The private benefits from vocational training:
a new framework

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The private benefits from vocational training: a new framework

Wendy Smits

Abstract

For designing policies aimed at stimulating private investments in IVT and CVT it is crucial to know who will benefit from various training investments: employers, individuals, both, or society as a whole? If any party, whether employers or individuals, do not share in the benefits of training this may hamper the success of a training programme. In this contribution we will develop a theoretical framework to characterise vocational training. We will identify four factors that determine to what extent different parties share the returns from training, namely: the degree of firm-specificity of training; the degree of imperfect competition on the market for trained workers; the retention rate of trained workers; the bargaining power of trained workers. Next this framework will serve as a handle for a review of empirical literature on the private benefits from training for both employers and individuals. What are employers’ and individuals’ benefits from different types of training? We will pay particular attention to empirical evidence on the four factors that determine the division of the returns to training.
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Introduction

For designing policies aimed at stimulating private investment in initial vocational training (IVT) and continuing vocational training (CVT) it is important to know who will benefit from various training investments: employers, individuals, both, or society as a whole? If any party, whether employers or individuals, does not share in the benefits of training this may hamper the success of a training programme. Firms which do not benefit from training themselves may be tempted to save on training costs by lowering the quality of training or training provision. Individuals, on the other hand, may not be motivated to spend much effort on the learning process if they do not benefit from training. As both the quality and quantity of training provided by a firm and the effort of individuals are difficult to monitor and influence, government policies aimed at increasing training participation will have a better chance of success if both parties share the benefits.

Previous research on the benefits of vocational training revealed that both individuals and employers may benefit from training (Cedefop; Descy and Tessaring, 2004) but little is known, however, about how these benefits are actually shared between individuals and employers. Economic literature on training usually departs from the dichotomy of general versus firm-specific training introduced by Becker (1962). General training is defined as training that is of value in many firms while firm-specific training is of value only in the training firm. The benefits of general training fully accrue to the worker whereas the benefits of firms-specific training are shared between the employer and the worker (Becker, 1962; Hashimoto, 1981).

The typology general and firm-specific training is of little empirical use to determine ex ante which party benefits from training. In most of the literature training is classified ex post as general or firm-specific based on observed wage growth (Werwatz, 1996; Euwals and Winkelmann, 2001). In reality, most training, especially vocational training, is neither completely general nor completely firm-specific (Smits and Stromback, 2001). Some elements of training may be useful in the training firm only, while other elements of the training may be of use in some or in many other firms. The dichotomy of general versus firm-specific training is not as straightforward as it may seem at first sight, as it refers not only to the characteristics of training content (could the skills trained for be used outside the training firm) but also to market conditions (are skills valued the same outside the training firm) (Soskice, 1994). Market conditions can prevent skills that are initially general to be valued the same outside the training firm, for example because there is incomplete information on the content or quality of the training programme. In that case market conditions allow employers to appropriate part of the benefits of this training. For example, generic skills such as reading and writing are of potential use in many firms. Training in generic skills could, therefore, increase workers’ market value, if they could. However, if training is not certified, individuals will not be able to signal these skills to new employers and the market value of training will be very low.
To determine *ex ante* the training benefits for each party, employers, individuals (and other employers), we need a new framework to classify training programmes. This framework should consider both the content of the training programme (what skills are learned: generic, occupational or firm-specific skills) and the market value of the training (Smits and Stromback, 2001; Smits and Zwick, 2004). The market value of the training depends not only on the content of the training programme but also on market conditions, for example the size of the market and its transparency. Such a framework would make it possible to:

(a) determine *ex ante* who benefits from the training and thus who should make the investment;

(b) formulate new balanced training programmes so both parties can reap benefits from it;

(c) determine what interventions (subsidies, tax systems) would be most appropriate to stimulate training investment.

If the market value of the training equals its value in the training firm, then employers have to pay individuals for their full productivity, so individuals profit and should make the investment. If the market value of training is low compared to its value in the training firm, then employers profit from the training as well and should share in the investment. In fact, if the market value of training is very low workers will not be prepared to invest in training unless they can share in the firm-specific benefits of the training. It would not be helpful in this case to stimulate training by means of subsidies or tax reductions aimed only at individuals. Such policies would probably increase the number of individuals participating in training programmes but would have an adverse effect on the success of these programmes, as individuals have little incentive to exercise much effort in the training if the benefits from doing so are low. A more fruitful approach is to design training programmes so both individuals and employers benefit from it and, therefore, should share the cost.

In this study we will develop a framework to characterise vocational training. We will identify the factors that determine to what extent different parties (the training firm, the worker and other firms) will share in the returns from training. Next this framework will serve as a handle for a review of empirical literature on the private benefits from training for both employers and individuals. What are employers’ and individuals’ benefits from different types of training? We will especially focus on empirical evidence of factors that determine the division of the returns, for example the degree of firm-specificity and market conditions.
1. Theoretical framework

The market value of training depends both on the type of skills learned during this training and on market conditions. It is not only important whether training has increased a worker’s potential productivity in the external market but also whether the market wage reflects this productivity increase. Market conditions can prevent technological general skills being valued in the labour market.

In this chapter we will develop a framework which characterises vocational training on two dimensions; the firm-specificity of the skills learned and the market values of these skills. The parameters of the model will have a different value for different training programmes as both content and market conditions will differ between different types of training. The model will not be tested empirically in this contribution, because there is no suitable dataset available, but will instead serve as a handle to present available evidence on dividing training returns between firms and workers from literature.

Box 1: List of symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y_1$</td>
<td>internal productivity</td>
</tr>
<tr>
<td>$y_2$</td>
<td>external productivity</td>
</tr>
<tr>
<td>$w_1$</td>
<td>internal wage rate</td>
</tr>
<tr>
<td>$w_2$</td>
<td>market wage</td>
</tr>
<tr>
<td>$p$</td>
<td>retention rate</td>
</tr>
<tr>
<td>$R_s$</td>
<td>social returns</td>
</tr>
<tr>
<td>$R_f$</td>
<td>returns to the training firm</td>
</tr>
<tr>
<td>$R_w$</td>
<td>returns to the worker</td>
</tr>
<tr>
<td>$\beta$</td>
<td>workers’ bargaining power</td>
</tr>
<tr>
<td>$\delta$</td>
<td>degree of firm-specificity</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>degree of imperfect competition</td>
</tr>
<tr>
<td>$H$</td>
<td>human capital production function</td>
</tr>
<tr>
<td>$C$</td>
<td>training cost function</td>
</tr>
<tr>
<td>$C_f$</td>
<td>training cost function of the firm</td>
</tr>
<tr>
<td>$C_w$</td>
<td>training cost function of the worker</td>
</tr>
<tr>
<td>$x_f$</td>
<td>effort of the firm</td>
</tr>
<tr>
<td>$x_w$</td>
<td>effort of the worker</td>
</tr>
<tr>
<td>$z$</td>
<td>vector containing training...</td>
</tr>
</tbody>
</table>
1.1. Degree of firm-specificity and degree of imperfect competition

Consider a simple two period model for training. We assume constant returns to scale so we can consider the training decision for a single worker. The first period is the training period, the second period is the remainder of working life. For simplicity, but without loss of generality, it is assumed there is no discounting between periods. The training may raise productivity both in the training firm (internal productivity) and in other firms (external productivity). Without loss of generality it is assumed that initial productivity is equal inside and outside the training firm and it is normalised at zero (\(^1\)). Let \(y_1\) denote internal productivity during the post-training period and \(y_2\) the maximum external productivity during the post-training period (\(^2\)). Analogously \(w_1\) denotes the internal wage and \(w_2\) the external wage in the second period. Suppose that a fraction \((1-p)\) of workers leaves the training firm after completing the training for exogenous reasons (that is for reasons unrelated to the wage that is paid during the post-training period) (\(^3\)). The retention rate \((p)\) can be interpreted as the probability that a single worker stays in the training firm. The expected social returns to training are given by the probability that the worker stays times his productivity in the training firm plus the probability that the worker leaves the training firm times his external productivity:

\[
R_s = py_1 + (1-p)y_2
\]

The firm’s expected share of the returns is equal to probability the worker stays times the gap between internal productivity and pay:

\[
R_f = p(y_1 - w_1)
\]

and the worker’s share is equal to the probability he stays times the internal wage rate plus the probability he leaves times the external wage rate:

\[
R_w = pw_1 + (1-p)w_2
\]

If the internal productivity exceeds the external wage rate then there is a surplus from training \((y_1 - w_2)\) which can be shared between the worker and the training firm. The internal wage rate is then given by:

\[
R_w = pw_1 + (1-p)w_2
\]

\(^1\) Some training programmes may include contractual arrangements that affect the division of the returns to training. For example, the duration of an apprenticeship contract may exceed the time needed to learn the trade. In the latter part of the indenture the apprentice still earns a relatively low training wage but his productivity has increased (Malcomson et al., 2003). Such an arrangement can be incorporated in the framework developed in this chapter by assuming that the worker will have to stay for some proportion of the post-training period while still receiving the training wage (Smits and Stromback, 2001). However, as most of the literature shows that apprentices are a net costs to the training firm during the training period (Bardenleben, 1997; Smits and Stromback, 2001; Smits, 2005b) we will only consider the divisions of the returns from apprenticeship training after completing the term of indenture.

\(^2\) The productivity in the external firm in which the worker reaches the highest productivity.

\(^3\) Separations may be quits as well as lay-offs.
(1.4) \[ w_1 = w_2 + \beta(y_1 - w_2) \]

where \( \beta \) is a measure of the worker’s bargaining power. Note that the external wage rate puts a minimum bound on the internal wage rate.

Define the degree of firm-specificity by the gap between the worker’s internal and external productivity relative to his external productivity:

(1.5) \[ \delta = \frac{(y_1 - y_2)}{y_2} \]

If \( \delta = 0 \) then \( y_2 = y_1 \) and the training is perfectly general. If \( \delta > 0 \) then the external productivity is lower than internal productivity \( (y_2 < y_1) \) and the training is more specific. If \( \delta \to \infty \) the training is hardly general at all \( (4) \) \( (5) \). Note that, using the above definition, the training can never be completely firm-specific although the general component may be neglectably small. For our purpose the situation where the training is completely firm-specific is of little interest because if it were completely firm-specific market conditions would not matter at all. Further, we are interested in vocational training which by definition can never be wholly firm-specific as it refers to a vocation and not to a firm. Finally, even if the training is meant to be completely firm-specific the worker will also acquire some skills and knowledge that can be applied in other firms. In other words it is difficult to think of skills and knowledge as completely firm-specific \( (6) \).

Analogously we can obtain a measure for the degree of imperfect competition in the external market:

(1.6) \[ \gamma = \frac{(y_2 - w_2)}{w_2} \]

The degree of imperfect competition is defined by the gap between external productivity and pay relative to the external wage rate. If \( \gamma = 0 \) external wages equal external productivity \( (w_2 = y_2) \) there is perfect competition. If, on the other hand, \( \gamma > 0 \), external wages will be below external productivity. For \( \gamma \to \infty \) there is hardly any competition at all. The economic literature provides several explanations why the market for skills is not perfectly competitive. Roughly we can distinguish three classes of explanations (Box 2):

(a) the market for trained workers is relatively small;

(b) firms have difficulties assessing the skill level and productivity of workers trained in other firms;

\( \ast \) In this contribution I will use the dichotomy general versus firm-specific to denote technological firm-specific and general training.

\( \dagger \) Theoretically it would be possible that \( y_2 > y_1 \) (and so \( \delta < 0 \)), for example in the case of generic skills (Smits, 2005b). This case is not considered in this contribution.

\( \ddagger \) The reverse is not necessarily true; training can be completely general if it takes place off-the-job independent of the context in the training firm.
(c) there are institutions, such as trade unions or minimum wage legislation that compress the wage structure.

**Box 2: Imperfect competition on the market for trained workers**

<table>
<thead>
<tr>
<th>The size of the market</th>
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<tbody>
<tr>
<td>Becker (1964) admitted that the dichotomy general/firm-specific is not applicable for all types of training. He states that ‘some training may be useful not in most firms nor in a single firm, but in a set of firms defined by product, type of work, or geographical location’. Stevens (1994; 1996) defines training that can be used in more than one firm as transferable. She argues that general training is only a special case of transferable training, which is characterised by a perfectly competitive labour market. If the labour market is not perfectly competitive, because only a small number of firms can use the skills, Becker’s results do not apply. Stevens (1994) shows that in imperfect competition, post-training wages will not necessarily equal marginal product (*).</td>
</tr>
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<table>
<thead>
<tr>
<th>The transparency of the market</th>
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<tbody>
<tr>
<td>In contrast to the training firm, external firms do not observe what training is taking place. Therefore, external firms might find it difficult to assess the value of a training programme, especially if it is not regulated by a third party. It follows that if an increase in the level of training is not observed by external firms, then it will not lead to an equivalent increase in the market wage. The consequence of informational asymmetries regarding the content of training programmes was first mentioned by Katz and Ziderman (1990) and later modelled by Chang and Wang (1996). Katz and Ziderman (1990) argue that the value of an externally trained worker is an increasing function of the recruiting firm’s information about a worker’s training. If the recruiting firm has no information about the training, it has to incur costs to discover the worker’s skill level. The value of an untrained worker in a job that requires training might be very low, or even negative. Additionally, it will probably take some time for a firm to discover the productivity of an externally trained worker. Therefore, firms might not be willing to hire externally trained workers for skilled jobs or to pay externally trained workers the skilled wage rate.</td>
</tr>
</tbody>
</table>

Another type of private information is the ability of workers. The training firm, by having the opportunity to observe workers during the training period, has an informational advantage compared to external firms. Although external firms might observe the training intensity, the outcome might depend on both the training intensity and worker’s ability. Several authors have addressed this issue, for example Elbaum and Singh (1995), Franz and Soskice (1995), Acemoglu and Pischke (1998), Clark (2002), Boom (2001) and Autor (2001). The common feature of most models in the literature is the assumption that training raises productivity more for high ability workers than for low-ability workers. That is, training and ability are complementary. After the training period, the high-ability workers are offered the market wage and low-ability workers dismissed or offered such a low wage that they will quit. However, some of the high ability workers will also leave for exogenous reasons. Acemoglu and Pischke (1998) show that in a competitive labour market the equilibrium market wage will equal the expected productivity of an externally hired worker. The expected profits on externally hired workers are, therefore, zero. Further, since the market wage is lower than the productivity of high ability workers, the firm earns a surplus on internally trained high-ability workers. It follows directly that the surplus on trained high-ability workers increases with the level of training and therefore firms will invest in training. |

<table>
<thead>
<tr>
<th>The role of institutions</th>
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<tr>
<td>Specific institutions in a country may enable firms to appropriate part of the returns to general training. Examples are minimum wage legislation and trade union influence. A minimum wage is commonly thought of as leading to less training than socially desirable. A minimum wage applicable to the training period can prevent a firm from shifting the cost of training onto apprentices. However, a minimum wage for the post training period may be an incentive for firms to provide general training (Acemoglu and Pischke, 1999b). This would be the case if, due to other labour-market distortions, the wage the firm would otherwise pay is strictly lower than the marginal productivity of the worker. Firms then have an incentive to raise productivity exactly to that level for which the wage they would otherwise pay equals this minimum wage. This is the minimum level of training for which the firm can appropriate the surplus from training.</td>
</tr>
</tbody>
</table>

(*) Harhoff and Kane (1997), Acemoglu and Pischke (1999a, c), Booth and Zoega (2000), Booth et al. (2002) and Lazear (2003) also present models in which the number of firms where the worker can use his skills is limited.
By substituting for $\gamma$ and $\delta$ in equations (1.1)-(1.3) we obtain the following formulas for the social returns, the return to the training firm and the returns to the worker:

\[
R_s = \frac{1 + p\delta}{(1 + \delta)} y_1
\]

(1.7) \\

\[
R_f = p(1 - \beta) \frac{(\delta + \gamma + \gamma \delta)}{(1 + \gamma)(1 + \delta)} y_1
\]

(1.8) \\

\[
R_w = \frac{(1 + p\beta(\gamma + \delta + \gamma \delta))}{(1 + \gamma)(1 + \delta)} y_1
\]

(1.9)

In this simple framework the division of the returns depends on four variables: the degree of competition ($\gamma$), the degree of firm-specificity ($\delta$), the bargaining power of the worker ($\beta$) and the exogenous retention rate ($p$). Note that in reality these four may not be completely independent but may to some extent interact. The social returns are equal to the internal productivity increase ($y_1$) times a factor that allows for the loss of the firm-specific component when the worker leaves the training firm ($(1+p\delta)/(1+\delta)$). If all workers were to stay in the training firm or if the training were completely general the social profits would equal the internal productivity increase. The training surplus, which is shared between the worker and the training firm, is given by the internal productivity times a factor that allows for the degree of imperfect competition and the degree of firm-specificity $(1-1/(1+\gamma)(1+\delta))$. If the degree of firm-specificity and the degree of imperfect-competition are both equal to zero ($\delta=0$ and $\gamma=0$) than there is no surplus from training to be shared. It can be shown that the worker’s share in the returns to training is increasing in the retention rate ($p$) and the worker’s bargaining power ($\beta$) and decreasing in the degree of firm-specificity ($\delta$) and the degree of imperfect competition ($\gamma$). The firm’s share in the returns is increasing in the retention rate ($p$), the degree of firm-specificity ($\delta$) and the degree of imperfect competition ($\gamma$) and decreasing in the worker’s bargaining power.

If the market for training is imperfectly competitive other firms also share in the returns to training because they can pay skilled workers less than their productivity. The returns to other firms are given by:

\[
R_s - R_w - R_f = \frac{(1 - p)\gamma}{(1 + \gamma)(1 + \delta)} y_1
\]

(1.10)
Figure 1: Division of training returns as a function of the degree of firm-specificity and of imperfect competition

Keeping the retention rate and bargaining power fixed at positive values we can distinguish four different situations:

(a) the training is perfectly general and there is perfect competition on the market for skills ($\delta=0$ and $\gamma=0$). The returns to training fully accrue to the worker;

(b) the training is perfectly general but there is imperfect competition on the market for skills ($\delta>0$ and $\gamma>0$). The training firm and external firms can appropriate some of the returns to training;

(c) the training is partly firm-specific but the market for (general) skills is perfectly competitive ($\delta>0$ and $\gamma=0$). The training firm can appropriate some of the returns to training but external firms cannot;

(d) the training is partly firm specific and the market for general training is not competitive ($\delta>0$ and $\gamma>0$). The training firm and external firms can appropriate some of the returns to training but the returns to the training firm are higher.

1.2. Socially optimal degrees of firm-specificity and competition

If any party, whether the employer or the individual, does not share in the benefits of the training this may hamper the success of a training programme. This holds in particular for the quality of the training provided by firms and the efforts exerted by individuals. Subsidies for stimulating employers or individuals to invest in training will not be effective in that case. For example, if firms are stimulated to invest in training while they do not benefit from the training themselves, they may be tempted to save on training costs by lowering the quality of
the training (Ryan, 1994; Smits, 2005a). By the same argument, individuals who are stimulated to participate in training from which they will not profit themselves, may not be motivated to spend much effort in the learning process (Acemoglu and Pischke, 2000; Barrett and O’Connell, 2001). As both the quality of the training provided by a firm and the effort of the individual are difficult to monitor, government policies aimed to increase training participation will have a better chance of success if both parties share in the benefits.

For both parties to share in the benefits we need imperfect competition ($\gamma > 0$) and/or firm-specificity of the training ($\delta > 0$). Usually both the degree of imperfect competition and the degree of firm-specificity are not completely exogenous to the parties involved in the training decision but can to some extent be influenced. If an external party, for example a training body, could set either the degree of firm-specificity or the degree of imperfect competition, what values for $\gamma$ and $\delta$ should it choose to maximise social profits? A higher degree of firm-specificity or a higher degree of imperfect competition may lower the worker’s share in the returns but as it induces the training firm to invest more, the total returns to the worker may increase. To determine the socially optimal degree of firm-specificity of training or degree of competition on the market for skills, both effects have to be considered.

**Box 3  How can the degree of firm-specificity and the degree of imperfect competition be influenced by an external party?**

The degree of firm-specificity of training is set by the training firm. The training firm knows what firm-specific skills and knowledge are important for it and how these can be acquired. Still, the degree of firm-specificity can to some extent be regulated by an external party, as is often the case for apprenticeship training. An external party can set a standard for general skills that must be acquired during the training, thereby limiting the available space in the training programme for firm-specific skills. Further, an external body can influence the degree of firm-specificity of training by regulating its didactical aspects... For example, if training takes place on-the-job merely through learning by doing, the worker will acquire more firm-specific skills than if training takes place off-the-job in an external training institution. In the latter case training is less tied to the context of the training firm. Another measure sometimes taken to reduce the firm-specificity of apprenticeship programmes is for apprentices to circulate between firms during the training period (Smits, 2005b).

The degree of imperfect competition on the market for skills is more difficult for an external party to influence than the degree of firm-specificity. The degree of imperfect competition depends on various factors simultaneously, such as the size and transparency of the market, as well as institutional factors. If the market for some skills is small the degree of imperfect competition can be decreased by adding more generic skills, those applicable in more occupations or industries that the worker is being trained for, into the training programme curricula,. Measures that make the labour market for trained workers more transparent, such as certification of training, also affect the degree of competition. Finally, the parties involved in training decisions at industry level, trade unions and employer organisations, may influence the degree of imperfect competition by making agreements on skill earnings profiles.
Suppose there is an external party which devises a training programme with fixed levels of firm-specificity of the training ($\delta$) and the degree of imperfect competition ($\gamma$) and some other characteristics, such as the number of hours trained and the type of training (on-the-job, off-the-job, learning by doing), denoted by $z$. The training firm and worker will participate in the training programme if their expected returns exceed their share in the training cost. The costs and returns to each party do not only depend on $\delta$, $\gamma$ and $z$ but also on the effort exerted by each party. Suppose that neither party can observe the effort of the other party. By varying effort both the worker and the firm can save on training costs but this will negatively impact on the output from training.

The increase in internal productivity is given by:

\begin{equation}
\tilde{y}_i = H(x_f, x_w, z)
\end{equation}

where $H$ represents the human capital production function which gives the internal productivity increase, $z$ is a vector containing training characteristics, $x_f$ is the effort of the training firm and $x_w$ the effort of the worker. We assume that the human capital production function is increasing in both the effort exerted by the training firm and the worker at a decreasing rate. There is no interaction between the effort exerted by the worker and the firm.

\[
\frac{\partial H}{\partial x_i} > 0, \quad \frac{\partial^2 H}{\partial x_i^2} < 0 \quad \text{and} \quad \frac{\partial^2 H}{\partial x_i \partial x_j} = 0.
\]

The training costs function is given by:

\begin{equation}
\tilde{C}(x_f, x_w, z) = C_f(x_f) + C_w(x_w) + \tilde{C}(z)
\end{equation}

Training costs for each party are increasing in the effort level at an increasing rate that is:

\[
\frac{\partial C_i}{\partial x_i} > 0, \quad \frac{\partial^2 C_i}{\partial x_i^2} > 0.
\]

So the training costs consist of some fixed component $\tilde{C}(z)$ which depends on the training characteristics set by the external party and a variable component depending on the effort exerted by each party ($\tilde{C}$). It is supposed that the variable part of the training costs depending on the firm’s effort is borne by the firm and the variable part of the costs depending on the worker’s effort by the worker. The fixed costs may be shared between the two parties, the exact division does not matter for the analysis as long as the total cost borne by each party does not exceed that party’s share in the return. The interpretation of the model is as follows: once the worker and the firm have reached an agreement on a training programme they have an incentive to cheat on this agreement by lowering their effort if they can increase their profits by doing so. This may be the case if a party’s share in the returns to training is

\[\text{(a)}\quad \text{A fixed component because neither the firm nor the worker has any influence on this cost component.}\]
The socially optimal levels of effort exerted by each party are found by equalising marginal social returns to the effort exerted in the training programme and the marginal training costs. So, the levels of effort that should be exerted by the training firm and the worker to optimise social welfare are given by $x'_f$ and $x'_w$ satisfying:

\[(1.13) \quad \frac{1 + p\delta}{1 + \delta} \frac{\partial H}{\partial x_f} = \frac{\partial C_f}{\partial x_f} \]

\[(1.14) \quad \frac{1 + p\delta}{1 + \delta} \frac{\partial H}{\partial x_w} = \frac{\partial C_w}{\partial x_w} \]

However, both the firm and the worker will only allow for their own share in the returns to training when deciding on the level of effort that should be exerted. The private optimums of the firm and the worker are found by equalising marginal private returns and marginal costs and are given by $x_f$ and $x_w$ satisfying:

\[(1.15) \quad \frac{p(1 - \beta)(\delta + \gamma + \delta\gamma)}{(1 + \gamma)(1 + \delta)} \frac{\partial H}{\partial x_f} = \frac{\partial C_f}{\partial x_f} \]

\[(1.16) \quad \frac{p\beta(\delta + \gamma + \delta\gamma)}{(1 + \gamma)(1 + \delta)} \frac{\partial H}{\partial x_w} = \frac{\partial C_w}{\partial x_w} \]

It is straightforward to see that both the level of effort exerted by the training firm and the level of effort exerted by the worker are too low compared to the social optimal level of effort exerted ($x'_f < x_f^*$ and $x'_w < x_w^*$). The levels of effort chosen by the firm and the worker are a function of the degree of firm-specificity and of the degree of competition. The firm’s share in the returns to training is increasing in the degree of firm-specificity and the degree of imperfect competition. The worker’s share is decreasing in the degree of firm-specificity and the degree of imperfect competition. Therefore a higher level of effort chosen by the firm will give a higher pay off for the firm as the degree of firm-specificity and/or the degree of imperfect competition is higher. The opposite is true for the worker. So we have:

\[\frac{\partial^2 R_f}{\partial \delta \partial x_f} = \frac{p(1 - \beta)}{(1 + \gamma)(1 + \delta)^2} \frac{\partial H}{\partial x_f} > 0\]

\[\text{(*) Although the effort of the worker is by nature non-material, the effort exerted by the worker still constitutes a cost as the time and effort devoted to the training cannot be used for other activities (other market activities or leisure). By lowering this cost the worker increases his profits.}\]
\[ \frac{\partial^2 R_w}{\partial \delta \partial x_w} = \frac{-(1-p\beta) \partial H}{(1+\gamma)(1+\delta)^2} \frac{\partial x_w}{\partial x_w} < 0 \]

\[ \frac{\partial^2 R_f}{\partial \gamma \partial x_f} = \frac{p(1-\beta) \partial H}{(1+\gamma)^2(1+\delta) \frac{\partial x_f}{\partial x_f}} > 0 \]

\[ \frac{\partial^2 R_w}{\partial \gamma \partial x_w} = \frac{-(1-p\beta) \partial H}{(1+\gamma)^2(1+\delta) \frac{\partial x_w}{\partial x_w}} < 0 \]

The higher the degree of imperfect competition, and the higher the degree of firm-specificity, the higher the level of effort chosen by the training firm and the lower the level of effort chosen by the worker. The social profits as a function of the degree of imperfect competition (\(\gamma\)) and the degree of firm-specificity (\(\delta\)) are given by:

\[ (1.17) \quad \frac{1+p\delta}{1+\delta} H(x_f(\delta,\gamma),x_w(\delta,\gamma),z) - C_f(x_f(\delta,\gamma)) - C_w(x_w(\delta,\gamma)) - \bar{C}(z) \]

The socially optimal degree of firm-specificity of the training is the degree of firm-specificity which maximises social profits. Differentiating (1.17) with respect to \(\delta\) and substituting for the private optimum gives the first order condition for the optimal degree of firm-specificity:

\[ (1.18) \quad -\frac{(1-p)}{(1+\delta)^2} H + \frac{1+p\beta(\delta + \gamma + \delta\gamma) \partial H}{(1+\gamma)(1+\delta)} \frac{\partial x_f}{\partial \delta} + \frac{p(1-\beta)(\delta + \gamma + \delta\gamma) \partial H}{(1+\gamma)(1+\delta)} \frac{\partial x_w}{\partial \delta} \]

\[ + \frac{\gamma(1-p)}{(1+\gamma)(1+\delta)} \left( \frac{\partial H}{\partial x_f} \frac{\partial x_f}{\partial \delta} + \frac{\partial H}{\partial x_w} \frac{\partial x_w}{\partial \delta} \right) = 0 \]

The first term of equation (1.18) is the marginal social loss from a higher level of firm-specificity because some workers leave the training firm. The second term is the marginal gain for the worker as the firm puts in more effort at a higher degree of firm-specificity. This gain depends both on the effect of the firm’s effort on output from training and on the worker’s share in training returns. The third term is the marginal loss for the firm if the worker puts in less effort at a lower degree of firm-specificity (\(^{(*)}\)). This loss depends on the effect of the worker’s effort on training output and the firm’s share in the returns. The fourth term is the gain or loss of other firms in the economy if the firm puts in more effort and the workers puts in less effort.

Differentiating social profits with respect to the degree of imperfect competition (\(\gamma\)) and substituting for the private optimum gives the first order condition for the optimal degree of imperfect competition:

\[ \text{Note that } \frac{\partial x_w}{\partial \delta} < 0. \]
The first term of (1.19) is the marginal gain of the worker as the firm puts in more effort and the second term the marginal loss of the training firm as the worker puts in less effort at a higher degree of imperfect competition. The third term represents the gain or loss of other firms in the economy depending on whether the loss due to a lower effort of the worker is outweighed by the gain of the higher effort of the training firm.

The socially optimal degree of firm-specificity of the training and the socially optimal degree of imperfect competition depend on the relation between the willingness to invest in training (to put in effort) for both the worker and the training firm and the effectiveness of these investments in terms of training output. If the effort of the training firm has a much bigger impact on training output than the effort of the worker then the socially optimal levels of firm-specificity and imperfect competition are higher *ceteris paribus* than if the worker’s effort has the highest impact.
2. Evidence on the division of training returns

As shown in the previous chapter the individual’s benefit of training is given by the wage increase due to training and the employer’s benefit by the (increase in the) wedge between the individual’s marginal productivity and pay (Acemoglu and Pischke, 1998, 1999a; Smits, 2005b). Of course, there may also be other kinds of benefits from training for both the worker and firms, some of which may seem non-material at first sight. For example, a better image or more loyal employees for the training firm and higher job satisfaction or better career perspectives for the worker. However, such derived benefits only hold if they eventually lead to higher profits and wages in the future.

A growing number of studies analyse the relation between training and subsequent wage growth. Most studies on the US find a considerable impact of training on wage (Veum, 1995; Frazis and Loewenstein, 2005). For the UK the estimated wage growth due to training is also high, ranging from 3% to 17%, depending on the type of training and the specification used (Blundell et al., 1999). Estimates of the wage returns in Germany range from very moderate (Pischke, 2001) \(^{(10)}\) to quite high (Kuckulenz and Zwick, 2003) \(^{(11)}\). For other European countries there is less evidence available on the wage returns to training. Bassanini et al. (2005) use the European Community household panel (ECHP) to estimate wage returns by country. In the preferred (fixed effects) specification the impact of training incidence on hourly wages is zero or insignificant for Ireland, France, Spain, the Netherlands and Austria while the wage returns are quite high for Portugal (10%) and Greece (6%).

Evidence of employees’ return to training is much more scarce as the wedge between productivity and pay is very difficult to measure, not only for the researcher (Werwatz, 1996; Harhoff and Kane, 1997; Bougheas and Georgellis, 2001; Clark, 2001; Euwals and Winkelmann, 2001) but also for the employer because there is often no information on individual productivity growth in relation to training. Some studies relate training to the firm’s profitability directly (Hansson, 2001) but for our purpose such an approach is less fruitful as we need to be able to relate the firm’s return to the return of the individual worker. A moderate increase in the firm’s profit after training does not necessarily mean that the worker profits, it may be the result of a small productivity increase. Therefore, we need information both on the total returns to training and on the division of these returns between firms and workers.

As there are hardly any datasets available which contain information on both productivity growth and wages of individual workers and on the division of the returns between firms and workers a different approach was followed. First, the available empirical evidence on

\(^{(10)}\) Pischke (2001) finds an annual wage return of 3% but this is not statistically significant.

\(^{(11)}\) Correcting the endogeneity bias (e.g. selection into training) Kuckulenz and Zwick (2003) find a wage return of 15%.
productivity growth after training are presented. Next, evidence on the factors that determine the division of these returns between firms and workers are discussed. In Chapter 1 it was shown that the division of the returns to training (denoted by $y_j$) depends on the degree of firm-specificity of the training ($\delta$), the degree of imperfect competition on the market for skills ($\gamma$), the worker’s bargaining power ($\beta$) and the retention rate ($p$). So, if we could obtain some measures for these factors by country, sectors of industry or occupation we could say something about the expected division of the returns to training for different training programmes in different European countries. In this chapter the available empirical evidence on the degree of firm-specificity, degree of competition, the retention rate and workers’ bargaining power in Europe and the US is collected from different sources and discussed.

2.1. Evidence on productivity increase

We are interested in a measure for the worker’s productivity increase in the training firm, denoted by $y_j$ in the model presented in Chapter 1. Note that $y_j$ is not equivalent to the social returns to training as some workers may leave the training firm in which case the firm-specific part of the returns to training is lost.

There are very few datasets which contain data on individual productivity. Most studies that try to relate training and productivity use indicators at firm level such as value added per employee or turnover/sales per employee. Other indicators considered in the literature are profit per employee, scrap rates, defects/quality standards/customer complaints/customer satisfaction measures, machinery/plant down-time, employee motivation and commitment, absenteeism, employment growth, new product as percentage of product range (Keep et al., 2002).

Cedefop, Hansson et al. (2004) give an extensive review of research on the impact of training on firm productivity and other variables of firm performance. Their main conclusion is that investments in training generate substantial gains for firms irrespective of whether the training is useful in other firms. For our purpose the studies considering the relationship between training and productivity (or other measures of company performance that relate to some extent to productivity) are most informative. Some of the studies already mentioned in Cedefop, Hansson et al. (2004) are discussed below as well as several more recent studies.

Most studies on the relation between training and productivity concern the US. The evidence for the US is quite mixed. Some studies find no or very weak relationships between training and productivity (Krueger and Rouse, 1998; Black and Lynch, 2001) while other studies find considerable productivity effects (Bartel, 1994).

Dearden et al. (2000), using various data sources, including the British labour force survey estimate the effects of training on direct measures of industrial productivity. They find that an increase of 5 percentage points in the proportion of employees who followed training, leads to 4% increase in productivity. The effect of training on productivity is about twice as large as
the effect on wages.

Barrett and O’Connell (2001) consider the returns to general training and firm-specific training separately. They use firm-level data on Irish firms to estimate the effect of training on the change in labour productivity and conclude that general training has a significantly positive effect while specific training has no significant effect. An increase in the number of general training days by 1% leads to a productivity increase of 3%.

Zwick (2005) studies the productivity effect of CVT in Germany. Using data from IAB establishment panels he finds that formal external courses have the largest positive impact on productivity (28%). Quality circles also have a positive impact. Formal internal courses, seminars and talks, job rotation and self-learning do not have a significant impact. Surprisingly, on-the-job training has a significantly negative impact on productivity. Zwick explains this result by the fact that firms that provide more on-the-job training often have a higher turnover or are restructuring. Both higher turnover and restructuring reduce productivity. In another paper, using the same dataset, he studies the effect of training intensity, measured as the proportion of employees trained, and finds that an increase in training intensity by one percentage point increases establishment productivity by 0.76 percentage points (Zwick, 2006). An important conclusion from his work is that firms’ training decisions are strongly related to skill gaps anticipated in the future.

Groot (1999) studies the relationship between training and productivity in Dutch firms. He finds that average productivity growth of training is 16%. However, these estimates are based on subjective estimates of individual productivity growth by company personnel and not on real productivity data.

Almeida and Carneiro (2006) estimate the return on investments in formal job training in Portugal. Using a census of large manufacturing firms between 1995 and 1999, they find that an increase in the amount of training per employee of 10 hours a year leads to an increase of current productivity of 0.6%.

Brunello (2004) estimates the relationship between training and productivity using a survey for 97 large Italian enterprises and finds that a 10% increase in the average number of hours training per head increases productivity in the sample by 1.32% (Brunello, 2004; cited in Bassanini et al. 2005).

Most studies in Europe find a significant impact of training on productivity. The estimates for different countries are very difficult to compare, however, as the studies mentioned all use different measures of training including training incidence, number of employees trained, number of training days and training expenditure.

2.2. Evidence on the degree of firm-specificity of training

Vocational training aims to provide vocational skills. But to practise a trade in a company a
worker will need a wide range of skills, not only vocational but also generic skills (problem solving skills, reading and writing skills, learning skills, communication skills) and firm-specific skills (knowledge of the company/procedures/specific machinery). Generic skills are especially important in the context of lifelong learning as people do not stay their whole life with one employer but change employers and occupations more often (Kearne, 2001).

Often these generic and firm-specific skills are learned as part of a training programme but, especially firm-specific skills may also be a by-product of the training. Simply by being in a firm, workers will often also learn some firm-specific skills, even if the training provided is aimed at skills that are more generally applicable. It is to be expected that the degree of firm-specificity is higher if most of the training takes place on-the-job than if the training takes place off-the-job. Therefore, it is to be expected that most on-the-job vocational training programmes provide some firm-specific skills and knowledge as well. There is, however, still little evidence on the size of this firm-specific component.

Most studies use off-the-job training as a proxy for general training and on-the-job training as a proxy for firm-specific training (OECD, 2003). However, while it is plausible that skills which are learned outside the workplace are to a great extent general, the reverse is not necessarily true. Skills learned at the workplace can still be perfectly general, especially if workplace practices vary little between firms within an industry. There are only a few studies, however, that contain direct information on the degree of firm-specificity of training.

Loewenstein and Spletzer (1999) show that the degree of firm-specificity of most training programmes in the US have a very small firm-specific component. From a direct question in the national longitudinal survey of youth (NSLY) 63% of the workers who received formal training provided by employers stated that all, or almost all, of the skills they learned during the training were useful for doing the same kind of work for another employer. About 14% of workers responded that more than half of the skills could be used at a different employer, 12% that about half of the skills could be used and only 11% that either less than half or none of the skills were useful. A similar question in an employer survey (employer opportunity pilot project) aimed at informal training at the start of the job gives a similar picture. About 58% of employers indicated that almost all skills learned could be used at another employer and only 8% that none of the skills could be used at another employer. It is important to note that there is little difference in the degree of firm-specificity between formal and informal training. Often formal training is used as a proxy for general training and informal training as a proxy for firm-specific training but, as shown by Loewenstein and Spletzer (1999), there is no empirical base for this practice.

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(12) Formal training refers to well-defined training programmes with an identifiable start and end and a (more or less) fixed content. Such training programmes may have different forms. Training may take place either off-the-job or on-the-job or may be a combination of the two. Informal training is training that occurs more or less spontaneously during work, such as learning-by-doing, watching others and instruction from colleagues.
Booth and Bryan (2002) provide some evidence of the degree of firm-specificity of training in the UK. They show, based on 1998-2000 waves of the British household panel survey, that about 85% of recipients of (formal) training programmes indicate that the training was aimed at developing their skills generally. This measure for the degree of firm-specificity is very crude, however. Saying that the training is mainly general does not preclude it from also having a firm-specific component.

Evidence for other European countries suggests that the degree of firm-specificity is higher there than in the UK and the US. Barrett and O’Connell (2001) use firm-level data for Irish firms. Training managers were asked to give a breakdown of the total number of training days per employee for general training courses (defined as broad skill and knowledge) and firm-specific training courses (specific to the company’s activity: training that is directly related to the operations of the company). They find that roughly 49% of training is firm-specific and 43% is general. About 7% of the training days could not be classified as clearly general or firm-specific. A disadvantage of this approach is, however, that it provided no grading of the degree of firm-specificity.

Smits (2005b) finds that apprenticeship training in the Netherlands has a large firm-specific component. From a direct question on the firm-specificity of apprenticeship training in an employer survey she finds that more than 40% of training firms indicate that more than 30% of training is firm-specific. Only 8% of respondents state that the training does not contain a firm-specific component.

Werwatz (1996) made an estimate of the firm-specificity of the German apprenticeship system by comparing the wages of former apprentices who stayed with the training firm after leaving school, with the wages of former apprentices who found employment in a different firm. The assumption is that former apprentices who found jobs elsewhere, can no longer use their firm-specific knowledge and skills and, therefore, earn less than apprentices who stay. He found, however, that those who had left, earned more, and concluded, therefore, that the firm-specific component was small. He did find a difference between large industrial firms and smaller, traditional firms. In the first group, the firm-specific component is greater than in the latter. Franz and Soskice (1995) also argue that large companies in Germany train apprentices in both required vocational skills and firm-specific skills.

There is little empirical evidence on the importance of firm-specific skills for IVT and CVT programmes in other European countries. The curricula of initial training programmes are often regulated. Therefore, it is to be expected that the degree of firm-specificity is lower for IVT than for CVT. However, it is important to remember that regulations mostly set a minimum standard and firms are free to provide more training than that.

Concluding, the degree of firm-specificity of training depends much on the type of training programme. Still, there is some evidence that in general, the degree of firm-specificity of training in firms is lower in the UK and US than in continental Europe.
2.3. Evidence on the degree of imperfect competition

If the market for technological general skills (that is skills for which $\delta=0$) is imperfectly competitive, then the external wage rate lags behind the worker’s (potential) productivity in the external market. In fact $\gamma=(y_2-w_2)/w_2 > 0$ implies that there is absolute wage compression as defined by Acemoglu and Pischke (1999a; 1999c), that is, the difference between external productivity and pay is increasing the skill level ($^{(13)}$) ($^{(14)}$).

As discussed in Chapter 1, economic literature provides several explanations for imperfect competition on the market for technological general skills. First, the number of firms in which the skills can be used may be limited. Second, there may be imperfect information either on the quality of training or the quality of the worker so that firms have difficulty assessing the skill levels of workers trained externally. Finally, there may be institutions, such as trade unions or minimum wage legislation that compress the wage structure. It has proven hard to test these theoretical explanations for imperfect competition empirically. In this section two approaches will be followed to get a picture of the extent to which the market for trained workers is imperfectly competitive. First, indirect evidence on the degree of competition will be discussed by considering the available evidence on the density of the market for trained workers, on certification and on the role of trade unions in different European countries. Second, some direct evidence of wage compression in Europe is presented.

2.3.1. Density of the market

Some skills may only be useful in a set of firms defined by product, type of work or geographical area (Becker, 1962). If this set of firms is relatively small, the market for trained workers may not be perfectly competitive and the external wage rate will lag behind external productivity.

Vocational training is, by nature, to a great deal specific to an occupational field or industry. If there are few employment opportunities in the occupation or industry the worker is trained for, there is a positive probability that workers who leave the training firm fail to find a skilled job (Acemoglu and Pischke, 1999a, 1999c). Further, many workers are reluctant to move too far away from their home towns. Anticipating limited employment opportunities in the region and high mobility costs, firms in the region can pay trained workers a wage below their productivity. This wedge between productivity and pay will decrease with better employment possibilities in the region and the industry the worker is trained for. Therefore,

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$^{(13)}$ Remember that initial productivity and pay is normalised at zero so that $y_2$ and $w_2$ can be interpreted as absolute productivity and wage growth respectively.

$^{(14)}$ Note that we have not defined $\gamma$ in the case of no training. If we define $\gamma^*=0$ as the degree of competition for untrained workers then $\gamma>0$ implies that there is relative wage compression as well. As pointed out by Booth and Zoega (2004) relative wage compression is a sufficient but not a necessary condition for firms to finance training.
firms in regions with low employment density and few employment possibilities are more willing to pay for technological general skills than employers in regions with a high employment density. Brunello and De Paola (2004) show that in Italy training incidence for general training is indeed higher in provinces with lower employment density. Brunello and Gambarotto (2004) find that in the UK (general) training is also less frequent in dense areas. A 10% decrease in density reduces the probability of training by 0.07, which is more than 20% of the average incidence of training in the UK. Density is measured as total employment in private industry and services per square kilometre. Backes-Gellner and Mure (2005) consider the relation between labour-market tightness and training investment in Germany. They use both data on regional labour-market tightness and industry-specific labour-market tightness. They define regional labour-market tightness by the ratio of job offers relative to the total labour force per region and industry-specific tightness by the ratio of job offers relative to all workers in the respective industry. They find that the regional labour-market tightness has a significant negative effect on firms’ investment in training while the industry labour-market tightness effect is insignificant.

Apart from the studies mentioned there is little empirical evidence on the relationship between training and the size of the market for trained workers in different occupations and industries by geographical area.

2.3.2. Certification

Successful certification of training makes the market for skilled workers more transparent and thus increases the degree of competition (Acemoglu and Pischke, 2000). In many European countries apprenticeship training is certified but the quality of the certification system differs between countries. For the degree of competition it is especially important that the skill level of trained workers is soundly evaluated and can be communicated to other employers. Ideally, the successful completion of both the theoretical and the practical component of training depends on an examination held by an organisation outside the firm. This is the case in most European countries, for example in Belgium, Denmark, Germany, Ireland, Greece, France, Luxembourg, the Netherlands, Austria, Portugal and Finland (Linderholm and Parker, 2000). In a few countries such as Spain, Italy, Sweden, and the UK, evaluation of practical skills is done by the training firm (Linderholm and Parker, 2000; Bassanini et al., 2005). It is clear a certification system that relies on evaluation of practical skills by training firms alone is insufficient to guarantee the competence level of the worker as training firms do not always have the right incentives to perform this evaluation adequately.

There is little information available on certification of CVT. Often continuing training is not certified. Pischke (2001) shows that about 62% of training recipients of the 1998 wave of German socioeconomic panels report they received a certificate from their training. There is, however, little evidence of the value of these certificates on the labour market. It will depend much on the type of training whether the training ends with some validation of the acquired skills. Training that takes place mainly on-the-job is usually not certified while training off-the-job provided by an external training institution sometimes ends with some evaluation.
Further, as CVT is usually not imbedded in the national qualification system, it is often unclear how widely this certification is recognised. Therefore, it is to be expected that, in general, firms can appropriate a higher share of returns from CVT than from returns to IVT.

2.3.3. Trade unions

In most European countries, unions are involved in wage determination but there are considerable differences in the level at which bargaining takes place and collective bargaining agreements are covered. For our study it is important to know to what extent unions tend to compress the external wage rate since the external wage level acts as the worker’s outside option and thus determines the worker’s minimum share in the benefits of training. The external wage rate will be affected if union bargaining takes place at industry or central levels. If wages at industry level are compressed, firms in that industry will be able to appropriate a bigger share of training returns. Union bargaining at firm level does not affect the external wage rate but instead increases workers’ bargaining power to obtain a higher share of the training surplus. This will be discussed in Section 2.5.

Table 1 gives an overview of collective bargaining coverage in several European countries and the US. Collective bargaining coverage is high in Belgium, France, Austria, Finland and Sweden and quite low in the UK and eastern Europe. As can be seen from Table 2, in most countries characterised by low coverage, bargaining takes place at company and plant levels. Industrial-level bargaining is dominant in Austria, Belgium, the Netherlands, Spain and Sweden. So, it is to be expected that firms in these countries can appropriate a higher share of returns to training.
Table 1: Collective bargaining coverage in Europe and the US: percentage of wage and salary earnings covered by collective bargaining in Europe and the US, 2000

<table>
<thead>
<tr>
<th>Countries</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT Austria</td>
<td>95*</td>
</tr>
<tr>
<td>BE Belgium</td>
<td>90*</td>
</tr>
<tr>
<td>CZ Czech Republic</td>
<td>25*</td>
</tr>
<tr>
<td>DK Denmark</td>
<td>80*</td>
</tr>
<tr>
<td>FI Finland</td>
<td>90*</td>
</tr>
<tr>
<td>FR France</td>
<td>90*</td>
</tr>
<tr>
<td>DE Germany</td>
<td>68</td>
</tr>
<tr>
<td>HU Hungary</td>
<td>30*</td>
</tr>
<tr>
<td>IT Italy</td>
<td>80*</td>
</tr>
<tr>
<td>LU Luxembourg</td>
<td>60*</td>
</tr>
<tr>
<td>NL Netherlands</td>
<td>80*</td>
</tr>
<tr>
<td>NO Norway</td>
<td>70*</td>
</tr>
<tr>
<td>PL Poland</td>
<td>40*</td>
</tr>
<tr>
<td>PT Portugal</td>
<td>80*</td>
</tr>
<tr>
<td>SK Slovakia</td>
<td>50*</td>
</tr>
<tr>
<td>ES Spain</td>
<td>80*</td>
</tr>
<tr>
<td>SE Sweden</td>
<td>90*</td>
</tr>
<tr>
<td>CH Switzerland</td>
<td>40*</td>
</tr>
<tr>
<td>UK United Kingdom</td>
<td>30*</td>
</tr>
<tr>
<td>US United States</td>
<td>14</td>
</tr>
</tbody>
</table>

* Lower bound estimates.


Table 2: Wage setting institutions 1995-2000: centralisation of bargaining

<table>
<thead>
<tr>
<th>Company and plant level bargaining</th>
<th>Czech Republic; Hungary; Poland; UK; US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination of industry and plant/level bargaining, with an important share of employees covered by company bargains</td>
<td>Denmark; France; Italy; Slovak Republic; Switzerland</td>
</tr>
<tr>
<td>Industry-level bargaining</td>
<td>Austria; Belgium; Germany; Netherlands; Spain; Sweden</td>
</tr>
<tr>
<td>Predominantly industrial bargaining but also central-level agreements</td>
<td>Ireland; Norway; Portugal</td>
</tr>
<tr>
<td>Central level agreements</td>
<td>Finland</td>
</tr>
</tbody>
</table>

2.3.4. Minimum wages and wage compression

In this section we collect some direct evidence on wage compression in different European countries. Minimum wages compress wages at the bottom of wage distribution. If the productivity of low-skilled workers is increased to the level that matches the wage floor, the returns to training fully accrue to the firm that employs them. Minimum wages have no effect on the distribution of training returns for workers with higher skill levels. Table 3 gives the relative minimum wages and the incidence of minimum wages per country. Relative minimum wages is rather high in France (60% of full-time median earnings) and as a consequence the incidence of minimum wages is also highest in France. Minimum wages are lowest in eastern European countries and also in Spain and the UK. In most countries the incidence of minimum wages is highest in wholesale/retail trade and much lower in manufacturing (OECD, 1997).

Table 3: Minimum wage relative to full-time average earnings and the incidence of minimum wages, 2004

<table>
<thead>
<tr>
<th>Countries</th>
<th>Minimum wage as a proportion of full-time average earnings</th>
<th>Proportion of workers earning a minimum wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>Belgium</td>
<td>46.39(^{(a)})</td>
</tr>
<tr>
<td>CZ</td>
<td>Czech Republic</td>
<td>38.81</td>
</tr>
<tr>
<td>FR</td>
<td>France</td>
<td>60(^{(a)}) ((^{(b)}))</td>
</tr>
<tr>
<td>EL</td>
<td>Greece</td>
<td>49(^{(a)}) ((^{(b)}))</td>
</tr>
<tr>
<td>HU</td>
<td>Hungary</td>
<td>40.70</td>
</tr>
<tr>
<td>IE</td>
<td>Ireland</td>
<td>50</td>
</tr>
<tr>
<td>LU</td>
<td>Luxembourg</td>
<td>49.57</td>
</tr>
<tr>
<td>NL</td>
<td>Netherlands</td>
<td>46.14</td>
</tr>
<tr>
<td>PL</td>
<td>Poland</td>
<td>35.06</td>
</tr>
<tr>
<td>PT</td>
<td>Portugal</td>
<td>40.70</td>
</tr>
<tr>
<td>SK</td>
<td>Slovakia</td>
<td>34.14</td>
</tr>
<tr>
<td>SL</td>
<td>Slovenia</td>
<td>44.13</td>
</tr>
<tr>
<td>ES</td>
<td>Spain</td>
<td>37.65</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
<td>37.89</td>
</tr>
<tr>
<td>US</td>
<td>United States</td>
<td>32.87</td>
</tr>
</tbody>
</table>

\(^{(a)}\) Data from 2002.
\(^{(b)}\) Relative to median wages.

Table 4 gives an overview of the wage dispersion in several European countries and the US. Wage dispersion is defined as the 90-10 percentile ratios for the gross earnings of full-time employees. The table shows there are considerable differences between countries. Wage dispersion is highest in the US. In Europe wage dispersion is highest in the UK and Ireland. Countries with very low wage dispersion are the Nordic countries (Norway, Finland, Denmark and Sweden).

It is important to realise that wage dispersion is not directly related to wage compression as defined by Acemoglu and Pischke (1999a; 1999c) since a low wage dispersion may either reflect skills compression or wage compression. For example, a lower wage dispersion in Germany than in the US may (partly) reflect a narrower skills distribution in Germany (Freeman and Schettkat, 2001).

**Table 4:** Earnings dispersions in OECD countries 1995-99: 90-10 percentile ratios for the gross earnings of full-time employees

<table>
<thead>
<tr>
<th>Countries</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>2.28*</td>
</tr>
<tr>
<td>CZ</td>
<td>2.86</td>
</tr>
<tr>
<td>DK</td>
<td>2.16*</td>
</tr>
<tr>
<td>FI</td>
<td>2.36</td>
</tr>
<tr>
<td>FR</td>
<td>3.07</td>
</tr>
<tr>
<td>DE</td>
<td>2.87</td>
</tr>
<tr>
<td>HU</td>
<td>4.15</td>
</tr>
<tr>
<td>IE</td>
<td>3.97</td>
</tr>
<tr>
<td>LU</td>
<td>2.40</td>
</tr>
<tr>
<td>NL</td>
<td>2.85</td>
</tr>
<tr>
<td>NO</td>
<td>1.96</td>
</tr>
<tr>
<td>PL</td>
<td>3.50</td>
</tr>
<tr>
<td>PT</td>
<td>3.76*</td>
</tr>
<tr>
<td>SE</td>
<td>2.23</td>
</tr>
<tr>
<td>CH</td>
<td>2.69</td>
</tr>
<tr>
<td>UK</td>
<td>3.45</td>
</tr>
<tr>
<td>US</td>
<td>4.59</td>
</tr>
</tbody>
</table>

* 1990-94.


Bassanini and Brunello (2003) measure wage compression by taking the difference between the median growth rates of gross hourly wages of employees who received training and those who did not. They show that there are considerable differences in wage compression between countries. In Austria, Germany and France the wage growth differential is close to zero while
in the UK, Italy, Spain and Belgium it is relatively high ranging from 0.026 to 0.048. The gain in median wages ranges from 2.6% to 4.8%. The wage growth differential also varies between high-skilled and low-skilled occupations and between industries. For high-skilled occupations it is close to zero, for low/medium occupations it is 0.027. In mining, manufacturing and utilities the wage growth differential is 0.033 and in services it is close to zero. Further, the wage growth differential is relatively high for the lowest educational attainment (0.04), close to zero for intermediate level and moderate (0.021) for higher educational level. Bassanini and Brunello (2003) find that their measure for wage compression correlates with the incidence of general training (measured as off-site training). In clusters with a low wage differential there is a higher incidence of general training, although the effect is quite small. For firm-specific training (measured by training on-the-job) there is no relation with wage compression. Note that Bassanini and Brunello implicitly assume that training increases productivity more than wages. It could be the case, however, that a low wage differential reflects a low productivity increase. If the wage differentials fully reflected productivity increases there would be no reason to expect a correlation between training incidence and the wage differential because firms would not be able to appropriate any of the returns to training.

Almeida-Santos and Mumford (2004) analyse the relationship between wage compression and training for Britain. They use data from the workplace employee relations survey 1998. Wage compression is measured as the log of the ratio of the 90th and the 10th percentile levels of wage distribution. They conclude that a higher level of wage compression is associated with a greater incidence and duration of training. When dividing the wage compression measure to explore the upper and lower halves of distribution separately, they find that it is the wage compression in the upper half that accounts for the positive relationship between wage compression and training.

Budria and Telhado Pereira (2005) study the relationship between education and wage dispersion in nine European countries (France, Finland, Germany, Greece, Italy, Norway, Portugal, Sweden and the UK). They conclude that in most countries wage dispersion is higher for higher-educated workers (tertiary education) than for lower-educated workers. Exceptions are Germany, Greece and Italy. This result suggests that firms can appropriate a higher share of training results for higher-educated workers than for lower-educated workers.

Mourre (2005) examines wage compression in the EU using data on wages from the structure of earnings survey 2002. He defines wage compression as the lower difference in wages across workers or firms compared with the difference in productivity. Mourre estimates wage compression across occupations and across educational attainment. As relative marginal productivity cannot be observed across occupations and educational attainment directly he uses a methodology ‘based on the derivation of a labour demand model which is estimated by means of cross sectional econometric analysis’ (Mourre, 2005, p. 3). In this model there is no data needed on relative productivity or relative output. An estimate of relative wage compression is obtained by comparing the estimated wage coefficient of the employment equation with that of the relative employment equation. Mourre presents estimates for
different groups of countries within the EU. He finds that there is relatively large wage compression across occupations in continental and southern countries (Belgium, Germany, Spain, France, Italy, Luxembourg and Austria), no wage compression across occupations in Anglo-Saxon countries (Ireland and the UK) as well as in northern European countries (Denmark, the Netherlands, Finland and Sweden). The latter surprising result suggests, according to Mourre, that the relative low wage dispersion in these countries, measured by the ratio of the upper and lower percentiles of wage distribution, just reflects compressed productivity distribution.

Comparing occupations he finds that wages are more compressed for plant and machine operators and assemblers, clerks, craft and related trade workers, service workers and shop and market sales workers and less compressed for professionals, technicians and associate professionals. Low-skilled occupations have the highest wage compression except for elementary occupations. Note that this result is contrary to the findings of Bassanini and Brunello (2003). However, Mourre’s estimates seem to depend much on the specification used.

Comparing the evidence for the degree of imperfect competition we can conclude that in general the market for trained workers is more competitive in the UK, the US and eastern European countries than in other European countries. In the UK, the US and most eastern European countries there is little trade union bargaining at industry level, trade union coverage is low and wage compression is low as well. In most continental, southern and northern European countries trade union bargaining takes place wholly or partly at industry level and trade union coverage is quite high resulting in a higher wage compression. Especially in Belgium, Spain, France and Italy there seem to be high wage compression.

2.4. Evidence on the retention rate

The retention rate is an important factor in determining the division of returns to training between the firm, the worker and other firms. If the worker leaves the firm immediately after completing training, the training firm cannot appropriate any of the returns to training. The firm-specific returns are then lost. If the worker finds a job at another firm the general returns are shared between the worker and his new employer, depending on the degree of competition on the market for general skills. If the worker does not succeed in finding a new job immediately and becomes unemployed for some time, some of the general returns are also lost (15). Of course, for workers who stay in the training firm after completing the training it

(15) Note that the change to become unemployed after finishing training is not explicitly modeled in Chapter 1. If there is a positive change to become unemployed the external wage rate \( w_2 \) can be interpreted as the worker’s expected earnings if he quits and these earnings are decreasing in the change to become unemployed. Suppose the change to become unemployed is \( q \), in which case the worker has zero earning and that the wage offer in any other firm is equal to \( \omega \) then the expected external wage rate is equal to \( w_2 = (1-q)\omega \).
also matters how long they stay. So we are not only interested in the retention rate immediately after training, but also in the retention rate in subsequent years.

Separations may be either voluntary, in which case the worker quits, or involuntary, in which case the worker is laid off. In the model presented in Chapter 1 all separations are exogenous and in that case the distinction between quits and layoffs does not matter. However, separations may be connected to the (division of) returns to training. For example, a worker may quit after completing training because the wage offered by the training firm is too low or he may be laid off because his productivity is too low. In practice it will be difficult to determine which part of the separations is exogenous and which part depends on training outcomes.

It is to be expected that there are considerable differences in retention rates after IVT and CVT. In the case of IVT, such as apprenticeship training, workers are often employed with the training firm because of the training. However, not all firms employ apprentices after training because of a future need for skilled labour. Some firms employ apprentices as a substitute for unskilled or skilled labour or because of a social obligation. These firms often lay off apprentices once training has been completed. Other firms use the apprenticeship period as probation and will only retain the most capable apprentices.

Further, job mobility is highest for younger workers in their early 20s at the beginning of their careers (Parsons, 1977; Hall, 1982; Beeson Royalty, 1998). During that period people change jobs until they find a job that matches their capabilities and preferences. Labour turnover also declines with tenure. In the first year of a job, 56% of women and 55% of men will stay in the same job, at seven years of tenure these percentages become 88% and 90% respectively (Beeson Royalty, 1998). There is some evidence that employers tend to select workers with the lowest expected job turnover for CVT. For example Beeson Royalty (1996) finds that differences in expected job turnover influence the probability of receiving training and is one reason for women to receive less training than men. Loewenstein and Spletzer (1997) find that employers tend to delay training new workers until they have more certainty that they will stay for some time. Therefore, it is to be expected that the retention rate after IVT is in general lower than the retention rate after CVT.

In the following section the evidence for labour turnover rates after apprenticeship training is presented, then the evidence for labour turnover in Europe and the US in general. Ideally we would like to have information on the retention rates directly after completing training as well as retention rates for subsequent years. Such information is sometimes available for

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(16) In the theoretical model it is assumed that workers will stay as long as they are offered at least the market wage and will quit otherwise. Firms on the other hand will never offer a wage below the market wage because it is assumed that the market wage never exceeds internal productivity. There is also a class of models that assumes that firms set a wage unilaterally while allowing for workers’ expected mobility costs or attachment to the training firm. In these models the retention rate depends on the gap between the market wage and the wage offered by the training firm (Smits, 2005b).
apprenticeship training but usually not for continuing training. Instead information on employer tenure and retention rates for the labour force as a whole differentiated by country and sector of industry is presented.

2.4.1.1. Retention rates after apprenticeship training

The retention rate is an important factor in determining firms’ expected profits from apprenticeship training. However, not all firms train apprentices because of investment motives. As mentioned above, some firms employ apprentices for their contribution to production during the training phase. These firms will probably lay off apprentices after the training period. Ideally, one should therefore make a distinction between quits and lay offs. Unfortunately most datasets do not allow this distinction. However, by assuming that apprentices after training first accept the job offer of the training firm and subsequently search for a better job opportunity, the initial retention rate can give an indication of the lay-off rate and the subsequent mobility an indication of the quit rate.

In Germany roughly 70 % of all apprentices stay for some time in the training firm after completing training (Harhoff and Kane, 1997; Euwals and Winkelmann, 2001). The proportion of stayers varies markedly between sectors. In large industrial firms the retention rate is much higher than in small firms which are mostly in the crafts sector. Two thirds of apprentices who initially stay with the training firm, leave within three years. After three years only 24 % of apprentices are still in the training firm. For firms with more than 1000 employees this is 45 % (Euwals and Winkelmann, 2001). In recent years the retention rate has decreased somewhat (Euwals and Winkelmann, 2001). In Britain it seems to be slightly higher. Only 16 % of apprentices are laid off at completion of training (Booth and Satchell, 1994). A few years later the retention rate has decreased to 45 %.

In other countries retention rates are lower. In the Netherlands, fewer than 50 % of graduated apprentices are still with the training firm one and a half years after graduation (Smits and Stromback, 2001). There are considerable differences between training occupations. Apprentices trained in technical and care occupations stay more often with their training firm than apprentices trained in administrative occupations. Apprentices in large firms stay more often than apprentices in small firms. From a survey among Dutch training firms it appears that the average chance an apprentice is offered to continue in the training firm is more than 70 %. It can, therefore, be concluded that far fewer apprentices stay than firms would like. In Denmark retention rates are not high either, 40 % to 50 % depending on the stage of the business cycle (Westergard-Nielsen and Rasmussen, 1997).

In France, the proportion of stayers is quite small. Less than 30 % of all apprentices remain for some time with training firms after completing training (Vialla, 1997 cited in Schwerdt, 2001). Schwerdt (2001) showed that in 1998 only 12 % of former apprentices remained with the training firm one year after training. This low rate is partly because apprentices who continue training at a higher level in the training firm are not included in the figures. In 1998, 29 % of apprentices continued training and 40 % of them did so in the training firm.
Surprisingly the retention rate is lowest for large training firms with more than 500 employees (only 7%). As nearly 40% of apprentices trained in large firms become unemployed after apprenticeship, it is clear that most apprentices do not leave voluntarily.

All in all it can be concluded that, with the exception of France, in most European countries the lay-off rate after apprenticeship is low but that the quit rate in subsequent years is considerable. This suggests that the training investment must be regained shortly after completing training.

2.4.1.2. *Labour turnover in Europe and the US*

Table 5 gives the median employer tenure for several European countries and the US. Employer tenure is, in general, much lower in the US than in Europe. There are, however, also several European countries that have very low employment tenure, notably Denmark, Spain, Ireland, the Netherlands and the UK. Employer tenure is high in Belgium, Germany, Italy and Poland.

Five-year retention rates, measured as the percentage of workers in a year who will still be with their current employer five years later, are only available for a few countries. Five-year retention rates are low in Spain and Finland and high in Germany (OECD, 1997). In Spain, France and Finland, retention rates are decreasing, mostly because of increased use of temporary contracts (OECD, 1997; Dolado et al., 2002).

*Table 5: Median employer tenure in years (1995) and five-year retention rate (1999-95)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DK</td>
<td>Denmark</td>
<td>4.4</td>
</tr>
<tr>
<td>FI</td>
<td>Finland</td>
<td>7.8</td>
</tr>
<tr>
<td>FR</td>
<td>France</td>
<td>7.7</td>
</tr>
<tr>
<td>DE</td>
<td>Germany</td>
<td>10.7</td>
</tr>
<tr>
<td>EL</td>
<td>Greece</td>
<td>7.5</td>
</tr>
<tr>
<td>IE</td>
<td>Ireland</td>
<td>5.3</td>
</tr>
<tr>
<td>IT</td>
<td>Italy</td>
<td>8.9</td>
</tr>
<tr>
<td>LU</td>
<td>Luxembourg</td>
<td>7.2</td>
</tr>
<tr>
<td>NL</td>
<td>Netherlands</td>
<td>5.5</td>
</tr>
<tr>
<td>PL</td>
<td>Poland</td>
<td>17.0</td>
</tr>
<tr>
<td>PT</td>
<td>Portugal</td>
<td>7.7</td>
</tr>
<tr>
<td>ES</td>
<td>Spain</td>
<td>4.6</td>
</tr>
<tr>
<td>SE</td>
<td>Sweden</td>
<td>7.8</td>
</tr>
<tr>
<td>CH</td>
<td>Switzerland</td>
<td>6.0</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
<td>5.0</td>
</tr>
</tbody>
</table>
Although there are considerable differences in median employer tenure between countries, the differences between industries and occupations within countries are even more striking. Moreover the degree of dispersion of tenure by industry and occupation across countries appears to be similar. Industries with low employer tenure are hotels and restaurants, wholesale and retail trade, real estate, renting and business activities. Industries with high average tenure are electricity, gas and water supply, public administration and financial services (OECD, 1997). For the US there is information available on annual separation rates by sector of industry, these figures are presented in Table 6. Separation rates by industry follow a similar pattern to average employer tenure. In 2005, the total annual separations rate was 40.9%. Industries with the highest separation rates are construction, retail trade, leisure and hospitality. The lowest separation rates are found in the government sector, financial activities and educational services.

There are also substantial differences in average employer tenure between occupations. In general lower skill white collar occupations such as service workers, shop and market sales workers and blue collar workers have a low average tenure while higher skilled white collar occupational groups such as legislators, senior officials and managers have a high average employer tenure (OECD, 1997). For educational levels the differences in average tenure are less marked but in general it seems that lower levels of educations have lower tenures. Five-year retention rates are also lower for workers with lower levels of education.
### Table 6: Annual total separations rates (1) by industry, 2005

<table>
<thead>
<tr>
<th>Industry</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total private</td>
<td>45.9</td>
</tr>
<tr>
<td>Natural resources and mining</td>
<td>34.9</td>
</tr>
<tr>
<td>Construction</td>
<td>65.8</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>31.6</td>
</tr>
<tr>
<td>Durable goods</td>
<td>32.1</td>
</tr>
<tr>
<td>Nondurable goods</td>
<td>30.8</td>
</tr>
<tr>
<td>Trade, transportation and utilities</td>
<td>46.1</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>27.7</td>
</tr>
<tr>
<td>Retail trade</td>
<td>55.1</td>
</tr>
<tr>
<td>Transportation, warehousing, and utilities</td>
<td>39.8</td>
</tr>
<tr>
<td>Information</td>
<td>29.3</td>
</tr>
<tr>
<td>Financial activities</td>
<td>25.9</td>
</tr>
<tr>
<td>Finance and insurance</td>
<td>22.5</td>
</tr>
<tr>
<td>Real estate and rental and leasing</td>
<td>35.5</td>
</tr>
<tr>
<td>Professional and business services</td>
<td>57.9</td>
</tr>
<tr>
<td>Education and health services</td>
<td>28.7</td>
</tr>
<tr>
<td>Educational services</td>
<td>22.7</td>
</tr>
<tr>
<td>Health care and social assistance</td>
<td>29.8</td>
</tr>
<tr>
<td>Leisure and hospitality</td>
<td>75.8</td>
</tr>
<tr>
<td>Arts, entertainment, and recreation</td>
<td>77.9</td>
</tr>
<tr>
<td>Accommodations and food services</td>
<td>75.4</td>
</tr>
<tr>
<td>Other services</td>
<td>44.2</td>
</tr>
<tr>
<td>Government</td>
<td>14.9</td>
</tr>
<tr>
<td>Federal</td>
<td>15.8</td>
</tr>
<tr>
<td>State and local</td>
<td>14.7</td>
</tr>
<tr>
<td>Total</td>
<td>40.9</td>
</tr>
</tbody>
</table>

(1) The number of total separations during the entire year as a percentage of annual average employment.


Reviewing empirical evidence on retention rates we can conclude that in general the retention rates in the US and the UK are lower than in continental Europe but that differences between industries within countries are more striking than differences between countries.

### 2.5. Evidence on workers’ bargaining power

The ability to influence the setting of prices or wages depends on several factors: the
bargaining skills of the parties involved and the competitive forces that determine the margins for negotiations. Some economists define bargaining power as the entire set of factors that determine the ability to set prices or wages while others refer to bargaining only as the ability to influence prices and wages given the margins set by competitive forces (Lindblom, 1948). As the competitive forces that determine the workers’ market wages have been discussed separately in Section 2.1, here, the second definition for bargaining power is used. Workers’ bargaining power, denoted by $\beta$ in the model of Chapter 1, determines what share of the training surplus (that is the difference between internal productivity and the external wage, $y_1 - w_2$) the worker can obtain. Note that the size of the training surplus depends on the external wage rate which is set by competitive forces. There may be either individual bargaining between the worker and the firm or workers may be represented by a trade union. In the latter case the trade union bargains with the firm on the wage of trained workers once the training has been completed (see also Booth and Chatterji, 1998). Note, that only trade union bargaining at firm level will increase workers’ bargaining power as it is defined here. Trade union bargaining at central or industry level will not affect workers’ bargaining power but will set the margins for bargaining at firm level as it set the external wage rate which is the worker’s outside option in the negotiations.

It is to be expected that, in general, workers will obtain a larger share of the training surplus in countries where trade union bargaining takes place mainly at firm level. Countries for which this is the case are the UK, the US, and eastern European countries (Czech Republic, Hungary and Poland). Other countries with an important share of employees covered by company bargains are Denmark, France, Italy, Slovakia and Switzerland (Table 2).

There are several studies on rent-sharing in the labour market that try to obtain direct estimates of workers’ bargaining power for different countries. These studies all depart from a model in which unions and the firm engage in Nash bargaining over wages and employment. They arrive at a similar expression for the bargained wage as equation (1.4) in Chapter 1, namely $w_i = w_2 + \beta(y_1 - w_2)$ (Blanchflower et al., 1996; Van Reenen, 1996; Hildreth and Oswald, 1997; Margolis and Slavanes, 2001; Ballot et al., 2002; Dobbelaere, 2005). Some studies present estimates of $\beta$, others present estimates of the elasticity between rents and wages, that is $\beta/(1-\beta) = (y_1 - w_1)/(y_1 - w_i)/w_i$. The estimated value of bargaining power from these studies ranges from 0.005 to 0.3 for various countries.

Ballot et al. (2002) use panel datasets of firms in France and Sweden to analyse how the returns to investments in physical capital, R&D and training are shared between firms and workers. They find that firms share in the returns from training but that this share is much lower than the share in returns to physical capital. In France firms’ share is 82% and in Sweden 67%. The bargaining power of workers is found to be 0.091 in France and 0.082 in Sweden.

Dobbelaere (2005) analyses imperfections in both the product and the labour market for firms in the Belgian manufacturing industry. She presents estimates of bargaining power for 18 sectors. She finds that workers’ bargaining power ranges from 0.034 in the milk products
sector to 0.394 in the sectors of office and data processing machines, precision and optical instruments. It seems as if the sectors of industries where workers have more bargaining power are also those sectors that employ relatively more highly skilled workers.

Margolis and Slavanes (2001) use matched firm-worker panel data from France and Norway to analyse rent-sharing in both countries. They report estimates of worker’s bargaining power of 0.0132 for France and 0.0244 for Norway. When allowing for heterogeneous bargaining power, that is different bargaining power parameters for high and low performing firms, the estimated average bargaining power is somewhat higher.

Blanchflower et al. (1996) find that the elasticity of wages with respect to the profit per employee in the US is 0.08. Hildreth and Oswald (1997) find figures ranging from 0.02 to 0.04 for the UK. Using the sample averages to calculate bargaining power we find bargaining power ranging from 0.036 to 0.175.

All in all we can conclude that estimates of workers’ bargaining power vary a lot, not only between countries but also between different studies referring to the same country. One of the reasons for these differences might be that workers’ bargaining power varies a lot between industries, as is shown by Dobelaere (2005). Therefore, estimates of workers’ bargaining power for a country may depend very much on the industry composition of the dataset used. It is to be expected that in industries where workers have more bargaining power, and thus appropriate a higher share of the training surplus, firms will invest less in training (Chapter 1). There are, however, no empirical studies available that test this relationship.
3. Conclusions and policy implications

In this contribution we developed a framework to characterise vocational training programmes based on the factors that influence the division of returns to training between the employer and the individual. We considered four factors:

(a) degree of firm-specificity of training;
(b) degree of imperfect competition on the market for trained workers;
(c) retention rate of trained workers;
(d) bargaining power of trained workers.

The higher the degree of firm-specificity, the degree of imperfect competition and the retention rate and the lower the worker’s bargaining power, the higher the training firm’s share in training returns. The worker’s share in returns increases in the retention rate and the worker’s bargaining power and decreases in the degree of firm-specificity and the degree of imperfect competition. It is to be expected that these factors differ much between different training programmes within countries and even within industries. There is, however, at the moment hardly any comparable information available on individual training programmes. Nevertheless, to gain more insight into division of training returns for different training programmes we collected the available empirical evidence on the values for these parameters of the model from different sources in the literature by country, and whenever available by sector of industry and occupation.

3.1. Differences between IVT and CVT

As mentioned above, there is little information available on individual training programmes. Nevertheless, we can say a few things about the differences between IVT and CVT. In general IVT programmes are aimed at transferable skills, therefore, the degree of firm-specificity will be lower than for CVT programmes. In most countries IVT programmes, notably apprenticeships, are certified and, therefore, the market for workers trained in an IVT programme, is as a rule, more transparent than the market for CVT. Further, although there is little comparable empirical evidence on retention rates after IVT and CVT, it is to be expected that retention rates are, in general, lower for IVT programmes than for CVT programmes as firms tend to select workers with the lowest expected job turnover for CVT. So, available evidence suggests that firms can appropriate a higher share of returns from CVT programmes than from IVT programmes.
3.2. Differences between countries

Comparing countries on the factors that determine the division of returns to training between firms and workers the most striking differences can be found between the UK and the US on the one hand, and Germany on the other. In both the UK and the US most training seems to have a very low degree of firm-specificity. In both countries there is little trade union bargaining at industry level, trade union coverage is low and wage compression is low as well. Labour turnover is relatively high. In Germany, most training is general as well, but there is some evidence, at least for apprenticeship training, that the training consists of a considerable firm-specific component as well. Trade union bargaining takes place at industry level and trade union coverage is quite high resulting in a high wage compression at industry level. Labour turnover is relatively low.

So the available empirical evidence on the factors that determine division of the returns to training between employers and workers suggests that firms in Germany can, in general, appropriate a higher share of returns to training than firms in the UK and US. These findings do not come as a surprise as they support the dichotomy in training systems between the UK and the US on the one hand, and Germany on the other which has been described extensively in training literature (see also Harhoff and Kane, 1997; Winkelmann, 1997).

For other European countries empirical evidence is less conclusive. In Belgium, France and Italy wage compression seems to be high and labour turnover is low, suggesting that firms can appropriate some of the returns to training. In Spain wage compression is high as well but labour turnover is also high. In Denmark and the Netherlands there is moderate wage compression and high labour turnover.

The evidence on eastern European countries is scarce, but in general wage compression seems to be low, most wage bargaining seems to take place at firm level and labour turnover is high (with the exception of Poland) suggesting that in these countries firms can appropriate little of the returns to training.

3.3. Differences between industries

The factors influencing the division of returns to training, especially the retention rate, bargaining power and the degree of imperfect competition (wage compression) appear to vary more between industries within countries than between countries. In most countries turnover rates are high in the services sector, notably in the retail trade, the leisure and hospitality sector, and in the construction sector. Low labour turnover is found in the public sector and in the financial services sector. Wage compression is found to be highest in the service sector. There is, however, still little information available at a lower aggregation level.
3.4. **Policy implications**

For a training programme to be successful it is important that both parties, the employer and the individual, are able to share in the returns to training. If either the employer or the worker does not share in the returns the quality of the training programme may be negatively affected. To ensure that both parties share in the returns the training should be partly firm-specific or there should be imperfect competition on the market for trained workers.

Government policies aimed at stimulating investment in training should consider this effect. First, it is important to know which party will profit from training and for which kind of training. For example, it makes little sense to stimulate firms by means of wage cost subsidies to invest in training, if firms do not share in the benefits from training. A wage cost subsidy raises the firm’s current profits but will not affect its future benefits from training. Therefore, the firm has little incentive to spend much effort in making the training programme a success. So policies aimed at stimulating training investments that lower the costs of training by means of subsidies or tax reductions should be directed at that party who benefits most from the training or should be accompanied by measures that affect the division of benefits. To obtain a clear picture on the division of the benefits of training, ideally one should consider, for each training programme separately, the factors influencing the division of training costs, that is, the degree of firm-specificity, the degree of imperfect competition, the retention rate and the worker’s bargaining power. As these factors vary a lot between industries within countries than between countries it is difficult to formulate a government policy for stimulating training at country level. Policies formulated at industry level will probably be more successful as they can better take these factors into account.

3.5. **Future research**

The framework developed in Chapter 1 has not been tested empirically yet, but has served as a handle to discuss the literature on the returns to training. In the literature, components of the model have been tested separately but there are hardly any publications that consider the effect of all the factors that might affect the division of training benefits between firms and workers simultaneously. The main reason is that there are very few suitable datasets available to test such a model. Therefore, further research should first concentrate on collecting better training data for Europe. As mentioned before, the factors influencing the division between firms and workers not only seem to vary a lot between countries but also between industries and regions. Therefore, to test the model, data by country, region and industry are needed. The ideal dataset should contain detailed information on private training expenses per worker and indicators for the degree of firm-specificity, the degree of imperfect competition, the retention rate and workers’ bargaining power. The model predicts that firms will invest more in training if they can appropriate a higher share of returns, that is, as the degree of firm-specificity, the degree of imperfect competition and the retention rate are higher and workers’ bargaining power is lower. The empirical relationship between the variables that
determine the division of training returns and firms’ training expenses thus provides a simple test of the model.

As discussed throughout this contribution, it is not straightforward to measure the various components of the model. Table 7 gives an overview of possible indicators for the various components of the model, most of which have been discussed in Section 2, and several potential datasets for Europe. There are no datasets available yet which cover all components of the model. The ECHP provides detailed information on training incidence paid for by the worker, and has information on the type of training and to a lesser extent on the type of skills which can be used as proxies for the degree of firm-specificity and also provides some information on certification of training. Further, the ECHP contains information on tendency to quit after training, which may be used as an indicator for the retention rate and on earnings. As it is an individual survey it contains little information on the firm, however. So, it provides no direct information on firms’ training expenditure. The CVTS is an employer survey which provides detailed information on firms’ training expenditure but it provides no measures for any other component of the model. Further, IVT is not included in this survey. Information on minimum wages and wage compression can be obtained from the OECD earnings database and the structure of earnings survey. For measures concerning trade union coverage OECD labour force statistics are a useful data source. Comparable measures of training technology or efficiency of training are not available. These have to be controlled by dummy variables for the training method, training level, type of training and type of skills and knowledge.

Most components of the model can be measured by using individual datasets such as the ECHP, but to obtain accurate measures on firms’ training expenditure employer survey data are required. Therefore, to cover all components of the model linked employer-employee panel data for Europe are needed which contain detailed information on training per worker, not only on the time and money devoted to training but also on the content of the training programme. Although such a dataset would be very valuable for research on the private benefits for training as well as for formulating and evaluating training policies (Bryson et al., 2006), unfortunately, it does not yet exist. This remains an issue for future research.
<table>
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<tr>
<th>Model component</th>
<th>Measure</th>
<th>Dataset</th>
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<td>Dummy variables for training method</td>
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<td>Level of training</td>
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<tr>
<td></td>
<td>Type of training (formal/informal training, on-the-job versus off-the job)</td>
<td>ECHP/IALS</td>
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<tr>
<td></td>
<td>Type of skills and knowledge learned (vocational reading skills, computer skills, foreign language)</td>
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<tr>
<td>Private training expenses ((C_f \text{ and } C_w))</td>
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<td></td>
<td>Volume of employer and non-employer sponsored training ((\text{hours}))</td>
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<td>Firms’ training expenditures per employee</td>
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<tr>
<td>Degree of firm-specificity ((\delta))</td>
<td>Direct measure in survey: How many of the skills that you learned in this training programme do you think could be useful in doing the same kind of work for an employer different than current employer</td>
<td>ECHP/IALS</td>
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<tr>
<td></td>
<td>Type of training: formal/informal training, on-the-job versus off-the job</td>
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<td>Type of skills and knowledge learned: vocational reading skills, computer skills, foreign language, etc.</td>
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<td>Degree of imperfect competition on the market for skills ((\gamma))</td>
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<td>Number of workers by region, occupation and/or industry per squared kilometre</td>
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<td>Ratio of job offers relative to total labour force per region/industry</td>
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<td>Trade unions</td>
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<td>Percentage of workers covered by bargaining at industry level</td>
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<td>Minimum wages relative to full-time median wages</td>
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<td>Wage compression</td>
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<tr>
<td>Retention rate ((p))</td>
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<td>One to five year retention rates for all workers</td>
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<tr>
<td>Model component</td>
<td>Measure</td>
<td>Dataset</td>
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<tr>
<td>Percentage of (recently) trained workers looking for another job</td>
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<td>Workers’ bargaining power ($\beta$)</td>
<td>Percentage of workers covered by bargaining at firm level</td>
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## List of abbreviations

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<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>CVT</td>
<td>Continuing vocational training</td>
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<tr>
<td>CVTS</td>
<td>Continuing vocational training survey</td>
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<td>ECHP</td>
<td>European Community household panel</td>
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<td>EU LFS</td>
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<td>IALS</td>
<td>International adult literacy survey</td>
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<td>IVT</td>
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Bibliography


Frazis, H.; Loewenstein, M.A. Reexamining the returns to training: functional form,


