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Heterogene Arbeit: Positive und Normative Aspekte der Qualifikationsstruktur der Arbeit

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Abstract:

The German dual apprenticeship system came under pressure in recent years because enterprises were not willing to offer a sufficient number of apprenticeship positions. A frequently made argument is that the gap could be closed if more firms would be willing to incur net costs during the training period. This paper investigates on the basis of representative data whether German enterprises on average indeed incur net costs during the apprenticeship period, i.e. if 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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Apprenticeship training in Germany – investment or productivity driven?

Thomas Zwick[1]

Abstract

The German dual apprenticeship system came under pressure in recent years because enterprises were not willing to offer a sufficient number of apprenticeship positions. A frequently made argument is that the gap could be closed if more firms would be willing to incur net costs during the training period. This paper investigates on the basis of representative data whether German enterprises on average indeed incur net costs during the apprenticeship period, i.e. if 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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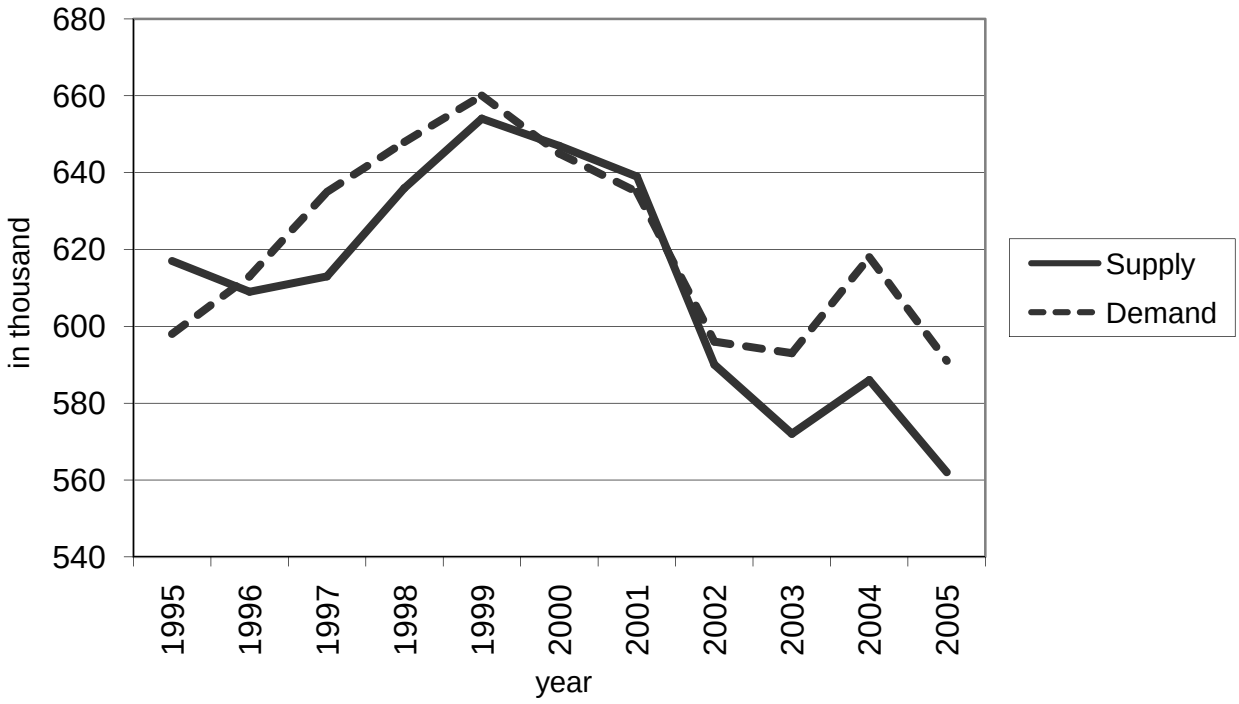
I. Introduction

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

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



Source: Institut der deutschen Wirtschaft (2006), own illustration

A frequent reaction to the apprenticeship gap is the complaint that the firms do not invest enough in training apprentices. In this regard, it is usually argued that apprentices' wages frequently lie above their productivity during their training period. This means, however, that companies have to retrieve the positive net investment costs after the graduation of the apprentice. This might be a problem especially if the shares of the apprentices who stay at their training firms are low or when the labour market situation does not allow to pay a wage for skilled employees trained in-house that is lower than the productivity (Smits and Zwick 2004; Wolter et al. 2006). An important empirical question for giving

advice on how to increase the number of apprenticeships therefore is 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 graduation of the apprentice.

A first indication that net investment costs during the apprenticeship period are indeed an important obstacle for an increase in apprenticeship training is that according to the IAB establishment panel 2004[2], 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 offer apprenticeship training but no appropriate applicants are available" were not mentioned as frequently. This paper therefore tries to assess whether German establishments indeed incur net investment costs during the apprenticeship training. This question is empirically assessed by measuring the impact of the apprentice share or its change on the contemporaneous profit (or its change) of the firm before they graduate. If the impact is negative, we deduct that establishments on average incur net investment costs during the apprenticeship period.

Beicht et al. (2004) calculate that there are net costs of apprenticeship training between 30 and 70% of the total training costs in Germany while Wolter et al. (2006) show that in the majority of Swiss firms with apprentice training, productivity is at least equal to apprentices' wages. The potential apprenticeship training costs of firms that do not offer that kind of training are markedly higher than the feasible productivity gain by apprenticeship training in Switzerland. Accordingly, the non-training firms would have to accept higher losses during apprenticeship training if they were to carry out such training. Both cross section approaches have the disadvantage that they include subjective estimations of costs and benefits that may be biased by measurement errors[3] and by social desirability. Beicht et al. (2004, p. 31) reckon that the costs for the supervisors probably are over-estimated and the productivity of the apprentices under-estimated.

[2] This is a descriptive evaluation of item 84 of IAB Betriebspanel 2004, concerning firms that, in spite of being authorised to carry out apprenticeship training, do not offer apprenticeship positions.

[3] In both studies for example apprentices´ benefits are calculated from benefits indicated by the respondent separately for typical unskilled and skilled activities and the share of activities the apprentices usually work as a substitute for unskilled and skilled employees in the firm. In Germany, 2500 establishments have been asked on one profession each. As about 50 professions were covered, only 50 answers constituted the basis for the costs calculations per profession on average (Beicht et al., 2004, pp. 9-20).

In order to measure the impact of apprenticeship training on company performance, one estimation strategy is to compare the apprentices' productivity and wages. In the literature usually the contributions of different qualification groups to a company's productivity and their shares to the wage costs are calculated separately. Hellerstein et al. (1999) and Galindo-Rueda and Haskel (2005) compare, for example, in non-linear panel regressions the marginal productivity of different employee types with their relative wages.[4] A higher positive share on productivity than the share on relative wages by 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 of different qualification shares on it and it uses linear estimation models.

Closer to our approach is the contribution by Fougère and Schwerdt (2002). 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 endogeneity of apprenticeship training into account by using a cross-section endogeneous switching regression model and distinguish between three groups of firm sizes. They find a relatively high productive impact of apprentices for middle-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 middle-sized establishments to offer apprenticeships.

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

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

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 section describe the data and the estimation results. The last section interprets the findings and their implications.

II. Literature and Theoretical Background

When asked about the crucial motives for 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 in apprentice 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 from calculating the costs of in-house training and the costs of adoption of workers trained elsewhere. Thereby it is assumed that both the shortfall and the excessive number of own apprenticeship trainees lead to opportunity costs. The decision to provide apprenticeship training in the own firm critically 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 the training through remuneration being lower than the staying former graduate apprentice's productivity (investment orientation). If the firm has a productivity orientation, the apprentices' contributions to productivity during their apprenticeship period cover or even go beyond the apprentice's wage, 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 were established that motivate an investment orientation that allows net investment costs during the apprenticeship period. Ex post, the net investment costs for training can be profitable for the firm if the personnel trained in-house, whose productivity is higher than the wage, is employed in the training firm (Acemoglu and Pischke, 1998, 1999a,b; Booth and Zoega, 2000). A lower wage than their productivity for the skilled employees can be justified by a number of arguments that focus on labour market imperfections

First of all, apprenticeship training may mainly be industry-specific or rather firm-specific (Becker, 1964). This means that the apprentice has a much smaller productivity at other potential employers and this gives the training firm 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 rather standardised, objectively tested and easily transferable to other firms in the same sector (Zwick 2001; Stevens, 2004).

A further argument for a profit contribution of own apprentices after the end of their traineeship is that apprentices prefer to stay in their home region (Niederalt et al., 2001). Remunerations below the productivity level are therefore possible as long as they are not lower than elsewhere 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 as important for wage reductions. When external firms cannot precisely assess the specific training in a firm, there is an incentive to provide also general training contents. Hence, the result is a higher productivity of the own apprentices which is not compensated by an equivalent wage increase (Chang and Wang, 1996; Katz and Ziderman, 1990; Smits and Stromback, 2001). The above described mechanism seems to be not particularly relevant for Germany because of the high transparency of the training contents (Smits and Zwick, 2004; Niederalt et al., 2001).

Asymmetric information on the specific apprentice's skills is another argument. Apprenticeship training providers are aiming at retaining a highly productive apprentice in the 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 these (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 the 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. The current paper examines for the first time for Germany whether the apprenticeship training intensity influences the

contemporary and the future profit per capita. It hereby assesses whether the German firms on average incur net investment costs during the apprenticeship period or not.

In a production-oriented firm, a higher share of apprentices increases profits. On the contrary, for investment-oriented firms a higher share of apprentices reduces contemporary profits. It can be positive in the long-run, however, to increase the share of apprentices whether it is possible to keep the apprentices in the firm and pay them a wage below their productivity. Correspondingly, the relation between the share of apprentices and contemporary profits is an indicator for 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. This can be motivated by labour market inflexibilities, i.e. in this case by dismissal protection. While the firms can directly affect their share of apprentices, especially shrinking firms may face an inefficient composition of staff because employees cannot be replaced and laid off 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 of the share of a particular employee groups 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 explanation factors for profits are the market size and the (international) competitiveness (Fletcher, 2001; Gale, 1972). These are taken account of by the share of exports (Abel and Blanchard, 1986). Another important factor may be investments. However, in contrast to the previously mentioned variables 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, East German firms are notoriously less profitable than their West German counterparts.

For the following estimation it is important to note that besides the variables mentioned above, the differentiation in 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 for the firm's profits while this cannot be directly controlled in our regressions.

III. Empirical Specifications

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

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

where t is a time indicator, i is an establishment indicator, π_{it} is the profit per capita, 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 expectance value of zero.

As a 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. That increases the number of observations, it also means that a firm that appears in several years is seen as a separate observation unit each time, however. Moreover, an estimation bias can occur in that 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 a firm faces. In our estimation, the influence of a large share of apprentices on profits is for example upward biased when good industrial relations lead to higher profits on the one hand and to higher 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 exogeneous 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 high apprenticeship training efforts. In contrast, a relatively low profit might be a signal for a structural labour costs problem the establishment might try to solve by substituting skilled workers by 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 employer qualification and other covariates. As a second step, the profit functions are therefore estimated using a so-called fixed effects or within estimator (Wooldridge, 2002, pp. 267-269):

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

Endogeneity of the explanatory variables finally can 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 endogeneous 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 endogeneous. The prediction power of the internal instruments could be small, however, given the only minor changes in the qualification structure of the employees from one year to another, for example. That could evoke biases in the GMM Estimator in first differences (Blundell and Bond, 1998).

Therefore we prefer the so-called System GMM Estimator 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 among firms in levels are taken account of in the estimation. That 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 help 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).

IV. 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 Employee Register (*Beschäftigtenregister*) which contains information on more than 98 percent of the employees in the firms from the IAB establishment panel (Alda, 2005). The advantage of this linked data set lies in the fact that no resorting to the subjective estimation of the respondent in the IAB establishment panel is needed with respect to the crucial employee qualification variable and therefore measurement error is minimised. The IAB establishment panel is an annual survey of between 9,000 (in the year 1997) and 16,000 (in the year 2004) establishments.[5] Some questions are posed retrospectively and therefore our panel spans the period 1997-2003.

The profit variable is calculated by subtracting the expenditures for 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.[6] Because of the lack of a variable concerning capital and capital costs in the panel, no capital costs can be considered in calculating 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 to measure scale effects such as a positive correlation between the levels of investments and profits. This means for example that profits per head are explained by the apprentice share.

[5] For further information about the IAB establishment panel see Kölling (2000).

[6] Profit per capita and investment per capita are added with a constant - the largest negative number found in the variables - to make sure that all 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 level. For the censored wage regressions, we use an imputation procedure analogously to that described in Addison et al., (2006).

As motivated above, we distinguish between the groups “in apprenticeship training“, “secondary school qualification without professional degree“, “secondary school qualification with professional degree”, “tertiary school qualification without professional degree, “tertiary school qualification with professional degree“, “degree from a university of applied sciences”, 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 do not know working hours. We also 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 investments per employee and export share are correlated with profits.

The variable “in apprenticeship training“ in the IABS also includes volunteers, interns, apprentices in full-time schools (e.g. in the healthcare sector), as well as participants in vocational training and initial training. Therefore, interns and volunteers with still not established careers are excluded from the information on “performed activity“. Furthermore, an alternative variable from the social assistance notification (*DEÜV Meldung*) is generated, that explicitly excludes interns, working students, and short-term employees. In both variables the shares of apprentices are with around 8% of the work force slightly higher than in comparable data sets, partly because they include apprentices in full-time schools and employees participating in vocational training. As a robustness check also the subjective information on the share of apprentices from the IAB establishment panel have been used. All three indicators for the share of apprentices lead to practically the same results and therefore only the results on the basis of the social assistance notification are presented (compare table 1).

V. 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 capita, the presence of works councils, collective bargaining, and the export share are all positively correlated with profits. The share of employees with a lower than tertiary qualification has a negative correlation, while the share of employees with a higher qualification is positively correlated with 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 is possibly biased because observations of the same company in different years are considered as independent and unobserved heterogeneity cannot be taken into account. The Fixed Effects Regression in table 3 shows, correspondingly, a smaller number of significant coefficients. Higher investments per capita and a higher share of parttime employees still correlate positively with higher profits per capita. The share of apprentices is now insignificant while again lower qualified employees have a negative and higher qualified employees 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 capita is regarded as a potentially predetermined variable, the dummies for industry, time, works councils, collective bargaining, East 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 capita (compare table 4). Both, the lagged share of apprentices and the contemporary share of apprentices have a positive albeit insignificant impact on profits. These results of our preferred estimation specification therefore comply with results from Switzerland that a majority of firms is not ready to bear net costs during the apprenticeship training (Wolter et al., 2006). They are in contrast, however, to German studies based on direct costs and benefits surveys that indicate that in almost all apprenticeship professions firms incur net costs during the apprenticeship training period (von Bardeleben et al., 1995; Beicht et al., 2004). While the contemporary shares of secondary education without and with professional degree and the share of 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 capita. The share of parttime employees as well as the share of foreigners has a positive impact on profits. The presence of works councils has a positive, the location in East Germany a negative impact on profits. [7] The estimation diagnostics indicate that our preferred estimation specification is acceptable:

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

The Hansen-Test does not indicate overidentification while the Arellano-Bond test does not indicate AR(2).

VI. 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 next year for Germany. The data basis are the waves 1997-2004 of the representative linked employer-employee panel data set of the IAB (LIAB). This data set has the advantage that crucial variables such as the wage sum, the qualification 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 this paper tries to answer is whether German establishments are investment oriented and accept net costs during the training period or whether they try to recuperate these costs with the apprentice´s productivity already during the training period. The motivation for this exercise is the notion that if German establishments would invest 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 and a year later. We might interpret this as a first indication that the majority of German firms does 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 higher willingness to invest in apprentices potentially could increase the number of apprenticeships offered.

In order to identify which establishments pay more than the productivity during the apprenticeship training and which professions 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 professions that have different net costs during apprenticeships (compare Schweri et al., 2003 or Beicht et al., 2004) should be taken into account.

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Tables

Table 1: Descriptive statistics on 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 apprentices	47640	0.08
Share employees with secondary education, without professional degree	47640	0.15
Share employees with secondary education, with professional degree	47640	0.62
Share employees with tertiary education, without professional degree (reference group)	47640	0.01
Share employees with tertiary education, with professional degree	47640	0.03
Share employees with polytechnics degree	47640	0.03
Share employees with university degree	47640	0.05
Average tenure in days	47637	1946.41
Average age	47640	38.81
Share exports	32314	7.82
Share females	47640	0.36
Share foreigners	47640	0.05
Share parttime employees	47640	0.13
Collective bargaining	47640	0.75
Works council	47265	0.41
East Germany	47640	0.42

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

Table 2: Pooled Regression, dependent variable: profit per employee

Variable	Coefficient	Standard deviation
Investment per employee	0.017***	0.001
Share apprentices	-0.194***	0.025
Works council	0.091***	0.005
Share employees with secondary education, without professional degree	-0.084***	0.014
Share employees with secondary education, with professional degree	-0.045***	0.009
Share employees with tertiary education, with professional degree	0.380***	0.047
Share employees with polytechnics degree	0. 262***	0.036
Share employees with university degree	0.117***	0.029
Average tenure	0.002	0.001
Average age	0.015	0.019
Share exports	0.050***	0.005
Share foreigners	0.083***	0.022
Collective bargaining	0.041***	0.004
Share females	-0.038***	0.009
Share parttime 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: tertiary education without professional degree, additional variables: year dummies, 16 sector dummies, 3 establishment size dummies and East Germany dummy.

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

Variables	Coefficients	Standard deviation
Investment per employee	0.003***	0.001
Share apprentices	-0.0005	0.039
Share employees with secondary education, without professional degree	-0.031	0.035
Share employees with secondary education, with professional degree	-0.041*	0.024
Share employees with tertiary education, with professional degree	0.133*	0.057
Share employees with polytechnics degree	-0.009	0.060
Share employees with university degree	0.110*	0.059
Average tenure	-0.001*	0.0004
Average age	0.011	0.032
Share exports	-0.006	0.007
Share foreigners	0.044	0.050
Share females	0.007	0.021
Share parttime 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: tertiary education without professional degree.

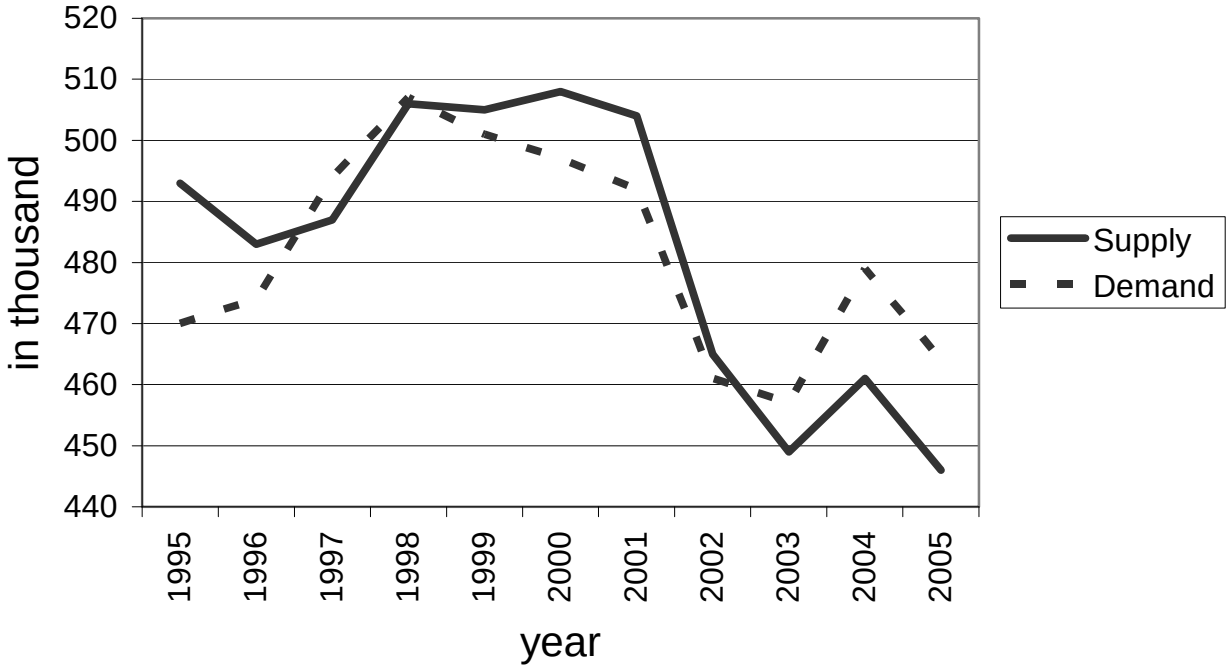
Table 4: Two-step dynamic panel system GMM regression, dep. var.: profits per employee

Variables	Coeff.	Standard deviation
Profits per employee		
L1	0.272***	0.048
Investments per employee	0.003**	0.001
L1	0.000	0.001
Share apprentices	0.085	0.197
L1	0.121	0.137
Share secondary education without professional degree	-0.410**	0.179
L1	0.278*	0.154
Share secondary education with professional degree	-0.235**	0.103
L1	0.226**	0.088
Share tertiary education with professional degree	-0.060	0.273
L1	0.243	0.266
Share polytechnics degree	0.082	0.300
L1	0.017	0.196
Share 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 exports	0.017	0.046
L1	0.012	0.020
Share foreigners	0.372**	0.170
L1	-0.162	0.157
Share females	0.095	0.098
L1	-0.056	0.060
Share parttime employees	0.202*	0.111
L1	-0.138**	0.055
Works council	0.053***	0.012
Collective bargaining	0.008	0.006
East Germany	-0.072***	0.019
Constant	8.541***	0.837
Number observations (establishments)	12,264 (5,152)	
F(53, 5151) (Probability F>0)	36.24 (0.00)	
Hansen Test on overidentification (Probability > χ2)	χ2(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: tertiary education without professional degree, additional variables: year dummies, 16 sector dummies, 3 establishment size dummies.

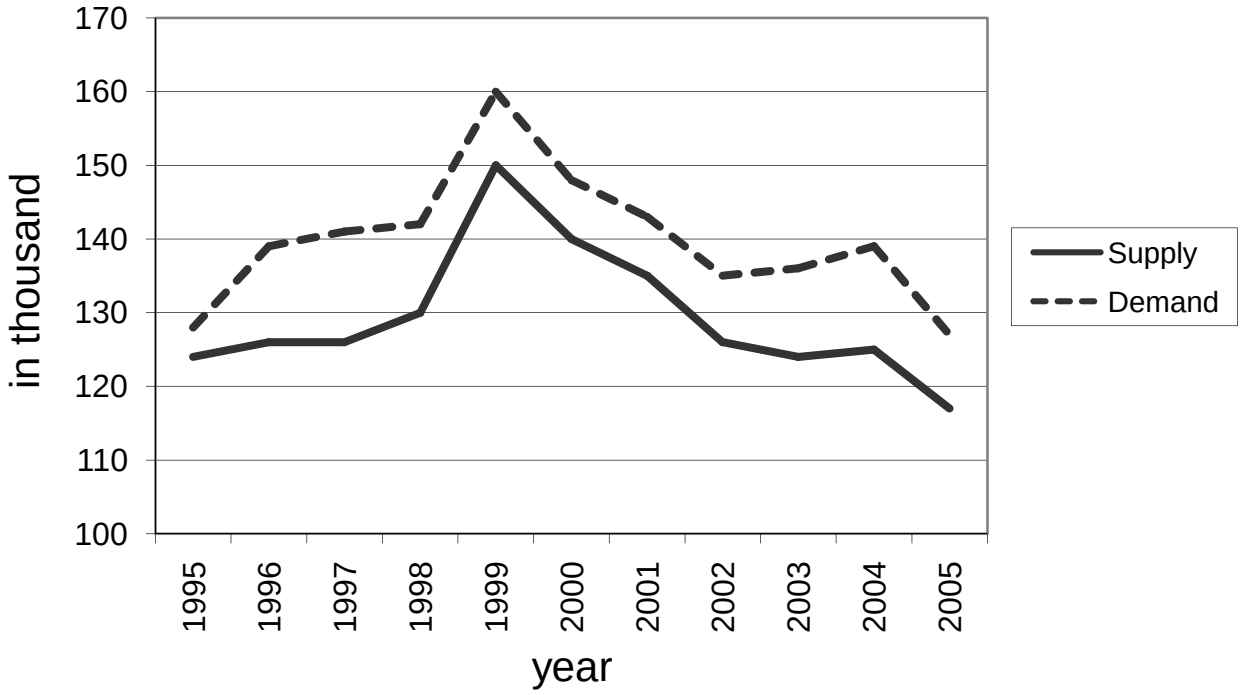
Appendix

Figure A1 Supply of and demand for apprenticeship positions in West Germany



Source: Institut der deutschen Wirtschaft (2006), own illustration

Figure A2 Supply of and demand for apprenticeship positions in East Germany



Source: Institut der deutschen Wirtschaft (2006), own illustration