretical paper by Moen and Rosen (2002). In sharp contrast with previous literature, however, they concluded that internal efficiency is a sufficient condition for an efficient allocation of resources in an economy characterised by endogenous human capital formation and endogenous turnover in the presence of search friction. Internal efficiency can be achieved either through long-term binding contracts or efficient bargaining between employers and employees.[40] Underinvestment in general training due to excessive turnover appears to arise in the absence of internal efficiency; that is, if employers do not set wages for experienced employees in a competitive way, but instead drive them too low in order to maximise profits. But even in this latter case, the social and private returns on investments in general training continue to coincide, and subsidies on general training would cause a reduction in welfare in this case as well. The authors argued that any subsidies should, at least, be combined with some additional policy measures aimed at reducing turnover.

Indeed, Moen and Rosen's (2002) theory of 'persistent' equality between the social and the private return on investment in general company training stands in sharp contrast to several – both theoretical and empirical – contributions arguing in favour of subsidies for general company training. It sharply contradicts the theoretical predictions of Stevens (1994), who argued that poaching creates a wedge between the social and the private return on investment in general company training, as long as the productivity of employees exceeds their wages. In line with these arguments, Booth and Snower (1996) argued in favour of subsidies for general company training in order to mitigate the market failures caused by poaching. Acemoglu and Pischke (1999a) and Gersbach and Schmutzler (2003) presented theoretical arguments justifying subsidisation of general company training. Ballot and Taymaz (2001) ran experiments to test the efficiency of a number of alternative training policies for long-term macroeconomic performance, and concluded in favour of subsidy policies. Government subsidies to counteract the under-investment tendencies caused by poaching externalities have also been suggested by the OECD (1994, 2003).

A different mechanism has been highlighted by Leuven et al. (2002). More specifically, they argued that in case workers are sufficiently motivated by reciprocity, then the amount of investment in both general and specific company training will be optimal also from a social point of view. In contrast

40. Acemoglu (1997), in contrast, found that turnover in the presence of search frictions creates positive externalities from investment in general company training for future employers. As a consequence, internal efficiency, such as long-term contracts with current employers, cannot offset the risk of underinvestment in general company training.

to the standard-model opportunistically-behaving individual, a reciprocal employee is characterised by a willingness to give most, or all, of the return on the training investment to the employer. Using a representative sample of the Dutch population, Leuven et al. (2002) obtained strong support for their proposed mechanism; that is, companies did not seem to under-invest in specific training and invested substantially in the general training of their workforce. In their training behaviour, companies show a clear preference to provide training to employees with a high sensitivity to reciprocity.

All in all, our current knowledge on the existence and magnitude of training market failures, on the one hand, and their causes and consequences, on the other, leaves a multitude of crucial questions unanswered. Among these are the need for and the most efficient mode of public intervention. The complexity of these open questions is further highlighted by the fact that there does not seem to exist a common solution for all countries and all situations. Instead, public intervention policies should be tailored, in a cost-efficient way, to fit the specific needs that exist in each country. This is certainly a challenging task, which is also clearly evident from a recent evaluation of policy measures proposed for stimulating on-the-job training in the Netherlands (van Leeuwen and van Praag, 2002). More specifically, there appear to be large differences in the cost-effectiveness of policy measures, and the outcome of measures may differ substantially among employers, employees, and the government.

Discussion and conclusions

It seems fair to summarise by arguing that only cautious conclusions can be drawn based on the current state-of-knowledge concerning the incidence, extent, and impact of company investment in training. Among these conclusions are the following.

- There is a confusing multitude of definitions of company training in use in the empirical literature. Apart from the traditional concepts of 'general' versus 'specific' training, the literature contains a growing number of competing concepts such as 'formal' versus 'informal' training, 'external' versus 'internal' training, and 'off-site' versus 'on-site' training. The conceptual confusion is further increased by the fact that on-the-job training is often used to cover both general and specific training. Additionally, the term appears in a commonly utilised way to distinguish between formal and informal company training on the basis of the location of the training (training provided 'off-the-job' compared to 'on-the-job').[41] These examples clearly show that there is an obvious need to clarify how to correctly label the different modes of company-provided training. The current situation undermines the comparison of results both across countries and within single countries. It also hampers the emergence of a more broad-based picture of the economic role of employers' investment in training.
- The existing empirical evidence states that companies do – and should – provide and pay also for the general training of their employees. This willingness of employers to invest in the more general skills of their

41. Another frequently used alternative when trying to distinguish between formal and informal company training is to depart from the formality versus informality of the provided training, irrespective of its location.

workforce has been shown to rely on the possibility to earn rents on their trained employees as – due to (labour) market imperfections – the wages of the trainees grow more slowly than their productivity. These findings stand in sharp contrast to the predictions of the standard general-versus-specific training theory.

- The research on the provision of company training is heavily biased towards participation versus non-participation in company-provided training, while corresponding results on the role of the intensity of training and for different modes of training are mostly lacking. Moreover, most of the existing empirical evidence concerns more formal modes of company training, while our current knowledge about the incidence, intensity, and effects of informal company training is scarce, often contradictory, and mostly lacking. A major explanation of this situation is that the existing microdata contain little, if any, information on informal training.
- The empirical research has succeeded in identifying a broad number of individual and job-related characteristics that affect an employee's probability of receiving employer-provided training. Many of these finding are already labelled 'stylised facts'. However, several of these stylised facts can be questioned based on more recent results. For example, better coverage of employer-related background characteristics suggests that the education–training association is not necessarily so clear-cut as indicated in earlier studies. Likewise, union wage formation does not seem to have the detrimental impact on work-related training that it is commonly alleged to have.
- One generalisation seems to hold, though: the less skilled are mostly in a less advantageous position when it comes to company training. For instance, employers engaged in sectors employing a disproportionately large amount of low-skilled labour are found to be the least likely to provide training in basic general skills, although these low-skilled employees are exactly the ones that would need and also benefit most from such training. Since the training opportunities of the low-skilled are likely to be affected by a combination of labour market imperfections, credit constraints, and training market failures, a recent OECD report (2003) emphasised the need to adopt co-financing policies in order to improve the incentives of companies to invest in the training of their employees in general and of their less-advantaged employees in particular.
- The link between education and training is crucial also from a broader perspective, since our knowledge on the interactions between formal education and employer-provided training is still weak. Is there an optimal mix of schooling and training? How do the returns on training interact with those of schooling? How does employer-provided training interact with other modes of adulthood schooling and training?
- Empirical evidence on the economic impact of employer investment in training is only just emerging. This situation is remarkable in view of the enormous amount of resources invested annually in company training. So far, most of the effort has been focused on the wage effects of training but, simultaneously, better data and/or more sophisticated estimation techniques have generated an increasingly more mixed picture of the wage returns on training. Moreover, the reported wage returns on training highlight, for the most part, only average effects, while information on the returns reaped by differently-

endowed individuals is still more or less missing.

- It is often argued in the economics literature as well as in policy debates that training improves an individual's employability and career prospects. However, a closer look at the existing empirical evidence reveals that surprisingly little research has been undertaken on these aspects and, as a consequence, there is still only weak, if any, empirical support for these arguments.[42] Indeed, it seems as if these contentions have been derived indirectly from the by now stylised 'fact' of a positive relationship between accumulated work experience and wages, as well as the evidence of those in a worse labour market position having a significantly lower probability of receiving employer-provided training.
- Only limited – and highly contradictory – evidence is available on the question of whether or not there are inefficiencies (underinvestment) in the provision of company training. Accordingly, the training literature provides little, if any, guidance on the social return on company investment in training, or on the need and mode for public intervention.

All in all, the growing interest in investigating the incidence, determinants, and impacts of company-provided training, evidently inspired by better data and more sophisticated research techniques, has without doubt substantially improved our current knowledge on the role and importance of the huge amounts of money that companies annually invest in the human capital of their employees. Simultaneously, however, as the topical literature has increased, so has the confusion surrounding this literature and the findings it has generated so far. For instance, returns to the employees in the form of wage growth seem to be much more modest than indicated by the earlier literature, whereas returns to companies in the form of productivity growth tend to be considerably larger than previously thought.

Another conspicuous feature of the training literature is that it is still quite selective in the sense that some questions have received considerable attention, both theoretically and empirically, while other aspects are so far almost entirely overlooked. Moreover, our knowledge about those questions to which relatively much attention has been paid is still quite heavily based on results concerning a specific age group (e.g. young people), a specific industry (e.g. manufacturing) or a specific country (mostly the UK or the USA). This reflects the fact that comprehensive analyses of the incidence, content, extent and effects of employer-provided training are still heavily constrained by data limitations. Indeed, it seems fair to conclude that the extensive review by Lynch (1998) of what current databases on employer-provided training are lacking, is today as relevant as it was in the late 1990s.

Taking all this together, our current knowledge on the economic role of company training demands great cautiousness in drawing policy implications concerning the crucial questions of the inequality of access to company training, on the one hand, and training market failures, on the other.

42. There are, to my knowledge, few more recent empirical studies that explicitly analyse, based on broad data sets, how company training tends to affect the employability, labour market mobility, and careers of individuals. These include a few studies for Germany (see the references in Kuckulenz and Zwick (2003)) and an ECHP-based study by Ok and Tergeist (2003).

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