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Dropping out and revising educational decisions: Evidence from vocational education

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Deutsche Zusammenfassung

Dieses Working Paper analysiert Revisionen von Ausbildungsentscheidungen in der dualen Ausbildung. Im Gegensatz zu früherer ökonomischer Forschung analysieren wir nicht nur Abbruchentscheidungen, sondern beziehen explizit auch andere choices nach der Auflösung eines Ausbildungsvertrages ein. In Anlehnung an frühere Arbeiten von Neuenschwander (96, 98, Neuenschwander et al. 99) unterscheiden wir nach Auflösung eines Ausbildungsvertrages zwischen Abbruch (dropout), Wechsel (change) und Rückkehr ins allgemein bildende Schulsystem (upgrade). Die empirische Analyse wurde unter Verwendung eines deutschen Datensatzes aus dem Jahr 2002 durchgeführt. Als Kontrollgruppe verwenden wir die Auszubildenden, deren Lehrvertrag aufgrund eines Bankrotts ihres Ausbildungsbetriebes aufgelöst wurde, und nehmen an, dass sie ihre Ausbildung ohne dieses Ereignis abgeschlossen hätten.

In einer competing risks Spezifikation eines hazard rate Modelles finden wir, dass finanzielle Beweggründe wie etwa die Opportunitätskosten einer Ausbildung oder finanzielle Schwierigkeiten entscheidende Determinanten des Ausbildungsabbruchs zu sein scheinen. Gleichzeitig scheinen lokale Arbeitsmarktbedingungen die Entscheidungen zu beeinflussen: in Regionen mit hoher Arbeitslosigkeit sind die Hazards des Verbleibs im Schulsystem signifikant niedriger. Zudem werden die drei unterschiedlichen Entscheidungen von unterschiedlichen Determinanten getrieben. Dieses Ergebnis zeigt, dass es nötig ist, zwischen den verschiedenen Verbleibsmöglichkeiten zu unterscheiden, statt ausschließlich auf die Abbruchentscheidung zu fokussieren.

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Dropping out and revising educational decisions: Evidence from vocational education

Donata Bessey[*]and Uschi Backes-Gellner[†]

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Abstract

Previous research on educational decisions has almost exclusively focused on individual decisions to start a particular education. At the same time, the decision to revise an educational choice has hardly been analyzed, unless it is the decision to drop out. However, dropping out is only one possibility of revising an educational choice. In this paper, we distinguish three different educational revisions, namely, dropping out, changing and upgrading. We analyze the determinants of these three different choices in apprenticeship training using hazard rate models for the empirical analysis. In a first research step, we carry out a simple hazard rate estimation of the decision to drop out vs. staying in the educational system because dropping out is associated with considerable risks, unlike the other two choices. Our most important finding here is that dropout decisions seem to be driven to a considerable amount by financial considerations such as the opportunity cost of apprenticeship training or financial distress, determinants that could rarely be analyzed in previous research due to lack of information. In a competing risks specification of the different educational choices, we find additional regional-level impact factors and remarkable differences in the determinants of the different choices. Less favorable local labor market conditions lead to lower hazards of staying within the educational system. These results underline the importance of distinguishing between the different choices instead of focusing exclusively on dropping out as one possible choice.

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1 Introduction

The determinants and consequences of high school dropout behavior have received considerable attention from researchers in the past. An extensive literature examines the long-term development of dropout rates (Heckman and LaFontaine 2007), possible determinants of the decision to drop out of high school (Card and Lemieux 2001), and its long-term consequences (Oreopoulos 2007). Much less attention has been paid to the possibility that youths may *revise* an educational decision in different directions. Basically, there are three different possibilities: they can change to another schooling choice, they can go to a more challenging educational choice or they can drop out from the educational system and either work as unskilled workers or end up unemployed.[1] We call the different choices *changing, upgrading* and *dropping out*, respectively.

While the first two groups (changers and upgraders) are rather unproblematic with respect to long-term labor market consequences of their decisions, the last group (dropouts) runs higher risks. Increasing qualification requirements and technical progress give dismal prospects to the unskilled and low-skilled labor force. Additionally, integration into the global economy leads to a lowered demand for unskilled labor (Wissenschaftlicher Beirat des Bundesministeriums für Wirtschaft und Technologie 2006). Empirical studies for the UK and the USA (e.g., Fabbri et al. 2003) seem to suggest that openness increases the elasticity of labor demand, probably especially for low-skilled labor.[2] Besides, wages for unskilled workers are considerably lower. Another risk for educational dropouts is the fact that they lack the requirements for many further education programs. In fact, Oreopoulos (2007) finds that the welfare loss from dropping out from compulsory school is large and probably not outweighed by lower costs because of the dropout decision according to his calculations. Hence, there should be a pronounced interest in understanding the reasons why youths drop out of education as opposed to other educational revisions.

For our empirical analysis of the decision to revise an educational choice, we

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[1]This is a simplified approach, which is nevertheless based on previous work, e.g. in several articles by Neuenschwander (1996, 1998, 1999).

[2]There are two possible reasons for this phenomenon: more trade leads to more competitive goods markets, and multinational firms' global production networks enable them to shift their production abroad more easily. The results are higher unemployment rates on less flexible labor markets (as the German one) for low-skilled workers. It seems that more flexible labor markets tend to end up with higher inequality in labor incomes. Barba Navaretti et al. (2003) use European panel data and also find that in a given country, foreign-owned enterprises adjust their employment systematically faster than domestic ones.

use a German data set on revisions of the decision to enter apprenticeship training. The advantage of this data set is that the different choices can be very clearly distinguished, instead of focusing solely on dropouts as one educational revision. We further add to the existing literature by taking into account various non-financial costs of apprenticeship training as an investment in human capital, as well as financial opportunity costs and perceived bad prospects after finishing the apprenticeship training. This relates to recent work by Dynarski (2008) who finds that scholarship programs lowering the costs of a college degree significantly decrease college dropout rates. Also, Maurin and Xenogiani (2007) find that higher benefits of education (in their case, the possibility to avoid military service for males) led to lower dropout rates from high school. In addition, our data set contains direct questions about the reasons why the individuals dropped out of their training. We believe that this is a big advantage over existing research that mainly hypothesizes about possible reasons for dropout behavior.

For the empirical analysis, we use two different types of duration analyses, namely, a simple hazard rate estimation and a competing risks model. In the simple hazard rate estimation, we analyze the decision to drop out of apprenticeship training as compared to staying within the educational system (i.e. upgrading or changing) because dropping out can be seen as the riskiest educational choice. We find a high importance of monetary reasons to drop out. The higher the apprenticeship wage is relative to the wage for unskilled workers, the lower is the hazard of dropping out. Also, ex-apprentices who named bad income prospects or financial distress as the main reasons to drop out had significantly higher hazards of dropping out. We also confirm results from earlier studies that individuals with a higher previous level of schooling have significantly lower hazards of dropping out.

In the competing risks model, we use the fact that there are apprentices in the sample whose contract was terminated because of a bankruptcy of their firm and assume that they would have completed their apprenticeship successfully without this event. Here, we analyze the decisions to enter the three different educational choices of dropping out, upgrading and changing. While the results for the financial impact factors are confirmed, we find in addition that several regional-level variables significantly affect these decisions. More favorable conditions on the local labor market for apprentices (i.e. more places available per seeker) lead to a signficantly higher hazard of changing. Also, a higher local unemployment rate leads to significantly lower hazard ratios of changing and upgrading. These results confirm earlier findings on the importance of local labor market conditions of educational choices. However, the most stable and probably most important result is the importance of financial impact factors for an individual's decision to drop

out, which is confirmed in all specifications.

The remainder of our paper is organized as follows. Part 2 provides a brief literature review. Part 3 presents theoretical considerations and the estimation framework for our empirical analysis. Part 4 gives some background information presents the main institutional features of the German educational system with a special emphasis on apprenticeship training, introduces the data set that we used and descriptive statistics. Part 5 presents and discusses our estimation results, while part 6 concludes and sketches an agenda for future research on the topic.

2 Literature

There is quite a substantive body of research on high school dropouts in the United States, but considerably less on revisions of educational choices. However, we think that the findings from the US studies on high school dropouts are relevant for our paper as well because they focus on the riskiest educational choice. Whenever there is evidence from research on dropouts from apprenticeship training, we discuss it briefly as well. The existing evidence on dropout determinants has focused (inter alia) on personal characteristics, risky behavior, family background, peer effects and regional labor markets, but only rarely on costs and benefits.

The studies typically find that more able individuals are less likely to drop out (see, for instance, Bishop and Mane 2001 for the United States or Bradley and Lenton 2007 for the United Kingdom). The same seems to be true for apprentices where all studies report that youths with a higher level of previous schooling are less likely to drop out (see, for example, Alda 2003). The importance of schooling can be due to two reasons: on the one hand, longer schooling should be associated with more ability and hence lead to less schooling problems, which can subsequently lead to the decision to quit the training because of high non-monetary costs. On the other hand, more schooling seems to lead to better decision-making abilities (Cutler and Lleras-Muney 2006), so individuals with more schooling make probably better educational decisions, resulting in less matching problems and consequent dropout decisions. Additionally, youths with more prior schooling have in general a larger set of choices available, so they are probably less often forced to start an apprenticeship just because it was the only offer that they received. This probably also leads to better matches and less resulting dropouts.

In general, the studies from the United States and the United Kingdom find important differences in behavior with respect to ethnicity. While they find that members of minorities are less likely to drop out, the results are the op-

posite for apprenticeship training in the German-speaking countries. Blacks and hispanics are found to have a higher probability of high school graduation (Nguyen et al. 2006), and members of ethnic minorities are also found less likely to drop out of post-secondary education in the UK (Bradley and Lenton 2007). However, members of ethnic minorities seem to fare worse than natives in the apprenticeship training system of the German-speaking countries. Neuenschwander (1999) finds in a descriptive study that apprentices without native citizenship are more likely to drop out, Stalder and Schmid (2006) find that natives are significantly more likely to continue their education, and Schöngen (2003) reports that fewer ex-apprentices with foreign parents are still planning to continue their education.

The literature on high school dropouts has in most cases not focused on the timing of the dropout decisions. For the apprenticeship dropouts, previous research has established that most terminations take place during an early stage of the training, and this also seems to be an indicator for matching problems: many youths say that they did not have enough information about their training firm (Stalder and Schmid 2006).

A bad working atmosphere, especially clashes with the instructor and/or colleagues rank among the most frequently cited reasons for a termination on firm level (Schöngen 2003, Neuenschwander et al. 1996, Stalder and Schmid 2006). This provides evidence for matching-related problems: apprentices want to change if the perceived costs are lower in another firm or occupation, hence, in a better match.

The regional labor market is another possible impact factor on educational decisions. Card and Lemieux (2000) find that higher regional unemployment rates lead to a rise in high school completion rates. In contrast, Neuenschwander (1999) finds that there are many dropouts in fields where there are abundant employment opportunities for unskilled workers. The short-term financial gains seem to lead the apprentices to not taking into account long-term implications of their decision. This can be seen as a hint towards the importance of time preference in education-related decision making. Also, this finding underlines the importance of economic incentives that can have adverse impacts on educational outcomes.

Revisions of educational decisions are a complex phenomenon and one reason for the partly contradictory results could be the fact that these studies have only focused on dropping out as one educational revision. However, the importance of decision-making abilities, resulting matching problems and economic incentives, for example adverse local labor market conditions, seems to be confirmed by all the presented results.

In the following section, we provide theoretical considerations for the different choices of changing, upgrading and dropping out that we identified earlier

on, and we derive testable hypotheses.

3 Estimation Framework

3.1 Theoretical Considerations

The economic theory of human capital as pioneered by Becker (1962) predicts that a rational agent will invest in education (as in any other asset) only if it yields a positive net present value (NPV). Future costs and earnings streams can be discounted in order to make different alternatives comparable and to identify the optimal one. For several available choices, an individual will pick the one that yields the highest net present value.

As we analyze the decision to revise educational choices, we have to slightly adjust this framework and incorporate learning about job or occupation characteristics into the decision framework. A characteristic of educational decisions is that decisionmakers typically have only incomplete information about costs and benefits related to their choice. Apprentices will revise an educational choice after learning more about its characteristics if the updated expected utility flows outside this choice exceed the updated expectations of their current choices plus the costs of changing. A choice that may initially have seemed profitable might ceteris paribus become unprofitable from an individual's point of view because of higher than initially expected costs or lower than expected benefits.

However, we expect different impact factors for the different choices. Changers should in general have realized that the NPV of their investment is positive. So, we expect a higher importance of matching-related cost factors for them. For upgraders, the NPV of their investment in education should also be positive in general, but they are probably more likely to be underchallenged by their apprenticeship. For dropouts as the last choice possibility, the NPV of their investment should not be positive, either due to the fact that their costs are too high or their benefits too low, why we expect general cost-and benefit-related impact factors to be more important for them.

Incorporating the idea of learning and updating expectations leads to the prediction that the hazard rates from a started apprenticeship to any destination will probably fluctuate with duration in a non-monotonic way. During the initial learning period, apprentices (and firms) learn about the quality of the match and will probably only remain in a satisfactory match (cf. Jovanovic 1979 for matching on the labor market). As only these satisfactory matches survive, the number of revisions will probably decrease after the initial learning period, leading to lower hazards later during the apprenticeship.

At the same time, the time period until the first returns from the apprenticeship will be realized decreases and the time period in which costs of the apprenticeship occur decreases. This should also lead to lower hazards to any educational choice later during the apprenticeship training.

Wheeler (2001) shows in a matching model that thicker labor markets lead to better matching between workers and firms due to lower search costs. This leads to higher productivity, higher inequality (in pay between different skill groups) and higher expected returns to skill. Hence, apprentices in thicker labor markets should have more incentives to complete their training (c.p.) than their counterparts in areas where the labor market conditions are less favorable. We therefore expect higher hazards of dropping out and lower hazards of changing and upgrading in regions with unfavorable labor market conditions.

3.2 Methods

The structure and available information of the data set offer the possibility to carry out different types of analyses. As we are interested in the timing of the decision to quit an already started apprenticeship training, we estimated various survival analysis models.[3]

Simple Hazard Rates

We started our analysis with a simple hazard analysis of the decision to switch to a different choice within the educational system (i.e., to change or to upgrade) vs. dropping out of it. The information on the timing of the decision to quit the apprenticeship training is available in discrete time (i.e., during probation, later in the first year, in the second, third, and fourth year). Hence, we have grouped data and use a complementary log-log specification for estimation.

Following Prentice and Gloeckler (1978), we specify the discrete time hazard as

$$h(x,t) = 1 - exp[-exp(x'_{ij}\beta + \phi(t))] \qquad (1)$$

where $\phi(t)$ describes how the duration of the spell affects the hazard rate. We worked with a fully non-parametric specification of the hazard function. In order to deal with unobserved heterogeneity (also referred to as "frailty" in the duration analysis literature), we worked with two different approaches. The first one was a parametric specification, using a Gamma-distributed individual heterogeneity term. We chose a Gamma distribution because Abbring

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[3]We started by carrying out simple probit and multinomial logit regressions for the decision to drop out of an apprenticeship. Results are available on request.

and van den Berg (2007) have shown that for exponential mixtures, the distribution of heterogeneity among survivors converges rapidly to a Gamma distribution. However, a test of the null hypothesis that the unobserved heterogeneity variance component is equal to zero could not be rejected. The second approach was a non-parametric specification following the approach by Heckman and Singer (1984). In this model, where we modeled the non-parametric unobserved heterogeneity using two mass points, we could not reject the null hypothesis that the mass point for type 2 is statistically no different to the mass point for type 1. Hence, we present only the results that do not take into account unobserved individual heterogeneity.[4]

Competing Risks Model

In order to estimate a discrete-time competing risks model, we need to make assumptions about the shape of the hazard rate within each time interval because this shape cannot be identified from the data at hand. The literature up tp now has worked with several different approaches, either dealing with assumptions on the timing of transitions (see Narendrenathan and Stewart 1993) or with assumptions on destination-specific densities or hazard rates (see, for example, Dolton and van der Klaauw 1999). We assume constant within-interval destination-specific hazard rates (an approach used by Roed and Zhang 2005) and use the fact that the likelihood function for small interval hazards in this case approaches a much simpler likelihood for the estimation. The likelihood is then given by

$$L = (L^A)^{\delta^A}(L^B)^{\delta^B}(L^C)^{\delta^C}(L^D)^{1-\delta^A-\delta^B-\delta^C} \tag{2}$$

where the δ's denote destination-specific censoring indicators and the L's denote the destination-specific likelihood contributions. Following Allison (1982), we assume a particular functional form for the destination-specific hazards and get the following likelihood contribution for an individual with spell length j:

$$L = \left[\frac{\exp(\beta'_A X)}{1 + \exp(\beta'_A X) + \exp(\beta'_B X + \exp(\beta'_C X))}\right]^{\delta^A} \times$$

$$\left[\frac{\exp(\beta'_B X)}{1 + \exp(\beta'_A X) + \exp(\beta'_B X + \exp(\beta'_C X))}\right]^{\delta^B} \times$$

$$\left[\frac{\exp(\beta'_C X)}{1 + \exp(\beta'_A X) + \exp(\beta'_B X + \exp(\beta'_C X))}\right]^{\delta^C} \times$$

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[4]It should also be kept in mind that these models are also "frail" in a statistical sense, meaning that the introduction of a possibly misspecified term that aims at capturing unobserved heterogeneity can lead to even more serious distortions than ignoring it (see, for example, Arulampalam and Stewart 1995 or Narendranathan and Stewart 1993).

$$\left[\frac{1}{1+\exp(\beta_A'X)+\exp(\beta_B'X+\exp(\beta_C'X)}\right]^{(1-\delta^A-\delta^B-\delta^C)} \times$$

$$\prod_{k=1}^{j-1}\left[\frac{1}{1+\exp(\beta_A'X)+\exp(\beta_B'X)+\exp(\beta_C'X)}\right] \qquad (3)$$

This is the same likelihood than the one for a multinomial logit model and can be estimated with re-organised data (Jenkins 1995). We used the fact that there is quite a substantial number of apprentices whose contract was terminated due to bankruptcy of their training firm. This enables us to treat them as a control group, assuming that they would not have terminated their apprenticeship without the bankruptcy.

The next section presents background information, our data sources and some descriptive statistics.

4 Background and Data

Our empirical analysis of dropout and changing behavior of apprentices is based on a survey of the German Federal Institute for Vocational Education (Bundesinstitut für Berufsbildung) in 2002.[5] Its main advantage is that it allows us to distinguish the three different possible revision decisions very clearly. In addition, it contains extensive information on the reasons for the youths' decision to terminate their apprenticeship. There are several questions that allow us to analyze possible impact factors that have never been used in previous research on the topic, such as the importance of exam nerves or financial distress.

Further questions include information on the current status of the former apprentices, on their educational background, on the year in which they terminated their contract, on respondents' gender and if they have non-native parents. The data set also includes information on the regional provenance of respondents that enabled us to add statistical information from Germany's regional statistics and from the federal employment agency's statistics on the regions of origin.

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[5]9000 questionnaires were sent out to youths who had dissolved their apprenticeship contract in 2001/2002. 2323 questionnaires were returned, but only a smaller number could be used for this work, e.g. because vital information was missing. As the focus of this research is on revision decisions, we also excluded the youths whose apprenticeship contract was terminated before they started their apprenticeship.

4.1 Institutions

Firm-provided apprenticeship training is still one of the most important ways of entering the labour market for youths in the German-speaking countries (Ryan 2001). In Germany, for example, 58 % of all school leavers started an apprenticeship in 2005, and about 20% of youths decided not to complete their apprenticeship, but decided to revise their educational choice.

After their school graduation, the youths in Germany who want to continue their education can either study at universities or polytechnics (*Fachhochschulen*) if they hold the necessary qualification, enter dual apprenticeship training or go to full-time vocational schools (*Berufsfachschule*).[6] There is of course also the possibility to enter the labor market directly after school without apprenticeship training. In the short run, this can be an attractive option for the youths because the typical wage for an unskilled worker is considerably higher than for an apprentice.

The focus of this work is on revising educational decisions in *dual vocational training*. It consists of in-firm training at the workplace and classes at a vocational school (*Berufsschule*). At the moment, there are nearly 350 state-approved occupations for which apprenticeship training is available. They last between 2 and 3.5 years. The apprenticeships are of general nature because they finish with a recognized degree. Winkelmann (1996) and Korpi and Mertens (2003) both find evidence for the importance of general, transferable skills from an apprenticeship as compared to firm-specific human capital. Apprentices earn a small wage paid by their training firms, and youths get their training place either on their own initiative or through the intermediation of the local employment agency or other institutions.

4.2 Descriptive Statistics

The following section presents some interesting descriptive features of the data set. We provide complete summary statistics in Appendix A.

Timing and educational choice after terminations of apprenticeship contracts are similar to previous studies. A majority of contracts was terminated during the first year of the apprenticeship (63%). Late terminations (3rd and 4th year) are quite uncommon. Nearly 80 % of all youths decided to continue their education, but one fifth decided to quit the educational system and work as unskilled workers or were unemployed.

A closer look reveals more interesting descriptive results: female teenagers drop out from the training system less often. This lower level is outweighed by

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[6]These schools exist, inter alia, for training in technical, health-related or business-related occupations. Some examples are chemical-technical assistants, or nurses.

a higher percentage of changers among the girls, while the level of upgraders is similar for both sexes.

Table 1: Choice by Gender

	Males	Females
Changer	71.86%	76.69%
Upgrader	6.44%	6.76%
Dropouts	21.70%	16.55%
n	931	858

A well-known result shows up for the previous level of schooling:[7] the higher it is, the lower is the youths' risk of dropping out from the schooling system. While 40 % of teenagers without any school-leaving certificate dropped out, only 7% of the ones holding an Abitur did so. Inversely, they chose much more often to upgrade, probably also due to the fact that they are the only ones among the respondents who can enter university directly.

Table 2: Choice by prior level of schooling

	None	Hauptschule	Realschule	Fachabitur	Abitur
Changers	55.17%	71.69%	79.09%	78.72%	67.53%
Upgraders	3.45%	2.25%	6.46%	11.7%	26.62%
Dropouts	41.38%	26.06%	14.44%	9.57%	5.84%
n	58	756	727	94	154

Finally, a look at the choice of terminating youths depending on the timing of their termination of contract shows that the early terminations seem to be less problematic than the late ones: while only 16% of the terminations during probation time led to a dropout, 37% of the terminations during the third year did so. This result is mirrored by the development of changing behavior, which decreases heavily for the later terminations. These later terminations of apprenticeship contracts seem to lead to more problems.

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[7]The German schooling system tracks pupil into three different schools after 4 or 6 years of primary school. The lower secondary school (*Hauptschule*) lasts 5 years while the middle secondary school (*Realschule*) lasts 6 years and the upper secondary school (*Gymnasium*) lasts either 8 or 9 years. The latter is the only type of school whose graduates are allowed to study at a university. However, there are also various possibilities to gain a Fachabitur (that allows its holders to study only in a certain field) or Fachhochschulreife (in order to study at a polytechnic) outside the Gymnasium.

Table 3: Choice by Timing

	Probation	First year	Second year	Third year	Fourth year
Changers	74.39%	76.03%	77.13%	60.13%	40.00%
Upgraders	9.42%	7.39%	3.74%	2.61%	6.67%
Dropouts	16.20%	16.58%	19.13%	37.25%	53.33%
n	531	609	481	153	15

As already mentioned, the data set contains information on the regional origin of respondents and allows to match regional-level information. Patterns of behavior across the regions vary remarkably, but neither according to the type of chamber (chamber of commerce vs. chamber of crafts) nor according to the location (east vs. west, north vs. south). The following table summarizes the inter-regional differences.

Table 4: Choice by Region of Origin

	Aachen	Augsburg	Darmstadt	Flensburg
Changers	73.05%	78.50%	61.36%	77.38%
Upgraders	5.39%	5.21%	11.36%	4.76%
Dropouts	21.56%	16.29%	27.27%	17.86%
n	167	307	44	168
	Frankfurt/O.	Freiburg	Gera	Karlsruhe
Changers	77.98%	77.84%	84.85%	76.64%
Upgraders	4.59%	11.98%	3.03%	6.54%
Dropouts	17.43%	10.18%	12.12%	16.82%
n	109	167	33	107
	Kiel	Krefeld	Leipzig	Osnabrueck
Changers	70.80%	59.78%	79.37%	78.02%
Upgraders	5.47%	12.85%	6.35%	2.2%
Dropouts	23.72%	27.37%	14.29%	19.78%
n	274	179	63	91
	Rostock	Entire Sample		
Changers	75.00%	74.18%		
Upgraders	3.75%	6.6%		
Dropouts	21.25%	19.23%		
n	80	1789		

Dropout rates are highest in Darmstadt and Rostock, while they are lowest in Freiburg and Gera. The thickness of regional labor markets could provide an explanation for the different dropout rates. We will test this hypothesis in the empirical part of our paper.

4.3 Selection and Construction of Variables

Several questions in the questionnaire can be used as proxies for direct and indirect costs and benefits of educational choices in order to test our empirical implications. Three of the questions aim at capturing the perceived long-term benefits of an apprenticeship: they ask for the importance of bad employment prospects after the apprenticeship, bad income and bad career prospects, respectively. Exam nerves are a form of short-term indirect costs due to stress and perceived mental overstrain of school. Respondents were also asked directly for financial distress as a reason for termination of the apprenticeship contract. More than 30% of the ex-apprentices who named this reason were employed as unskilled workers, compared to only 12 % among those who did not have financial problems. This provides descriptive evidence for the possible importance of financial distress as a form of opportunity cost of an apprenticeship. We also included a measure for another form of non-monetary cost: being a girl in a male occupation or, vice versa, a boy in a female occupation that we measured as being trained in an occupation with on average more than 60% apprentices of the other gender. The higher cost could be due to the fact that youths without peers of the same sex are more often the victims of bullying at work (see, for instance, Litzcke 2003). Finally, the Federal Institute for Vocational Education and Training (BiBB) gathers data on the average salary that the apprentices are paid (*Ausbildungsverguetungen*), while the state-level statistical offices compile statistics on the average salaries for workers, depending on their skill-level and the industry sector where they are working.[8] From these two variables, we constructed a measure of the opportunity cost of an apprenticeship training, namely, the relative wage of apprentices as compared to unskilled workers. We expect all these cost-related variables to lead to higher hazards of dropping out.

The prior level of schooling of respondents should also influence their costs of finishing an apprenticeship. Individuals with a higher level of prior schooling should have less problems in school and learn more easily, leading to lower costs of the apprenticeship. We included four dummies for respondents' school leaving certificates (from Hauptschule, Realschule, and Gymnasium, as well as the ones who hold a Fachabitur), using the ones without any certificate as a baseline category. We expect respondents with a higher school leaving certificate to drop out less often because they should incur lower costs for an apprenticeship. Possibly, they also had a larger set of choices for an apprenticeship available and consequently, they should end up in a better match. This should also lead to lower dropout hazards, and to higher haz-

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[8]However, these average salaries for unskilled workers are not available for all federal states and industrial sectors, reducing our sample size by approximately one third.

ards of changing and upgrading.

Our theoretical considerations predict higher incentives to invest in human capital in thicker labor markets. The thickness of a labor market cannot be captured directly, but there are different measures that can be used in order to proxy it. As a spatial bound, we just took the size of the respective Chamber's area. The relative immobility of apprentices can be seen as a justification for this simplifying assumption. On the supply side, we used the density of the working age population between 15 and 65. On the labor market demand side, we took the local unemployment rate as a proxy.[9] Additionally, the availability of public transport and traffic routes within each Chamber area should also influence the size of a local labor market. Commuting should be much easier in areas where there is a better transport network disposable because more jobs can be reached within reasonable time spans. We included the "population accessible by public transport within one hour" as a measure of transport smoothness. We expect higher hazards of dropping out in thinner local labor markets.

As the descriptive results in earlier studies showed, various other variables could possibly influence dropout and changing decisions. Hence, we also included all the information on socioeconomic status of respondents that was available as control variables. We also included four dummies for the field of training as a substitute for industry sector information: technical, business-related, crafts and "simple" (mostly in services) occupations because there seem to be differences in dropout behavior across the fields (see Alda 2003). On the firm side, we included the available information on firm size (in four groups).

As a last group of regressors, we used information from the regional employment centers (*Arbeitsagenturen*) on the labour market for apprentices and on the numbers of youths participating in labor market measures. The employment centers gather information on registered apprenticeship-seeking youths and on registered open apprenticeship places, and calculate a supply-demand ratio (the number of offered apprenticeship places per 100 apprenticeship seekers). However, as the employment centers can only use registered numbers for their calculations, these numbers do not give a complete picture of regional apprenticeship markets.[10] Many places are filled directly without the intermediation of the job centre and are therefore not included in the centres' statistics. These regressors are intended to control for regional differences in the labor market for apprentices. Riphahn (2002) and Wolter and Mühlemann (2006) both provide evidence for the importance of regional-level

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[9]Results did not change when we used the youth unemployment rate instead.

[10]See, for instance, Ulrich (2006) for a more complete discussion of the topic.

impact factors in vocational education, for employers as well as for youths. Finally, we included a measure that captures the incidence of non-firm-provided training in full-time vocational schools (*ausserbetriebliche Ausbildung*). It is an additional control for conditions on the local labor market for apprentices. We expect both variables to lead to lower dropout hazards because matches should be better when there are more choices available or when firms can pick the best (and probably most motivated) candidates for an apprenticeship.

Detailed information on all variables and data sources can be found in Appendix A.

5 Estimation Results

5.1 Simple Hazards

The following table displays results for our simple hazard rate estimations in various model specifications. The dependent variable takes the value of 1 if the individual dropped out of apprenticeship training and 0 else (i.e., he or she either stayed in the educational system or is a bankruptcy victim). ***, **, and * denote significance levels of 1 %, 5%, and 10 %, respectively. Standard errors are given in brackets. These estimations include controls for the field of apprenticeship and the firm size and various regional-level impact factors, but the estimated coefficients are not reported in this table. However, the complete results are available upon request.[11]

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[11]Additional results for logistic (proportional odds) estimations of the same model confirmed our results, as well as a sensitivity check where we removed various regional-level variables from the estimation equations. The results for these additional estimations again confirm our results and are can be found in Appendix C.

Table 5: Simple Hazard Rates

	Model I	Model II	Model III	Model IV	Model V	Model VI
d1	0.111***	0.128*	0.118**	0.043***	0.044***	0.037***
	[0.072]	[0.159]	[0.102]	[0.015]	[0.022]	[0.018]
d2	0.280*	0.466	0.246	0.074***	0.079***	0.062***
	[0.182]	[0.575]	[0.211]	[0.026]	[0.040]	[0.031]
d3	0.668	1.246	0.575	0.134***	0.150***	0.113***
	[0.454]	[1.620]	[0.514]	[0.048]	[0.077]	[0.056]
d4	1.751	8.574	1.075	0.347***	0.757	0.196***
	[1.288]	[12.223]	[1.022]	[0.135]	[0.412]	[0.106]
d5	2.305		1.788	0.642	1.767	0.415
	[2.127]		[1.938]	[0.341]	[1.767]	[0.282]
non-native parents	1.273	1.953	1.178	1.388*	1.188	1.475
	[0.322]	[0.918]	[0.362]	[0.268]	[0.425]	[0.349]
appr.wage/wage unskilled	0.030***	0.008*	0.030***			
	[0.033]	[0.022]	[0.039]			
female	0.938			0.824		
	[0.234]			[0.146]		
appr. in occupation with > 60% females	0.941		0.874	0.9		0.877
	[0.181]		[0.170]	[0.137]		[0.135]
appr. in occupation with > 60% males	1.279	1.252		1.193	1.175	
	[0.310]	[0.315]		[0.208]	[0.209]	
school dropout	1.707*	2.488	1.539	1.754**	1.705	1.849**
	[0.537]	[1.560]	[0.563]	[0.406]	[0.658]	[0.538]
Realschule	0.587***	0.515**	0.567**	0.582***	0.579***	0.586***
	[0.104]	[0.152]	[0.136]	[0.079]	[0.115]	[0.111]
Fachabitur	0.203***		0.464	0.171***	0.066***	0.266**
	[0.108]		[0.268]	[0.080]	[0.068]	[0.142]
Abitur	0.196***	0.199**	0.161*	0.284***	0.243***	0.343**
	[0.118]	[0.151]	[0.166]	[0.100]	[0.122]	[0.181]
bad prospects	1.126	0.911	1.329	0.826	1.782	0.616
	[0.503]	[0.922]	[0.715]	[0.301]	[1.001]	[0.299]
bad income prosp.	1.945**	2.913**	1.428	1.678**	2.578**	1.413
	[0.581]	[1.482]	[0.585]	[0.398]	[0.972]	[0.453]
bad career prosp.	0.8	0.993	0.732	0.837	0.281*	1.205
	[0.400]	[1.029]	[0.452]	[0.321]	[0.208]	[0.533]
exam nerves	1.151	1.419	1.15	1.159	0.882	1.223
	[0.326]	[0.864]	[0.381]	[0.239]	[0.311]	[0.324]
financial distress	2.332***	2.649**	2.259***	1.847***	1.864*	1.766**
	[0.527]	[1.278]	[0.600]	[0.331]	[0.600]	[0.396]
Observations	2329	818	1439	3879	1785	2094
Log Likelihood	-566.18873	-182.98222	-366.61294	-978.39857	-395.14262	-567.21845
Remarks		females only	males only		females only	males only

Models I - III are estimations including a measure for the financial incentive to drop out represented by the ratio between the apprenticeship wage and the regional wage for unskilled workers in the same sector, for the entire sample (I), females (II) and males (III). Models IV - VI exclude the information on the financial incentive (because this information is not available for all sectors and regions), and again, estimation coefficients presented here are for the entire sample (IV), females only (V), and males only (IV).

In this table, we present hazard ratios (exponentiated coefficients). The effect of the regressor of interest on the hazard is significantly positive if the

hazard ratio is significantly larger than one and significantly negative if the hazard ratio is significantly smaller than one.

We start the discussion of our estimation results with the results for timing of the dropout decision. It turns out that individuals who terminated their apprenticeship during probation time are significantly less likely to drop out in all model specifications. An early termination of the apprenticeship contract seems to lead to less difficulties of staying within the educational system.

The coefficient signs on cost- and benefit-related regressors show some empirical evidence for the predictions of our theoretical considerations. With respect to respondents' prior level of schooling, we find the descriptive findings confirmed. Individuals with a higher previous level of schooling are more likely to stay within the educational system, either as apprentices in another firm or as full-time students again. This could be due to lower costs of learning, but also to a higher level of awareness for the future consequences of dropping out. On the other hand, school dropouts are significantly more likely to drop out from apprenticeship training as well in estimations for the two largest samples (Models I and III) and for males in Model VI.

One of the short-term cost measures also shows a significantly positive coefficient sign. Individuals who said that financial distress was a reason for terminating their contract are significantly more likely to drop out. At the same time, higher apprenticeship wages relative to wages for unskilled workers in the same sector lead to lower hazards of dropping out. This ratio can be seen as a measure for the opportunity cost of completing an apprenticeship (and not working as an unskilled worker), and both results can be seen as a hint that the dropouts care more about financial issues than the non-dropouts. Also, individuals who said that bad income prospects were the reason for terminating their apprenticeship are significantly more likely to drop out, and this result seems to be driven by the females in the sample (the corresponding coefficients in the male-only estimations are not significant).

Firm size dummies were included in the regressions, but they showed only significant coefficients for the largest firms (over 500 employees) and firms between 10 and 49 employees in the two models with the largest sample sizes (Model I and Model IV). In both cases, apprentices have a significantly higher hazard of dropping out.

Dummies for the field of occupation (crafts, technical, business-related and simple service occupations) were also included, where we found that apprentices in technical occupations have significantly lower hazards to drop out in models I, IV, V, and V. These occupations are often quite demanding, and the result could be due to the fact that apprentices who had a place in such an apprenticeship are more able and subsequently have less problems to

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find a new place. Surprisingly, none of the regional impact factors shows a significant impact on the hazard of dropping out of apprenticeship training. In order to uncover possible differences in behavior across the different choices after terminating the apprenticeship contract, we now turn to estimation results for a competing risks specification.

5.2 Competing Risks

The following table displays results for our competing risks estimations, where the control group are those apprentices whose contract was terminated because of bankruptcy of their firm. The different states into which a transition is possible are changing, upgrading and dropping out. ***, **, and * denote significance levels of 1 %, 5%, and 10 %, respectively. Again, we present exponentiated coefficients that can be interpreted as hazard ratios and results for a model with (I) and without (II) the financial incentive.[12]

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[12]Additional estimations for a complementary log-log specification of the model (assuming that transitions in the different choices can only occur at the boundary of time intervals) confirmed the results and can also be found in Appendix C.

Table 6: Competing Risks Estimates

	change I	change II	upgrade I	upgrade II	dropout I	dropout II
d1	35.270***	0.74	3.021	0.029***	1.513	0.078***
	[16.307]	[0.164]	[3.243]	[0.017]	[1.102]	[0.030]
d2	78.286***	1.4	6.609*	0.050***	4.842**	0.158***
	[37.403]	[0.316]	[7.356]	[0.030]	[3.604]	[0.061]
d3	231.608***	3.115***	11.526**	0.062***	19.547***	0.406**
	[118.064]	[0.738]	[13.647]	[0.040]	[15.329]	[0.160]
d4	914.420***	6.293***	14.078*	0.091***	118.213***	1.72
	[542.346]	[1.908]	[22.350]	[0.079]	[103.138]	[0.765]
d5	351.130***	3.984*	0	0	136.704***	3.085
	[375.678]	[3.004]	[0.000]	[0.000]	[155.416]	[2.248]
appr. wage/	0.000***		0.000***		0.000***	
wage unskilled	[0.000]		[0.000]		[0.000]	
non-native parents	0.824	0.892	0.724	0.958	1.197	1.307
	[0.161]	[0.129]	[0.364]	[0.342]	[0.337]	[0.279]
female	1.204	1.442***	0.584	0.597*	0.988	0.969
	[0.191]	[0.161]	[0.214]	[0.166]	[0.269]	[0.185]
appr. in occupation	0.955	0.972	0.536	0.524**	0.909	0.911
with > 60% females	[0.131]	[0.104]	[0.204]	[0.152]	[0.194]	[0.152]
appr. in occupation	0.641***	0.787**	1.159	1.107	1.037	1.023
with > 60% males	[0.105]	[0.086]	[0.437]	[0.312]	[0.280]	[0.194]
school dropout	1.275	1.239	1.375	1.811	2.113**	2.311***
	[0.397]	[0.285]	[1.467]	[1.380]	[0.788]	[0.619]
Realschule	1.003	1.229**	2.305**	2.431***	0.567***	0.630***
	[0.120]	[0.106]	[0.823]	[0.701]	[0.110]	[0.092]
Fachabitur	0.992	0.902	2.637*	3.374***	0.175***	0.241***
	[0.241]	[0.162]	[1.516]	[1.405]	[0.102]	[0.097]
Abitur	1.129	1.237	9.562***	12.251***	0.213**	0.345***
	[0.264]	[0.195]	[4.174]	[3.970]	[0.134]	[0.128]
bad prospects	1.706*	1.37	0.491	1.042	1.517	1.026
	[0.514]	[0.302]	[0.419]	[0.592]	[0.731]	[0.398]
bad income prosp.	1.242	1.652***	0.944	1.242	2.227**	2.155***
	[0.321]	[0.299]	[0.576]	[0.572]	[0.780]	[0.586]
bad career prosp.	1.139	1.236	2.554*	2.015	0.707	0.795
	[0.354]	[0.282]	[1.434]	[0.907]	[0.390]	[0.335]
exam nerves	0.649	0.407***	0.409	0.212	1.034	0.892
	[0.194]	[0.087]	[0.427]	[0.217]	[0.349]	[0.215]
financial distress	0.565**	0.692**	0.828	0.598	2.320***	1.755***
	[0.158]	[0.127]	[0.623]	[0.362]	[0.645]	[0.371]
local perc. of youth	87.250***	42.736***	54.156*	6.977	6.314	1.878
in out-of-firm train.	[73.320]	[26.192]	[111.488]	[12.515]	[9.165]	[2.082]
local population	9.284	0.855	2,663.387*	3.671	31.716	0.419
density	[16.776]	[1.083]	[12,585.145]	[13.563]	[92.836]	[0.886]
local sup-dem ratio on	1,833.306**	584.564**	302.831	51.373	0.199	0.936
job market for appr.	[6,551.418]	[1,485.579]	[3,054.881]	[403.159]	[1.310]	[4.073]
local density of	0.067**	0.895	0.003	0.781	0.098	5.52
public transport	[0.090]	[0.839]	[0.011]	[2.151]	[0.217]	[8.806]
local unemployment	0.000***	0.000***	0.000***	0.000*	0	0.1
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.450]
n	2394	3991	2394	3991	2394	3991
Log Likelihood	-1958.9199	-3535.6305	-1958.9199	-3535.6305	-1958.9199	-3535.6305

Duration effects are captured by the dummy variables on the period of time
in which the apprenticeship contract was terminated (i.e. probation, remain-
der of first year, second year, third year, fourth year). These effects are

non-monotonic for changers and for upgraders, and this result supports our decision to use a non-parametric specification of the baseline hazard.

Being female significantly affects the transition rate into changing and upgrading, but not into dropping out in the model specifications without including the wage ratio. More precisely, females have significantly higher hazards to transit into changing and significantly lower hazards to transit into upgrading.

The previous level of schooling affects the transition rates into upgrading and into dropping out, and into changing for Realschule graduates in the larger sample, where Realschule graduates are more likely to change. In addition, individuals with a higher level of previous schooling have significantly higher hazards of upgrading and significantly lower hazards of dropping out. School dropouts, on the other hand, have a significantly higher hazard of dropping out from apprenticeship training as well. This confirms our results from the simple hazard rate estimation and previous research on the topic.

We now turn to estimation results on the field of individuals' first apprenticeship. Individuals who started their first apprenticeship in a technical occupation have significantly lower hazards of changing and dropping out in both specifications. The same result appears for individuals with a first apprenticeship in a crafts occupation (for changing in the smaller model and for dropping out in the larger one). Finally, individuals who started their first apprenticeship in a business-related occupation have significantly lower hazards of changing in the larger sample.

With respect to the questions on reasons why individuals terminated their first apprenticeship prematurely, we find that the hazards of dropping out are significantly higher for those who said thad bad income perspectives were a reason for them to terminate their first apprenticeship. The same holds true for the hazard of changing, but only in the larger sample. Those who said bad prospects in general were a main reason to terminate have a significantly higher hazard of ending up with a change, but only in the smaller sample. The ones who named bad career prospects as a main reason have (somewhat logically) a higher hazard of upgrading, because a higher level of schooling or a university degree offer of course better career options.

Unlike in the simple hazard specifications, several regional-level impact factors now significantly affect transition rates. A higher local supply-demand ratio on the job market for apprentices leads to significantly higher hazards for changing behavior: when there are more places available, it is of course much easier to find a new apprenticeship place. The higher the number of youth in out-of-firm training, the higher is the hazard of changing. This could be due to the fact that typically only the better school leavers get places in dual training in regions with a high incidence of out-of-firm training. Con-

sequently, they probably also have less problems to change and find another apprenticeship place.

With respect to the local unemployment rate, we find that the hazards of changing and upgrading are significantly lower, the higher the unemployment rate is. This result could be due to individuals' not perceiving the benefits of a completed education in a labor market with a high unemployment rate. It also confirms the theoretical predictions from Wheeler's (2001) model that predicts less incentives to invest in human capital in thinner local labor markets.

The result that dropouts seem to care too much about short-term financial issues from the simple hazard rate estimations is confirmed by the competing risks estimation results. It is especially disturbing that youths who named financial distress and bad income prospects as the reason for dissolving their apprenticeship contract have significantly higher hazards of dropping out: this decision will probably worsen their financial situation considerably in the long term, even if they are better off in the short term with the higher salary of an unskilled worker as compared to their apprenticeship wage. This result seems to suggest that dropouts suffer from a lack of awareness for the long-term consequences of their dropout decision: their discount rate for future payoffs is simply too high.

The overall results seem to suggest that there are indeed remarkable differences in behavior across the different educational choices and that it is useful to distinguish between them instead of focusing exclusively on dropouts.

6   Conclusion

In the present paper, we analyzed revisions of youths' educational choices. Unlike previous research, we did not focus exclusively on dropping out as one revision of an educational decision, but we considered also the choices of changing and upgrading. Using theoretical considerations from human capital theory and matching theory, we tested the hypotheses that cost-related impact factors should be more important for the dropouts, while the importance of bad matches should be higher for the changers. The upgraders should possibly be underchallenged and change to a more demanding educational choice. In addition, we expected stronger incentives to complete apprenticeship education in thicker local labor markets, where employment opportunities after graduation are better, leading to better matches and hence to higher benefits of a completed education. We used a data set on revisions of educational choices in vocational education, where the different choices can be distinguished very clearly.

A simple hazard rate analysis of the decision to drop out vs. staying in the educational system revealed a high importance of various monetary impact factors. The fact of experiencing financial distress significantly increased the hazard of dropping out, as well as stating bad income prospects as the main reason to drop out of vocational education. Also, the lower the financial opportunity cost of an apprenticeship is (measured as the apprenticeship wage relative to the wage for unskilled workers in the same sector), the lower is the hazard of dropping out. These results could point toward the possibility that dropouts are too much guided by monetary considerations when deciding about their education. They also confirmed our hypothesis that cost-related impact factors seem to be decisive for dropout decisions.

With respect to previous educational attainment, we find that individuals with a higher level of previous schooling have lower hazards of dropping out. This result confirms findings from earlier studies and could be due to at least two different reasons: either lower costs of learning or better decision-making abilities for more able individuals and confirm again our hypothesis.

In the competing risks estimations, we find additionally that various measures of local labor market situation affect the hazards of transition in the different states significantly. More precisely, more available places on the local job market for apprentices lead to a higher hazard of changing and a higher local unemployment rate leads to significantly lower hazards of changing and upgrading. This result confirms our hypothesis that individuals should have weaker incentives to invest in human capital in thinner local labor markets. Revising an educational choice is not risky per se, but dropping out of the educational system without a certificate that qualifies its holders for skilled jobs and many further training possibilities is. Our results indicate that there are indeed different determinants for the different educational choices and several policy measures could be promising in order to avoid "true" dropouts, including increasing apprentices' regional mobility in order to achieve better matches between apprentices and firms and increasing youths' awareness for the long-term consequences of dropping out, including the foregone earnings losses due to lower wages and higher unemployment risk for unskilled workers.

Future research on the topic could either include an analysis of the consequences of dropping out from vocational education using longitudinal datasets or focusing on other possible impact factors, such as firm or instructor characteristics.

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A   Data Sources and Descriptive Statistics

Table 7: Variables: Data Sources and Description

Name	Scale	Source
mig	1 = migration background	BiBB
female	1 = female	BiBB
boygirlsjob2	1 = boy in occupation with more than 60% females	BiBB
girlboysjob2	1 = girl in occupation with more than 60% males	BiBB
none	1 = no school leaving certificate	BiBB
haupt	1 = Hauptschule graduate	BiBB
real	1 = Realschule graduate	BiBB
fachabi	1 = Fachabitur holder	BiBB
abi	1 = Gymnasium graduate	BiBB
firstyear	1 = contract termination during first year of apprenticeship	BiBB
secondyear	1 = contract termination during second year of apprenticeship	BiBB
thirdyear	1 = contract termination during third year of apprenticeship	BiBB
fourthyear	1 = contract termination during fourth year of apprenticeship	BiBB
business	1 = contract termination in business-related occupation	BiBB
crafts	1 = contract termination in crafts occupation	BiBB
technical	1 = contract termination in technical occupation	BiBB
simple	1 = contract termination in simple (mostly service-related) occupation	BiBB
under10	1 = firm size under 10 employees	BiBB
betw1049	1 = firm size between 10 and 49 employees	BiBB
betw5099	1 = firm size between 50 and 99 employees	BiBB
betw100499	1 = firm size between 100 and 499 employees	BiBB
over500	1 = firm size over 500 employees	BiBB
badprospects	1 = bad prospects as a reason for termination	BiBB
badincomeprospects	1 = bad income prospects as a reason for termination	BiBB
badcareerpros	1 = bad career prospects as a reason for termination	BiBB
examnerves	1 = exam nerves as a reason for termination	BiBB
findistress	1 = financial distress as a reason for termination	BiBB
percbue	% of youths in full-time school for dually provided occupation	Federal Employment Agency
labmarket2001	population between 15-65/surface	Regional Statistics
supdem2001	supply-demand ratio on the labor market for apprentices	Federal Employment Agency
accpop	Accessible population with public transport within one hour	INKAR
unempl01	unemployment rate	Regional Statistics

Table 8: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	n
1 = migration background	.0786146	.2692103	0	1	1819
appr.wage/wage for unskilled worker	.3209563	.0917546	0	.7892514	1059
1 = boy in occupation with more than 60% females	.2242991	.4172346	0	1	1819
1 = girl in occupation with more than 60% males	.2094557	.4070321	0	1	1819
1 = no school leaving certificate	.0324354	.1772022	0	1	1819
1 = Realschule graduate	.4106652	.4920898	0	1	1819
1 = Fachabitur holder	.0522265	.2225446	0	1	1819
1 = Gymnasium graduate	.0857614	.2800884	0	1	1819
1 = contract termination in business-related occupation	.3018142	.4591713	0	1	1819
1 = contract termination in crafts occupation	.2820231	.4501083	0	1	1819
1 = contract termination in technical occupation	.2380429	.4260026	0	1	1819
1 = firm size between 10 and 49 employees	.3457944	.4757574	0	1	1819
1 = firm size between 50 and 99 employees	.1028037	.3037859	0	1	1819
1 = firm size between 100 and 499 employees	.0934579	.2911532	0	1	1819
1 = firm size over 500 employees	.0670698	.2502117	0	1	1819
1 = bad prospects as a reason for termination	.0439802	.2051075	0	1	1819
1 = bad income prospects as a reason for termination	.0615723	.2404432	0	1	1819
1 = bad career prospects as a reason for termination	.0439802	.2051075	0	1	1819
1 = exam nerves as a reason for termination	.0379329	.1910866	0	1	1819
1 = financial distress as a reason for termination	.0538758	.2258344	0	1	1819
% of youths in full-time school for dually provided occupation	.1520373	.1667809	.020776	.6169014	1819
working age population density	.1857529	.1388806	.0547729	.5554956	1819
public transport density	.2697383	.1897619	.0559182	.737625	1819
local unemployment rate	.0890995	.045999	.0468462	.2008182	1819

B   Additional Estimation Results

Table 9: Simple Hazard Rates, full results

	Model I	Model II	Model III	Model IV	Model V	Model VI
during probation	-2.963	-3.14	-2.933	-2.179	-2.097	-2.417
	[0.657]***	[1.120]***	[0.889]***	[0.346]***	[0.489]***	[0.486]***
later first year	-3.504	-3.224	-3.764	-2.996	-2.781	-3.359
	[0.651]***	[1.089]***	[0.884]***	[0.348]***	[0.483]***	[0.490]***
second year	-3.771	-3.512	-4.02	-3.317	-3.109	-3.685
	[0.688]***	[1.173]***	[0.927]***	[0.348]***	[0.498]***	[0.485]***
third year	-3.804	-2.848	-4.372	-3.141	-2.309	-3.899
	[0.764]***	[1.359]**	[1.008]***	[0.386]***	[0.531]***	[0.550]***
fourth year	-3.917		-4.261	-3.027	-2.174	-3.66
	[0.931]***		[1.119]***	[0.517]***	[0.875]**	[0.673]***
non-native parents	0.202	0.279	0.205	0.295	0.152	0.378
	[0.251]	[0.457]	[0.308]	[0.192]	[0.347]	[0.235]
appr.wage/wage unsk.	1.076	1.116	0.995			
	[1.049]	[2.191]	[1.234]			
female	-0.049			-0.245		
	[0.246]			[0.172]		
appr. in occupation	0.027		-0.037	-0.045		-0.075
with > 60% females	[0.189]		[0.191]	[0.150]		[0.152]
appr. in occupation	0.318	0.229		0.263	0.233	
with > 60% males	[0.241]	[0.247]		[0.174]	[0.176]	
no school-leaving certificate	0.435	0.627	0.391	0.452	0.599	0.376
	[0.311]	[0.616]	[0.366]	[0.230]**	[0.381]	[0.292]
Realschule graduate	-0.53	-0.573	-0.55	-0.632	-0.596	-0.628
	[0.176]***	[0.283]**	[0.236]**	[0.134]***	[0.196]***	[0.187]***
holder of a Fachabitur	-1.577		-0.726	-1.762	-2.588	-1.284
	[0.526]***		[0.553]	[0.463]***	[1.018]**	[0.527]**
holder of an Abitur	-1.878	-1.726	-2.194	-1.505	-1.445	-1.438
	[0.600]***	[0.756]**	[1.028]**	[0.353]***	[0.479]***	[0.532]***
apprenticeship in	0.189	0.079	0.259	-0.028	-0.071	-0.102
business occupation	[0.299]	[0.411]	[0.496]	[0.173]	[0.220]	[0.299]
apprenticeship in	0.064	0.307	0.032	-0.24	-0.048	-0.38
crafts occupation	[0.321]	[0.518]	[0.476]	[0.180]	[0.259]	[0.264]
apprenticeship in	0.057	0.246	0.127	-0.393	-0.669	-0.374
technical occupation	[0.331]	[0.628]	[0.476]	[0.196]**	[0.427]	[0.263]
firm size betw.	0.265	0.572	0.152	0.261	0.467	0.121
10-49 employees	[0.180]	[0.310]*	[0.228]	[0.137]*	[0.208]**	[0.185]
firm size betw.	0.128	-0.352	0.226	0.207	-0.28	0.374
50-99 employees	[0.264]	[0.641]	[0.305]	[0.205]	[0.399]	[0.244]
firm size betw.	0.001	0.597	-0.299	0.285	0.516	0.124
100-499 employees	[0.288]	[0.458]	[0.390]	[0.209]	[0.322]	[0.277]
firm size over	0.325	0.609	0.119	0.501	0.558	0.416
500 employees	[0.315]	[0.498]	[0.431]	[0.231]**	[0.378]	[0.297]
bad prospects	-0.18	-0.536	0.035	-0.343	0.218	-0.475
reason for termination	[0.419]	[0.880]	[0.512]	[0.356]	[0.553]	[0.475]
bad income prospects	0.646	0.812	0.452	0.393	0.743	0.249
reason for termination	[0.297]**	[0.504]	[0.398]	[0.240]	[0.376]**	[0.327]
bad career prospects	-0.194	0.189	-0.371	-0.236	-1.155	0.083
reason for termination	[0.474]	[0.904]	[0.594]	[0.375]	[0.723]	[0.433]
exam nerves	0.34	0.379	0.372	0.47	0.274	0.501
reason for termination	[0.282]	[0.574]	[0.334]	[0.209]**	[0.353]	[0.267]*
financial distress	0.894	0.899	0.934	0.694	0.816	0.67
reason for termination	[0.224]***	[0.473]*	[0.264]***	[0.181]***	[0.319]**	[0.226]***
local percentage of youth	-1.761	0.676	-3.2	-2.057	0.117	-3.957
in out-of-firm training	[1.380]	[2.265]	[1.806]*	[1.033]**	[1.554]	[1.476]***
local population density	-0.615	-4.399	-0.099	-0.97	1.173	-2.831
	[2.679]	[5.004]	[3.318]	[1.948]	[3.403]	[2.542]
local supply-demand ratio on the	-7	-16.582	-0.026	-3.952	-2.056	-4.004
job market for apprentices	[5.995]	[10.989]	[7.215]	[3.957]	[6.926]	[5.028]
local density	1.499	4.002	1.14	1.737	0.037	3.192
of public transport	[2.039]	[3.823]	[2.518]	[1.470]	[2.540]	[1.925]*
local unemployment rate	7.569	0.465	12.883	9.509	-0.817	17.697
	[5.603]	[9.740]	[7.312]*	[4.115]**	[6.870]	[5.643]***
n	2329	818	1439	3879	1785	2094
LogL	-624.5478	-220.9826	-388.74944	-1023.8992	-433.1368	-576.2081

Table 10: Simple Hazards, logit

	Model I	Model II	Model III	Model IV	Model V	Model VI
d1	0.122***	0.176	0.116**	0.042***	0.042***	0.037***
	[0.086]	[0.231]	[0.109]	[0.016]	[0.023]	[0.019]
d2	0.32	0.687	0.249	0.075***	0.078***	0.062***
	[0.226]	[0.898]	[0.234]	[0.028]	[0.043]	[0.033]
d3	0.816	1.943	0.629	0.142***	0.152***	0.118***
	[0.603]	[2.692]	[0.614]	[0.055]	[0.085]	[0.062]
d4	2.473	22.794**	1.258	0.429**	1.071	0.221***
	[1.989]	[36.103]	[1.309]	[0.181]	[0.651]	[0.129]
d5	3.683		2.604	0.888	2.831	0.551
	[3.986]		[3.264]	[0.578]	[3.970]	[0.441]
non-native parents	1.282	1.834	1.189	1.41	1.205	1.52
	[0.356]	[0.945]	[0.399]	[0.297]	[0.460]	[0.394]
appr.wage/wage unskilled	0.023***	0.005*	0.025***			
	[0.027]	[0.013]	[0.035]			
female	0.898			0.801		
	[0.243]			[0.152]		
appr. in occupation with > 60% females	0.925		0.866	0.905		0.876
	[0.194]		[0.181]	[0.150]		[0.145]
appr. in occupation with > 60% males	1.304	1.317		1.21	1.196	
	[0.344]	[0.377]		[0.228]	[0.235]	
school dropout	1.834*	2.532	1.623	1.981***	2.033	1.984**
	[0.661]	[1.840]	[0.674]	[0.522]	[0.910]	[0.650]
Realschule	0.553***	0.461**	0.530**	0.558***	0.547***	0.560***
	[0.106]	[0.154]	[0.136]	[0.081]	[0.119]	[0.113]
Fachabitur	0.176***		0.428	0.151***	0.055***	0.237**
	[0.101]		[0.269]	[0.074]	[0.058]	[0.135]
Abitur	0.178***	0.164**	0.144*	0.269***	0.228***	0.323**
	[0.110]	[0.133]	[0.151]	[0.099]	[0.119]	[0.177]
business	1.236	1.166	1.266	0.876	0.781	0.887
	[0.408]	[0.566]	[0.692]	[0.166]	[0.194]	[0.289]
crafts	0.85	1.023	0.771	0.660**	0.911	0.537**
	[0.303]	[0.613]	[0.407]	[0.133]	[0.268]	[0.157]
technical	0.535*	0.884	0.523	0.508***	0.397**	0.501**
	[0.197]	[0.626]	[0.274]	[0.110]	[0.184]	[0.145]
1 = firm size betw. 10-49 employees	1.407*	1.987*	1.257	1.267	1.604**	1.104
	[0.283]	[0.713]	[0.316]	[0.189]	[0.372]	[0.221]
1 = firm size betw. 50-99 employees	1.34	0.766	1.568	1.119	0.662	1.378
	[0.391]	[0.530]	[0.529]	[0.250]	[0.293]	[0.365]
1 = firm size betw. 100-499 employees	0.971	2.028	0.711	1.12	1.639	0.892
	[0.311]	[1.089]	[0.301]	[0.257]	[0.602]	[0.268]
1 = firm size over 500 employees	1.695	2.238	1.424	1.505	1.638	1.353
	[0.591]	[1.341]	[0.672]	[0.382]	[0.715]	[0.436]
1 = bad prospects reason for termination	1.137	0.956	1.343	0.806	1.862	0.59
	[0.555]	[1.017]	[0.797]	[0.315]	[1.121]	[0.308]
1 = bad income prospects reason for termination	2.024**	3.335**	1.47	1.751**	2.855**	1.43
	[0.687]	[1.945]	[0.676]	[0.462]	[1.196]	[0.504]
1 = bad career prospects reason for termination	0.734	0.824	0.668	0.809	0.240*	1.233
	[0.398]	[0.915]	[0.447]	[0.331]	[0.190]	[0.593]
1 = exam nerves reason for termination	1.173	1.498	1.156	1.162	0.884	1.224
	[0.381]	[1.075]	[0.432]	[0.272]	[0.363]	[0.363]
1 = financial distress reason for termination	2.713***	2.918*	2.563***	2.009***	2.048**	1.906**
	[0.715]	[1.636]	[0.781]	[0.412]	[0.748]	[0.485]
local percentage of youth in out-of-firm training	1.182	13.439	0.263	0.558	2.232	0.142
	[1.691]	[33.426]	[0.491]	[0.617]	[3.885]	[0.221]
local population density	11.942	0.239	20.84	0.714	1.703	0.245
	[34.378]	[1.395]	[73.827]	[1.508]	[6.373]	[0.653]
local supply-demand ratio on the job market for apprentices	0.037	0	39.883	0.295	0.975	0.463
	[0.236]	[0.000]	[313.102]	[1.264]	[7.466]	[2.470]
local density of public transport	0.34	4.255	0.236	4.45	2.412	10.108
	[0.737]	[18.667]	[0.628]	[7.084]	[6.713]	[20.434]
local unemployment rate	0.176	0	63.907	25.877	0.016	11,056.14
	[1.049]	[0.000]	[492.660]	[116.069]	[0.121]	[66,415.128]
Observations	2329	818	1439	3879	1785	2094

Table 11: Competing Risks Model, complementary log-log

	change I	change II	upgrade I	upgrade II	dropout I	dropout II
d1	1.502***	-0.756***	-1.672*	-4.231***	-1.966***	-3.209***
	[0.315]	[0.181]	[0.966]	[0.583]	[0.617]	[0.354]
d2	2.105***	-0.286	-1.229	-3.929***	-1.102*	-2.726***
	[0.328]	[0.182]	[1.000]	[0.586]	[0.626]	[0.353]
d3	2.720***	0.199	-1.216	-4.107***	-0.205	-2.138***
	[0.344]	[0.187]	[1.056]	[0.616]	[0.649]	[0.357]
d4	3.257***	0.31	-1.963	-4.294***	0.775	-1.213***
	[0.384]	[0.220]	[1.462]	[0.832]	[0.702]	[0.386]
d5	2.533***	-0.248			0.906	-0.656
	[0.791]	[0.534]			[0.891]	[0.525]
appr.wage/wage unskilled	-5.535***		-6.033***		-4.419***	
	[0.518]		[1.375]		[1.001]	
non-native parents	-0.172	-0.124	-0.523	-0.123	0.257	0.328*
	[0.159]	[0.117]	[0.530]	[0.355]	[0.246]	[0.190]
female	0.174	0.319***	-0.561	-0.627**	-0.031	-0.14
	[0.123]	[0.089]	[0.344]	[0.262]	[0.242]	[0.174]
appr. in occupation	0.023	0.019	-0.654*	-0.669**	-0.063	-0.09
with > 60% females	[0.111]	[0.087]	[0.377]	[0.282]	[0.189]	[0.151]
appr. in occupation	-0.342***	-0.189**	0.311	0.206	0.205	0.109
with > 60% males	[0.128]	[0.085]	[0.353]	[0.266]	[0.238]	[0.172]
school dropout	0.148	0.024	0.267	0.472	0.515	0.531**
	[0.242]	[0.182]	[1.048]	[0.750]	[0.314]	[0.230]
Realschule	0.06	0.192***	0.926***	0.888***	-0.532***	-0.521***
	[0.095]	[0.069]	[0.358]	[0.289]	[0.174]	[0.134]
Fachabitur	-0.022	-0.136	1.100*	1.352***	-1.616***	-1.634***
	[0.206]	[0.155]	[0.561]	[0.406]	[0.535]	[0.428]
Abitur	0.012	0.1	2.276***	2.470***	-1.667***	-1.263***
	[0.185]	[0.125]	[0.416]	[0.313]	[0.601]	[0.354]
business	-0.053	-0.159*	0.378	0.252	0.255	-0.071
	[0.165]	[0.093]	[0.649]	[0.312]	[0.302]	[0.173]
crafts	-0.594***	-0.123	-0.431	-0.262	-0.158	-0.402**
	[0.179]	[0.101]	[0.716]	[0.399]	[0.323]	[0.184]
technical	-0.786***	-0.169	-0.265	0.023	-0.597*	-0.618***
	[0.183]	[0.105]	[0.679]	[0.348]	[0.338]	[0.200]
1 = firm size betw. 10-49 employees	-0.139	-0.075	0.123	0.113	0.297	0.224
	[0.102]	[0.071]	[0.328]	[0.253]	[0.181]	[0.137]
1 = firm size betw. 50-99 employees	-0.043	-0.164	0.875**	0.901***	0.326	0.141
	[0.151]	[0.110]	[0.395]	[0.296]	[0.262]	[0.204]
1 = firm size betw. 100-499 employees	-0.132	-0.196*	-0.021	0.532*	0.094	0.171
	[0.151]	[0.118]	[0.425]	[0.314]	[0.281]	[0.205]
1 = firm size over 500 employees	-0.029	-0.169	0.219	0.45	0.545*	0.427*
	[0.172]	[0.136]	[0.439]	[0.334]	[0.316]	[0.230]
1 = bad prospects	0.327	0.2	-0.932	-0.062	0.257	-0.085
reason for termination	[0.240]	[0.168]	[0.816]	[0.542]	[0.418]	[0.353]
1 = bad income prospects	0.101	0.329**	-0.158	0.013	0.665**	0.558**
reason for termination	[0.195]	[0.135]	[0.565]	[0.430]	[0.291]	[0.234]
1 = bad career prospects	0.123	0.168	0.789	0.587	-0.4	-0.305
reason for termination	[0.245]	[0.174]	[0.500]	[0.411]	[0.492]	[0.387]
1 = exam nerves	-0.342	-0.685***	-0.814	-1.291	0.182	0.197
reason for termination	[0.248]	[0.182]	[1.025]	[1.013]	[0.277]	[0.203]
1 = financial distress	-0.688***	-0.401***	-0.13	-0.455	0.890***	0.628***
reason for termination	[0.234]	[0.152]	[0.737]	[0.594]	[0.222]	[0.177]
local percentage of youth	3.358***	2.825***	1.776	0.237	0.033	-0.836
in out-of-firm training	[0.632]	[0.487]	[2.004]	[1.748]	[1.294]	[1.024]
local population density	0.582	-0.114	5.908	1.363	2.372	-0.581
	[1.390]	[1.011]	[4.544]	[3.605]	[2.610]	[1.925]
local supply-demand ratio	5.331*	4.736**	-0.026	0.825	-4.193	-2.34
on the job market for apprentices	[2.773]	[2.051]	[9.727]	[7.592]	[5.991]	[3.931]
local density of public transport	-1.19	-0.273	-3.925	-0.395	-1.138	1.449
	[1.027]	[0.746]	[3.381]	[2.685]	[1.966]	[1.458]
local unemployment rate	-15.264***	-12.655***	-12.215	-5.233	-0.603	4.429
	[2.795]	[2.120]	[8.709]	[7.313]	[5.404]	[4.140]
Observations	2394	3991	2385	3975	2394	3991