To recruit skilled workers or to train one's own? Vocational training in the face of uncertainty as to the rate of retention of trainees on completion of training*

*Lutz Bellmann and Florian Janik***

The article deals with the impact of uncertainty as regards the retention of trainees completing vocational training programmes on firms' training behaviour. As an alternative to vocational training, the external recruitment of skilled workers is considered via an opportunity costs approach. The uncertainty is traced back to staff turnover, considerable product market competition and changing skill requirements. Indicators of these causes of uncertainty are examined as to their impact on vocational training and the recruitment of skilled workers with a fractional logit model, using a seemingly unrelated cluster-adjusted sandwich estimator with data from the IAB Establishment Panel. There is no empirical evidence that the presumed correlations exist in manufacturing. A negative correlation is identified in the service sector between high staff turnover coupled with rapid change in the skills required on the one hand, and commitment to vocational training on the other, while there is a positive link with the external recruitment of skilled workers. This is interpreted as an indication that uncertainty with regard to retention after training can go some way towards explaining the growing gap between employment and vocational training in the tertiary sector.

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1 Introduction

Year after year, many young people fail to obtain a vocational training place and as a result frequently attend state-funded skill-building schemes. Manifold reasons have been expressed in the public debate for this dramatic situation, which has been continuing for years despite various promotional programmes and the "Pakt für Ausbildung" (Pact for Training). Too high training costs, inadequate orders, a lack of job prospects after training and insufficiently qualified applicants are frequently referred to in this context. Tertiarisation is commonly identified as a further reason for this development. Firstly because the rationalisation processes in manufacturing and the concomitant reduction of employment also reduce the number of training places, and secondly because the ratio between training places offered and the number of employees is deteriorating in the service sector (Baethge et al. 2007).

The stiffer competition faced by firms at both national and international level is indicated as a further reason for firms providing less vocational training. The results of the IAB Establishment Panel also suggest that firms engage in less training because they are unsure as to whether they will be able to offer subsequent employment to the trained workers if they enter into a training agreement, because of the considerable competitive pressure and the uncertainty with regard to their income situation which this entails (cf. Bellmann/Hartung 2005). Another reason that is frequently expressed for firms' reticence when it comes to vocational training lies in the organisation and structure of the German system of vocational training as such. Where firms are not only subject to considerable competitive pressure, but are also operating in innovative fields in which worker skill requirements are high and subject to rapid change, one may presume that vocational training, with its firmly established training content over which the firms have little influence, is not the right source of skilled workers because it is too uncertain whether the training contents actually match the current requirements at the end of the training period. For these reasons, the external recruitment of skilled workers may be preferred over vocational training. Both arguments entail the hypothesis that uncertainty influences firms' training behaviour and that increasing uncertainty has a negative influence on it.

This uncertainty is modelled in this paper using the probability of a trainee not remaining in the firm on completion of his/her training. Firms respond to a low expected retention rate and reduce their commitment to vocational training. At the same time, the recruitment of already trained workers to cover

the need for skills becomes more attractive because of falling opportunity costs.

Evidence of this circumstance is provided by Falk (2002), who studied firms employing or seeking ICT specialists. The enterprises were surveyed in 2000, in other words during the IT boom. The ICT sector is a very good example of the modern, innovative sectors of the economy. If these firms need additional skilled labour, then overtime, outsourcing and the use of freelancers are preferred to creating training places. Particularly in technical and entrepreneurial services, the firms state that they prefer ICT specialists who have graduated from university over their own in-house trainees (Falk 2002). This finding is not without its detractors, however. Steedman et al. (2006) and Steedman/Wagner (2007) reach the conclusion in a comparative analysis of the United Kingdom and Germany that, particularly in the ICT field, dual training is more attractive for enterprises in Germany than the recruitment of external skilled workers, since the trainees in the dual system can be deployed more flexibly if they are provided with appropriate further training.

Various studies have examined the impact of high resignation rates and retention rates on vocational training. They all reach the conclusion that these reduce the provision of training by firms (Niederalt 2004, Beckmann 2002a, Neubäumer/Bellmann 1999). Smits/Zwick (2004) provide empirical evidence for the presumption that the matching of the skills provided in vocational training with the actual skill requirements poses a greater problem in the service sector than it does in manufacturing. A number of studies (e. g. Wolter et al. 2006, Hartung/Leber 2004, Beckmann 2002a) take into account the impact of the share of skilled workers on training provision and training intensity, but the impact on the external recruitment of skilled workers and commitment to vocational training has so far not been the subject of studies using establishment data.

The text is structured as follows: the second chapter presents the theoretical model, which is discussed particularly with regard to the uncertainty of further employment after completion of training. The third part follows with the empirical examination, using data taken from the IAB Establishment Panel. The fourth and final part summarises the results and also interprets them in relation to the refinement of the dual system of vocational training.

2 Vocational training or external recruitment?

In the model used here, vocational training is regarded as a part of staff planning reaching beyond

the training period, with the aim of meeting firms' requirements in terms of skilled workers. As an alternative to vocational training, firms can also recruit skilled workers via the external labour market. These arguments are based on considerations made by Franz/Soskice (1995) and taken up by Niederalt (2004), and are used below as a basis for modelling.

2.1 Recruitment costs: opportunity income of vocational training

It is not worthwhile for firms to invest in general human capital where there is complete competition on labour markets, since they have no guarantee that individuals who have received general training will remain in the firm on completion of the skill-building measure. If the trainees leave, the firm can no longer benefit from the increase in productivity as a result of training and bears only its costs (Becker 1964). Investment in general human capital is only worthwhile for firms if the trainees are paid wages after completion of training which are lower than their productivity, and thus a margin can be realised. This type of remuneration is conditional on a compressed wage structure in which, as skills increase, wages grow less quickly than productivity (Acemoglu/Pischke 1998, 1999a, 1999b). This means that vocational training is only profitable for enterprises if those completing training can be paid less than skilled workers recruited externally. This can not be described clearly in either theoretical or empirical terms (Niederalt 2004). If it is therefore assumed for the sake of simplicity that the wages and the productivity of internally-trained workers are the same as those of externally-recruited skilled workers at least after a certain familiarisation phase, the vocational training decision can be modelled via the concept of opportunity income (Niederalt 2004, Wolter/Schweri 2002, v. Bardeleben et al. 1995).

In this view, the focus is not on productivity being higher than remuneration as the source of earnings from vocational training, but on meeting the need for skilled workers. The opportunity income derived from vocational training can be deduced by comparing it with the recruitment of skilled workers on the external labour market, in other words cost advantages gained by retaining trained workers who have completed in-house training (Niederalt 2004). This opportunity income consists of:

– staff acquisition costs being avoided (Franz/Soskice 1995), since it is no longer necessary to look for and select skilled workers from the external labour market;

– familiarisation costs being avoided because the new employees already know the firm (Kau 1997);

– savings being gained by stabilising the wage and salary structure (Cramer/Müller 1994);

– costs being avoided as a result of lower staff turnover since those completing training remain in the firm longer (Cramer/Müller 1994) and because of a reduced risk of recruiting the wrong employees (Franz/Soskice 1995).

Considerations made by Niederalt (2004) are used in modelling this decision on the part of the firm. The modelling extends to the time when both alternatives lead to equivalent results, which in this case applies after the familiarisation of the externally recruited skilled workers in the firm. If it is assumed that an additional need for skilled workers exists prior to commencement of training for the period $s + 1$, the transaction costs of familiarisation lead to more or less fixed costs being incurred for the recruitment of external skilled workers. If these transaction costs, which conversely can also be regarded as opportunity income gained from internal training, are higher than the net costs of training, vocational training is worthwhile for the firm. The following decision rule can thus be formulated:

$$\sum_{t=s+1}^{n} RK_t \quad > \quad \sum_{t=1}^{s} NK_t \qquad (1)$$

where RK = recruitment costs for external skilled workers, and NK = net costs of vocational training.

Therefore, if the recruitment costs, which conversely can also be interpreted as opportunity income gained from vocational training, exceed the net costs of training, it becomes attractive for the firm to provide apprenticeships. This decision rule is, however, based on the assumption that all people completing training remain in the firm. If some or all of the trainees leave the firm on completion of training, the need for skilled workers must be at least partly met via the external market. It is therefore only possible to avoid recruitment costs for those trainees who do remain in the firm. The decision rule must therefore be supplemented by the retention rate q of those completing training

$$q \sum_{t=s+1}^{n} RK_t \quad > \quad \sum_{t=1}^{s} NK_t \qquad (2)$$

with $0 \leq q \leq 1$.

Therefore the lower the retention rate q is, the lower the opportunity income gained from internal train-

ing is, and hence the lower the costs must be to encourage firms to invest in training. If it is assumed that workers who have completed vocational training may be substituted by workers who have other qualifications (from vocational academies, technical colleges, universities etc.), it can be shown that the costs of these substitutions are already accommodated in the possibilities of recruiting (Niederalt 2004). Short-term productivity differences due to the firm-specific human capital which is imparted in on-the-job vocational training, as well as temporary additional wage costs which may be caused by external recruitment, can also be modelled by the recruitment costs (Niederalt 2004). Vocational training is consequently always profitable with a given need for skilled labour if the net training costs are lower than the costs of the external recruitment of skilled workers, taking into account the retention rate of those completing internal vocational training.

2.2 Uncertainty and vocational training

This retention rate is, however, unknown to firms at the time of the training decision. Whether vocational training is profitable or not is thus uncertain for them at this time. The higher the retention rate is estimated to be, the more likely it is that firms' vocational training is also valued as worthwhile.[1] Three different sources of this uncertainty are discussed below with regard to the impact on the decision-making situation described.

Acemoglu/Pischke (1998, 1999b) argue on the basis of the classic human capital theory that provision of vocational training vitally depends on the firm's resignation rate. The authors reach the conclusion that there are two equilibrium states of participation in training, namely the "low quit – high training" and the "high quit – low training" equilibriums. The argument is structured as follows: if a firm's rate of voluntary departures is high, the continued employment of trained workers is also uncertain; the retention rate is therefore estimated to be relatively low. This leads to the employer having less pronounced monopoly power over the workers, which in turn reduces the incentive to invest in general human capital. Beckmann (2002a) shows that this model can be expanded to accommodate the risk of poaching, in other words the probability that a trained worker is recruited away by another firm. It can be said in very general terms that low stability of employment

relationships also reduces the expected retention rate and hence the opportunity income, therefore also reducing the provision of vocational training.

In their theoretical analysis Acemoglu/Pischke presume that the retention rate q depends primarily on the exogenously-stated resignation rate of workers in the firm, but state elsewhere that q denotes the probability that the worker or the firm, or both, suffer an adverse shock and therefore separate (Acemoglu/Pischke 1999b). Stevens (1994) also emphasises that it is continued employment per se which is vital to the vocational training calculation and not whether employment is terminated by the employer or employee. The reasons for retention or separation after training can thus be traced not only to the trainees and to potential third-party employers, but also to the training firm itself. These sources of uncertainty are discussed in detail below.

One of these sources of uncertainty is for instance the argument put forward by Baethge et al. (2007) that firms which are subject to strong national or international competitive pressure react to this by applying new methods of enterprise control which reduce firms' involvement in training. This argument can be integrated into the decision-making calculation with the aid of the above uncertainty considerations. The more a firm is in competition, the more difficult it is for the firm to foresee at the time of the training decision whether it will be possible to offer jobs to the trainees on completion of training. A firm which finds itself in such a situation will thus tend to estimate a low retention rate q, which increases the incentive to meet the need for skilled workers via external recruitment. According to this argument, high competitive pressure can be regarded as a source of uncertainty. Hence firms which are subject to strong national or international competitive pressure can be expected to train fewer apprentices. This does not mean, however, that firms which find themselves in such a competition situation have no need of skilled workers. If competition is not for the lowest price, but for the highest quality, one may indeed anticipate the opposite. On the basis of this argument it is rather to be anticipated that these firms will tend to meet their needs via the external labour market instead of by investing in their own vocational training programmes.

The organisation of vocational training can also be regarded as an even more significant cause of the uncertainty of continued employment because of its consequences. If one presumes, as Acemoglu/Pischke (1999b) do, that the need for skilled workers also increases with modern production techniques, it appears initially also to be consistent that these firms

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[1] If, however, the firm does not incur any costs at all due to training ($NK = 0$), vocational training is even worthwhile with an expected retention rate of $q = 0$.

are very much committed to vocational training. The opposite may apply, however, if modern production techniques are also accompanied by constant changes in these techniques, if the firms are therefore operating in highly innovative fields. Bartel/Lichtenberg (1987) state that jobs held by the highly skilled are more short-term, since the half-life of knowledge relating to new products and procedures is particularly short. Heidenreich (1998) argues that the vocational training system that is typical of an industrial society is therefore coming under pressure in three areas in line with the transition towards the service society, and the new forms of organisation and work which this entails:

- Firstly, today's vocational training system spans firms, in other words the standardised, uniform training content is negotiated between the chambers, the employers' associations and the trade unions. Firm-specific, and hence variable, requirements as to qualifications, can be integrated in principle in the context of the dual training system, but this is hardly practiced at present.

- Furthermore, it is presumed that the industrial form of organisation, compartmentalised as it is according to functions with specific qualifications, constitutes a stumbling block to firms' innovativeness. Work and organisation processes are thus being restructured in many enterprises in order to take account of these new requirements. Vocational training is, however, primarily orientated in line with the old functional units. Apprentices are therefore trained mostly in a particular department, and are more rarely given access to different areas or processes. Training therefore frequently becomes less attractive for innovative organisations in particular.

- Finally, the dual training system is also coming under pressure as a result of educational expansion, and by virtue of the expansion of skill-intensive services. Because of educational expansion, firms can also place school-leavers or graduates in medium-ranking posts where more interdisciplinary thinking and acting is expected. This group of individuals thus competes with vocational training graduates. People completing training in the dual system are in a relatively poor position, which decreases the perspectives of those with vocational training, and the same therefore applies to their attractiveness for future employers.

There is therefore uncertainty for the firm as to whether the skills imparted in vocational training are indeed useable and whether they must separate

from the trainees after completion of training, which corresponds to a lower expected retention rate q. The firm would then have to meet the skill requirements by recruiting external skilled workers, despite having invested in vocational training, which accordingly reduces the opportunity income obtained from internal training, thus making it less attractive.

In the case of uncertainty, firms therefore tend to opt against vocational training for a variety of reasons, and are more likely to recruit a skilled worker. This is firstly because at the beginning of vocational training it is uncertain whether the trained worker will leave the training firm of his/her own volition. Secondly, it is also possible for changes to take place on the sales and buying markets, in particular those subject to high competitive pressure, which can make one or more jobs obsolete. Thirdly, what is more, firms are uncertain as to whether the skill requirements are met by the content of the training. These may have altered for instance as a result of technical and organisational changes.

3 Empirical analysis

3.1 Data

The IAB Establishment Panel of 2005 is used for the analysis below. This is a survey which has been conducted annually since 1993 in western Germany and since 1996 in eastern Germany, generally using oral interviews. The population covers all establishments which have at least one employee subject to social security contributions.[2] Because of the fundamental differences existing between the labour and training markets in eastern and western Germany (cf. Beckmann 2002b), the following analyses are confined to western Germany, only. One focus of the IAB Establishment Panel in 2005 was the staff recruitment process, in particular that of skilled workers (cf. Bellmann et al. 2006).

3.2 Empirical strategy and econometric modelling

According to the theoretical considerations, both the recruitment of skilled workers and the provision of vocational training can serve to meet the need for skills. Hence, both are treated as dependent variables in the analysis. The share of training posts of-

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[2] For further information on the IAB Establishment Panel cf. Bellmann (2002).

fered in the previous year, in other words both those that were occupied and those which were vacant, is used as a measure of the need for trainees. The measure of the need for skilled workers is the share of jobs offered to skilled workers in the first half of the year under observation, in each case in relation to all workers in the firm.[3] Workers who have undergone vocational training, who have comparable vocational experience or a university degree are classed as skilled workers.

Both share values are between zero and one, and indeed assume these values. The use of a tobit model for estimation is not ideal since a share value below zero is not possible, but the tobit model is orientated towards censored values because of unobservability. A logit model taking the shape of $E(\log[y/(1-y)]|x) = x\beta$ could be estimated, but does not provide a perfect description of the available data since it is not defined for y = 0, and y = 1, and $E(\log[y/(1-y)]|x)$ cannot be transformed into $E(y|x)$ without difficulty (Papke/Wooldridge 1996). Both share values are thus estimated with the fractional logit proposed by Papke/Wooldridge (1996), since this can represent the spread of the share values.

The fractional logit model, which is used here for estimating the shares, takes on the general form:

$$E(y_i|x_i) = G(x_i\beta), \qquad (3)$$

where $0 \leq y_i \leq 1$ applies and x_i is the vector of the explanatory variables, β is the coefficient vector, i = 1,2,...,N and N is the number of observations. $G(x_i\beta)$ assumes the form of a probability density function of the logistic function $G(z)$, and $0 < G(z) < 1$ applies. The coefficients are obtained by maximising the Bernoulli log likelihood function

$$l_i(b) = y_i \log[G(x_ib)] + (1-y_i)\log[1-G(x_ib)] \quad (4)$$

(Papke/Wooldridge 1996).

In order to determine the influence of the dependent variables on both the independent variables "share of training places offered" and "share of jobs offered for skilled workers", these are estimated using the Seemingly Unrelated Cluster-Adjusted Sandwich Estimator (SURE) proposed by Weesie (1999): This method makes it possible to study whether the same independent variables have a similar impact on two (or more) dependent variables:

$$y_1 = \alpha_0 + x_{1i}\beta' + u_1 \qquad (5.1)$$

$$y_2 = \gamma_0 + x_{2i}\beta'' + u_2 \qquad (5.2)$$

Using a test proposed by Breusch/Pagan (1980), it is examined whether the precondition for the use of a SURE approach is met, namely the non-diagonality of the covariance matrix of the disturbance values. Furthermore, as in a Hausman test, the coefficients of the individual estimates are compared (Weesie 1999):

$$H_0 : \beta' - \beta'' = 0 \qquad (5.3)$$

Other conceivable methods, for example a Heckman correction or the use of instrumental variables, are impossible since the need for skills – expressed on the one hand by the demand for skilled workers and on the other hand by the demand for trainees – depends on the same influencing values. Both procedures, however, would require variables which correlate with the demand for apprentices, but not with the demand for skilled workers or vice versa. However, such variables are not available in the IAB Establishment Panel.

Along with Heidenreich (1998) and Baethge et al. (2007), one should presume that the matching of the skills imparted to those actually required tends to have more of a reducing impact on training in the service sector than in manufacturing. A decline in employment in the secondary sector, underway since the mid-nineties, has also been accompanied by a fall in the number of trainees. The number of employees in the tertiary sector has grown in the same period, but the number of trainees cannot keep pace with this growth (Bundesministerium für Bildung und Forschung 2005). In order to accommodate these different presumptions and developments in the secondary and tertiary sectors, the estimates are implemented separately for the two economic sectors.

It should also be pointed out that the study presented here does not measure uncertainty as such. Rather, the impact of (soft) indicators on training behaviour is analysed. Accordingly, it cannot be ruled out that the results are distorted. Because of the theoretical considerations, it is presumed that these indicators have an impact, on the anticipated retention rate via the unobservable uncertainty and, hence, that they influence training. This analysis also does not make it possible to say whether increased uncertainty leads to less training since only a cross-

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[3] The variable actually needed, namely the expected demand for skilled workers at the time of completion of vocational training, in other words in two to three years, is not available in the IAB Establishment Panel. For this reason, the current demand for skilled workers is used as a proxy variable.

section of the IAB Establishment Panel is used as a data basis. Fixed effects, such as firm sizes or the sector, may also be the cause of the correlations that were identified.

3.3 Variables and hypotheses

In order to model uncertainty on the basis of competitive pressure, as proposed by Schank (2003), a distinction is made between competitive pressure on the international markets (globalisation) and that on

Table 1
Expected correlations with the demand for trainees

Independent variable	Expected correlation
Competition pressure	
Concentration index (log.)	+
Export share (reference 0%)	
1% – 10%	-
11% – 25%	-
26% – 100%	-
Employment stability	
Share of worker resignations	-
Share of temporary employment	-
Churning rate	-
Skill requirements	
Share of skilled workers	-
IT investment	-
Expansion investment	-
Investment per worker	-
Very modern plant	-
Wage structure distortions	
Collectively agreed wages	+
Remuneration above collective agreed rates	+
Control variables	
Poor profit situation	-
Employment growth	+
Foreign-owned	-
Independent company	+
Works council	-
Firm-size dummies	yes
Sector dummies	yes
Federal state dummies	yes

the domestic market. The influence of globalisation is measured by the firm's export share, i.e. its exports as a percentage of turnover in the last business year. In line with the Acemoglu-Pischke model, a negative correlation with the share of training places offered and a positive one with the share of skilled workers is anticipated since firms with international linkages are under greater competitive pressure and this reduces the probability that they can offer the trained workers jobs on completion of training. As with Schank (2003), the export share is portrayed by three dummies each taking on the value of "one" if the share is 1–10 percent, 11–25 percent or more than 25 percent respectively. These and the following considerations are summarised in Table 1.

A lower training intensity and a larger share of skilled workers recruited is also to be expected for firms with higher competitive pressure at national level. A yardstick for competition intensity is the concentration of workers in the sector in which the firm is active. The calculation of the index is based on the procedure according to Herfindahl-Hirschmann. If n states the number of firms, the index varies between 1/n (all firms have the same number of workers, considerable competition) and 1 (a firm has all workers, no competition).[4] A high index value should therefore coincide with a large demand for trainees. This can be put down to lower uncertainty as to continued employment by virtue of the less fierce competition in the sector. Firms which are subject to less competition need spend less time worrying about orders. One may also assume that the workers have fewer external options in less competitive sectors.

Three variables are included in the model which represents the stability of the employment relationships since, according to the theory, high staff turnover leads to lower training intensity in firms. In accordance with the "low quit – high training" and "high quit – low training" equilibriums derived by Acemoglu/Pischke (1998), the share of worker resignations as a percentage of all workers is included in the estimate equations. According to the theory, a negative correlation with the share of trainees is expected since in a firm with a large number of resignations the margin obtained by investing in general human capital is reduced by the departure of the trained workers. Also, a large share of worker resignations may signify considerable instances of successful poaching by other enterprises, also leading

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[4] The calculation is implemented using the establishment file of the Federal Employment Agency at 3-digit level of the classification of sectors.

to the expectation that a firm will react by reducing its training efforts (Beckmann 2002a). A similar argument can be applied to the variables "share of temporary employment" and the churning rate,[5] which indicates the share of staff turnover that does not contribute to changes in the staff headcount. Both are also used as a measure of the stability of employment relationships. Accordingly, a negative correlation is presumed to exist in each case with the share of trainees, and a positive one with the jobs offered for skilled workers.

The third source of uncertainty, namely the matching of the skills taught in training to rapidly changing markets, is represented by five variables in the model. It appears plausible that firms with a considerable skill requirement which are operating in a dynamic market also employ many skilled workers. Hence, their share of the workforce is included in the model. Furthermore, the amount of investment in information technology and additional investment as a share of all investment expenditure is accommodated. A dummy takes on the value of one if the enterprise's technical plant is highly modern. Furthermore, the amount of investment per worker is incorporated into the model. On the basis of the arguments put forward by Heidenreich (1998), who claims that the dual system of training is less adaptable to dynamic markets, a negative correlation is expected in each case. Conversely, it follows from this argument that firms with a considerable demand for skilled workers will be more likely to attempt to cover this need by recruiting additional skilled workers.

Furthermore, variables are included in the model which, although they are not directly associated with uncertainty, may nonetheless be relevant to the training decision. Since wage structure compressions, which count against skilled workers, constitute an incentive to provide training (Acemoglu/Pischke 1998, 1999a, 1999b), as with Beckmann (2002a) a dummy is used for denoting whether firms are bound by collective agreements. It can be presumed that such firms invest more in training. The same applies to remuneration above the collectively agreed rates, which Acemoglu/Pischke interpret as an indication of efficiency wages, which in turn con-

tribute to wage compression and are assumed to have a positive impact on the share of trainees. A further dummy therefore takes on the value of one if wages are paid above the collectively agreed rates. On the basis of the data available, however, it is not possible, in this way to portray which groups of individuals (e.g. highly-skilled, low-skilled or the trainees themselves) enjoy this increased remuneration.

The economic situation of the firm is represented by two variables. A dummy is included if the firms have evaluated their profit situation in the past year as "three" or worse on an ordinal scale from "one" (very good) to "five" (poor). Secondly, employment growth in the firm is incorporated into the model. On the basis of the costs incurred in vocational training, it can be presumed that firms in which employment is growing are more likely to be able to afford training and that firms with a poor income situation are accordingly less committed to training (Beckmann 2002a).

The company-internal decision-making structures can also be significant for the training decision. Two dummies are therefore formed which state whether the firm is foreign-owned or is an independent company. A positive correlation is presumed to exist in the case of independent companies, and a negative correlation is expected in the case of foreign enterprises. It has been shown in empirical terms that independent companies are more committed to training than branches (Niederalt 2004). Foreign-owned firms are said to provide less training because of a lack of training traditions and higher information costs on the dual system (Niederalt 2004). A further dummy states whether a works council exists in the firm. Although no well-founded theoretical reasoning exists to date, it has been shown in several empirical studies that the existence of a works council has a negative impact on the provision of training (Niederalt 2004).

Both Neubäumer/Bellmann (1999) and Niederalt (2004) have shown that the provision of training increases with firm size, but that training intensity falls. Since the analysis observes both firms which engage in training and firms which do not, as with Beckmann (2002a) one may not expect an effect to be exerted by the ten firm size dummies included. A further reason for including the dummies is the data set used. Since the respondent firms in the IAB Establishment Panel are selected using a stratified random selection (Bellmann 2002), it would be necessary according to DuMouchel/Duncan (1983) and Winship/Radbill (1994) to carry out the control procedure for the level variables. For this reason, dummies for the federal state and for sectoral affiliation

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[5] This "churning rate" (CR) describes the part of worker mobility which cannot be explained by the change in the number of workers in a firm. It is calculated as follows:
$CR = (H + S - |H - S|)/L$, where H stands for the number of recruitments, S for the number of departures and L for the average number of workers in the period under observation. There are several measuring concepts for the "churning rate". The "churning rate" used here is calculated as in Alda/Allaart/Bellmann (2005).

are included in addition to firm size. Furthermore, the sector dummies also partly control for different net costs of training in the various economic activities (Niederalt 2004). The distribution of the variables[6] used can be found in Tables A and B in the Annex.

3.4 Results

Manufacturing

Table 2 shows the estimation results for manufacturing. An unexpected picture is revealed regarding the potential sources of uncertainty as to being able to retain trained workers after training. While it is possible to recognise the expected negative influence of international competition on training intensity, measured against the export share, a significant explanation of the share of the training places offered is, however, only provided by the dummies for a 1 % to 10 % and for a 11 % to 25 % export share. The national competition index also has an influence, but not the positive one that was anticipated.

In contradistinction to the theoretical considerations, the variables on employment stability in the firm have no independent influence on the share of trainees. That said, the churning rate and a large share of temporary contracts both have a positive influence on the share of jobs offered for skilled workers. In contradistinction to Beckmann (2002a), the share of resignations is not significant. High staff turnover appears not to exert an influence on the training intensity in manufacturing, but it does exert an influence on the demand for already qualified workers.

The indicators of the modernity of the firm show contradictory results. Manufacturing firms which make large investments also train more. The share of skilled workers exerts a positive influence on the demand for external skilled workers, and has a negative correlation, albeit not a significant one, with training intensity. Also, these variables thus impact at best on the demand for skilled workers, but not on that for trainees.

The estimation of the profit situation does not exert an influence on the training intensity, and not on the demand for skilled workers in the firms, either. However, a link can be identified between the

growth of the firm and the demand for skilled workers, but there is no independent influence on training intensity. As might be expected, foreign-owned firms also train less. The negative influence of the works council on training is in line with the results obtained by Niederalt (2004). The positive influence of collective bargaining on the provision of training also corresponds with the results from other surveys (e.g. Niederalt 2004, Beckmann 2002a). Firms bound by collective agreements train more.

To sum it up, it can be stated that the considerations made regarding uncertainty and its impact on training and the external recruitment of skilled workers in manufacturing are not confirmed. The theoretical approach is therefore not well suited to explain the training behaviour of firms in manufacturing. The only slightly significant Breusch-Pagan test also corresponds with this picture. Hence, in manufacturing there tends not to be a correlation between the demand for skilled workers and that for trainees. It should be pointed out once more here that the indicators used for the various causes of uncertainty tend to be soft, and therefore distortions due to misspecifications cannot be ruled out.

Services

The fact that the demand for skilled workers and the demand for apprentices in this sector of the economy are interrelated is also confirmed by the result of the Breusch-Pagan test. The estimate results for the service sector from Table 3 also confirm the considerations as to uncertainty.

This does not apply to the variables which measure national and international competitive pressure, however. None of these have any significant impact on training behaviour.

The negative link between the share of skilled workers and the provision of training, coupled with the positive link with the demand for skilled workers, supports Heidenreich's thesis (1998). Both of the coefficients also differ highly significantly from one another. Service-providers with a relatively large number of skilled workers are therefore more likely to meet their need for skilled workers by recruiting new workers rather than by engaging in vocational training. Heidenreich (1998) puts this down to the low level of adaptability of dual vocational training to the requirements of a knowledge-based society. It therefore also appears to be plausible that this effect is found more in the growing service sector than in the secondary sector. The other variables intended to portray the modernity or innovativeness of enterprises, however, have no significant effect on

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[6] The age of the firm and the regional unemployment rate were initially included in the estimate model. Like the separate estimate by firm size classes, however, this provided no additional information.

Table 2

Fractional Logit[#] – Manufacturing

	Share of training places offered				Share of skilled worker jobs offered			Wald test (Chi²)
	Co-efficient		Z value		Co-efficient		Z value	H_0: $\beta` - \beta`` = 0$
Competition pressure								
Concentration index (log.)	−0.09**		−2.28		0.05		0.94	4.31**
Export share (reference 0%)								
1% – 10%	−0.61***		−4.71		0.25		1.06	10.77***
11%– 25%	−0.23**		−1.94		−0.07		−0.33	0.45
26%– 100%	−0.15		−1.63		0.03		0.11	0.52
Employment stability								
Share of worker resignations	−0.23		−0.12		0.40		0.26	0.05
Share of temporary employment	−0.42		−0.92		1.25***		2.69	5.97**
Churning rate	0.72		0.92		4.69***		7.60	14.54***
Skill requirements								
Share of skilled workers	−0.01		−0.05		1.16***		3.49	8.84***
IT investment	0.00		0.64		−0.00		−0.54	0.60
Expansion investment	0.00		−0.33		0.00		1.26	1.32
Investment per worker	0.03**		1.98		0.02		0.86	0.16
Very modern plant	0.00		0.03		0.14		0.74	0.39
Wage structure distortions								
Collectively agreed wages	0.28**		2.19		−0.13		−0.54	2.42
Remuneration above collectively agreed rates	0.07		0.63		0.02		0.12	0.07
Control variables								
Poor profit situation	0.05		0.57		−0.16		−1.33	1.97
Employment growth	0.10		0.71		0.79***		4.09	12.89***
Foreign-owned	−0.24***		−3.37		0.16		0.75	3.10*
Independent company	0.02		0.29		0.00		0.02	0.02
Works council	−0.29***		−2.79		−0.36		−1.36	0.07
Firm sizes (9 dummies)		yes				yes		
Sectors (15 dummies)		yes				yes		
Federal states (10 dummies)		yes				yes		
Constant	−4.23***		−11.91		−4.80***		−5.85	
No. of cases								1,946
Pseudo R²		0.3845				0.4843		
Breusch-Pagan test				2.87*				

Source: IAB Establishment Panel 2005 West; own calculations.
*p<0.1, **p<0.05, ***p<0.01
[#] *Seemingly Unrelated Cluster-Adjusted Sandwich Estimator*

Table 3

Fractional Logit[#] — Services

	Share of training places offered			Share of skilled worker jobs offered			Wald test (Chi²)
	Co-efficient		Z value	Co-efficient		Z value	H₀: β`− β``= 0
Competition pressure							
Concentration index (log.)	0.00		0.09	−0.02		−0.36	0.11
Export share (reference 0%)							
1% – 10%	0.28		1.29	0.26		1.49	0.00
11%– 25%	0.13		0.43	0.24		1.17	0.10
26%– 100%	0.20		0.81	0.09		0.46	0.12
Employment stability							
Share of worker resignations	0.53		0.52	0.79		0.56	0.02
Share of temporary employment	−0.70**		−2.11	0.70*		1.92	8.31***
Churning rate	−1.10**		−2.55	2.53***		7.93	50.57***
Skill requirements							
Share of skilled workers	−1.00***		−5.46	1.61***		8.11	94.96***
IT investment	0.00		0.87	0.00		0.34	0.19
Expansion investment	0.00		1.00	0.01***		3.76	3.90**
Investment per worker	−0.02		−1.41	−0.01		−0.55	0.43
Very modern plant	0.19		1.65	0.21**		2.02	0.01
Wage structure distortions							
Collectively agreed wages	0.09		0.76	−0.04		−0.33	0.60
Remuneration above collectively agreed rate	0.36***		3.13	0.35***		2.66	0.00
Control variables							
Poor profit situation	−0.14		−1.01	−0.15		−1.24	0.00
Employment growth	−0.04		−0.78	0.10***		3.79	5.12**
Poor income	−0.21		−0.73	0.09		0.31	0.52
Independent company	−0.09		−0.70	−0.05		−0.49	0.07
Works council	−0.42***		−4.06	−0.36***		−3.42	0.16
Firm sizes (9 dummies)		yes			yes		
Sectors (12 dummies)		yes			yes		
Federal states (10 dummies)		yes			yes		
Constant	−3.86***		−9.49	−5.09***		−13.35	
No. of cases				3,788			
Pseudo R²		0.3306			0.3033		
Breusch-Pagan test				24.44***			

Source: IAB Establishment Panel 2005 West; own calculations.
*p<0,1, **p<0,05, ***p<0,01
[#] Seemingly Unrelated Cluster-Adjusted Sandwich Estimator

the share of training places offered, which rather puts the significance of these considerations into perspective.

The findings on staff turnover and flexibility also correspond with the theoretical considerations. Both a high churning rate and a large share of temporary employment relationships reduce firms' provision of training. At the same time, both variables have a positive impact on the demand for skilled workers and differ significantly from one another. The resignation rate has no significant effect. In this sense, the thesis of Acemoglu/Pischke (1998) of the "low quit – high training" and the "high quit – low training" equilibriums appears initially to have been countered. The idea on which this is based, namely that high staff turnover is an indication of a lower probability of continued employment, to which firms react by reduced provision of training, is confirmed, however.

As is the case in manufacturing, in the service sector, too, the profit situation and employment growth do not impact on the provision of training. However, a positive effect of growth on the demand for skilled workers can be ascertained. The further control variables "works council", "foreign owners" and "independent company" demonstrate a similar picture to that in manufacturing. However, collective agreements do not impact on training behaviour, which can be explained by the wage structure in the service sector. Collectively-agreed wages are very low in some of the sectors, in particular in personal services.

Summing up, the empirical results for the service sector bear out the theses put forward in this paper regarding the link between uncertainty and vocational training and the external recruitment of skilled workers.

4 Summary and conclusions

In addition to high staff turnover (Acemoglu/Pischke 1998, 1999a, 1999b), this paper analyses two further causes of a high separation probability, in other words of uncertainty as to the retention of trainees in the firm after completion of training. It is stated that high competitive pressure can reduce the provision of training (Baethge et al. 2007) since firms are in greater competition, and hence find it difficult to estimate their requirements and cannot be certain of being able to offer a job on completion of training. Furthermore, according to Heidenreich (1998), vocational training is also less attractive for

modern and innovative enterprises since – given its relatively inflexible organisation – firms have little latitude to influence the training content, and therefore it cannot be predicted at the beginning of the training whether the acquired qualifications will be useable once training has been completed. If for one or more of the three mentioned reasons, firms are uncertain as to whether they will be able to take on workers after training, one may presume that in the case of a need for skilled workers the recruitment of already qualified workers will be preferred, and that commitment to training will be reduced accordingly.

This paper did not measure directly the indicators of uncertainty, but (soft) indicators from the IAB Establishment Panel for western Germany were used and their impact on vocational training behaviour studied. On the basis of the theoretical considerations, these indicators are presumed to exert an impact via the unobservable uncertainty regarding the anticipated retention rate, and hence exert an impact on training. The fractional logit estimator proposed by Papke/Wooldridge (1996) is deployed here. In order to accommodate the alternative hiring of skilled workers, both shares of employment are estimated using the Seemingly Unrelated Cluster-Adjusted Sandwich Estimator proposed by Weesie (1999).

Little evidence is available in manufacturing to confirm the theoretical considerations. The results obtained in the service sector correspond on the whole to the considerations put forward in this paper as to the significance of uncertainty for vocational training behaviour. While competitive pressure does not take on any major significance, the expected correlations are, however, confirmed for both of the other uncertainty factors – i.e. high staff turnover and the matching of vocational training to the actual skill requirements. Firms with considerable movement in the headcount and with a large share of skilled workers train less and at the same time have a larger demand for skilled workers who already have the requisite skills. Vocational training is obviously not optimal for these firms with regard to their need for skilled workers. Uncertainty as to retention after training can help to explain the growing gap between employment and training in the tertiary sector in this context. However, it should be noted here that the indicators used for the various causes of uncertainty tend to be weak, and therefore distortions caused by mis-specifications cannot be ruled out. Furthermore, because of the cross-sectional view, the results may be influenced by fixed effects such as firm size. The results can thus only be evaluated as indications of a link between uncer-

tainty with regard to the retention rate and training commitment.

If this relationship were to be confirmed in further analyses, it would mean that the dual system of vocational training is faced not only by quantitative challenges against the background that, firstly, future employment gains are to be expected more in the tertiary sector and, secondly, employment relationships are becoming increasingly flexible. In order to make the provision of training more attractive in these sectors, and to give it a future, one approach to be explored is that of greater interlinking between practical work experience, higher education and dual training. The growing trend towards more dual courses of study (cf. Ausbildung-Plus.de 2006) is an indication that the stakeholders have already recognised this need. One must also consider how current changes in the demand for skills can be integrated more rapidly into the dual system. Furthermore, the increasing flexibilisation of the labour market, for which many are calling, is to be critically analysed against the background of these results.

References

Acemoglu, D./Pischke, J.-S. (1998): Why do firms train? Theory and evidence. In: The Quarterly Journal of Economics 113, 79–119.

Acemoglu, D./Pischke, J.-S. (1999a): Beyond Becker: Training in imperfect labour markets. In: Economic Journal 109, pp. F112–F142.

Acemoglu, D./Pischke, J.-S. (1999b): The structure of wages and investment in general training. In: Journal of Political Economy 107, 539–572.

Ausbildung-Plus.de (2006): Projekt Ausbildung-Plus. Informationssystem über Zusatzqualifikationen in der Berufsbildung und duale Studiengänge. Institut der deutschen Wirtschaft, gefördert vom Bundesministerium für Bildung und Forschung.

Alda, H./Allaart, P./Bellmann, L. (2005): Churning and institutions. Dutch and German establishments compared with micro-level data. IAB Discussion Paper 12/2005.

Baethge, M./Solga, H./Wieck, M. (2007): Berufsbildung im Umbruch: Signale eines überfälligen Aufbruchs. Friedrich Ebert Foundation: Berlin, Bonn. http://library.fes.de/pdf-files/stabsabteilung/04258/index.html, accessed on 12 March 2007.

Bardeleben, R. v./Beicht, U./Fehér, K. (1995): Betriebliche Kosten und Nutzen der Ausbildung. Repräsentative Ergebnisse aus Industrie, Handel und Handwerk. Berichte zur beruflichen Bildung 187, Bielefeld: Bertelsmann.

Bartel, A. P./Lichtenberg, F. R. (1987): The Comparative Advantage of Educated Workers in Implementing New Technology. In: The Review of Economics and Statistics 69(1), 1–11.

Becker, G. S. (1964): Human Capital. A Theoretical and Empirical Analysis, with Special Reference to Education. New York, London – Columbia University Press.

Beckmann, M. (2002a): Lohnstrukturverzerrungen und betriebliche Ausbildung. Empirische Analyse des Acemoglu-Pischke-Modells mit Daten des IAB-Betriebspanels. In: Mitteilungen aus der Arbeitsmarkt- und Berufsforschung 35(2), 189–204.

Beckmann, M. (2002b): Wage compression and firm-sponsored training in Germany: Empirical evidence for the Acemoglu-Pischke Model from a zero-inflated count data model. In: Applied Economics Quarterly (Konjunkturpolitik) 48, 368–387.

Bellmann, L. (2002): Das IAB-Betriebspanel. Konzeption und Anwendungsbereiche. In: Allgemeines Statistisches Archiv 86(2), 177–188.

Bellmann, L./Bielenski, H./Bilger, F./Dahms, V./Fischer, G./Frey, M./Wahse, J. (2006): Personalbewegungen und Fachkräfterekrutierung. Erste Ergebnisse des IAB-Betriebspanels 2005. IAB Forschungsbericht 11/2006.

Bellmann, L./Hartung, S. (2005): Zu wenig Stellen und doch sind nicht alle besetzt. IAB Kurzbericht 27/2005.

Breusch, T. S./Pagan, A. R. (1980): The lagrange multiplier test and its applications to model specification in econometrics. In: The Review of Economic Studies 47(1), 239–253.

Bundesministerium für Bildung und Forschung (2005): Berufsbildungsbericht 2005. Bonn, Berlin.

Cramer, G./Müller, K. (1994): Nutzen der betrieblichen Berufsausbildung. In: Beiträge zur Gesellschafts- und Bildungspolitik 195, Institut der deutschen Wirtschaft. Köln.

DuMouchel, W. H./Duncan, G. J. (1983): Using sample survey weights in multiple regression analysis of stratified samples. In: Journal of the American Statistical Association 78, 535–543.

Falk, M. (2002): IKT-Fachkräftemangel und Anpassungsreaktionen der Unternehmen. In: Bellmann, L./Velling, H. (eds.): Arbeitsmärkte für Hochqualifizierte. Beiträge zur Arbeitsmarkt- und Berufsforschung 256. Nürnberg, 37–73.

Franz, W./Soskice, D. (1995): The German apprenticeship system. In: Buttler, F./Franz, W./ Schettkat, R./Soskice, D. (eds.): Institutional frameworks and labor market performance. London, New York, 208–234.

Hartung, S./Leber, U. (2004): Betriebliche Ausbildung und wirtschaftliche Lage * empirische Ergebnisse des IAB-Betriebspanels. In: Krekel, E./Walden, G. (eds.): Zukunft der Berufsausbildung in Deutschland. Empirische

Untersuchungen und Schlussfolgerungen. Ergebnisse der BIBB-Fachtagung am 4./5. November 2003 in Bonn. Berichte zur beruflichen Bildung 273. Bielefeld. 111–129.

Heidenreich, M. (1998): Die duale Berufsausbildung zwischen industrieller Prägung und wissensgesellschaftlichen Herausforderungen. In: Zeitschrift für Soziologie 27(5), 321–340.

Kau, W. (1997): Ausbildung in Großbetrieben: Gewinn oder Belastung? In: Beicht, U./Berger, K./Herget, H./Krekel, E. (eds.): Berufsperspektive mit Lehre; Wert und Zukunft dualer Berufsausbildung. Berichte zur beruflichen Bildung 211. Bielefeld, 333–343.

Neubäumer, R./Bellmann, L. (1999): Ausbildungsintensität und Ausbildungsbeteiligung von Betrieben: Theoretische Erklärungen und empirische Ergebnisse auf der Basis des IAB-Betriebspanels 1997. In: Beer, D./Frick, B./Neubäumer, R./Sesselmeier, W. (eds.): Die wirtschaftlichen Folgen von Aus- und Weiterbildung. München and Mering: Hamp, 9–41.

Niederalt, M. (2004): Zur ökonomischen Analyse betrieblicher Lehrstellenangebote in der Bundesrepublik Deutschland. Europäische Hochschulschriften. Series 5, Volks- und Betriebswirtschaft * 3082. Frankfurt a. M.: Lang.

Papke, L. E./Wooldridge, J. M. (1996): Econometric methods for fractional response variables with an application to 401(K) plan participation rates. In: Journal of Applied Econometrics 11, 619–632.

Schank, T. (2003): Die Beschäftigung von Un- und Angelernten. Eine Analyse mit dem Linked Employer-Employee Datensatz des IAB. In: Mitteilungen aus der Arbeitsmarkt- und Berufsforschung 36(3), 257–270.

Smits, W./Zwick, T. (2004): Why do business service firms employ fewer apprentices? A comparison between Germany and the Netherlands. In: International Journal of Manpower 25(1), 36–54.

Steedman, H./Wagner, K. (2007): The impact of rational ICT qualification systems on companies' recruitment practices – an Anglo-German comparison. In: ZAF 40(2+3).

Steedman, H./Wagner, K./Foreman, J. (2006): Das Angebot an IKT-Fachkräften im Vereinigten Königreich und in Deutschland. In: Europäische Zeitschrift für Berufsbildung 37, 9–23.

Stevens, M. (1994): A theoretical model of on-the-job training with imperfect competition. In: Oxford Economic Papers 46(4), 537–562.

Weesie, J. (1999): Seemingly unrelated estimation and the cluster-adjusted estimator. In: Stata Technical Bulletin 52, 231–248.

Winship, C./Radbill, L. (1994): Sampling weights and regression analysis. In: Sociological Methods and Research 23, 230–257.

Wolter, S. C./Schweri, J. (2002): The cost and benefit of apprenticeship training: The Swiss case. In: Applied Economics Quarterly (Konjunkturpolitik) 48, 347–367.

Wolter, S. C./Mühlemann S./Schweri, J. (2006): Why some firms train apprentices and many others do not. In: German Economic Review 7(3), 249–264.

Annex

Table A
Description of variables – Manufacturing

Independent variables	$\overline{\chi}$	SD
Share of skilled worker jobs offered	0.0193	0.0369
Share of training places offered	0.0150	0.0448
Competition pressure		
Concentration index (log.)	–5.7364	1.5090
Export share (reference 0%)		
1% – 10%	0.1043	0.3057
11% – 25%	0.1131	0.3167
26% – 100%	0.3638	0.4812
Employment stability		
Share of worker resignations	0.0063	0.0255
Share of temporary employment	0.0326	0.0703
Churning rate	0.0236	0.0586
Skill requirements		
Share of skilled workers	0.3113	0.2349
IT investment	14.5267	24.7063
Expansion investment	21.3453	32.6115
Investment per worker	5.9989	3.7998
Very modern plant	0.1665	0.3726
Wage structure distortions		
Collectively agreed wages	0.6331	0.4821
Remuneration above collectively agreed rates	0.4347	0.4959
Control variables		
Poor profit situation	0.3530	0.4780
Employment growth	–0.0047	0.2060
Foreign-owned	0.1423	0.3495
Independent company	0.6567	0.4749
Works council	0.5509	0.4975
No. of cases	1,946	

Source: IAB Establishment Panel West 2005.

Table B

Description of variables – Services

Independent variables	$\bar{x}$	SD
Share of skilled worker jobs offered	0.0299	0.0796
Share of training places offered	0.0232	0.0645
Competition pressure		
Concentration index (log.)	−7.4444	0.0221
Export share (reference 0%)		
1% – 10%	0.0473	0.0038
11%– 25%	0.0151	0.0022
26%– 100%	0.0284	0.0029
Employment stability		
Share of worker resignations	0.0170	0.0009
Share of temporary employment	0.0800	0.0030
Churning rate	0.0603	0.0029
Skill requirements		
Share of skilled workers	0.5512	0.0058
IT investment	22.8361	0.6220
Expansion investment	15.3172	0.5427
Investment per worker	4.6616	0.0687
Very modern plant	0.1885	0.0069
Wage structure distortions		
Collectively agreed wages	0.4811	0.0089
Remuneration above collectively agreed rates	0.1573	0.0065
Control variables		
Poor profit situation	0.2358	0.0075
Employment growth	0.0352	0.0113
Foreign-owned	0.0325	0.0031
Independent company	0.6977	0.0082
Works council	0.2897	0.0081
No. of cases	3,788	

Source: IAB Establishment Panel West 2005.