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**WHY DO FIRMS TRAIN?
EMPIRICAL EVIDENCE ON THE FIRST LABOUR MARKET OUTCOMES OF GRADUATED APPRENTICES**

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ABSTRACT

Why do Firms Train? Empirical Evidence on the First Labour Market Outcomes of Graduated Apprentices*

The apprenticeship system is the most important source of formal post-secondary training in Germany. Our Paper contributes to the ongoing debate as to why firms are willing to invest in such training even though many apprentices will leave the training firm soon after completion of the apprenticeship. A particular advantage over previous empirical studies is that we use German register data, the IAB Employment Sample, which gives us a large sample size, and which gives us detailed information on occupations. We find that apprentices staying with their training firm after graduation have (1) higher wages and (2) longer first job duration than apprentices leaving the training firm. These results support theories according to which firms use the apprenticeship system to select and retain the more able apprentices, thereby recouping the costs of investing in skills that are, in principle, portable.

JEL Classification: C24, C41, J24, J31, J44
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NON-TECHNICAL SUMMARY

In international comparisons on education, vocational training, and labour market performance, Germany shows a high involvement of firms in the education and training of the young by means of a well developed apprenticeship system. This fact is seen as a positive characteristic of the German education and labour market system, as it contributes to the low youth unemployment rates and the high general skill levels of the workforce.

A peculiar fact about German apprenticeship training (GAT) is that it mainly provides general training and thus portable skills. In addition, there is ample empirical evidence that firms actually make substantial net investments into GAT. This is a puzzle as the existence of (partially) firm-financed apprenticeship training is not easily reconcilable with standard human capital theory according to which profit-maximizing firms should not pay for general training but rather free-ride on the investment of others. Most explanations in the literature are based on the idea that the training firms are able to recoup the costs of the training by extracting rents from the graduated apprentices that stay with the training firm. Examples of such explanations are based on asymmetric information on the ability of the apprentices (Acemoglu and Pischke, 1998), high mobility costs and low general labour turnover in the German labour market (Harhoff and Kane, 1997), or, more generally, market imperfections and compressed wage structures (Acemoglu and Pischke, 1999a, 1999b). In these models firms are able to pay post-apprenticeship wages below marginal productivity and thus recoup the cost of investment.

Despite the substantial size of the literature on GAT, few ‘stylised’ facts have emerged (the only robust finding being that about two-thirds of all apprentices leave their training firm within five years of graduation). More often than not, the empirical evidence is inconclusive or even contradictory. For instance, there are no robust results available so far concerning whether jobs are more stable and wages higher for those GAT graduates staying in the training firm than for those moving on to another firm. And yet this type of evidence is crucial for understanding the nature of GAT, including the firms’ motivation to contribute to it.

We argue in this Paper that the lack of solid evidence is due to the shortcomings of the data sources used in the previous literature, and we set out to address this deficit by using a more appropriate data set that has become available recently. The problem with previous data sets – such as the German Socio-Economic Panel (GSOEP) or the German Qualification and Career survey (Q&C) – is that in order to understand the effect of the GAT on the trainees’ skills and labour market choices, it is most instructive to study the period immediately following the apprenticeship when the external labour

market comes to its fullest force and before a host of other influences has obscured these initial relationships.

In our study we overcome the difficulties of other studies by using official German social security register data. We have access to the IAB Employment Sample, a 1% sample of the complete employment histories of all workers subject to social security contributions at least once between 1975–95. Clearly, we do not suffer from a small sample problem. Even after restricting the sample to the male cohort born between 1960–65, and conditioning on the completion of apprenticeship training, we keep 16,281 observations. Second, the official register data provide accurate records on wages paid, as well as on job duration (where the accuracy is daily). The data are not without drawbacks either. For instance, the amount of socio-economic background information is limited. Moreover, one cannot tell for sure what individuals do during times when they are not in a job subject to social security contributions.

Still, the data set offers in our view a unique opportunity to provide more reliable empirical evidence on several of the key issues discussed in the literature. In particular, we analyse the wages after the apprenticeship, distinguishing between apprentices who stay in their training firm ('stayers') and those who don't ('movers'). Another contribution of this study is that we also analyse a rarely addressed aspect: the duration of the first job. This duration is important as part of the rent-extracting behaviour of the training firms might take the form of longer first-job durations for the apprentices that stay with the training firm.

We provide robust evidence on two questions that are important for understanding the firms' benefit from training, and on which previous studies using alternative data sources have offered conflicting evidence. The first question was whether apprentices who are retained in the training firm receive higher or lower wages than apprentices who move to a new employer. Our finding is that stayers employed in large firms do indeed command a wage premium. The second question was the relationship between apprenticeship training and the duration in the first job. We found that retained graduate apprentices, and especially those of larger firms, stay significantly longer in their first job than apprenticeship graduates recruited by another firm. Thus firms – particularly large firms – benefit from lower subsequent turnover rates among their retained trainees.

Taken together, the evidence is compatible with a cream-skimming hypothesis for large firms. One cannot exclude, however, that the training is at least in part firm-specific after all. Such non-transferable human capital could also, at least in part, contribute to higher wages and longer duration of stayers.

1. Introduction

In international comparisons on education, vocational training, and labour market performance, Germany shows a high involvement of firms in the education and training of the young by means of a well-developed apprenticeship system. This fact is seen as a positive characteristic of the German education and labour market system, as it contributes to the low youth unemployment rates and the high general skill levels of the workforce.

A peculiar fact about German apprenticeship training (GAT) is that it mainly provides general training and thus portable skills. In addition, there is ample empirical evidence that firms actually make substantial net investments into GAT. This is a puzzle as the existence of a (partially) firm-financed apprenticeship training is not easily reconcilable with standard human capital theory according to which profit maximizing firms should not pay for general training but rather free-ride on the investment of others. Most explanations in the literature are based on the idea that the training firms are able to recoup the costs of the training by extracting rents from the graduated apprentices that stay with the training firm. Examples of such explanations are based on asymmetric information on the ability of the apprentices (Acemoglu and Pischke, 1998), high mobility costs and low general labour turnover in the German labour market (Harhoff and Kane, 1997), or, more generally, market imperfections and compressed wage structures (Acemoglu and Pischke, 1999a, 1999b). In these models firms are able to pay post-apprenticeship wages below marginal productivity and thus recoup the cost of investment.

Concurrently, a substantial related empirical literature has emerged that investigates various aspects of the GAT, among them, but not exclusively, the question of why firms train. Two recent papers use firm level data to directly estimate the determinants of firms' demand for apprentices (Dietrich, 2000, Fougère and Schwerdt, 2001). Other papers have used individual level survey data to establish the wage returns to apprenticeship training (Winkelmann, 1996b), the effect of post-apprenticeship mobility on wages and wage growth (Werwatz, 1996, Winkelmann, 1996a, Clark, 2001, Bougheas and Georgellis, 2001), the wage effects of moves out of the training occupation (Werwatz, 1997, Clark, 2000), and the incidence of unemployment and non-employment spells during the transition from apprenticeship to regular employment (Winkelmann, 1996a, Franz *et al.* 2000, Franz and Zimmermann, 2000, Riphahn, 2000).

Despite the substantial size of the literature, few "stylised" facts have emerged (the only robust finding being that about two-thirds of all apprentices leave their training firm within five years of graduation). More often than not, the empirical evidence is inconclusive or even contradictory. For instance, there are no robust results available so far, whether jobs are more stable and wages higher for those GAT graduates staying in the training firm than for those moving on to another firm. And yet, this type of evidence is crucial for understanding the nature of the GAT, including the firms' motivation to contribute to it.

We argue in this paper that the lack of solid evidence is due to the shortcomings of the data sources used in the previous literature, and we set out to address this deficit by using a more appropriate dataset that has become available recently. The problem with previous data sets, such as the German Socio Economic Panel (GSOEP) or the German Qualification and Career survey (Q&C), is that in order to understand the effect of the GAT on the trainees' skills and labour market choices, it is most instructive to study the period immediately following the apprenticeship when the external labour market comes to its fullest force and before a host of other influences has obscured these initial relationships.

Whereas in the GSOEP, apprentices can in principle be observed during their transition to employment, only few valid cases are obtained. Studies in this area rarely use more than 400 or 500 observations. The Q&C survey, by contrast, is relatively large, with 20-30 thousand observations. However, people in the survey completed their apprenticeship training on average almost 20 years before the survey date. While some retrospective information is available, in particular on the transition pattern, its reliability is doubtful. Moreover immediate post-apprenticeship wages are not collected at all. Finally, it is unclear whether the experiences of GAT graduates of some ten, twenty, or thirty years ago have any close relation to the experiences of current and future cohorts.

In our study we overcome these difficulties by using official German social security register data. We have access to the IAB Employment Sample, a one percent sample of the complete employment histories of all workers being subject to social security contributions at least once between 1975 and 1995. Clearly, we don't suffer from a small sample problem. Even after restricting the sample to the male cohort born between 1960 and 1965, and conditioning on the completion of apprenticeship training, we keep 16,281 observations. Secondly, the official register data provide accurate records on wages paid, as well as on job durations (where the

accuracy is daily). The data are not without drawbacks either. For instance, the amount of socio-economic background information is limited. Moreover, one cannot tell for sure what individuals do during times when they don't work in a job subject to social security contributions.

Still, the dataset offers in our view a unique opportunity to provide more reliable empirical evidence on several of the key issues discussed in the literature. In particular, we analyse the wages after the apprenticeship, distinguishing between apprentices who stay in their training firm ("stayers") and those who don't ("movers"). Another contribution of this study is that we also analyse a rarely addressed aspect: the duration of the first job. This duration is important as part of the rent-extracting behaviour of the training firms might take the form of longer first-job durations for the apprentices that stay with the training firm.

The paper is organized as follows: Section 2 discussed the recent developments of the GAT, and argues that the system continues to be an attractive source of training for the youth. Section 3 discusses some of the explanations provided by the literature on why firms train, as well as their empirical predictions. Section 4 introduces the data source for this study – the IAB Employment Sample – and details the selection of the sample that we use for this study. Next, Section 5 analyses the mobility after the apprenticeship, the duration of the first job, and the wage in the first job. Section 6 concludes.

2. German Apprenticeship Training (GAT)

At the turn of the millennium, apprenticeship training maintains its position as the foremost source of training among young adults in Germany. The GAT, also referred to as the dual system of vocational training, combines 2-3 years of class room training in public vocational schools with firm-based on the job training. Apprenticeships exist for as many as 350 different occupations. Detailed curricula are developed in cooperation with state institutions, employer organizations, and unions. Firms' participation is voluntary. Participating firms are subject to a number of rules and regulations for an adequate training environment. About 1.66 Mio apprentices were enrolled in 1998, 22 percent of them in East Germany. About 0.61 Mio new training contracts were formed during that year, more than twice the 0.27 Mio new enrolments in universities and polytechnics (*Zahlenbarometer* 2000).

The dominance of the GAT is unbroken despite a secular decline in the number of apprentice over the last 15 years. For West Germany, the number went down by 28 percent from 1985 to 1998. However, much of this decline is due to demographic and compositional factors. First, the general demographic development means that there are fewer children in the relevant age brackets. For example, the total resident population aged 6-18 in Germanydecreased from 8.25 Mio in 1985 to 7.70 Mio in 1995 (*Zahlenbarometer* 2000). Secondly, there is a trend towards increasing levels of school qualification. For example, in former West Germany, the proportion of school leavers with university-entrance qualification increased from 19 percent in 1980 to 34 percent in 1990 (Basic and Structural Data 1999/2000). But more highly qualified school leavers traditionally have a lower propensity to start an apprenticeship. In a 1998 survey of West German pupils in their last year of mandatory schooling, 71 percent of all school leavers with basic education, but only 26 percent of all school leavers with university entrance qualification, intended to take up an apprenticeship (*Berufsbildungsbericht* 2000). Hence, a decrease in the proportion of leavers with basic education lowers the aggregate apprenticeship-training rate even in the absence of any behavioural changes.

The basic attitude towards the apprenticeship seems to be remarkably stable. The aforementioned survey of school pupils was also conducted in earlier years. The proportion of those disposed favourably towards apprenticeship training, conditional on the level of schooling, did not change much over time. For instance, in the 1994 survey the fraction of pupils in the final year of mandatory schooling interested in apprenticeship training was also 71 percent. This may come as a surprise, given the current emphasis on the emergence of a “knowledge society” and ever increasing skill requirements. Not only academics occasionally question whether the GAT can cope with these demands and whether increased crowding out by tertiary graduates does not put apprentices at an increasing disadvantage, as they are more appropriately classified as “semi-skilled” rather than “skilled” (e.g. Fitzenberger, 1999). Nevertheless, the GAT shows a remarkable resilience to those considerations and, at least in the eyes of the young, remains a viable option.

Part of the attraction of the GAT, from the vantage point of the trainee, is the portability of the acquired skills. On a conceptual level, one can distinguish between firm-specific skills, industry (or occupation) specific skills, and general skills. By definition, skills are portable, i.e., the former apprentice can move to employers other than the training firm without risking

instantaneous depreciation of skills, if they are of the second or third type. The prevailing perception is that most of the skills obtained in the GAT are portable. This view is supported both by the institutional set-up and by indirect empirical evidence. Institutionally, the portability is enforced by the adherence to detailed nationwide curricula for the various training occupations, by including courses in general subjects such as mathematics or business, and by the issue of a diploma at the end of training that certifies the skills and proficiency levels. Empirically, relatively high-turnover rates at the end of apprenticeship training provide *prima-facie* evidence against a high firm-specific component of training.

3. Theory and empirical implications

The question of why firms train has been at the forefront of the international economic research on the German apprenticeship training (e.g., Franz and Soskice, 1995, Harhoff and Kane, 1997 Acemoglu and Piscke, 1998). The question is frequently cast as a puzzle as the existence of an apprenticeship system cannot be easily reconciled with standard human capital theory according to which a profit maximizing firms should not pay for general training, but rather free-ride on the investment of others. In reality, many firms train beyond their own needs, and there is ample evidence that firms especially in the industry and trade sector incur substantial net costs for providing the training. Moreover, there are functioning external markets for trained apprentices.

Apprenticeship contracts expire at a fixed date, typically after 2 or 3 years, or on the day the external examination is passed. On principle, no further obligations exist afterwards, although in some industries, collective bargaining agreements include retention clauses. Such clauses became more widespread in the mid and late 1990s. Nevertheless, firms tend to have substantially lower separation costs for apprentices than for regular employees, where firms are subject to restrictive advance notice rules, need the cooperation of the works council, and may need to make severance payments. Based on this view of the process, apprenticeship training has the character of an extended probation period, which gives the firm otherwise unattainable flexibility in its recruitment decisions. The firms' ability to retain only the better apprentices (who, of course, can chose to decline the offer and move anyway), and not to offer continuing contracts to the "lemons" is, in one way or the other, a key to many attempts to explain firms'

willingness to train. Examples of theories based on this idea are Franz and Soskice (1995) and Acemoglu and Pischke (1998). Both theories claim that training firms are able to extract rents from graduated apprentices because at least a part of their ability is not observable by outside firms. As outside firms cannot distinguish between lay-offs and quits, the training firm can offer graduated apprentices with high (unobservable) ability wages that are below their marginal productivity. As long as these wage-offers are above the going market wages, where the graduated apprentices would be treated as potential lay-offs, the graduated apprentices will accept the wage-offers of the training firm.

A consequence of the above-described theory is that stayers should earn marginally higher wages than movers. A problem is that even with high quality data, the wage gap might be empirically unobservable. Therefore we also analyse another aspect that is important for the firms to recoup the costs of general training: the duration of the first job. Besides the fact that the rents extracted from graduated apprentices depend both on wages and first job-durations, long first job-durations also lead to low labour turnover costs. And although this aspect is not considered explicitly in the asymmetric information argument, it is conceivable that firms make a trade off when setting wages of graduated apprentices below marginal productivity: a substantial underpayment would lead to a high risk of graduated apprentices quitting. Therefore training firms are likely to moderate the size of underpayment, and this should lead to long first job-durations.

Of course, asymmetric information is not the only possible explanation for the firm's willingness to pay for general training. Mobility costs are another one. The argument is that firms anticipate the relatively high mobility costs and the relatively strong preference of the young to stay in the city or village from where they come. For that reason the training firms are able to pay graduated apprentices wages below their marginal productivity, as long as this underpayment does not exceed the (potential) costs of mobility. Harhoff and Kane (1997) provide some empirical evidence: First, based on the 1985/6 Q&C survey they find that in 1996 about 80 percent of the German workforce never moved to take another job. And secondly, based on the 1992 Mannheim Innovation Panel they find that firms are more willing to train apprentices when there are fewer firms around (geographically) to poach their trainees. In the absence of any selection, the predictions are straightforward: stayers should earn less than movers, and stayers should have longer first-job durations (as they are likely to have higher mobility costs).

Thus, the overall predictions of the two theories are ambiguous for the wages in the first job. However, the prediction on the duration of the first job is clear: stayers should have a longer first-job duration than movers. Based on the 1984-90 GSOEP, Winkelmann (1996a) does not find supporting evidence for this prediction. Still the theoretical predictions on the first job durations are in line with the general characteristics of the German labour market: a low average job mobility and high average job durations (see, for instance, Winkelmann and Zimmermann (1998)). Therefore the predictions concerning the first job duration deserve a more detailed analysis that distinguishes between movers and stayers.

4. Data

The data for this study are drawn from the IAB Employment Sample 1975-1995, which is a one percent sample of employment histories of all workers with at least one recorded spell during the 21-year period (see Bender, Haas and Klose, 2000). As the data come from official registers, an important advantage is its accuracy. On the other hand, the event-history format of the data needs a more detailed description, as it differs substantially from usual survey data such as the GSOEP or the Q&C.

By law all employers are required to report information on their workforce to the German Social Security Administration, who administers the health insurance, statutory pension, and unemployment insurance. The population includes all workers and salaried employees, as long as they are not exempt from paying social security contributions. Exempt are civil servants, family workers (without pay), and those in marginal employment (this exemption was removed in 1999). Remarkably, and for the purpose of our study of great importance, the data also include apprentices who, regardless of their wages, are considered employed for the purpose of social security and official statistics. All in all, the employee register covered nearly 80 percent of all employed persons in West Germany in 1995.

The data is organized in terms of spells between "notifiable" events. Notifiable events include the start and termination of employment at a certain employer, and an obligatory end-of-year notification for continuing employment relations. Thus the maximum duration between two notifications is 365 days. Apart from notifications by employers, records from the social security

administration fill in information on unemployment spells, if any, and type of termination. Gaps in a worker's history indicate any period during which a worker either took up exempt employment or left the labour force.

Each spell-record provides information on the starting and end dates (in days) of the period between the current notification and the previous one, a personal identifier and an establishment number. The observed characteristics include individual and family characteristics, like gender, year of birth, nationality, marital status, number of children, and qualifications. And they include employment characteristics, like occupational codes, occupational status, gross earnings (up to the contribution assessment ceiling), industry and establishment size.

The rules underlying the generation of this dataset imply some limitations that we need to take into account in our analysis. One of the more serious limitations is that changes of educational level, occupational status, or wage are all non-notifiable events. This feature implies that not in all cases can the date of apprenticeship completion be exactly identified (note that apprenticeships usually do not finish at the end of year). Essentially, apprentices can be in one of three states at the day following graduation: they continue working in the training firm, they immediately switch to a new employer, or they stop being employed. From the viewpoint of the register, the second and third options imply termination of employment at the training firm. In these cases, a notification by the training firm is required, and the exact termination date of the apprenticeship is known. If, however, the apprentice is retained as a regular employee, no notification is made. In this case, the mandatory end-of-year-notification by the training firm on the graduated apprentice will reveal two status changes: the notified occupational status changes from "Apprentice" to "Skilled worker" and the educational level changes from "without vocational qualification" to "with vocational qualification". For such workers only the graduation year is known.

Consistent with the data structure, we adopt the following two definitions:

a) **stayer**. A stayer is an apprentice whose first job after apprenticeship is in the training firm.

b) **mover**. A mover is an apprentice whose first job after apprenticeship is in a firm other than the training firm.

This definition allows in both cases for intervening non-employment spells. For instance, a graduate who is drafted into military service immediately following the apprenticeship and then returns to the same firm afterwards is still classified as a stayer. The same would apply if the interruption followed after the apprentice had started already to work for a few months as a full employee in his former training firm and then had to take a leave of absence for the military. In this case, the duration of the first job is calculated as the sum of the employment durations before and after the interruption due to the draft.

The identity of training and first job firms relate to the unique establishment number provided in the IAB data. This is a certain weakness, as one cannot distinguish between workers moving within a multi-establishment firm, and those moving between firms. Both events lead to a change of establishment number. This feature may tend to overstate the post-apprenticeship mobility somewhat, in particular for sectors and occupations where multi-establishment firms are prevalent.

Next, we describe the selection of the sample. We are guided by the wish to observe the labour histories of the graduated apprentices as complete as possible. The earliest starting age for an apprenticeship is the age of 15. The labour market data start in 1975 and end in 1995. For cohorts born before 1960, we wouldn't necessarily observe all the apprenticeship spells in the data. At the other end of the data, we notice that apprentices are rarely older than 22 when they complete the apprenticeship. For the 1965 cohort, we thus observe 7 or 8 of the first years in the labour market. In order to reduce the right censoring of first-employment spells, we thus exclude later cohorts and concentrate on those born between 1960 and 1965.

For our study we select West-German men who are trained in an occupation recognized by the Federal Institute for Vocational Training (*Bundesinstitut für Berufsbildung*) for a minimum number of 450 days (see Bender and Dietrich, 1994, for details on this 450 days rule), and who have a completed occupational degree. In total we get 16,281 observations. Table 1 shows that the observations are equally distributed over the six birth cohorts of 1960 to 1965. Only 2 to 3 percent are foreigners. This proportion falls substantially short of the overall proportion of non-Germans in the labour force, around 10 percent. This result reflects the well-known fact that foreigners are less likely to start an apprenticeship, even if they are born and raised in Germany.

The average apprentice is about 17 years old when he starts to train. The proportion of trainees with university entrance qualification (*Abitur*) is only 3 percent for the initial cohort. This finding highlights the traditional role of GAT as a source of non-academic secondary training after completion of mandatory schooling (10 years). Interestingly, the proportion of trainees with *Abitur* doubles from 3 to 6 percent in just six years, while the average age upon entering training increases by about 8 months. Thus, the secular trend towards higher schooling shows strongly, also among those who eventually start an apprenticeship.

[TABLE 1 ABOUT HERE]

Next, the Table shows that unemployment spells and out-of-data spells are common between training and the first job. The out-of-data spells very likely relate in many cases to mandatory military service (or its substitute for contentious objectors; Appendix A discusses in more detail how we deal with this issue). The risk of unemployment was highest for apprentices born in 1964 who entered the labour market around 1984. The correlation between the immediate post-apprenticeship unemployment incidence and the official German unemployment rate is about 0.9. Thus, the transition is strongly affected by the business cycle, a relationship that Franz and Zimmermann (1999) study in more detail. Comparing the average ending age of the apprenticeship and the average beginning age of the first job shows that the unemployment and out-of-data spells are relatively short on average. Even at the start of the first job higher education plays a minor role; only about 1 percent acquired a degree between the apprenticeship and the first job. About 70 percent stays with the training firm after the apprenticeship, whereby the retention rates declined by about 6 percentage points over the cohorts.

5. Empirical Analysis

5.1. Mobility after Apprenticeship

A first concern for training firms to recoup the costs of the general training within the GAT is that the retention rates should be reasonably high. Table 1 already showed that about 70 percent of the graduated apprentices have their first job with their apprenticeship firm. Table 2 presents the sample statistics by mobility after the apprenticeship, and shows that the stayers are on average younger, and are more often trained at large firms. Obviously the movers experience more frequently unemployment- or out-of-data-spell between apprenticeship and the first job. About 3.5 percent of the movers acquire a higher education degree following the apprenticeship. On average movers are employed in firms that are larger than the training firm. This is consistent with the idea that the small firms, which are mostly firms in the crafts sector, are net "exporters" of apprenticeship trainees. The distinction between industrial firms, which are mostly large, and firms in the crafts sector, which are mostly small, is important especially as industrial firms have substantial net costs for providing apprenticeship training. Since our data do not include information on the sector (industrial or crafts), we use firm size as a proxy.

[TABLES 2, 3, 4, 5 ABOUT HERE]

To go into more detail, Table 3 presents the immediate retention rates and the survivor rates after 3, 5, and 10 years by size of the training firm. Seven out of ten apprentices stay in their training firm initially. However, within three years, two thirds of those leave so that the three-year retention rate is only 24 percent. After ten years, only 12 percent of all graduates still work in the firm they were trained in. As expected, there is some significant variation by firm size. The variation is, however, less pronounced initially as the immediate retention rates are, with the exception of very large firms (1000 and more employees) quite homogeneous. After 10 years, however, a much larger fraction of a graduation cohort still works in the training firm in mid-sized and large firms (for instance 28 percent in firms with at least 1000 employees), compared

to small firms with less then 100 employees, where the ten-year retention rates are below 10 percent. Thus, there is some evidence that larger firms may recoup the costs of the training by retaining a larger fraction of their trainees for a longer time.

Table 4 looks at retention rates by occupation rather than firm size. The variation in the immediate retention rates by occupation is substantial. Examples for occupations with high long-term retention rates are manual occupations like Machine Engineer, Toolmaker, Metalworker, and Lathe Operator, where more than 20 percent of the graduated apprentices are still working for their training firm after 10 years. In contrast, almost all Butchers, Cooks and Pastry-cooks have left the training firm by then. Not coincidentally, the former four occupations are mostly trained at large industrial firms (more than 70 percent at firms with more than 100 employees), while the latter three occupations are mostly trained at small firms.

A more detailed duration analysis will be performed in subsection 5.2, in the remaining part of this subsection we concentrate on the mover/stayer choice. Table 5 presents probit estimation results for the probability of staying with the training firm (the “immediate retention rate”) for graduated apprentices. Individual characteristics play only a minor role: age has a negative impact on the probability of staying with the training firm. More important is the size of the training firm: apprentices trained at firms of 1000 and more employees are more likely to stay with their training firm. Furthermore, the year of ending the training plays a significant role. The estimated year effects strongly correlate with the aggregate unemployment rate, indicating that retention rates are significantly affected by the state of the business cycle. The estimation results on the training occupations are in line with Table 4; the additional correction for the training firm size did not change their impact. These results are therefore not displayed in Table 5.

Overall the conclusions on the immediate retention rates are in line with expectations: the retention rates are generally high, and important determinants of the probability of staying with the training firm are the training firm size, the training occupation, and the calendar year when training was completed. Large firms may indeed benefit from the skills that the apprentices acquired during the training by means of the high retention rates for these firms, and for certain training occupations

5.2. Duration of the First Job

The second important aspect for training firms to recoup the costs of the general training in the GAT is the duration of the first job. Not only profit training firms from long first job durations of their trained apprentices in the sense that they make use of their skills for a long time, but also in the sense that it keeps the recruitment costs low.

There are two studies that have analysed the duration of the first job after apprenticeship before: Winkelmann (1996a) and Franz and Zimmermann (1999). Winkelmann, based on data from the GSOEP, reports five year retention rates of 30 percent, whereas Franz and Zimmermann, based on a sample from the 1991/2 German Qualification and Career Survey, including both men and women, find retention rates after five years of about 35 percent. In contrast, our estimated five-year retention rate is 19 percent. As our data are extracted from register data of the German Social Security Administration (*Bundesanstalt für Arbeit*), and the previously used data are self-reported and retrospective, our survivor rates are likely more accurate. Based on a first job duration analysis for stayers, the Franz and Zimmermann (1999) conclude that durations are longer for large and industrial sector firms. Winkelmann (1996a) compared the first job duration of the movers and stayers and found, somewhat unintuitive, that movers tend to have longer durations. We have now the chance to settle this issue with much better quality data.

[TABLE 6 ABOUT HERE]

Table 6 shows non-parametric estimates of the first-job duration for movers and stayers. Stayers clearly have larger survivor probabilities after 3, 5, and 10 years. Breaking down the survivor rates by the first job firm size shows that the survivor probabilities for stayers are larger than for movers regardless of firm size. And as could be seen from Table 3 already, especially for the largest firms the survivor probabilities are large: after 10 years about 36 percent of the stayers of the firms with 1000 or more employees are still employed by the training firm.

The next question is whether the gap in the survivor probabilities between the stayers and the movers persists once we formally correct for various characteristics (in addition to firm size) by

means of a duration analysis. In principle, time t is measured on a daily basis, which is precise enough to consider time as a continuous variable. However, for stayers we observe only an upper and a lower bound for the first job duration, and hence the likelihood contribution for stayers is discrete. A parametric duration model is ideal to handle such a mixed discrete-continuous duration problem, and we decided to start from a mixed proportional hazard rate model. Define a vector of individual characteristics x, a parameter vector β, and an unobserved individual heterogeneity term ε. The hazard rate $\lambda(t|x,\varepsilon)$ is defined as the probability that the spell is completed at time t given that it has not been completed before time t. Let

$$(1) \qquad \lambda(t|x,\varepsilon) = \lambda_0(t)\, exp\{ x'\beta + \varepsilon \} \qquad \text{(hazard rate)}$$

with $\lambda_0(t)$ the baseline hazard, which represents the individual duration dependence. Solving the standard differential equation, the survivor function conditional on x and ε can be written as (Lancaster, 1990):

$$(2) \qquad S(t|x,\varepsilon) = exp\{ -\Lambda_0(t)\, exp\{ x'\beta + \varepsilon \} \} \qquad \text{(survivor function)}$$

with $\Lambda_0(t) = \int \lambda_0(u)du$ the integrated baseline hazard. Now for integrating out the unobserved heterogeneity term ε we follow Lancaster (1979), who assumes that the variable $u = exp(\varepsilon)$ is gamma distributed independently of x with expectation 1 and variance σ^2 . The advantage of this distribution is that it leads to a closed form for the survivor function. Abbring and Van den Berg (1998) give a less ad hoc argument in favour of this distribution, by showing that (under mild conditions) the unobserved heterogeneity distribution among the survivors at time t converges to a gamma distribution for large t. The closed form of the survivor function conditional on x is

$$(3) \qquad S(t|x) = [\, 1+\sigma^2\Lambda_0(t)exp\{ x'\beta\} \,]^{-(1/\sigma^2)} \qquad \text{(survivor function)}$$

The first derivative with respect to time t for $F(t|x)=1-S(t|x)$ gives the density function:

$$(4) \qquad f(t|x) = \lambda_0(t)\, exp\{ x'\beta \}\, [1+\sigma^2\Lambda_0(t)exp\{ x'\beta\}]^{-(1+1/\sigma^2)} \qquad \text{(density)}$$

By deriving the survivor and density function we in principle have all we need to formulate the likelihood. The only thing we still need to do is to specify the baseline hazard. As we have a relatively large number of observations we use the flexible piecewise constant baseline hazard:

$$(5) \qquad \lambda_0(t) = exp\{ \Sigma_{k=1,K} \ \lambda_k \ I(k=t) \} \qquad \text{(baseline hazard)}$$

which implies for the integrated hazard:

$$(6) \qquad \Lambda_0(t) = \Sigma_{k=1,t} \ exp\{ \lambda_k \} \qquad \text{(integrated baseline hazard)}$$

where K represents the maximum possible number of days. As estimating K parameters λ_k would be too demanding, even with our large number of observations, and we thus restrict these parameters on a monthly or yearly basis. The model is suitable to tackle the problem of imprecisely measured first job durations for the stayers: we know that the realized duration t is between a certain observed minimum duration t_{min} and a certain observed maximum duration t_{max}. Therefore the probability of such an observation is:

$$(7) \qquad P(t_{max} \geq t > t_{min} \mid x) = S(t_{min} \mid x) - S(t_{max} \mid x) \qquad \text{(partly censored observation)}$$

A third kind of observation occurs due to the observation period: Graduated apprentices still in their first job at January 1, 1996, are right censored. Taking the three different kinds of observations together, the log-likelihood function can be written as

$$(8) \qquad Log\ L(\beta,\sigma^2) = \Sigma_{uncensored} \ Log(\ f(t|x) \ ) \ + \\ \Sigma_{partly\ censored} \ Log(\ S(t_{min} \mid x) - S(t_{max} \mid x) \ ) \ + \\ \Sigma_{right\ censored} \ Log(\ S(t \mid x) \ )$$

Since for stayers the firm and the graduated apprentices know each other already for 2 to 3 years, whereas for movers both the firm and the graduated apprentices still have to learn about each other, the baseline hazard might be substantially different for the two groups. Therefore we stratify the model by allowing for separate baseline hazards for movers and stayers. All other parameters are set equal for stayers and movers, a restriction that cannot be rejected.

[TABLE 7 AND FIGURES 1.A, 1.B, 2.A, 2.B ABOUT HERE]

Table 7 presents the maximum likelihood estimation results. Let us start with a remark on the variances of the unobserved heterogeneity term *u*. Given the substantial standard errors, the null hypothesis of the absence of unobserved heterogeneity is not rejected. This is not an uncommon finding, given that our baseline hazard is specified very flexibly and identification becomes a problem. We still decide to maintain the model with unobserved heterogeneity in order to protect estimates against spurious duration dependence. Among the individual characteristics, only marital status has a significant impact: a graduated apprentice married at the time of starting the first job has a longer expected first job duration. The first job firm size has a highly significant impact in line with the expected pattern: graduated apprentices at large firms have longer durations. The impact of the training firm size is insignificant once we control for the size of the current firm (Identification is on the basis of movers since for stayers the training and first job firm size is equal by definition unless the size changes over time).

Since we have stratified the baseline hazard by staying with the training firm, Table 7 does not contain a dummy for stayers. Figure 1.A shows the hazard rates for a representative individual. According to theories based on (asymmetric) information and learning, the hazard rates should be different especially in the first months as for the stayers some information should be revealed already during the training period. Formal tests on the hazard rates yield that they are indeed significantly different. In the first months the probability of leaving the first job is larger for movers. Still it is remarkable that for the very first month the stayers actually have a substantially larger probability of leaving the first job. After the first year the hazard rates are almost the same. Another question is whether the stayers have a larger survivor probability then the movers. Figure 1.B shows that after 1 year the survivor probability of the stayers is larger than for the movers. After 10 years the survivor probability of the movers is about 80 percent of the survivor of the stayers. This means that the explanatory variables do not explain away the ‘raw’ survivor probability gap of Table 6. Therefore a stayer trained and employed by a firm of a certain size has a longer first job durations than a mover trained and employed by a firm of the same size.

As it are mainly large firms that have to recoup the costs of providing the general training, we repeat the analysis for the graduated apprentices trained at firms of 100 or more employees, see also Table 7. The estimation results stay in line with the results for the sample of all apprentices,

except for marital status. But more important are the results on the hazard, see Figures 2.A and 2.B. First of all, it should be noted that the form of the hazard rate does not change. This is reassuring, since otherwise the proportionality assumption for the analysis of the data including all apprentices would be put into question. But the main result is that the hazard of the stayers stays substantially below the hazard of the movers until the fourth year (except for the first month). The consequence is clearly visible in Figure 2.B: after 10 years the survivor probability of the movers is about 60 percent of the survivor of stayers. This produces strong evidence for the fact that a stayer trained and employed by a large firm has a substantial longer first job duration than a mover trained and employed by a large firm of the same size.

The fact that in the first month the stayers have a substantially larger probability of leaving the first job is somewhat puzzling. A possible explanation is that some employers might not have open positions, but still hire some of their graduated apprentices to give them time to search for another job. Such behaviour could be influenced by collective bargaining agreements in certain industries whereby temporary retention requirements are specified. Employers subject to such agreements cannot separate at will.

5.3. First Wages after Apprenticeship

A particular advantage of our data is that we observe the wages in the first job after the apprenticeship, whereas most other empirical studies on the GAT observe the wages many years after the apprenticeship. To get a first impression of the wages, Table 8 presents the last wage during the apprenticeship and the first wage in the first job. The wages are measured on a daily basis (including weekends and holidays) in real 1985 DM. For the first wage in the first job we actually have to use the wage of the second notification in the first job, as for stayers the wage of the first notification is a weighted average of the last wage as an apprentice and the first wage in the first job. Using the wage of the second notification means that some selection is present in the data; some of the graduated apprentices have left the first job by then. This is the case for about 6 and 14 percent of the movers and stayers respectively, which is in line with the result from the previous section where for the stayers hazard of the first month was large. And there is a second source of selection present: for a certain amount of graduated apprentices the wage of

the second notification is missing, as they did not receive a wage from their employer for that observational period (which is mostly due to mandatory military service). The numbers here are more substantial than for the first type of selection: about 31 percent of movers, and about 27 percent of stayers.

The wage in the last period of the apprenticeship is about one third of the wage in the first job. During the ten years where the majority of the observations occur – from 1978 to 1987 –stayers earn on average more than the movers. For the later years this does not hold anymore. This could be a result of the fact that the graduated apprentices that go on for higher education after the apprenticeship are typically included among the movers. The question is whether stayers still earn more than movers after correcting for additional characteristics.

[TABLE 8, 9 ABOUT HERE]

Table 9 presents the results of first job wage regressions. It shows that the individual characteristics age, marital status, and higher education have a significant positive impact on the wage. The year dummies are highly significant, and pick up the real wage increases over the years. Considering the sample of all graduated apprentices, stayers and movers earn the same wage. In the sample of graduated apprentices trained at large firms, however, stayers earn significantly higher wages than movers. As we also control for the first job firm size, the interpretation is that a stayer trained and employed by a large firm earns about 4 percent more than a mover trained and employed by a large firm of the same size. The two results together are evidence that the stayers of the large firms are a positively selected group. As we, obviously, cannot correct for all the relevant observable variables, we cannot judge how much of this selection is on the basis of asymmetric information.

6. Conclusion

The main goal of our analysis was to provide new empirical evidence on an old question, namely the motivation of the firms participating in the GAT to invest in general skills. We argued that

the IAB Employment sample is particularly well suited for this task, due to its accuracy, the long observation period (1975-95), and the large number of observations. The large sample size was exploited, among other things, to perform occupation specific analyses at a level of disaggregation hitherto unavailable.

Most importantly, however, we provided robust evidence on two questions that are important for understanding the firms' benefit from training, and on which previous studies using alternative data sources have offered conflicting evidence. The first question was whether apprentices who are retained in the training firm receive higher or lower wages than apprentices who move to a new employer. Our finding is that stayers employed in large firms indeed command a wage premium. The second question was the relationship between apprenticeship training and the duration in the first job. We found that retained graduated apprentices, and especially those of larger firms, stay significantly longer in their first job than apprenticeship graduates recruited by another firm. Thus especially large firms benefit from lower subsequent turnover rates among their retained trainees.

Taken together, the evidence is compatible with a cream-skimming hypothesis for large firms. One cannot exclude, however, that the training is at least in part firm-specific after all. Such non-transferable human capital could also, at least in part, contribute to higher wages and longer durations of stayers.

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Appendix A: Mandatory Military Service

Over most of the period analysed in this paper, military service lasted for 15 months. Men were drafted usually after reaching the age of 18. For school leavers with university entrance qualification, this meant that military service could be scheduled between graduation and the start of an apprenticeship. In other cases, though, the apprenticeship had usually started when the qualifying age was reached, which meant typically a postponement of the draft until the completion of the apprenticeship which then affected the timing of the transition to a first job. Military service falls outside the social security system (although time spent in military service counts for the calculation of pension awards). It can be identified in IAB data as follows. If it falls within the tenure at a given firm (such as is the case if an apprentice leaves upon graduation and then later returns to the training firm for regular employment after completing the military service) it is usually coded as a spell of "employment without pay". If the establishment numbers before and after the service have changed, it is usually coded as a non-employment spell. In either case, the distinctive feature of military training spells is their length of around 15 months.

Figure 1.A: hazard rate over first 5 years (all apprentices)

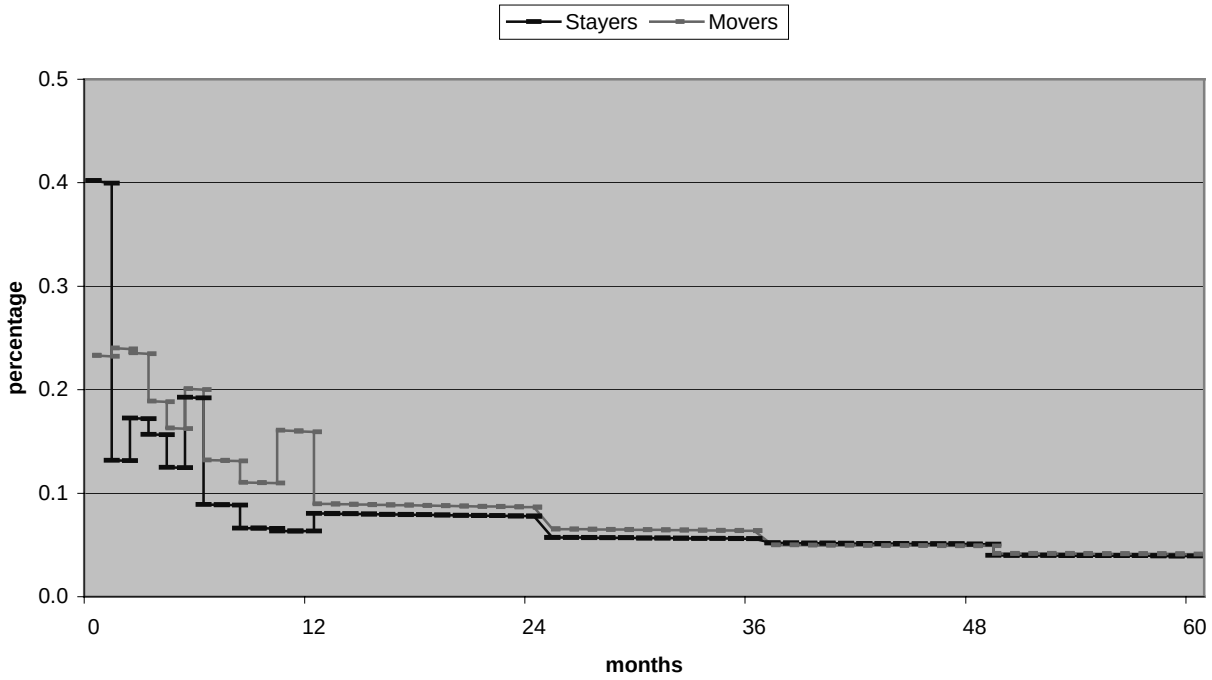
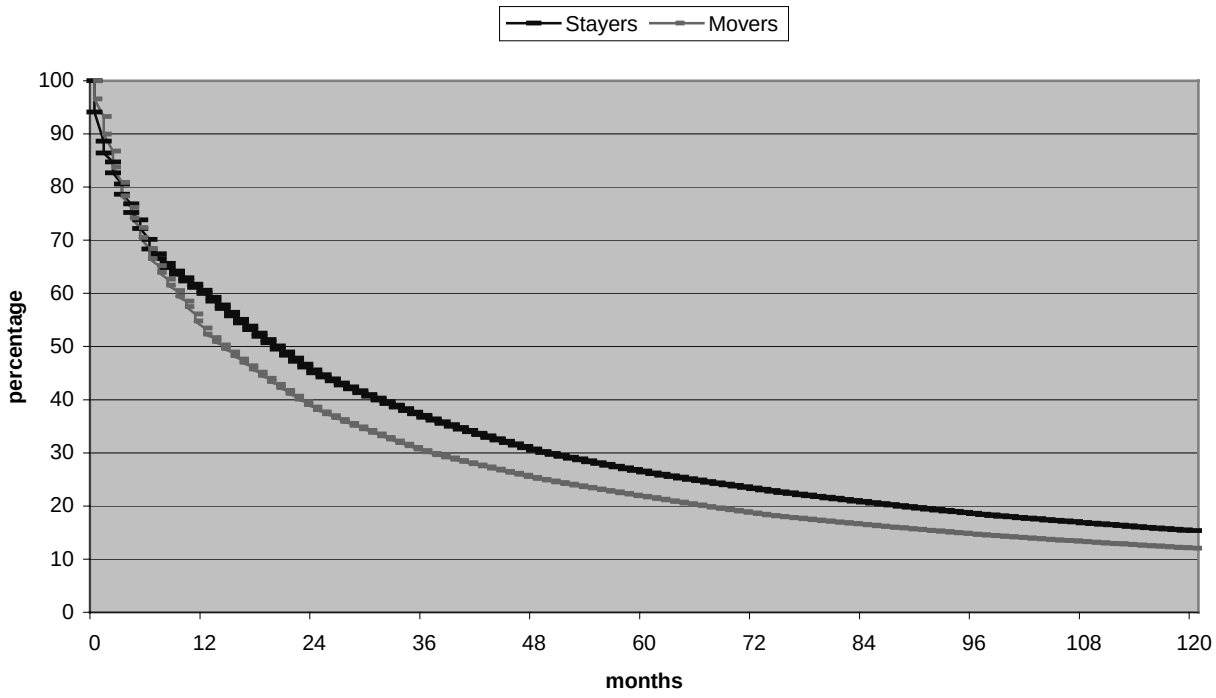


Figure 1.B: survivor function over first 10 years (all apprentices)



Note: the corresponding estimation results are reported in Table 7. The hazard rate and the survivor function are calculated for a graduated apprentice who starts his first job at age 18, unmarried, no *Abitur* or higher education, training and first job firm size 100-499 employees, training occupation Car Mechanic.

Figure 2.A: hazard rate over first 5 years (apprentices trained at large firms (≥100))

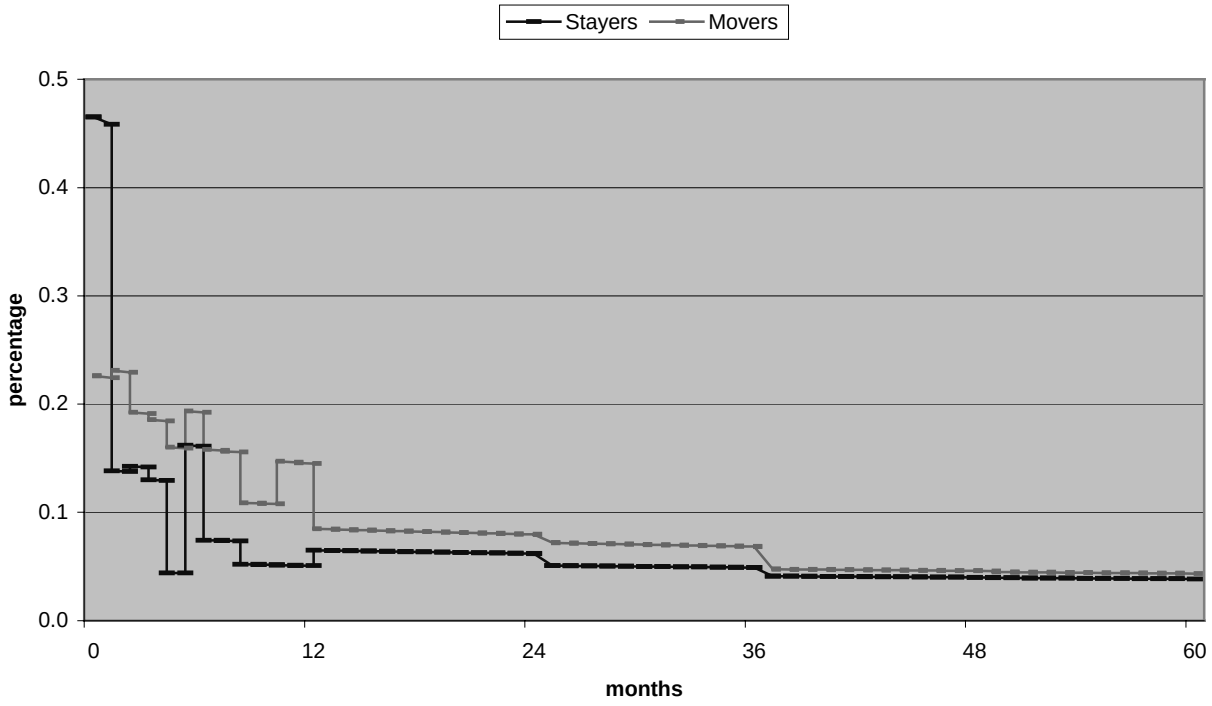
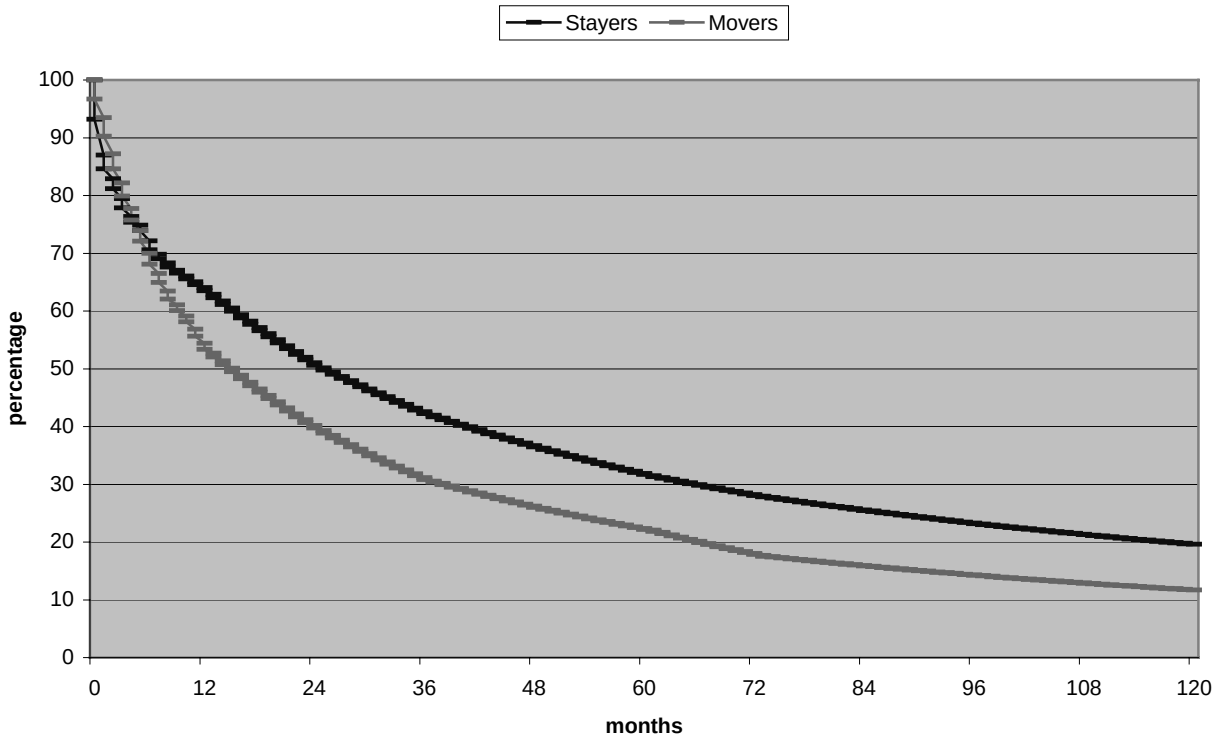


Figure 2.B: survivor function over first 10 years (apprentices trained at large firms (≥100))



Note: the corresponding estimation results are reported in Table 7. The hazard rate and the survivor function are calculated for a graduated apprentice who starts his first job at age 18, unmarried, no *abitur* or higher education, training and first job firm size 100-499 employees, training occupation Car Mechanic.

Table 1: Sample statistics by year of birth

Birth year	1960	1961	1962	1963	1964	1965	Total
(Number of observations)	(2790)	(2623)	(2511)	(2725)	(2857)	(2775)	(16281)
German nationality	0.984	0.987	0.979	0.977	0.969	0.970	0.978
Age at start of training	16.505	16.949	17.030	17.008	17.142	17.191	16.970
Size training firm							
1 employee	0.017	0.017	0.020	0.016	0.013	0.013	0.016
2-9 employees	0.262	0.230	0.223	0.244	0.230	0.234	0.238
10-19 employees	0.127	0.151	0.146	0.146	0.134	0.137	0.140
20-49 employees	0.155	0.153	0.159	0.146	0.166	0.143	0.154
50-99 employees	0.088	0.090	0.082	0.084	0.085	0.104	0.089
100-499 employees	0.163	0.165	0.172	0.175	0.175	0.168	0.170
500-999 employees	0.057	0.061	0.060	0.059	0.065	0.067	0.062
1000- employees	0.129	0.133	0.137	0.128	0.133	0.134	0.132
End of training							
Age	19.393	19.952	20.014	19.988	20.134	20.197	19.945
Married	0.016	0.014	0.008	0.006	0.009	0.006	0.010
Abitur	0.030	0.032	0.042	0.050	0.049	0.061	0.044
Higher education	0.004	0.002	0.001	0.001	0.002	0.004	0.002
Between training and first job							
Unemployment	0.082	0.112	0.170	0.192	0.219	0.191	0.162
Other training	0.024	0.022	0.025	0.027	0.020	0.023	0.023
Out-of-data (includes military)	0.214	0.222	0.239	0.250	0.265	0.254	0.241
Begin of first job							
Age	19.681	20.285	20.426	20.381	20.531	20.535	20.305
Married	0.034	0.034	0.024	0.026	0.025	0.022	0.027
Abitur	0.038	0.042	0.052	0.060	0.061	0.074	0.055
Higher education	0.013	0.013	0.011	0.013	0.014	0.017	0.014
Stay with training firm	0.754	0.737	0.706	0.679	0.675	0.691	0.710
Size first job firm							
1 employee	0.015	0.024	0.017	0.020	0.012	0.015	0.017
2-9 employees	0.246	0.228	0.215	0.229	0.216	0.215	0.225
10-19 employees	0.114	0.138	0.149	0.144	0.134	0.133	0.135
20-49 employees	0.159	0.157	0.146	0.147	0.155	0.142	0.151
50-99 employees	0.092	0.090	0.084	0.089	0.090	0.102	0.091
100-499 employees	0.168	0.169	0.184	0.178	0.184	0.181	0.177
500-999 employees	0.066	0.058	0.059	0.058	0.068	0.066	0.063
1000- employees	0.139	0.138	0.146	0.134	0.140	0.146	0.140

Table 2: Sample statistics by mobility after apprenticeship

	Stayers		Movers	
(Number of observations)	(11554)		(4727)	
	mean	(s.d.)	mean	(s.d.)
German nationality	0.978	(0.146)	0.976	(0.153)
Age at start of training	16.853	(1.893)	17.258	(2.171)
Size training firm				
1 employee	0.013	(0.113)	0.023	(0.151)
2-9 employees	0.222	(0.416)	0.275	(0.447)
10-19 employees	0.142	(0.349)	0.134	(0.341)
20-49 employees	0.156	(0.363)	0.150	(0.357)
50-99 employees	0.092	(0.289)	0.081	(0.274)
100-499 employees	0.171	(0.376)	0.168	(0.374)
500-999 employees	0.059	(0.236)	0.067	(0.251)
1000- employees	0.145	(0.352)	0.101	(0.301)
End of training				
Age	19.854	(1.886)	20.168	(2.151)
Married	0.009	(0.096)	0.011	(0.105)
Abitur	0.043	(0.202)	0.048	(0.214)
Higher education	0.002	(0.047)	0.003	(0.050)
Between training and first job				
Unemployment	0.027	(0.161)	0.492	(0.500)
Other training	0.013	(0.115)	0.048	(0.214)
Out-of-data (includes military)	0.058	(0.233)	0.688	(0.463)
Begin of first job				
Age	19.905	(1.921)	21.282	(3.061)
Married	0.019	(0.135)	0.049	(0.216)
Abitur	0.048	(0.215)	0.069	(0.254)
Higher education	0.003	(0.058)	0.039	(0.193)
Size first job firm				
1 employee	0.012	(0.109)	0.029	(0.169)
2-9 employees	0.222	(0.416)	0.232	(0.422)
10-19 employees	0.142	(0.349)	0.118	(0.323)
20-49 employees	0.156	(0.363)	0.140	(0.347)
50-99 employees	0.092	(0.289)	0.090	(0.286)
100-499 employees	0.170	(0.376)	0.195	(0.396)
500-999 employees	0.060	(0.238)	0.068	(0.252)
1000- employees	0.146	(0.353)	0.128	(0.334)

Note: the category ‘stayers’ includes all graduated apprentices whose first job after apprenticeship is in the training firm, while the category ‘movers’ includes all graduates whose first job after apprenticeship is in a firm other than the training firm.

Table 3: Training firm and mobility after apprenticeship

	Number of apprentices	Stayers	Survivor rates: At least 3 years	At least 5 years	At least 10 years
Size training firm					
1 employee	261	57%	19%	16%	10%
2-9 employees	3867	66%	15%	11%	6%
10-19 employees	2276	72%	19%	13%	7%
20-49 employees	2508	72%	19%	14%	8%
50-99 employees	1450	73%	24%	17%	9%
100-499 employees	2764	71%	28%	21%	14%
500-999 employees	1002	68%	30%	24%	17%
1000- employees	2153	78%	45%	38%	28%
Total	16281	71%	24%	19%	12%

Note: the survivor rate at time t is the percentage of graduated apprentices whose first job spell lasted for a period t or longer. We use the Kaplan-Meier method, as observations might be right censored. The exact date when stayers switch from apprentice to regular employee is not observed. We take the time elapsed since the first post-apprenticeship end-of-year-notification which means that the true job duration will typically a few months longer, with a theoretical maximum underestimate of one year.

Table 4: Training occupation and mobility after apprenticeship

		Apprenticeship training			Survivor Rates		
ID	Name	Code	Number of apprentices	Stayers	At least 3 years	At least 5 years	At least 10 years
1	Car mechanic	281	1606	64%	14%	10%	6%
2	Office worker	781	1234	69%	29%	22%	15%
3	Electrician	311	1222	67%	18%	15%	10%
4	Engineer (machines)	270	843	75%	34%	28%	21%
5	Joiner	501	833	71%	22%	16%	9%
6	Plumber	262	748	78%	18%	13%	7%
7	Bricklayer	441	680	84%	24%	16%	8%
8	Bank clerk	691	502	85%	41%	33%	22%
9	Retail salesman / wholesaler	681	485	67%	20%	15%	8%
10	Painter	511	470	79%	17%	13%	6%
11	Toolmaker	291	467	82%	39%	32%	22%
12	Salesman	682	458	65%	16%	9%	4%
13	Butcher	401	391	66%	9%	6%	2%
14	Fitter on building site	271	378	75%	26%	17%	9%
15	Metalworker	274	365	73%	43%	37%	28%
16	Cook	411	328	49%	2%	0%	0%
17	Baker	391	315	69%	16%	13%	5%
18	Engineer (telecommunication)	312	254	48%	22%	13%	4%
19	Engineering draughtsman	635	240	68%	23%	20%	12%
20	Carpenter	451	239	87%	34%	26%	14%
21	Lathe operator	221	233	78%	43%	38%	27%
22	Pastry-cook	392	223	60%	12%	7%	0%
23	Engineer (electrical appliance)	314	218	69%	30%	23%	17%
24	Mechanic (agricultural machines)	282	206	69%	15%	9%	6%
25	Mechanic	285	157	70%	29%	21%	14%
26	Metal worker (sheet metal)	261	143	73%	31%	27%	21%
27	Haulage contractor	701	137	69%	17%	12%	9%
28	Container builder	252	128	80%	29%	24%	12%
29	Metal worker (steel)	275	127	83%	28%	15%	8%
30	Insurance broker	694	116	68%	29%	21%	11%
31	Precision engineer	284	111	61%	29%	21%	13%
32	Builder	442	109	76%	15%	8%	5%
33	Mechanic (radio equipment)	315	108	47%	6%	4%	2%
99	Others	---	2207	72%	29%	24%	16%
	Total	---	16281	71%	24%	19%	12%

Note: see the note of Table 3 for the calculation of the survivor rates.

Table 5: Analysis for staying (probit)

	Parameter Estimate	Standard error
Intercept	0.6448	(0.2082)***
Individual characteristics		
German nationality	-0.1772	(0.2978)
Age	-0.0186	(0.0104)*
Married	-0.0422	(0.1075)
Abitur	-0.0604	(0.0609)
Size training firm		
1 employee	-0.3830	(0.0849)***
2-9 employees	-0.1352	(0.0374)***
10-19 employees	0.0401	(0.0409)
20-49 employees	0.0353	(0.0390)
50-99 employees	0.0872	(0.0454)*
100-499 employees	---------	----------
500-999 employees	0.0193	(0.0513)
1000- employees	0.2186	(0.0417)***
Year dummies	yes	(---------)***
Occupational dummies	yes	(---------)***

Note: the dependent variable concerns having the first job after the apprenticeship in the training firm. The individual characteristics are measured at the end of the apprenticeship. Parameters marked with *, ** or *** are significant at a 10, 5 and 1 percent significance level. The year dummies include dummies from 1976 to 1994, and the occupational dummies include dummies for the occupations of Table 4, whereby the remaining group (code 99) is split up in 14 subgroups.

Table 6: First job duration of movers and stayers

	Survivor rates of stayers				Survivor rates of movers			
	Number of stayers	At least 3 years	At least 5 years	At least 10 years	Number of movers	At least 3 years	At least 5 years	At least 10 years
Size first job firm								
1 employee	139	34%	29%	17%	139	21%	17%	10%
2-9 employees	2567	23%	17%	9%	1098	22%	15%	7%
10-19 employees	1643	25%	17%	9%	558	20%	16%	8%
20-49 employees	1799	26%	18%	11%	661	26%	19%	9%
50-99 employees	1059	34%	25%	14%	425	24%	16%	9%
100-499 employees	1966	39%	30%	20%	921	31%	22%	13%
500-999 employees	699	44%	35%	24%	321	42%	28%	17%
1000- employees	1682	58%	49%	36%	604	50%	41%	28%
Total	11554	34%	26%	16%	4724	29%	21%	12%

Note: see the note of Table 3 for the calculation of the survivor rates. Notice that this table gives the survivor rates in the first job (so for $t=0$ the survivor rate is 100%), while Table 3 gives the survivor rate of the graduated apprentices trained at a particular firm (so for $t=0$ the survivor rate is equal to the fraction of stayers).

Table 7: First job duration analysis (mixed proportional hazard rate model)

	All apprentices		Apprentices trained at large firms (≥100)	
	par.	(s.e.)	par.	(s.e.)
Individual characteristics				
German nationality	0.0720	(0.1504)	-0.0850	(0.2720)
Age	0.0072	(0.0194)	0.0200	(0.0363)
Married	-0.2343	(0.1493)	-0.1431	(0.2532)
Abitur	-0.2739	(0.6544)	-0.5027	(1.1672)
Higher education	-0.0264	(0.6953)	0.1536	(1.2097)
Size training firm				
1 employee	-0.0915	(0.2042)		
2-9 employees	-0.0478	(0.0973)		
10-19 employees	-0.0963	(0.1068)		
20-49 employees	-0.0381	(0.1035)		
50-99 employees	-0.0352	(0.1164)		
100-499 employees	---------	---------	---------	---------
500-999 employees	0.0177	(0.1350)	0.0224	(0.1428)
1000- employees	0.0762	(0.1185)	0.2127	(0.5379)
Size first job firm				
1 employee	0.2323	(0.1936)	0.2803	(0.2328)
2-9 employees	0.3476	(0.0972)***	0.3062	(0.2613)
10-19 employees	0.3435	(0.1061)***	0.3949	(0.2261)
20-49 employees	0.2902	(0.1028)***	0.3249	(0.2290)
50-99 employees	0.1726	(0.1136)	-0.0836	(0.1719)
100-499 employees	---------	---------	---------	---------
500-999 employees	-0.1797	(0.1329)	-0.4202	(0.1618)***
1000- employees	-0.5212	(0.1207)***	-0.1870	(0.2122)
Variance	0.1199	(0.1153)	0.2134	(0.2349)
Year dummies	yes	(---------)	yes	(---------)
Occupational dummies	yes	(---------)	yes	(---------)

Note: the parameter estimates concern the impact on the transition probability of leaving the first job (the hazard rate). So a negative parameter implies a smaller probability of leaving the first job, and therefore a longer first job duration. The individual characteristics are measured at the beginning of the first job. Parameters marked with *, ** or *** are significant at a 10, 5 and 1 percent significance level. The year dummies include dummies from 1976 to 1994, and the occupational dummies include dummies for the occupations of Table 4, whereby the remaining group (code 99) is split up in 14 subgroups.

Table 8: Real wages

	Last wage in apprenticeship				First wage in first job			
	Stayers		Movers		Stayers		Movers	
year	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean
1976	3	20.72	22	21.76	3	46.61	19	55.01
1977	194	21.84	59	24.66	180	69.29	42	72.17
1978	411	23.25	120	25.75	333	73.25	81	71.36
1979	810	24.03	278	26.04	531	80.37	166	77.02
1980	1213	25.14	392	26.17	679	86.04	179	76.99
1981	1571	25.58	515	28.57	912	79.88	223	78.81
1982	1641	26.00	633	26.18	981	77.34	297	73.87
1983	1555	26.34	685	26.29	1019	79.10	354	78.99
1984	1282	27.11	626	27.06	817	82.62	380	79.93
1985	930	28.08	425	28.18	588	85.96	302	84.48
1986	529	30.43	279	31.96	335	88.67	229	88.06
1987	316	33.48	176	32.26	202	92.20	184	89.92
1988	155	33.36	93	37.33	113	94.23	143	99.27
1989	104	37.20	57	35.91	69	97.23	105	106.55
1990	59	38.98	41	33.17	38	99.51	106	123.96
1991	30	49.16	20	37.03	32	112.84	56	122.96
1992	23	49.70	10	48.31	17	109.28	40	117.74
1993	17	52.32	8	45.75	12	104.83	36	120.00
1994	6	69.14	5	54.28	8	121.23	38	119.78
1995	3	62.82	4	61.15	0	0.00	1	68.16
total	10852	26.78	4448	27.95	6869	81.91	2981	85.73

Note: the wages are in 1985 real wages using the Consumer Price Index for all private households for the former territory of the Federal Republic of Germany (*Statistisches Bundesamt*, 2001). As for the stayers the first wage in the first job is a mixture between the last wage as an apprentice and the first wage as a regular employee, we decided to use the second wage in the first job. This leads to reduced numbers of observations, as 27 percent of the stayers and 31 percent of the movers already left the first job by then. The remaining losses in the numbers of observations, which are relatively small, are due to the fact that no wage was reported.

Table 9: First job wage regression (ordinary least squares)

	All Apprentices		Apprentices trained at large firms (≥100)	
	par.	(s.e.)	par.	s.e.
Intercept	2.3868	(0.2680)***	2.1923	(0.4078)***
Individual characteristics				
German nationality	0.0713	(0.0405)*	-0.0082	(0.0783)
Age	0.1556	(0.0245)***	0.1744	(0.0373)***
Age²	-0.0029	(0.0006)***	-0.0033	(0.0009)***
Married	0.0358	(0.0173)**	0.0434	(0.0297)
Abitur	0.0075	(0.1017)	0.1207	(0.0665)
Higher education	0.2203	(0.1047)***	0.0640	(0.0760)
Stayer	0.0003	(0.0079)	0.0406	(0.0144)***
Size training firm				
1 employee	-0.0072	(0.0330)		
2-9 employees	-0.0014	(0.0157)		
10-19 employees	-0.0219	(0.0163)		
20-49 employees	-0.0184	(0.0154)		
50-99 employees	0.0166	(0.0180)		
100-499 employees	---------	---------	---------	---------
500-999 employees	-0.0295	(0.0209)	-0.0245	(0.0236)
1000- employees	-0.0317	(0.0172)*	-0.0226	(0.0206)
Size first job firm				
1 employee	-0.2560	(0.0315)***	-0.1678	(0.0467)**
2-9 employees	-0.1771	(0.0153)***	-0.1667	(0.0399)***
10-19 employees	-0.1120	(0.0165)***	-0.0732	(0.0483)
20-49 employees	-0.0922	(0.0149)***	-0.0426	(0.0337)
50-99 employees	-0.0813	(0.0185)***	-0.0894	(0.0395)*
100-499 employees	---------	---------	---------	---------
500-999 employees	0.0504	(0.0189)***	0.0408	(0.0239)*
1000- employees	0.1326	(0.0147)***	0.1097	(0.0209)***
Year dummies	yes	(---------)***	yes	(---------)***
Occupational dummies	yes	(---------)***	yes	(---------)***

Note: Parameters marked with *, ** or *** are significant at a 10, 5 and 1 percent significance level. The year dummies include dummies from 1976 to 1994, and the occupational dummies include dummies for the occupations of Table 4, whereby the remaining group (code 99) is split up in 14 subgroups.