Swiss Leading House
Economics of Education • Firm Behaviour • Training Policies

Working Paper No. 38

Specificity of Occupational Training and Occupational Mobility: An Empirical Study Based on Lazear's Skill-Weights Approach

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IBW – Institut für Betriebswirtschaftslehre

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October 2008

Published as: "Specificity of Occupational Training and Occupational Mobility: An Empirical Study Based on Lazear's Skill-Weights Approach." *Education Economics: Routledge*, 19(2011)5: 519-535. By Uschi Backes-Gellner, Regula Geel and Johannes Mure.
Available at: http://dx.doi.org/10.1080/09645291003726483

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An Empirical Study Based on Lazear's Skill-Weights Approach

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Abstract

According to standard human capital theory firm financed training cannot be explained if skills are of general nature. Nevertheless, investments of firms into general training can be observed and there has been a large literature to explain this puzzle, mostly referring to imperfect labor market issues. In German speaking countries firms invest heavily into apprenticeship training although it is assumed to be general. In our paper, we study the question to what extent apprenticeship training is general at all. Our paper for the first time studies how specificity of training may be defined based on Lazear's skill-weights approach. In our empirical part we use a unique German Qualification Survey, containing extensive information about the required skills at a workplace. We build occupation-specific skill-weights and find that the more specific the skill portfolio in an occupation is in comparison to the general labor market, the higher are the net costs firms have to bear for apprenticeship training in the respective occupations. At the same time, the more specific the skill requirements are in an occupation, the smaller is the probability of an occupational change during an employee's entire career. Due to the new definition of occupational specificity, we thus find that apprenticeship training - formerly seen as general training - is very heterogeneous in its specificity.

Key Words: Mobility, Skill-weights, Occupational specificity, Apprenticeship training

JEL Classification: J62, M53

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[1] This research is partly funded by the Swiss Federal Office for Professional Education and Technology through its Leading House on Economics of Education, Firm Behaviour and Training Policies. We thank Ed Lazear, and the participants of the Economics of Education Session of the German Economic Association in Bern, of the international conference of economics of education in Zurich and of the research seminars at the University of Zurich for helpful comments and suggestions. The data used in this paper have been obtained from the German Zentralarchiv für Empirische Sozialforschung at the University of Cologne (ZA). The data for the studies "Qualifikation and Berufsverlauf" were collected by the 'Bundesinstitut für Berufsbildung (BIBB)' and the 'Institut für Arbeitsmarkt- und Berufsforschung (IAB)' and are documented by the ZA. Neither the producers of the data nor the ZA bear any responsibility for the analysis and interpretation of the data in this paper.

1. Introduction

Occupational skills of employees are important to the competitiveness of their firms. However, firms may still not be willing to invest in occupational skills if they are transferable to other firms and if workers frequently leave the company after training because then investments cannot be expected to pay off. Apprenticeship training is one such example of transferable occupational skills. According to standard human capital theory (Becker 1964) firms financing apprenticeship training therefore cannot be explained. Thus, firm financed apprenticeship training - as it is typical in the German speaking countries (see Noll et al. 1983, Von Bardeleben et al. 1995 and Beicht et al. 2004) – raises important research questions. There has been a large literature to explain why firms may still be willing to invest in general training, most of it referring to imperfect labor market issues (see Katz/Ziderman 1990, Harhoff/Kane 1997, Acemoglu/Pischke 1998 and 1999, Euwals/Winkelmann 2004, Zwick 2007). However, the question to what extent apprenticeship training is general and how differences in transferability might impact worker mobility and thereby firms willingness to invest has never been explicitly raised nor studied.

Our paper therefore takes one step back and actually studies how specificity of training may be defined and whether different degrees in specificity might influence how much firms are willing to invest. Since the aim of apprenticeship training is receiving a particular occupational degree, we consider the specificity of the occupation to be an important determinant for the willingness of firms to cover a substantial share of training costs. Fortunately, Lazear’s skill-weights approach (2004) provides a model to define specificity on the skill level. Whereas standard human capital theory strictly differentiates between general and specific human capital, Lazear’s skill-weights approach assumes that all skills are general in nature but the combination of single skills varies from firm to firm. Thus only the combination of single skills makes them specific. This approach therefore provides an ideal foundation to operationalize the specificity of any type of occupational training (see also Mure 2007). We build occupation-specific skill-weights and derive empirically testable hypotheses on the mobility of workers who have been trained in a particular occupation and accordingly on the willingness of firms to invest in training of this particular occupation.

In our empirical part German apprenticeship training serves as an example to test our implications. We use the BIBB/IAB Qualification and Career Surveys[2] and BIBB cost-benefit evaluations[3]. The first data set contains extensive information regarding the required skills at a workplace and allows constructing an occupational specificity index. From the second study we use data on the costs of apprenticeship training as an indicator for the investment share of firms in a particular occupation. We find all implications to be borne out in the data. Occupational mobility is lower if the specificity is higher and at the same time firms bear a higher share of the training costs if specificity of an occupation is higher.

The remainder of this paper is structured as follows. In Section 2, we use Lazear's skill-weights model to derive empirically testable implications about financial investment in apprenticeship training and employee mobility after completion. In Section 3, we introduce the data sets and explain our explanatory variable, the degree of specificity. In section 4, we present empirical results using ordinary least square estimations and probit regressions. We conclude with a short summary and implications in Section 5.

2. The Skill-Weights Approach: Basic Idea and Testable Implications

Lazear's main assumption is that all skills are naturally general. All firms can use the general skills, but the combination of these skills varies from firm to firm. Specificity therefore occurs as firms demand different combinations and different weights of skills. These varying demands result in firm-specific skills. In the basic skill-weights model, there are only two skills and two periods. The two skills are general and can thus be used at other firms as well. A worker invests in either skill in the first period and receives a payoff in the second period. In the first period, the worker decides to acquire particular amounts of

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[2] The BIBB/IAB Qualification and Career Surveys of the years 1979, 1991/92 and 1998/99 were gathered by the Federal Institute for Vocational Training (BIBB - Bundesinstitut für Berufsbildung), Berlin, in collaboration with the Federal Employment Service's Institute for Employment Research (IAB - Institut für Arbeitsmarkt- und Berufsforschung), Nuremberg.

[3] These descriptive cross-section cost and benefit evaluations were undertaken by the Federal Institute for Vocational Training (BIBB - Bundesinstitut für Berufsbildung) for the years 1980, 1991 and 1999.

skills A and B at cost $C(A,B)$, which determines his payoff in the second period. His payoff at firm i is determined according to the following earnings function (Lazear 2004: 3):

$$y_i = \lambda_i A + (1-\lambda_i)B$$

λ_i is the relative weight of skill A in firm i. Since λ_i may be different from the relative weight of skill A in any other firm j, the worker must determine the extent to which he wants to acquire skills A and B, given that he stays at the initial firm or moves on to another firm with skill-weights λ_j. If the employee could be certain that he remains at the initial firm indefinitely, then he would focus on λ_i and invest in the skill bundle which maximizes his income at the initial firm. However, if the employee can not be certain that he can stay with his original firm he must consider looking for a new job in another firm. Other firms may demand a different weighting of skills and the employee's skill bundle may not be optimal in an outside firm, making part of his investment worthless. Therefore, in case of a separation, the worker may be faced with a wage loss. The outside market determines how much his investment will depreciate, which in the model is given by the difference between the weight of the initial firm and the expected market weight, λ_i - $\bar{\lambda}$. Thus, skill combinations can be rather general or rather specific. If a combination is rather general, then the difference between the weight of the initial firm and the market weight λ_i - $\bar{\lambda}$ is small, as is the expected wage loss. However, if a skill combination is rather specific, the difference λ_i - $\bar{\lambda}$ is large and the wage loss is large as well. Firms anticipate this and expect workers to be unwilling to invest in rather specific skill combinations. Therefore, firms are willing to finance a larger part of the investment if they want employees to acquire the firm's ideal skill combination. Thus, the firm's share of expenses increases with a more specific combination of skills in the firm.

We use this basic idea and apply it to apprenticeship training, whereas the combination of skills is given by the training occupation. The intuition is rather clear: Employees in occupations with more specific skill combinations are faced with higher losses if they have to change their occupation. The more likely occupational change is the less willing are employees to invest in these occupations. If firms want employees to acquire skills in an occupation that is needed in the firm but is rarely required on the external labor market, they must bear a larger part of the investment. Thus, a firm's investment share is higher in occupations with a more specific combination of skills. Accordingly, we derive our first empirically testable hypothesis:

H1 *The more specific the skill requirements of an occupation are (compared to the labor market in general), the bigger is the share of the educational investment the firm bears.*

At the same time, a very rare combination of skills in an occupation prevents a worker from changing occupations. Thus our second testable hypothesis is:

H2 *The more specific the skill requirements of an occupation are (compared to the labor market in general), the smaller is the likelihood that workers change occupations after completion of apprenticeship training.*

3. Data, Sample Selection and Variables

Our empirical estimation is based on the German BIBB/IAB Qualification and Career Surveys of the years 1979, 1991/92 and 1998/99. These surveys are cross-sectional samples of the working population in Germany and were gathered by the Federal Institute for Vocational Training (BIBB - Bundesinstitut für Berufsbildung), Berlin, in collaboration with the Federal Employment Service's Institute for Employment Research (IAB - Institut für Arbeitsmarkt- und Berufsforschung), Nuremberg. The samples are representative of Germany and contain retrospective information on educational and occupational careers. These datasets are especially interesting because of the extensive information about the skill profiles of the interviewees. Based on a large set of questions about the workers' skills, we are able to generate skill portfolios and operationalize our main explanatory variable, occupational specificity. Additionally, we also require information about the costs of apprenticeship training in the particular occupations to estimate the firm's investment share. This data is provided in a series of descriptive cross-section cost/benefit evaluations[4] by the Federal Institute for Vocational Training (BIBB - Bundesinstitut für Berufsbildung) for the years 1980[5], 1991[6] and 1999[7].

We restrict our analysis to individuals between 15 years (the minimum age for leaving school and entering the labor market) and 65 years of age (the mandatory age of retirement for paid employees). Furthermore, we exclude all civil servants (because they have no layoff risk) and all self-employed people. Only employees in West Germany are included[8] and the mobility analysis is restricted to male employees[9]. After eliminating observations with missing data, a sample of 15,319 male employees was left for analysis. Descriptive statistics of all variables used in our analysis are given in Table 4 in the Appendix.

Explanatory Variable: Degree of Specificity

One of the main innovations in this paper is to define an index to measure the degree of specificity according to the skill-weights approach. The BIBB/IAB Qualification Surveys contain a set of questions about workers' skill portfolios. The respondents were asked to report on a large set of skills that are required to perform their current job[10]. Hence, we are able to generate a unique skill portfolio for each individual. Table 1, left panel, for example shows the skill portfolio of an individual bank clerk. If the respective skill is required at the workplace, the variable takes the value of 1, 0 otherwise.

To determine the specificity of an occupation we use this information on individual skill profiles of those who completed apprenticeship training in this particular occupation dur-

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4 Since the number of occupations in these cost evaluations is limited we have to concentrate the empirical analysis in this paper on these particular occupations.

5 See Noll et al. 1983.

6 See Von Bardeleben et al. 1995.

7 See Beicht et al. 2004.

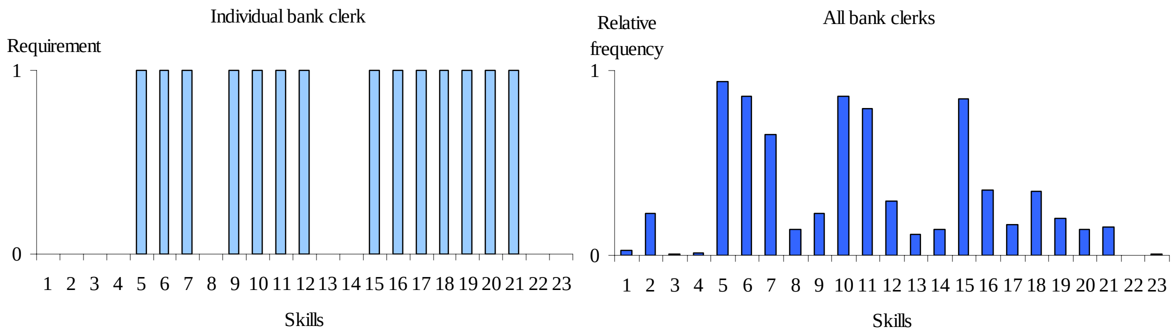
8 The cost evaluation 1991 includes only training firms from West Germany, while the newest study also includes East Germany. Not only were the labor market structures (and thus mobility) of the two parts of the country quite different, but also training compensation and therefore training costs differ considerably.

9 To homogenize our sample we exclude female employees as they show a different behaviour towards mobility than their male counterparts. We cannot control for any interruption in working life, e.g. pregnancy or maternity leave.

10 A complete list of skills in the data sets can be found in the Appendix, Table 8.

ing the last five years and did not change their occupation since then[11]. The aggregation of these individual skill portfolios by occupation leads us to a weighted occupation-specific skill portfolio (cf. table 1, right panel).

Table 1: Skill portfolios of bank clerks: individual and occupational level



Source: BIBB/IAB 1979, own calculations.

Table 1, right panel, provides the skill portfolio of bank clerks in the year 1979. On the x-axis there are 23 single skills, on the y-axis are their relative frequencies over all employees working as a bank clerk. As can be seen and as one would expect, not all of the single skills are equally important for bank clerks. For example skill #5 mathematics, #6 orthography, #10 typing, #11 accounting and #15 finance are required for more then 80% of all bank clerks, whereas knowledge in #1 material science, #3 technical drawing, #4 electrical engineering, #22 physical technics and #23 chemical engineering are required by none or less than 3% of all bank clerks.

Next we take the analysis one step further and aggregate all individual skill profiles to receive a skill portfolio for the German labor market in general with which we compare an occupation-specific skill portfolio in order to derive a measure for the specificity of a particular skill portfolio. Again, we take the bank clerk as an example. If on the one hand, bank clerks use exactly the same skill portfolio as is used on the German labor market in general, then their occupational skill portfolio would be a very general one and not at all

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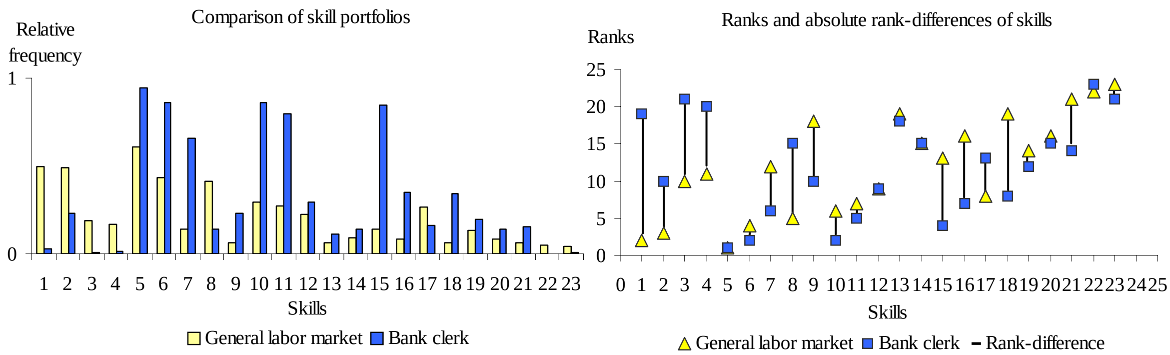
11 A complete list of all in this paper analyzed apprenticeship training occupations can be found in the Appendix, Table 9.

specific. Accordingly, it would be easy for a bank clerk to change the occupation and the risk of loosing the initial investment in occupation-specific training would be low. Accordingly, banks would not be interested in investing into this type of apprenticeship training. If, on the other hand, bank clerks use a completely unique skill portfolio that is used in no other occupation on the German labor market, their occupational skill portfolio would be very specific. Accordingly, if they have to change occupations they would heavily loose on their training investments and would thus not be willing to invest, forcing firms to invest more if they require this particular type of skill combination. In reality none of the two extremes is expected but every occupation will be found somewhere in between these two extremes. For example the skill portfolio for bank clerks which we can observe in 1979 is for some skills very different and for some skills quite similar to the overall skill portfolio of the labor market (cf. table 2, left panel).

Table 2: Comparison of occupation-specific skill portfolios with overall skill portfolio of the general labor market



Source: BIBB/IAB 1979, own calculations.

To calculate to degree of specificity we compare how important the single skills are in the occupation in comparison to its importance on the general labor market. Therefore, we ranked the skills of each occupation and of the general labor market according to the relative frequencies. If for example the most important skill in the occupation is the least important skill on the labor market in general, then a large part of the occupation-specific skill portfolio is likely to become useless if an individual changes the occupation. If the most important skill in the occupation is the same as on the external labor market, then a large part of the occupation-specific skill portfolio is likely to be used again on the outside labor market. The same of course applies to the second, third or fourth most important skill. Thus we compare the relative importance of each skill in the occupation-specific portfolio to the relative importance of the respective skill in the general labor market portfolio. For each occupation we calculate the distances between the ranks of the individual skills in the occupation portfolio and the overall labor market portfolio.[12] An example of how these distances look like is given in table 2, right panel. For example, skill #5 mathematics is the most important skill for bank clerks as well as for the general labor market. But the rank of #1 material science is very different: it takes rank 19 in the bank clerks skill portfolio compared to rank 2 in the general labor market portfolio. Therefore material science is very important on the general labor market but it is very unimportant for bank clerks. To generate a single specificity variable measuring the degree of specificity of a particular occupation, we weighted the absolute rank-differences between each occupation and the general market with their corresponding relative frequency and summed them. The larger the number is we get, the more untypical are the skill ranks in a particular occupation. Thus, an increase in the number indicates that skill-weights in the occupation are very different from skill-weights in the general labor market. Therefore this variable gives us the degree of specificity as it is suggested by the skill-weights approach. The empirical results of our specificity degrees range from 4.1 to 31.1 units, with a mean of 14.0 units. According to our hypotheses, we therefore expect a higher degree of occupational specificity to correspond with a higher share of firm investment and with a lower rate of occupational change on the workers side.

For our empirical analysis we calculate the degree of specificity for all occupations as mentioned above. Since we have data for three very different time periods (1980, 1991/92 and 1998/99) in between which there may have been substantial changes in some occupations, we calculate the degree of specificity for each occupation for each of the periods.

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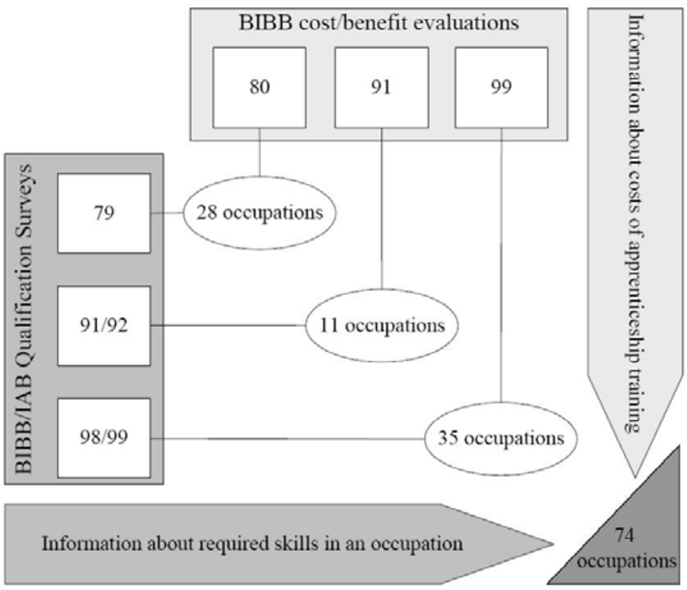
[12] We use ranks instead of relative frequencies to normalize our explanatory variable. The specificity degree must not be distorted by the number of acquired skills in an occupation. If so, we would replicate the (low or high) skill level of an education, instead of the specificity of a skill combination.

Dependent Variable: Net costs

To measure firms' investments into apprenticeship training in these occupations we use occupation-specific net costs of apprenticeship training derived from the BIBB cost-benefit evaluations. We use the net costs which consist of all costs an apprentice causes during the training period minus all benefits an apprentice generates due to his productivity in the same period. According to the BIBB cost/benefit evaluations net costs of apprenticeship training vary substantially across occupations. For example, apprenticeship training as a chemical laboratory assistant was the most expensive occupation (18,673 EUR in 1998/99), while apprenticeship training to become a legal assistant incurred the lowest net costs (4,287 EUR in 1998/99). The average net costs of a year of apprenticeship training amounted to 7,825 EUR. We have occupation-specific net costs of apprenticeship training for 74 occupations from the BIBB cost-benefit study, which we combine with our explanatory variable, degree of occupational specificity, which we derive from the BIBB/IAB Qualification Surveys.[13] Table 3 shows how the different data sets are matched.

Table 3: Matching of BIBB cost/benefit evaluations with BIBB/IAB Qualification Surveys



[13] We were able to perfectly match 28 training occupations in the 1980s, 11 training occupations in the early 1990s, and 35 occupations in the late 1999s. Overall, this makes 74 cases with different degrees of occupational specificity.

Dependent Variable: Occupational Mobility

Occupational Mobility is measured with two different variables. First we generate a variable representing occupational change during an individuals work life ("occhange"), which stands for mobility in the long run. Here we compare workers current occupation with the occupation of their apprenticeship. If workers no longer work in their original occupation, we consider this to be an occupational change and the dependent variable takes the value of 1 (it takes the value of 0, if the occupation remains unchanged). Overall, about 60% of the employees in our sample changed their occupation, about 40% did not. Second, we generate a mobility variable covering only occupational changes occurring right after apprenticeship training has been finished ("occhangeapp"), representing mobility in the short run. To do this we compare the year of the completion of the apprenticeship training with the year in which an occupational change took place. If the years are the same, the dummy variable takes the value 1 (if the years are different, it takes the value 0). About five percent of the apprenticeship graduates changed their occupation in the first year, 95 % did not.

4. Empirical Results

First, we study the impact of occupational specificity on firms' investments in apprenticeship training, using a standard ordinary least square regression. We use the net costs of the 74 occupations as dependent variable, as we only have occupation-specific cost and skill portfolio information. The analysis of the investment share is therefore based on the population of these 74 training occupations in our sample. Due to the small number of observations the conclusions should be interpreted with some caution, but the result is none the less very clear. We use control variables in our regression model, which take the values of the means of the observations on occupation level. We include the age upon completion of apprenticeship training, the size of the training firm and year dummies. Estimation results with robust standard errors are provided in table 5, model 1.

As expected, the degree of occupational specificity is positive and statistically significant. The more specific the skill portfolio in an occupation is in comparison to the labor market in general, the higher are the net costs firms are bearing for apprenticeship training in the respective occupations because workers are unwilling to bear costs for such types of training. The less specific an occupation is compared to the whole labor market, the smaller are the net costs firms bear. Thus, our results provide a different explanation for why firms finance apprenticeship training than previous literature. Formally, apprenticeship training is an investment in general human capital as assumed by previous studies: firms must follow national training curricula and apprentices attend vocational schools for 1-2 days per week. Apprentices are awarded a certificate after successful completion of final exams, which are recognized nationwide. Therefore, apprenticeship training was always considered to be general training. Standard human capital theory would not be able to explain firms investments in such training and therefore a number of new models have been developed to explain why firms nevertheless invest in such training. We argue that in the first place apprenticeship training should in principal not be considered to be general training. Rather, the degree of specificity depends on the combination of skills in the respective occupation although all single skills are general. There are some occupations that are highly specific whereas other occupations are far more general. According to Lazear's skill-weights approach it can be expected that firms invest to a larger degree in the former ones because workers have only a limited interest to invest in this type of occupational skill portfolio.

Second, we study the impact of occupational specificity on occupational mobility of employees. Since both dependent variables (occupational mobility in the short run right after apprenticeship training as well as occupational mobility in the long run) are dummy variables, ordinary least square estimations are not appropriate. In accordance with Wooldridge (2009: 575-585), we use probit regressions to account for this. We use a standard set of control variables in our regression models. We include age, age-squared and the age upon completion of an apprenticeship. Other control variables are the size of the training firm (five dummies), the size of the community (four dummies) and the highest educational degree (four dummies). Furthermore, we include a dummy for participation in further vocational training and year dummies. Table 6 and 7 provide the results of our probit estimations with robust standard errors. In model 2 (table 6), we analyze the short-term influence of occupational specificity on occupational change. As expected in our second hypothesis, the specificity degree is negatively correlated with an employee's probability to change occupations. The more specific the skill requirements are in an occupation, the smaller is the probability of an occupational change right after completion of apprenticeship training. According to Lazear's model, graduates in very specific occupations are stuck in their occupation because if they change their occupation the value of their particular skill combination will be dramatically reduced. So in the short run occupational mobility is indeed restricted. It is interesting to study whether this also holds in the long run or whether the specificity of the initial skill combination evades over time? Therefore, in model 3 (table 7) we study the impact of occupational specificity on occupational change in the long run. We find that the effect of specificity on occupational mobility in the long run is also negative and significant, i.e. the more specific the skill requirements are in an occupation, the smaller is the probability of an occupational change during an employee's entire career. Even in the long run, an employee is bound to the original occupation if its skill combination is specific. Overall, we find clear evidence supporting our theoretical predictions. Occupational specificity can be analyzed according to Lazear's skill-weights approach (2004) and such an analysis shows that not all apprenticeship training is general. Rather, there is a continuum of specificity and depending on whether an occupation is more or less specific, workers are more or less mobile, and firms are more or less willing to invest in apprenticeship training.

5. Conclusions

According to standard human capital theory firm-financed training cannot be explained if skills are of general nature. Nevertheless, investments of firms into general training can be observed and there has been a large literature to explain this puzzle, mostly referring to imperfect labor market issues. Moreover, in German speaking countries firms invest heavily in apprenticeship training, which is also assumed to be general. However, the question to what extent apprenticeship training is general and how differences in transferability might impact worker mobility and thereby firms willingness to invest has never been explicitly raised nor studied.

Our paper therefore studies for the first time how specificity of training may be defined and whether different degrees in specificity might influence how much firms are willing to invest. Lazear's skill-weights approach provides a model to define specificity on the skill level, assuming that all skills are general in nature but the combination of single skills varies. Based on this approach we derive empirically testable hypotheses on the mobility of workers after training and accordingly on the willingness of firms to invest in training. In our empirical part German apprenticeship training serves as an example to test our implications. Since the aim of apprenticeship training is getting a particular occupational degree, we consider the specificity of the occupation as crucial. We use a unique German Qualification Survey, containing extensive information about the required skills at a workplace. With this information we can build occupation-specific skill-weights and operationalize our main explanatory variable, the degree of specificity. We study the impact of occupational specificity on firm's investment in apprenticeship training and on occupational mobility of employees. We find all implications to be borne out in the data: The more specific the skill portfolio in an occupation is in comparison to the general labor market, the higher are the net costs firms are bearing for apprenticeship training in the respective occupations because workers are unwilling to bear costs for such types of training. At the same time, the more specific the skill requirements are in an occupation, the smaller is the probability of an occupational change during an employee's entire career.

Due to this new definition of occupational specificity, we find that apprenticeship training - formerly seen as general training - is very heterogeneous in its specificity. Some apprenticeships are more general, whereas others are highly specific compared to the whole labor market. The general contents of apprenticeship training are specifically bundled and vary strongly in their specificity degree. The empirical analyses presented here demonstrate both a higher willingness of the firm to invest in training and reduced mobility of the employee as a result of an increasing specificity of skill combinations. Obviously, there exists a trade-off: if apprenticeship training should become less specific in order to prepare employees for technological changes, occupational mobility might increase, but, at the same time, firms would reduce their training investments.

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Appendix

Table 4: Descriptive Statistics

Description	Variable	Mean	Std. Dev.	Min	Max
Occupational specificity	specdegree	14.0	5.97	4.1	31.1
Net costs (EUR)	netcost	7,825	3,842	1,230	18,673
Occupational change after apprenticeship	occhangeapp	0.05	0.23	0	1
Later occupational change	occhange	0.59	0.49	0	1
Age	age	38.9	11.1	15	65
Age squared	age2	1,636	896	225	4,225
Age leaving school	ageschool	16.0	2.7	8	50
Age leaving apprenticeship	ageapprent	19.0	2.3	11	53
Age at occupational change	ageocchange	27.2	8.2	12	63
Lower secondary school (Hauptschule)	lowsecschool	0.68	0.47	0	1
Intermediate secondary school (Realschule/Mittlere Reife)	intermsecschool	0.24	0.43	0	1
Entrance examination for university of applied science (Fachhochschule)	applscience	0.04	0.18	0	1
High school diploma (Abitur)	highschool	0.05	0.21	0	1
No graduation	noschool	0.00	0.00	0	0
Tenure	tenure	12.6	10.0	0	53
Experience	exp	16.9	11.4	0	49
Further training	voceduc	0.35	0.48	0	1
Firm size under 10 employees	firmsize9	0.32	0.47	0	1
Firm size between 10 and 49 employees	firmsize49	0.31	0.46	0	1
Firm size between 50 and 99 employees	firmsize99	0.09	0.29	0	1
Firm size between 100 and 999 employees	firmsize999	0.17	0.38	0	1
Firm size over 1000 employees	firmsizeover1000	0.10	0.30	0	1
Industry	industry	0.27	0.44	0	1
Handcraft	handcraft	0.53	0.50	0	1
Trade	trade	0.09	0.29	0	1
Other sector	othersect	0.11	0.31	0	1
Community size ≤ 20'000	comsize20	0.44	0.50	0	1
Community size ≤ 100'000	comsize100	0.27	0.44	0	1
Community size ≤ 500'000	comsize500	0.16	0.37	0	1
Community size > 500'000	comsizeover500	0.13	0.34	0	1
BIBB/IAB - Survey 1979	survey79	0.42	0.49	0	1
BIBB/IAB - Survey 1991	survey91	0.24	0.43	0	1
BIBB/IAB - Survey 1998	survey98	0.35	0.48	0	1

Table 5, Model 1: Linear Regression

netcost	Coef.	Robust Std. Err.	t	P>|t|	
specdegree	128.74	52.66	2.44	0.017	**
ageapprent	852.53	316.82	2.69	0.009	**
survey79	-3,568.84	989.97	-3.6	0.001	***
survey91	-3,281.81	961.87	-3.41	0.001	***
firmsize49	-160.41	2,061.94	-0.08	0.938	
firmsize99	-1,455.06	4,680.71	-0.31	0.757	
firmsize999	4,747.19	3,423.6	1.39	0.170	
firmsizeover1000	12,695.13	1,980.88	6.41	0.000	***
cons	-10,576.53	6,405.71	-1.65	0.104	
n	74				
F(8, 65)	28.94				
Prob > F	0.0000				
R-Squared	0.6865				

* significant at 10% ** significant at 5% *** significant at 1%

Table 6, Model 2: Probit Regression

occhangeapp	dF/dx	Std. Err.	z	P>|z|	
specdegree	-0.0008	0.0004	-2.09	0.037	**
ageapprent	0.0017	0.0007	2.41	0.016	**
comsize100	0.0012	0.0040	0.31	0.759	
comsize500	0.0073	0.0050	1.52	0.129	
comsizeover500	-0.0086	0.0048	-1.69	0.092	*
firmsize49	-0.0051	0.0038	-1.34	0.181	
firmsize99	-0.0150	0.0049	-2.68	0.007	***
firmsize999	-0.0139	0.0042	-3.02	0.003	***
firmsizeover1000	-0.0245	0.0041	-4.65	0.000	***
intermsecschool	0.0051	0.0044	1.18	0.237	
applscience	-0.0013	0.0096	-0.13	0.894	
highschool	0.0233	0.0112	2.41	0.016	**
survey79	0.0763	0.0070	12.24	0.000	***
survey91	0.0031	0.0067	0.47	0.640	
obs. P	0.0538				
pred. P	0.0439	(at x-bar)			
Number of Obser\	15,319				
LogL	-3,008.71				
Wald chi2 (16)	392.0				
Prob > chi2	0.0000				
Pseudo R2	0.0626				
* significant at 10%	** significant at 5%		*** significant at 1%		

Table 7, Model 3: Probit Regression

occhange	dF/dx	Std. Err.	z	P>|z|	
specdegree	-0.0032	0.0010	-3.04	0.002	***
age	0.0397	0.0026	15.51	0.000	***
age2	-0.0004	0.0000	-12.06	0.000	***
voceduc	0.1302	0.0086	14.81	0.000	***
comsize100	0.0186	0.0100	1.86	0.063	*
comsize500	0.0082	0.0118	0.69	0.487	
comsizeover500	-0.0070	0.0129	-0.54	0.586	
intermsecschool	0.0312	0.0099	3.14	0.002	***
applscience	0.1867	0.0194	8.36	0.000	***
highschool	0.1122	0.0187	5.65	0.000	***
survey79	0.0419	0.0132	3.17	0.002	***
survey91	0.0684	0.0150	4.49	0.000	***
obs. P	0.5866				
pred. P	0.5911	(at x-bar)			
n	15,319				
LogL	-9,780.57				
Wald chi2 (16)	1,175.66				
Prob > chi2	0.0000				
Pseudo R2	0.0584				
* significant at 10%	** significant at 5%		*** significant at 1%		

Table 8: List of required Skills at a Workplace

	#	English Translation	German Expression
1998/99	1	Mathematics, statistics	Mathematik, Statistik
	2	Orthography (German)	Deutsch, Rechtschreibung
	3	Presentation techniques, conduct of negotiations	Vortragstechnik, Verhandlungsführung
	4	Foreign languages	Fremdsprachen
	5	Sales, marketing, public relations	Vertrieb, Marketing, Werbung
	6	Design	Gestaltung
	7	Programm application	Anwendung von Computerprogrammen
	8	Software developement	Entwicklung von Computersoftware
	9	Computer literacy	Computertechnik
	10	Other technical knowledge	andere Technikkenntnisse
	11	Labor law	Arbeitsrecht
	12	Other legal knowledge	Andere Rechtskenntnisse
	13	Business Management, Human Resource Management	Management, Personalführung
	14	Finance, taxes	Finanzierung, Steuern
	15	Controlling	Kostenwesen
	16	Accident prevention, Safety instructions	Arbeitsschutz, Sicherheitsvorschriften
	17	Medical science	Medizinische Kenntnisse
	18	Other skills	Andere Fachkenntnisse
1991/92	1	Mathematics, statistics	Mathematik, Statistik
	2	Foreign languages	Fremdsprachen
	3	Typing	Maschinen schreiben
	4	Computer literacy	Computertechnik
	5	Data processing	Datenverarbeitung
	6	Accounting	Buchhaltung
	7	Finance, taxes	Finanzierung, Steuern
	8	Purchase	Einkauf
	9	Sales, marketing, public relations	Vertrieb, Marketing, Werbung
	10	Business Management, Human Resource Management	Betriebsführung, Personalwesen
	11	Chemistry	Chemie
	12	Mechanics	Mechanik
	13	Electrical engineering	Elektrotechnik
	14	Measurement and regulation technology	Mess- und Regeltechnik
	15	Physics	Physik
	16	Technical drawing	Technisches Zeichnen
	17	Commercial knowledge of commodities	Warenkunde
	18	Accident prevention, Safety instructions	Unfallverhütung, Sicherheitsvorschriften
	19	Labor law	Arbeitsrecht
	20	Other legal knowledge	Andere Rechtskenntnisse
	21	Pedagogy, psychology	Pädagogik, Psychologie
	22	Medical science	Medizin

1979	1	Material science	Material- und Werkstoffkunde
	2	Machinery Skills	Maschinenkenntnisse
	3	Technical drawing	Technisches Zeichnen
	4	Electrical engineering	Elektrotechnik
	5	Mathematics, statistics	Mathematik, Statistik
	6	Orthography (German)	Rechtschreibung, Grammatik
	7	Computer literacy	EDV-Kenntnisse
	8	Commercial knowledge of commodities	Warenkunde
	9	Foreign languages	Fremdsprachen
	10	Typing	Maschinenschreiben
	11	Accounting	Buchhaltung
	12	Sales, marketing, public relations	Vertrieb, Marketing, Werbung
	13	Human Resource Management	Personalverwaltung
	14	Business Management	Betriebsführung
	15	Finance	Finanzierung
	16	Taxes, tax law	Steuern, Steuerrecht
	17	Accident prevention, Safety instructions	Unfallverhütung, Sicherheitsvorschriften
	18	Private law	Privatrecht
	19	Labor law	Arbeitsrecht
	20	Social law	Sozialrecht
	21	Administrative law	Verwaltungsrecht
	22	Physical technics	Physikalische Technik
	23	Chemical engineering	Chemotechnik

Table 9: List of Apprenticeship Training Occupations

	English Translation	German Apprenticeship Training Occupation (Ausbildungsberuf)
1998/99	Bank clerk	Bankkaufmann
	Architectural drafter	Bauzeichner
	Office clerk/Office management assistant	Bürokaufmann
	Chemical laboratory assistant	Chemielaborant
	Skilled chemical worker	Chemikant
	Typographer	Drucker
	Power supply technician	Energieelektroniker
	Florist	Florist
	Hotel clerk	Hotelfachmann
	Industrial business management assistant	Industriekaufmann
	Industrial mechanic	Industriemechaniker
	Retail salesperson	Einzelhandelskaufmann
	Wholesale and international trade specialist	Gross-/Aussenhandelskaufmann
	Chef/Cook	Koch
	Travel agent	Reiseverkehrskaufmann
	Tool mechanic	Werkzeugmechaniker
	Optician	Augenoptiker
	Baker	Bäcker
	Electrician	Elektroinstallateur
	Sales Clerk	Verkäufer
	Butcher	Fleischer
	Hairdresser	Friseur
	Plumber	Gas-/Wasserinstallateur
	Motor vehicle mechanic	Kraftfahrzeugmechaniker
	Painter/Varnisher	Maler/Lackierer
	Mason	Maurer
	Metal worker	Metallbauer
	Carpenter	Tischler
	Dental technician	Zahntechniker
	Heating and ventilation engineer	Zentralheizungs-/Lüftungsbauer
	Doctor's assistant	Arzthelfer
	Certified dental assistant	Zahnmed. Fachangestellte
	Legal assistant	Rechtsanwaltsfachangestellte
	Assistant tax accountant	Steuerfachangestellte
	Administrative specialist	Verwaltungsfachangestellte

1991/92	Industrial mechanic	Industriemechaniker
	Wholesale merchant	Grosshandelskaufmann
	Retail salesperson	Einzelhandelskaufmann
	Bank clerk	Bankkaufmann
	Industrial business management assistant	Industriekaufmann
	Motor vehicle mechanic	Kraftfahrzeugmechaniker
	Electrician	Elektroinstallateur
	Carpenter	Tischler
	Hairdresser	Friseur
	Salesperson in the food industry	Nahrungsmittelverkäufer
	Office clerk/Office management assistant	Bürokaufmann
1979	Bank clerk	Bankkaufmann
	Office clerk/Office management assistant	Bürokaufmann
	Chemical laboratory assistant	Chemielaborant
	Lathe operator	Dreher
	Typographer	Drucker
	Chef/Cook	Koch
	Mechanic	Mechaniker
	Draftsperson	Technischer Zeichner
	Sales Clerk	Verkäufer
	Tool maker	Werkzeugmacher
	Baker	Bäcker
	Electrician	Elektroinstallateur
	Butcher	Fleischer
	Hairdresser	Friseur
	Motor vehicle mechanic	Kraftfahrzeugmechaniker
	Agricultural machine mechanic	Landmaschinenmechaniker
	Painter	Maler
	Mason	Maurer
	Locksmith	Schlosser
	Carpenter	Tischler
	Dental technician	Zahntechniker
	Pharmacy assistant	Apothekenhelfer
	Doctor's assistant	Arzthelfer
	Assistant tax accountant	Steuerfachgehilfe
	Telecommunication craftsman	Fernmeldehandwerker
	Administrative specialist	Verwaltungsfachangestellter
	Gardener	Gärtner
	Agronomist	Landwirt