Apprenticeship training in Germany – investment or productivity driven?*

*Thomas Zwick***

The German dual apprenticeship system has come under pressure in recent years because enterprises have not been willing to provide a sufficient number of apprenticeship positions. An argument that is frequently put forward is that the gap could be closed if more firms were willing to incur net costs during the training period. This paper investigates on the basis of representative data whether German enterprises do indeed incur net costs on average during the apprenticeship period, i.e. whether the impact of an increase in the share of apprentices on contemporary profits is negative. The paper uses the representative linked employer-employee panel data of the IAB (LIAB) and takes into account possible endogeneity of training intensity and unobserved heterogeneity in the profit estimation by employing panel system GMM methods. An increase in the share of apprentices has no effect on profits. This can be interpreted as a first indication that most establishments in Germany do not invest more in apprentices than their productivity effects during the apprenticeship period.

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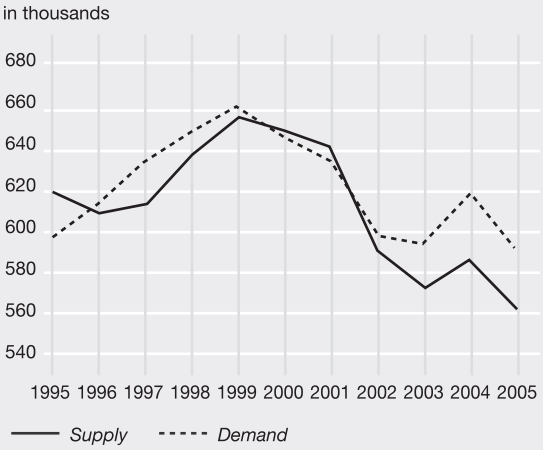
Contents

1 Introduction

The German apprenticeship system is stuck in a deep crisis. Since 2002 the demand for apprenticeship positions has permanently exceeded the supply (see figure 1). While eastern Germany traditionally exhibits a lack of such positions, since 2003 demand for them in western Germany has once again risen above the available number of apprenticeship jobs for the first time in years (see figures A1 and A2 in the appendix).

Figure 1
Development of supply of and demand for apprenticeship positions in Germany



Source: German Institute for Economic Research (Institut der deutschen Wirtschaft) (2006), own illustration.

A frequent reaction to the apprenticeship gap is the complaint that firms do not invest enough in training apprentices. In this respect, it is usually argued that apprentices' wages frequently lie above their productivity during their training period. This means that companies have to recoup the positive net investment costs after the apprentice has completed training. This might be a problem especially if the shares of apprentices who stay at their training firms are small or when the labour market situation does not make it possible to pay skilled employees who have been trained in-house a wage that is lower than their productivity (Smits and Zwick 2004; Wolter et al. 2006). An important empirical question that needs investigating in order to be able to provide advice on how to increase the number of apprenticeships is therefore whether German firms do invest in apprentices during their training period, i. e. whether they have net costs that have to be recovered after the apprentices have completed training.

A first indication that net investment costs during the apprenticeship period are indeed an important obstacle to an increase in apprenticeship training is that according to the IAB establishment panel of 2004,[1] the most important reasons for not conducting apprenticeship training were: "We cannot retain the apprentices after the end of their apprenticeship" and "Self-conducted apprenticeship training is too laborious/expensive". By contrast, reasons such as "We meet our requirements by hiring qualified staff" or "We would like to provide apprenticeship training but no appropriate applicants are available" were not mentioned as frequently. This paper therefore tries to assess whether German establishments do indeed incur net investment costs during apprenticeship training. This question is assessed empirically by measuring the impact of the apprentice share or its change on the firm's contemporaneous profit (or its change) before the apprentices complete training. If the impact is negative, we deduce that establishments on average incur net investment costs during the apprenticeship period.

Beicht et al. (2004) calculate that the net costs of apprenticeship training amount to between 30 and 70 % of the total training costs in Germany, while Wolter et al. (2006) show that in the majority of Swiss firms that provide apprentice training, productivity is at least equal to the apprentices' wages. The potential apprenticeship training costs of firms that do not offer this kind of training are markedly higher than the feasible productivity gain due to apprenticeship training in Switzerland. Accordingly, the non-training firms would have to accept greater losses during apprenticeship training if they were to provide such training. Both cross-section approaches have been carried out on the basis of extensive and careful measurements of the costs and benefits of apprentices during the apprenticeship training. They have to impute the potential apprenticeship benefits and costs of those firms that do not train apprentices using selection models and cannot directly tackle unobserved time invariant heterogeneity between firms, however.

In order to measure the impact of apprenticeship training on company performance, one estimation strategy is to compare the apprentices' productivity and their wages. In the literature the contributions of different qualification groups to a company's productivity and their shares of the wage costs are usually calculated separately. Hellerstein et al. (1999)

[1] This is a descriptive evaluation of item 84 of the IAB establishment panel of 2004, concerning firms which, in spite of being authorised to conduct apprenticeship training, do not offer apprenticeship positions.

and Galindo-Rueda and Haskel (2005), for example, compare in non-linear panel regressions the marginal productivity of different employee types with their relative wages.[2] A larger positive share of productivity than the share of relative wages for a certain qualification group is interpreted as rent extraction by the firm from this qualification group. This paper pursues a different route here – it constructs a direct measure of profits and estimates the impact that different shares of qualification levels have on it, and it uses linear estimation models.

The contribution by Fougère and Schwerdt (2002) is closer to our approach. They estimate the net effect of the number of apprentices on the expected output value for French and German firms using translog production functions. They take the endogeneity of apprenticeship training into account by using a cross-section endogenous switching regression model and distinguish between three groups of firm sizes. They find a relatively high productive impact of apprentices for medium-sized German establishments (20–200 employees). They conclude that small and large German establishments use apprenticeship training mainly to find and hire appropriate skilled workers while the productivity contribution is the most important motivator for medium-sized establishments to provide apprenticeships.

This paper makes two main contributions to the literature on the impact of apprenticeship training on the profitability of enterprises. It presents – for the first time to my knowledge – direct evidence based on representative and extensive data including training and non training establishments and it estimates the contribution of the share of apprentices to establishment profit directly in a profit estimation. Here the relatively low productivity of apprentices is compared directly with their relatively low wages. Moreover, with the aid of panel estimation techniques this paper takes the endogeneity in the composition of the qualification structure into account in the profit function as well as the unobservable time-invariant heterogeneity of firms.

The paper is structured as follows. The next section discusses the determinants of the demand for apprentices and their impact on profits. Subsequently, the estimation strategy of the paper is presented. The fourth and the fifth sections describe the data and the estimation results. The last section interprets the findings and their implications.

[2] Please note that these studies include neither apprenticeship shares nor German data.

2 Literature and theoretical background

When asked about the crucial motives for providing apprenticeship training in their own firms, company owners often point out the social responsibility, the positive effects on the company's image, or the company's tradition of apprenticeship training (Sadowski 1980; Stalder 1999; Niederalt et al. 2001; Schweri et al. 2003). In contrast, empirical studies show that the concrete decision for apprenticeship efforts mainly depends on the company owner's individual cost-benefit calculation (Wolter et al. 2006).

According to the so-called "warehouse model" (Backes-Gellner 1992, 1995) the optimal number of apprentices is derived by calculating the costs of in-house training and the costs of taking on workers trained elsewhere. Thereby it is assumed that both a shortfall and an excessive number of a firm's own apprenticeship trainees lead to opportunity costs. The decision to provide apprenticeship training in one's own firm crucially depends on whether the firm's owner expects the training costs to be covered during training by means of the apprentice's own productivity (productivity orientation, Lindley 1975; Neubäumer 1999) or after training by the remuneration of the newly trained employee who remains with the firm being lower than his/her productivity (investment orientation). If the firm has a productivity orientation, the apprentices' contributions to productivity during their apprenticeship period cover or even exceed the apprentices' wages, the trainer's wage, the acquisition and preservation costs for material, instruments and infrastructural facilities.

Based on Becker's theory of human capital (Becker 1964), a number of models have been established that motivate an investment orientation which allows net investment costs during the apprenticeship period. Ex post, the net investment costs for training can be profitable for a firm if the personnel who are trained in-house, and whose productivity is higher than their wage, are subsequently employed in the training firm (Acemoglu and Pischke 1998, 1999a, b; Booth and Zoega 2000). Paying skilled employees a wage that is lower than their productivity can be justified by a number of arguments that focus on labour market imperfections.

First of all, apprenticeship training may be mainly industry-specific or rather firm-specific (Becker 1964). This means that the apprentice would have a much lower productivity with other potential employers, which puts the training firm in a favourable bargaining position (Acemoglu and Pischke 1999a,

b; Smits and Stromback 2001). This argument is weak in the German context because most qualifications are quite standardised, objectively tested and easily transferable to other firms in the same sector (Zwick 2001; Stevens 2004).

A further argument for a profit contribution by a firm's own apprentices after the end of their traineeship is that apprentices prefer to stay in their home region (Niederalt et al. 2001). Remuneration below the productivity level is therefore possible as long as it is not lower than elsewhere when considering the opportunity costs for mobility (Harhoff and Kane 1997; Euwals and Winkelmann 2001).

Also, asymmetric information with regard to the contents of training programmes can be considered important for wage reductions. When external firms cannot assess the specific training in a firm precisely, there is an incentive to provide general training contents, too. Hence, the result is a higher productivity of a firm's own apprentices which is not compensated by an equivalent wage increase (Chang and Wang 1996; Katz and Ziderman 1990; Smits and Stromback 2001). The mechanism described above seems not to be particularly relevant for Germany because of the high transparency of the training contents (Smits and Zwick 2004; Niederalt et al. 2001).

Asymmetric information on a specific apprentice's skills is another argument. Apprenticeship training providers aim to retain a highly productive apprentice in their own firm. Their information advantage over other firms is utilized by firing the less productive apprentices. External firms cannot assess the real potential of a newly-trained apprentice and are thus not willing to pay the full wage for them (Elbaum and Singh 1995; Franz and Soskice 1995; Acemoglu and Pischke 1998).

Altogether, there is neither a theoretical nor an empirical consensus with regard to the extent to which the demand for apprentices in Germany is influenced by the willingness of firms to invest in apprentices (Schwerdt and Bender 2003; Dustmann and Schönberg 2004). It is therefore unclear whether firms pursue a productivity-oriented or an investment-oriented apprenticeship training policy. This paper examines for the first time for Germany whether the intensity of apprenticeship training influences the contemporary and the future profit per employee. For this it assesses whether German firms on average incur net investment costs during the apprenticeship period or not.

In a production-oriented firm, a larger share of apprentices increases profits. In contrast, in investment-oriented firms a larger share of apprentices reduces contemporary profits. It can be positive in the long run, however, to increase the share of apprentices if it is possible to keep the apprentices in the firm after training and pay them a wage below their productivity. Correspondingly, the relation between the share of apprentices and contemporary profits is an indicator of an orientation towards production or towards investment.

We also include the share of other employee groups, e. g. different qualification groups in the profit function. These shares can be affected by labour market inflexibilities, i. e. in this case by dismissal protection. While firms can influence their share of apprentices directly, especially shrinking firms may face an inefficient composition of staff because employees cannot be laid off and replaced at will (Berthold and Fehn 1998). Another reason for inflexibilities and an inefficient composition of the workforce may be a lack of suitably skilled job applicants (Kölling 2002). As a consequence, some firms might not have their profit-optimal employee mix and an increase in the share of a particular employee group would boost profits. Further personnel characteristics that can play a role with regard to profits are the share of foreign nationals (Zimmermann 1998), as well as the average age and the average tenure (Lazear 1981).

Classical explanatory factors for profits are the market size and (international) competitiveness (Fletcher 2001; Gale 1972). These are taken into account by the share of exports (Abel and Blanchard 1986). Another important factor may be investments. However, in contrast to the variables mentioned previously it is not clear whether high investments boost profits or whether high profits enhance the investment affinity. In addition, works councils may have an impact on profits or on productivity (Addison et al. 2004; Zwick 2004). Finally, eastern German firms are notoriously less profitable than their western German counterparts.

For the following estimation it is important to note that apart from the variables mentioned above, the differentiation into different sectors, industries and firm sizes, additional potentially important factors cannot be observed. The quality of industrial relations or cyclic fluctuations in demand, for example, can also be determinants of a firm's profits but this cannot be controlled for directly in our regressions.

3 Empirical specifications

In this paper the impact of the share of apprentices on profits is estimated as follows:

$$\pi_{it} = \alpha + \beta \cdot x'_{it} + y \cdot u'_i + \delta_i + \varepsilon_{it}, \qquad (1)$$

where t is a time indicator, i is an establishment indicator, π_{it} is the profit per employee, and x is a column vector of time-variant explanatory variables. The column vector u represents (practically) time-invariant explanatory variables. Finally, δ denotes the unobservable time-invariant factors and ε stands for the normally distributed error term with an expected value of zero.

In the first step the profit functions of the firm are pooled, i. e. they are estimated as a cross-section regression including observations from different years. This increases the number of observations, it also means that a firm that appears in several years, though it is seen as a separate observation unit each time. Moreover, an estimation bias can occur in this specification because of the unobserved firm heterogeneity, i. e. most firms have unobserved characteristics that influence both the firm's profits and the share of apprentices. Examples are the quality of industrial relations or the innovation pressure that a firm faces. In our estimation, the influence that a large share of apprentices has on profits is, for example, upwardly biased when good industrial relations lead to higher profits on the one hand and to greater training endeavours on the other hand. A further source of estimation bias is the possible endogeneity of the share of apprentices and other explanatory variables. It is possible that firms alter their qualification structure simultaneously with profits or that both are influenced by exogenous shocks such as a positive trend in demand. It is conceivable, for example, that higher profits are a consequence of good personnel management and this also goes along with relatively intensive apprenticeship training efforts. In contrast, a relatively low profit level might be an indication of a problem associated with structural labour costs, which the establishment might try to solve by substituting skilled workers with apprentices.

Time-invariant unobserved heterogeneity can be avoided by estimating the model in first differences or by demeaning the cross-section equations. In other words, we explain the change in profits from one year to the next by means of a change in the composition of the qualification of the employees and other covariates. In the second step, the profit functions are therefore estimated using a so-called fixed effects or within estimator (Wooldridge 2002: 267–269):

$$\Delta\pi_{it} = \beta \cdot \Delta x'_{it} + \varepsilon_{it}. \qquad (2)$$

Endogeneity of the explanatory variables can finally be removed by an instrumental variable regression. It is convenient, in this respect, to use GMM estimations with internal instruments, i. e. other moments of the same variable (Arellano and Bond 1991). More precisely, the first differences of the explanatory variables are instrumented here by the levels of the lagged variables. We have to use lags t-2 if the variables are potentially endogenous and lags t-1 if they are predetermined. We argued above that investments might be predetermined, i. e. profits in the last period have an impact on contemporary investments, while we assume that all other time-variant covariates are potentially endogenous. The prediction power of the internal instruments could be small, however, given the only minor changes in the qualification structure of the workforce from one year to another, for example. This could evoke biases in the GMM estimator in first differences (Blundell and Bond 1998).

We therefore prefer the so-called system GMM estimator developed by Arellano and Bover (1995). Here, the differences are instrumented again with lagged levels as internal instruments. Simultaneously the levels of the covariates are instrumented by adequate lagged differences. The main advantage of this approach is that besides the temporary differences, also differences in levels between firms are taken into account in the estimation. This improves the information used in identifying the effect and usually enhances the precision of the estimator. A necessary condition for the system GMM estimator is that the correlations between the unobserved fixed effects and the covariates remain constant over time (Arellano and Bover 1995). The profit estimations are carried out with the aid of a two-step method under the application of Windmeijer's adjustment process for variances (Windmeijer 2005), using the command xtabond2 in STATA 9.2 (Roodman 2006).

4 Data

The data originate from the Linked Employer-Employee dataset of the IAB (LIAB), waves 1997–2004. The LIAB combines the employment statistics of the Federal Employment Agency (IABS) with establishment data from the IAB establishment panel. The employee statistics are taken from the German Register of Employees (*Beschäftigtenregister*), which contains information on more than 98 percent of the employees in the firms of the IAB establishment panel (Alda 2005). The advantage of this linked data set is that it is not necessary to resort to the subjective estimation of the respondents in the IAB establishment panel with respect to the crucial employee qualification variable, thus minimising measurement error. The IAB establishment

Table 1
Descriptive statistics at establishment level

Variables	Number of observations	Averages
Profits per employee in € (log)	27007	11.95
Number of employees	47476	183.04
Investment per employee in € (log)	31048	6.87
Share of apprentices	47640	0.08
Share of employees with lower secondary school education, without vocational training	47640	0.15
Share of employees with lower secondary school education, with vocational training	47640	0.62
Share of employees with upper secondary school education, without vocational training (reference group)	47640	0.01
Share of employees with upper secondary school education, with vocational training	47640	0.03
Share of employees with a polytechnic degree	47640	0.03
Share of employees with a university degree	47640	0.05
Average tenure in days	47637	1946.41
Average age	47640	38.81
Share of exports	32314	7.82
Share of females	47640	0.36
Share of foreigners	47640	0.05
Share of part-time employees	47640	0.13
Collective bargaining	47640	0.75
Works council	47265	0.41
Eastern Germany	47640	0.42

Source: LIAB, waves 1997–2004, own calculations.

panel is an annual survey of between 9,000 (in 1997) and 16,000 (in 2004) establishments.[3] As some questions are asked retrospectively, our panel spans the period 1997–2003.

The profit variable is calculated by subtracting the expenditure on inputs and the wage sum from the turnover (all divided by the number of employees) and by subsequently taking the logs in order to reduce the impact of outliers on the results.[4] Because of the lack of a variable concerning capital and capital costs in the panel, no capital costs can be considered when calculating the profits – I assume that this is unproblematic especially in the estimation specifications based on differences because it seems improbable that capital costs vary with shares of apprentices. Investments, profits and employee characteristics are divided by the number of employees in order to avoid measuring scale effects such as a positive correlation between the levels of investments and profits. This means, for example, that profits per employee are explained by the share of apprentices.

As motivated above, we distinguish between the groups "in apprenticeship training", "lower secondary school qualification without vocational training", "lower secondary school qualification with vocational training", "upper secondary school leaving certificate without vocational training", "upper secondary school leaving certificate with vocational training", "degree from a university of applied sciences/polytechnic", and a "degree from a university". Here we take into account full-time employees only because a similar classification of qualifications is not available for part-time employees and we have no information about working hours. We also

[3] For further information on the IAB establishment panel see Kölling (2000).
[4] Profit per employee and investment per employee are added with a constant – the largest negative number found in the variables – to ensure that all the values are positive and hence can be logarithmised. The wage sum stems from the individual wage information in the employment register. It is censored at the social security insurance ceiling. For the censored wage regressions, we use an imputation procedure analogous to that described in Addison et al. (2006).

include further employee characteristics such as the average tenure and age, the share of foreigners, females and part-time employees. Two indicators for industrial relations are also included: the presence of works councils and collective bargaining. Finally, it can be assumed that investment per employee and the export share are correlated with profits.

The variable "in apprenticeship training" in the IABS also includes volunteers, interns, apprentices in full-time vocational schools (e. g. in the healthcare sector), as well as participants in vocational training and initial training. Therefore, interns and volunteers whose careers are still not established are excluded from the information on "activity performed". Furthermore, an alternative variable is generated from the social insurance notification (*DEÜV Meldung*), which explicitly excludes interns, working students, and short-term employees. In both variables the shares of apprentices are slightly larger than in comparable data sets, at around 8 % of the workforce, partly because they include apprentices in full-time vocational schools and employees participating in continuing training. As a robustness test, the subjective information on the share of apprentices from the respondents of the IAB establishment panel was also used. All three indicators for the share of apprentices yield practically the same results and therefore only the results based on the social insurance notification are presented (cf. table 1).

5 Findings

The pooled profit estimation in table 2 shows that the share of apprentices is significantly negatively correlated with profits. In addition, higher investments per employee, the presence of works councils, collective bargaining, and the export share are all positively correlated with profits. The share of employees with a qualification below the level of the upper secondary school certificate has a negative correlation, while the share of employees with a higher qualification is positively correlated with

Table 2
Pooled regression, dependent variable: profit per employee

Variable	Coefficient	Standard deviation
Investment per employee	0.017***	0.001
Share of apprentices	–0.194***	0.025
Works council	0.091***	0.005
Share of employees with lower secondary school education, without vocational training	–0.084***	0.014
Share of employees with lower secondary school education, with vocational training	–0.045***	0.009
Share of employees with upper secondary school education, with vocational training	0.380***	0.047
Share of employees with a polytechnic degree	0. 262***	0.036
Share of employees with a university degree	0.117***	0.029
Average tenure	0.002	0.001
Average age	0.015	0.019
Share of exports	0.050***	0.005
Share of foreigners	0.083***	0.022
Collective bargaining	0.041***	0.004
Share of females	–0.038***	0.009
Share of part-time employees	0.288***	0.019
Constant	11.699***	0.069
Number of observations	22,590	
Adjusted R^2	0.1267	
F (15, 22590) (Probability F>0)	210.92 (0.00)	

Source: LIAB, Waves 1997–2004, own calculations.
*Notes: Significance levels: * < 0.1; ** < 0.05; *** < 0.01, reference value for qualification shares: upper secondary school education without vocational training, additional variables: year dummies, 16 sector dummies, 3 establishment size dummies and eastern Germany dummy.*

Table 3
Fixed effects regression, dependent variable: profits per employee

Variable	Coefficient	Standard deviation
Investment per employee	0.003***	0.001
Share of apprentices	–0.0005	0.039
Share of employees with lower secondary school education, without vocational training	–0.031	0.035
Share of employees with lower secondary school education, with vocational training	–0.041*	0.024
Share of employees with upper secondary school education, with vocational training	0.133*	0.057
Share of employees with a polytechnic degree	–0.009	0.060
Share of employees with a university degree	0.110*	0.059
Average tenure	–0.001*	0.0004
Average age	0.011	0.032
Share of exports	–0.006	0.007
Share of foreigners	0.044	0.050
Share of females	0.007	0.021
Share of part-time employees	0.494***	0.020
Constant	11.805***	0.121
Number of observations (firms)	22,757 (9,130)	
F(13,13614) (Probability F>0)	54.08 (0.00)	

Source: LIAB, Waves 1997–2004, own calculations.
*Notes: Significance levels: * < 0.1; ** < 0.05; *** < 0.01, reference value for qualification shares: upper secondary school education without vocational training.*

profits. The share of foreigners and part-time employees is positively correlated with profits while the share of female employees is negatively correlated.

The pooled regression might be biased because observations of the same company in different years are regarded as independent, and unobserved heterogeneity cannot be taken into account. The fixed effects regression in table 3 correspondingly shows a smaller number of significant coefficients. Higher investments per employee and a larger share of part-time employees still correlate positively with higher profits per employee. The share of apprentices is now insignificant, while again employees with lower qualification levels have a negative correlation with profits and employees with higher qualification levels have a positive correlation with profits. Average tenure is now negatively correlated with profits. Please note that we had to exclude all time-invariant variables in the fixed effects estimation.

The endogeneity problem is tackled in the system GMM regressions. Here, the lagged endogenous variable is added and instrumented. Investment per employee is regarded as a potentially predetermined variable, the dummies for industry, time, works councils, collective bargaining, eastern Germany and firm size are assumed to be exogenous. The remaining variables are potentially endogenous. The lagged endogenous variable has a significantly positive impact on profits per employee (cf. table 4). Both the lagged share of apprentices and the contemporary share of apprentices have a positive but insignificant impact on profits. These results of our preferred estimation specification therefore correspond with results from Switzerland to the effect that the majority of firms are not willing to bear net costs during apprenticeship training (Wolter et al. 2006). They are, however, in contrast to German studies based on surveys of direct costs and benefits, which indicate that firms incur net costs during the apprenticeship training period in almost all apprenticeship occupations (von Bardeleben et al. 1995; Beicht et al. 2004).

While the contemporary shares of lower secondary education with and without vocational training and the share of employees with a university degree have a negative impact on profits, their lagged values are positive. According to our theoretical hypotheses, the contemporaneous share of investments has a positive impact on profits per employee. Both the share of part-time employees and the share of foreigners have a positive impact on profits. The

Table 4

Two-step dynamic panel system GMM regression, dep. var.: profits per employee

Variable	Coefficient	Standard deviation
Profits per employee		
L1	0.272***	0.048
Investments per employee	0.003**	0.001
L1	0.000	0.001
Share of apprentices	0.085	0.197
L1	0.121	0.137
Share of lower secondary school education without vocational training	–0.410**	0.179
L1	0.278*	0.154
Share of lower secondary school education with vocational training	–0.235**	0.103
L1	0.226**	0.088
Share of upper secondary school education with vocational training	–0.060	0.273
L1	0.243	0.266
Share of polytechnic degree	0.082	0.300
L1	0.017	0.196
Share of university degree	–0.633*	0.330
L1	0.779***	0.285
Average tenure	0.059	0.043
L1	–0.038	0.033
Average age	–0.210	0.192
L1	0.218	0.134
Share of exports	0.017	0.046
L1	0.012	0.020
Share of foreigners	0.372**	0.170
L1	–0.162	0.157
Share of females	0.095	0.098
L1	–0.056	0.060
Share of part-time employees	0.202*	0.111
L1	–0.138**	0.055
Works council	0.053***	0.012
Collective bargaining	0.008	0.006
Eastern Germany	–0.072***	0.019
Constant	8.541***	0.837
Number of observations (establishments)	12,264 (5,152)	
F(53, 5151) (Probability F>0)	36.24 (0.00)	
Hansen Test on over-identification (Probability > χ^2)	$\chi^2(259) = 252.96$ (0.594)	
Arellano-Bond Test for AR(1) in first differences (Pr > z)	z = -7.87 (0.00)	
Arellano-Bond Test for AR(2) in first differences (Pr > z)	z = 1.23 (0.217)	

Source: LIAB, Waves 1997–2004, own calculations.
*Comments: Significance levels: * < 0.1; ** < 0.05; *** < 0.01. L1 means lag by 1 year, reference value for qualification shares: upper secondary school education without vocational training, additional variables: year dummies, 16 sector dummies, 3 establishment size dummies.*

presence of works councils has a positive impact on profits, location in eastern Germany a negative impact.[5] The estimation diagnostics indicate that our preferred estimation specification is acceptable: the Hansen test does not indicate over-identification and the Arellano-Bond test does not indicate AR(2).

6 Conclusions

This paper examines for the first time the impact of (changes in) apprenticeship training intensity on (changes in) firms' profits in the same and in the subsequent year for Germany. The data basis is the 1997–2004 waves of the representative linked employer-employee data set of the IAB (LIAB). This data set has the advantage that crucial variables such as the wage sum, the qualification-level shares and the share of apprentices in an establishment stem from administrative individual data and they are therefore measured with a comparatively low measurement error.

The main question which this paper tries to answer is whether German establishments are investment-oriented and accept net costs during the training period or whether they already try to recoup these costs via the apprentice's productivity during the training period. The motivation for this exercise is the notion that if German establishments invested more in apprenticeship training, the current gap in apprenticeship offers could probably be reduced. Our preferred estimation version shows that on average an increase in the share of apprentices has no impact on establishment profits in the same year or a year later. We might interpret this as a first indication that the majority of German firms do not pay more for the apprentices than their productivity during the apprenticeship period. This finding is similar to results from Switzerland and indicates that a greater willingness to invest in apprentices could potentially increase the number of apprenticeships offered.

In order to identify which establishments pay more than productivity during apprenticeship training and which occupations lead to net costs or returns during the apprenticeship period there are several natural extensions to the present approach. On the one hand, differences in the profit impact of training intensities for several groups of establishments (for example those with and without works councils, establishments in a certain sector, size bracket, region etc.) should be analysed. On the other hand, the share of different occupations that have different net costs during apprenticeships (cf. Schweri et al. 2003 or Beicht et al. 2004) should be taken into account.

[5] These coefficients may be biased, however, because we do not correct for potential endogeneity.

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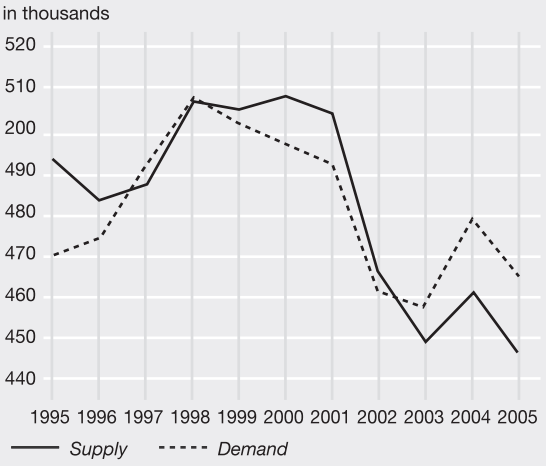
Appendix

Figure A1

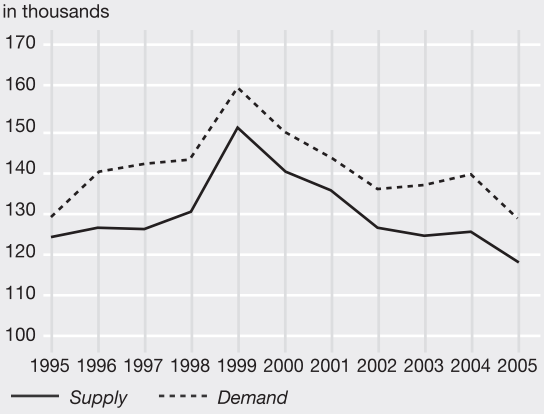
Supply of and demand for apprenticeship positions in western Germany



Source: German Institute for Economic Research (Institut der deutschen Wirtschaft) (2006), own illustration.

Figure A2

Supply of and demand for apprenticeship positions in eastern Germany



Source: German Institute for Economic Research (Institut der deutschen Wirtschaft) (2006), own illustration.