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## WHAT GOES WRONG WHEN IT GOES WRONG? EMPIRICAL ANALYSIS OF THE TIMING AND REASONS FOR PREMATURE APPRENTICESHIP TERMINATIONS IN GERMANY

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**Abstract:**

This paper empirically investigates whether contractual terminations for various reasons predominantly occur in certain phases of apprenticeship training. With a self-collected data set of apprenticeship firms and former apprentices from the crafts sector, an insight was gained into critical stages during apprenticeship training from two perspectives. Using multinomial logit and probit regression analyses, the results show that contractual terminations in Germany's dual apprenticeship system because of the apprentices' educational background and performance in vocational training schools happen at late stages in apprenticeship training. In contrast to this, drop-outs resulting from wrong occupational choices were mainly realized in the probationary period or first apprenticeship year.

**JEL Classification:** J23, J24, M12, M53

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## 1 Introduction

“Germany’s “dual system” of apprenticeship training is frequently cited as a model for providing non-college bound youth with a broad base of work related skills” (Buechtemann et al., 1993, p. 97). Therefore, the German apprenticeship system is highly respected internationally (Blanchflower & Lynch, 1994; Clark & Fahr, 2002), and is also often used by other countries as a role model to enhance their own apprenticeship systems (e.g., Gitter & Scheuer, 1997; Harhoff & Kane, 1995; Lehmann, 2000).

The dual apprenticeship, which combines workplace-training in firms and vocational education in public training schools, is regarded as the backbone of the German economy (Fitzenberger & Spitz, 2003). As the acquired skills from apprenticeship training are high quality and easily transferable, young professionals face good employment prospects and thus experience a smoother transition to the labor market with fewer unemployment periods than non-apprentices (Winkelmann, 1996a). Hence, the dual apprenticeship contributes to the economic success of Germany (Euwals & Winkelmann, 2004). To maintain this, large amounts of money are spent each year on the apprenticeship system to provide the German economy with trained specialists. In 2012, Germany’s public sector<sup>4</sup> paid about 11.3 billion Euro for the provision of the apprenticeship system, e.g., to finance part-time vocational education in public training schools (Bundesinstitut für Berufsbildung (BIBB), 2013). The economy, as the provider of the practical part of the apprenticeship training, contributed approximately 5.9 billion Euro in net costs<sup>5</sup> to dual vocational training in 2013, e.g., for training wages, instructors, etc. These amounts again reflect the importance of this system.

As a result of its importance, it is crucial to ensure the continuity of the apprenticeship system. However, the apprenticeship system currently faces some drawbacks. Demographic changes—as a major contextual challenge—have diminished the number of school graduates in Germany (Kultusministerkonferenz, 2013). During recent years, this has led to an increasing number of vacant training positions. In 2012 and 2013, 33,000 offered training places remained vacant (Federal Ministry of Education and Research (BMBF), 2013). Compared with 2009 with about 17,000 vacancies, the apprenticeship system suffered a doubling of the number of unfilled apprenticeship positions within a three-year period (BMBF, 2013). As the vacancies for apprentices increase with a declining number of employees, particularly small and medium-sized enterprises (SMEs) have significant problems in contrast to their larger competitors (BMBF, 2013).

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<sup>4</sup> In this context, the public sector comprises the Federal and State Governments as well as the Federal Employment Agency.

<sup>5</sup> This figure is based on my own calculation. Thereby, the net cost per apprentice per year of 3,596 Euro from the latest cost and benefits statistics of Schönfeld et al. (2010) was combined with the number of apprenticeship starters in the years 2011, 2012, and 2013 from the annual vocational education report (“Berufsbildungsbericht”) (BMBF, 2014). As an average of three years for apprenticeship duration is assumed for the calculation and as apprentices who dropped out were not taken into account, the computed net costs to the economy tend to be rather overestimated.

With these developments in mind, the value of attracted and recruited apprentices rises for SMEs. In this context, it is highly problematic for the economy as well as for the single training firm to lose apprentices due to premature terminations<sup>6</sup>. Nevertheless, in 2012, approximately 150,000 (24.4%) apprenticeship contracts were terminated (BIBB, 2014). Thereby, SMEs are again badly affected with drop-out rates above average. The crafts sector with mainly small firms offering apprenticeship positions recorded that about one third (31.5%) of their existing apprenticeship contracts were terminated prematurely in 2012 (BIBB, 2014). At present, no other sector in Germany exceeds this drop-out rate from the crafts sector. Regarding this drawback, it is surprising that only a few studies have been conducted so far on the causes of these drop-outs (Bessey & Backes-Gellner, 2007). Thus, the present paper aims to meet this shortcoming by investigating what reasons determine premature apprenticeship terminations for SMEs in the crafts sector. Thereby, drop-out reasons are considered separately at varying times (probationary period, first, second, or after the second apprenticeship year).

This research question is particularly relevant for the crafts sector not only because of the mentioned frequency of premature apprenticeship terminations occurring in this industry but also concerning the future supply of qualified staff. Whereas the crafts sector was formerly known for training apprentices above demand (Franz & Zimmermann, 2002), nowadays every trained talent is necessary in order to keep production running at a stable level (Teuber et al., 2011). To learn how to prevent drop-outs, it is important to understand why they happen. Therefore, information on the reasons for premature terminations in different apprenticeship periods is not negligible because the later the drop-out, the more harmful it is for the craft firms' already committed investment (Wenzelmann et al., 2009).

The structure of the present paper is as follows: In section 2, an overview of previous research on premature apprenticeship terminations is given. Then, the German apprenticeship system is introduced in detail. Next, theories are presented which explain the participation of young people and firms in dual apprenticeship training. Furthermore, problems are discussed that occur when firms and apprentices do not fit together. Thereby, the hypotheses are derived. Then, section 3 gives a methodological overview including the data set, the empirical strategy, and measurements of the variables. Next, the regression results are presented in section 4, while section 5 ends up with a discussion of the findings and the study limitations as well as possibilities for further research on the topic of premature apprenticeship terminations.

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<sup>6</sup> In the present study, premature apprenticeship terminations are defined as contractual terminations within the apprenticeship period, which can be initiated by the training firm, the apprentice, or result from mutual agreement. It means that the started apprenticeship training does not come to a conclusion with a final certification of the acquired occupational qualifications of the apprentice. In the present study, premature apprenticeship terminations are synonymously denoted as drop-outs.

## 2 Theoretical considerations and hypotheses

In the present study, drop-outs from the German apprenticeship system are addressed. Thus, in a first step, previous work on this topic is introduced and the contribution of this study is presented. An overview on the structure of the dual system is given in section 2.2. Thereby, it is deduced why drop-outs may occur by considering characteristics such as the age of apprentices when entering vocational training. Section 2.3 focuses on the question why firms decide to train and what apprenticeship firms from the crafts sector may contribute to the emergence of drop-outs. Section 2.4 finally deals with drop-out reasons that arise when craft firms and apprentices work together in practice. In framing this section theoretically, person-organization and person-job fit theory is introduced.

### 2.1 Literature overview and contribution of the present study

Although there is a large body of research on school drop-outs, e.g., in secondary or vocational education (e.g., Eckstein & Wolpin, 1999; Oreopoulos, 2007; Rumberger, 2001) or concerning employees' job quit behavior in general (e.g., Böckerman & Ilmakunnas, 2009; Kristensen & Westergård-Nielsen, 2004; Tett & Meyer, 1993), to the author's knowledge, there are very few studies in the field of drop-outs during apprenticeship training. This may be because only Germany and Switzerland have comparable apprenticeship systems, which combine vocational training at schools with training in firms. Hence, one benefit of the present paper is the contribution to this research field by empirically investigating drop-out reasons for different time periods during apprenticeship training. An additional benefit is that drop-out reasons resulting from school as well as from work background were included in the present study. Thus, comprehensive conclusions on drop-outs from both parts of the dual apprenticeship can be gained.

Concerning previous research, an interview study conducted with former Swiss apprentices shows that there are two main groups of drop-out reasons. The first group of reasons for drop-outs arises in work-based training and includes day-to-day problems with the apprenticeship company. These reasons are mainly mentioned by apprentices aged between 18 and 23 years. The second group of reasons for drop-outs contains difficulties with the transition from school to work. These reasons are mainly mentioned by younger apprentices (aged 15–17 years) (Jordan & Lamamra, 2010). While the study gives useful results by connecting the apprentices' age with different problems during apprenticeship training, the reasons for drop-outs are examined quite generally. Thus, it is not possible to draw detailed conclusions. In addition, the reasons were found using qualitative methods and should thus be reflected by quantitative designs.

Using German data, Bessey & Backes-Gellner (2008) empirically investigated the determinants of three different educational revisions happening in the dual apprenticeship. The authors distinguished between “drop-outs” where the revision of the vocational decision implies an exit from the German apprenticeship system. After exit, these young people might become unskilled workers or unemployed. “Changes” were specified in the study as those revisions attended by a change within the apprenticeship system. The third choice was termed as “upgrading”, implying that the young people also stay in the system but decide on a more challenging educational choice. Using hazard rate models, Bessey & Backes-Gellner (2008) found short-term-oriented monetary factors to be significantly important for drop-outs, whereas the change in a decision is affected by “favorable conditions on the local labor market” (p. 2). However, the benefit of Bessey & Backes-Gellner’s (2008) paper is given mainly for authorities responsible for the dual apprenticeship system. The perspective of single apprenticeship firms and their possibilities for preventing drop-outs, changes, or upgrades in order not to lose future skilled labor is not the central theme.

With an extended data set, Bessey & Backes-Gellner (2007) analyzed factors influencing the decision of apprentices to drop out from an apprenticeship. Thereby, they considered the apprentices’ perspective by questioning failed apprentices. They found again that the “local labor market situation is among the most important individual-level determinants of the decision to drop out from an apprenticeship” (Bessey & Backes-Gellner, 2007, p. 19). Moreover, they detected that the short-term costs perspective of the apprentices dominates their decision making over the long-term benefits perspective of a finished vocational qualification. Whereas the analysis included important reasons for drop-outs, plenty of other possibilities were neglected because of the limited data set. As mentioned before, only the apprentices’ perspective on premature apprenticeship termination was involved (Bessey & Backes-Gellner, 2007). This has to be regarded as critical (Uhly, 2013) because a one-sided approach in this context tends to be biased (Greilinger, 2013). Therefore, the present study includes not only the apprentices but also the apprenticeship firms’ views on the drop-outs.

The few scientific studies mentioned before did not focus on a single apprenticeship sector to analyze the drop-out reasons. Looking for research on drop-outs for specific sectors, more practically oriented studies provide useful results. The descriptive analysis of the EMNID study (2002) examined for the first time premature apprenticeship terminations in the German crafts sector from the perspective of apprentices, firms, and teachers in vocational training schools. A decade later, but also on the basis of multidimensional perspectives, Greilinger (2013) extended and renewed the knowledge on drop-outs in the crafts sector using recent data. She showed that firms and previous apprentices predominantly point out reasons that make the other party responsible for the premature termination. Whereas the apprenticeship firms complained about a lack of motivation, reliability, and performance of the young person in the firm and at school, the former apprentices mentioned the negative working climate, received tasks (e.g., tasks that were not related to training), and poor working conditions (e.g., pressure of time and performance) as the most important reasons for dropping out (Greilinger, 2013).

Interestingly, about 70% of the failed apprentices stated that their apprenticeship training was within their profession of choice and about 50% mentioned that they even did an internship before starting their training. Most drop-outs were based on decisions by the apprentices and occurred very quickly: In about 50% of the cases, there were only two months between reflecting and realizing the drop-out (Greilinger, 2013).

As former work with the data set of Greilinger (2013) solely included descriptive statistics, for the present study, these data are used for more comprehensive analyses on drop-out reasons at different times in apprenticeship training. Thereby, the results are of particular interest for various stakeholders. First, not only the crafts sector as an industry with high participation in apprenticeship training, but also SMEs in general, which face similar problems during training, could use the results to reduce drop-out rates. Second, craft institutions gain insights into their member firms' as well as apprentices' problems, weaknesses, and needs. Thereby, craft institutions are able to develop adequate measures (e.g., mediation, training of instructors, etc.) to support both parties in preventing drop-outs in future (Greilinger, 2013).

## **2.2 The German apprenticeship system**

After leaving general school (secondary school level I) in Germany, young people have many opportunities to shape their vocational future. One alternative is given by the dual apprenticeship system in Germany, which comprised 1.43 million apprentices in 2012 (BIBB, 2014). The apprenticeship system enjoys great popularity, as about 55% (2012) of all school graduates decide to enter the labor market this way. Thereby, the dual apprenticeship offers about 330 different training occupations in Germany (BMBF, 2014).

Dual apprenticeship is a combination of practical on-the-job training within a training firm that is supplemented by part-time vocational education in public training schools (Smits & Stromback, 2001). With this combination, Germany has an outstanding position in Europe, as the vocational training system in other countries is based solely on vocational education in schools (Dustmann & Schönberg, 2010). Highly comparable to the dual apprenticeship in Germany is the Swiss system, which shows similarities in institutional and structural dimensions (Dionisius et al., 2008). Concerning the benefits of the dual apprenticeship system for Germany, the relatively low youth unemployment rate is often mentioned (Buechtemann et al., 1993). In addition, the dual apprenticeship system is frequently associated with economic success and growth as well as the innovative capabilities of Germany (BMBF, 2014).

Overall responsibility for the dual apprenticeship system in Germany lies with the Federal Ministry of Education and Research. Thereby, the individual States account for part-time vocational education in public training schools. Also, the social partners are strongly involved in the design, provision, and control of apprenticeship training in Germany. For example, they have a role in the development and reformation of the official training regulations. For the crafts sector, the chambers take over advisory services for craft firms and act as supervisors to ensure training quality. Furthermore, they register apprenticeship contracts for their member firms, are available as consultants for apprenticeship firms as well as for apprentices, and arrange or carry out the final examinations—to mention just a few of the craft chambers' obligations (BMBF, 2014; Hoeckel & Schwartz, 2010; Soskice, 1994).

As already mentioned, the dual apprenticeship offers about 330 different training occupations which are laid down in official training regulations for each qualification (Franz & Soskice, 1995). For example, the training regulations comprise the title of the apprenticeship training, the duration or the profile of the profession, and set out the final examination requirements (Deissinger, 1996; Hoeckel & Schwartz, 2010). The duration depends on the requirements of the respective vocation and varies between two and three and a half years (BIBB, 2014). As the training regulations also schedule important content during the training period, they give firms a guideline for training provision (Wagner, 2012). To ensure high training quality, firms are allowed to train apprentices only if they have an employee who has an instructor license (Franz & Soskice, 1995). Thus, in-company trainers are provided with “a qualification in the training occupation and knowledge of education theory” (Hoeckel & Schwartz, 2010). In the crafts sector, most firm owners themselves possess the instructor license because it is part of the master education for craftsmen (Glasl, 2007).

To start the dual apprenticeship, a contract has to be concluded between the apprentice and the training firm. In doing so, the apprentice becomes an employee of the training firm during the training period. For his/her work, the apprentice receives a wage, which is specified by collective bargaining and rises during the training period to reflect growing productivity (Bosch, 2010). On average, the apprentices' wage amounts to 30% of the starting pay for a skilled worker (Hoeckel & Schwartz, 2010). In contrast to apprenticeship training in large industrial companies, where the training is also held in training centers, training in SMEs from the crafts sector is mostly integrated in the production process (Glasl, 2007).

The training programs at school are regulated in terms of the curriculum and the level of education. The latter has been observed to rise steadily in recent years (Bosch, 2010; Franz & Soskice, 1995). The curriculum comprises the delivery of occupationally specific skills (Wachter, 2008) as well as general education, for example in mathematics or languages (Bosch, 2010). Lessons at vocational training schools are organized on two different concepts: On the one hand, there are weekly classes on one or two days per week for the whole school year. On the other hand, some schools structure

vocational education in blocks, in which attendance at school is required over a few weeks (Hoeckel & Schwartz, 2010).

Concerning the educational background, most apprenticeship beginners have the “Realschule” leaving certificate (2012: 42.3%). The second largest group in the apprenticeship system is pupils from the “Mittelschule”. 2.8% (2012) of these pupils enter apprenticeship training without any leaving certificate and 30.8% (2012) with the “Mittelschule” graduation certificate. 24.0% (2012) of apprentices in the dual system have higher education entrance qualifications (BIBB, 2014).

In contrast to the educational background of all apprentices, beginners in the crafts sector show a different distribution (Soskice, 1994). The highest share of apprentices comes from the “Mittelschule”—3.7% (2012) without a leaving certificate and 50.4% (2012) with a leaving certificate. Thus, the share of those graduates in the crafts sector is about 20 percentage points higher than the average entry rate. Consequently, the share of beginners from a higher educational background (“Realschule” leaving certificate: 36.8% (2012); Higher education entrance qualification: 9.1% (2012)) is significantly below average (BIBB, 2014). On this basis, it could be assumed that problems in the apprenticeship training of craft firms occur due to higher proportions of less educated entrants.

With a higher share of graduates from the “Mittelschule”, the average training age of new apprentices is significantly lower in the crafts sector. Furthermore, there might be a relation between the educational background of the apprentices and their training maturity, nationality, and social/family background (BIBB, 2014; BMBF, 2013, 2014). It could be assumed that the educational level limits the success of apprenticeship training when prior education is not sufficient to meet the requirements of the training firm in the workplace and at the public training school. This also applies to the physiological and mental state of the apprentice, which might be determined again from training age, training maturity, and family background.

In this context, analysis of the timing of the drop-out in combination with the educational background and the physiological and mental requirements as possible drop-out reasons is very important. Generally, apprenticeship firms should recognize critical stages in their vocational training in order to have early awareness if problems occur that are linked to the respective stages. Having an “early warning system” is crucial because firms have to act quickly to be able to prevent drop-outs (Greilinger, 2013). Moreover, knowing the main reasons for drop-outs at each stage (probationary period, first, second, or after the second apprenticeship year) in the apprenticeship period may help firms to install particular support measures for apprentices, e.g., private lessons in the first apprenticeship year. In doing so, problems regarding the educational background of apprentices might be countered before they become a threat to the apprenticeship training. Additionally, the timing of drop-outs plays a role if the associated investment costs of the training firms are considered at each stage in the apprenticeship period (Wenzelmann et al., 2009). In particular, late drop-outs (second or after the second apprenticeship year) render it impossible for firms to retrieve their investments in

training provision. Thus, it is crucial for firms to be particularly aware of the reasons for late drop-outs.

Regarding the timing of the drop-out, it is assumed that an inadequate educational background as well as insufficient physiological and mental requirements of an apprentice could be noticed quickly by firms or apprentices because of the need to work together very closely right from the start of apprenticeship training (Glasl, 2007; König, 2006). Thus, it is supposed that drop-outs based on those reasons occur at an early phase in apprenticeship training.

*H<sub>1</sub>: Drop-outs in the crafts sector due to inadequate educational backgrounds of the apprentices will be positively related to early phases in apprenticeship training.*

*H<sub>2</sub>: Drop-outs in the crafts sector due to insufficient physiological and mental requirements of the apprentices will be positively related to early phases in apprenticeship training.*

Another reason for premature apprenticeship terminations in the crafts sector may result from serious matching problems that the dual apprenticeship system currently faces (BMBF, 2014). Matching problems describe a situation where the supply of apprenticeship positions by firms is not in accordance with the young people's demand for apprenticeship positions. Matching problems may occur because of regional or vocational disparities or can be attributed to a lack of professional requirements by young job seekers (BMBF, 2014). Hence, not all school graduates have the chance to start apprenticeship training in their supposed dream occupation. Some of them have to accept training positions that only represent their "second-best" option concerning the employer or the vocation. Thus, it could be supposed that possibilities arising to change the employer or the vocation may lead to terminations of the "second-best" option. Furthermore, the decision to terminate an apprenticeship prematurely may also arise when apprentices realize that they do not fit with their perceived dream occupation (Holland, 1959, 1997). Whereas empirical studies on drop-outs show that apprentices are commonly confident of taking up their dream job before starting apprenticeship training, which is often confirmed through a former internship (Greilinger, 2013), their view can change after experiencing working reality for a longer period of time.

Regarding the timing of the drop-out, it is assumed that the wrong occupational choice of an apprentice could be experienced quickly by firms or apprentices. In the crafts sector, apprentices are mostly integrated in the production process (Glasl, 2007). Thereby, they can quickly test themselves in the working reality. Thus, it is supposed that drop-outs for this reason occur at an early phase in apprenticeship training.

*H<sub>3</sub>: Drop-outs in the crafts sector due to wrong occupational choices of the apprentices will be positively related to early phases in apprenticeship training.*

### 2.3 Overview of theoretical approaches and empirical studies to explain the training decision of firms

There are different approaches that provide insights into the question why firms offer training and why employees participate in those measures. Thereby, the majority of empirical studies consider the wage and productivity effects of those investments (e.g., Almeida & Carneiro, 2009; Büchel & Pannenberg, 2004; Daerden et al., 2000; Kuckulenz & Zwick, 2005; Pischke, 2001; Schöne, 2004). As the present study focuses on drop-outs from a specific training measure—vocational training in the German apprenticeship system—in a first step, theoretical approaches concerning this particular training decision should be given.

Based on neoclassical assumptions, *Becker's human capital theory* (1962) has turned out to be the basic model for explaining investments in training measures (Wachter, 2008). Human capital contains the employees' physical and mental resources, from which future income prospects can be derived (Becker, 1962). These are given, for instance, due to medical care or education. The theory distinguishes between training measures that foster employees' general human capital and measures that convey firm-specific qualifications. Depending on whether the training is general or firm-specific, the allocation of costs and benefits is affected (Becker, 1962).

Training that affects general human capital—such as training in foreign languages or general computer skills—enables an employee to work productively with the acquired skills in several firms (Becker, 1994). Thus, the employee benefits from higher labor market mobility, whereas the training firm faces the risk that another employer poaches the trained employee (Mohrenweiser et al., 2013). If the firm takes over the costs of general training, it only profits when it is able to pay wages below the trainees' productivity after training to retrieve the expenses. As this would also foster the movement of the trained employee (Backes-Gellner et al., 2001), a rationally acting employer is not willing to pay for the general training measures of his workforce (Becker, 1962). Nevertheless, Benson et al. (2004), Katz & Ziderman (1990), or Loewenstein & Spletzer (1999) found empirical evidence that firms bear the costs of providing training measures in their employees' general human capital.

In contrast to general human capital, training in firm-specific human capital goes along with knowledge and skills referring to workflows, procedures, methods, or products of an individual firm and is, therefore, often conducted on the job (Wachter, 2008). Thus, this leads to an increase in the employees' productivity only in the training firm. According to this, the firm as well as the employee benefit exclusively from the training if the trainee stays within the firm (Becker, 1962). Based on the increases in productivity and to accomplish employee retention, trainees gain higher wages in the training firm compared with other firms. In doing so, firms and employees share returns. But they also have to share the costs of training. Otherwise, the party who is paying becomes susceptible to blackmail because the other party has the possibility of forcing higher or lower wages compared with employees' marginal productivity by threatening termination of the employment contract (Becker,

1962). However, different studies have shown that firm-specific training measures strengthen the binding of employer-employee relationships (e.g., Zweimüller & Winter-Ebmer, 2003).

As mentioned in section 2.2, vocational training in the German apprenticeship system is highly standardized by its legal framework (Pahnke et al., 2013). Enabling the apprentices to acquire a broad basis, the qualifications provided in apprenticeship training are of rather a general nature with only a small proportion of truly firm-specific skills (Korpi & Mertens, 2003; Schönfeld et al., 2010; Winkelmann, 1996a; Zwick, 2001). Thereby, young professionals face good labor market mobility after finishing apprenticeship training as skills are easily transferable to other firms from the same sector (Korpi & Mertens, 2003; Stevens, 1994; Winkelmann, 1996a, 1996b). However, it should be noted that inter-occupational mobility in Germany is restricted because training content is more occupation-specific than it is in school-based vocational training from other countries such as Sweden (Korpi & Mertens, 2003).

When considering that the acquisition of skills in apprenticeship training predominantly implies general human capital, according to Becker's approach (1962), firms should not be willing to offer apprenticeship positions. However, practice shows that German firms are disposed to train apprentices: Even if it was the smallest absolute number of contracts for the last 20 years in 2013, still more than 530,000 (2012: 550,000) new apprenticeship contracts were concluded nationwide. 26.8% of the contracts came from the crafts sector, which is therefore the second largest provider of training positions in the German apprenticeship system (BMBF, 2014).

To explain the existing willingness of craft firms to train apprentices, Becker's theory (1962, 1994) has to be considered with extensions from *Acemoglu & Pischke* (1998a, 1998b, 1999). Thereby, the authors rely on the assumption that labor markets are imperfect. Apprenticeship investments that foster the development of general human capital may be amortized in imperfect labor markets if the training firm is able to extend the employment beyond the training period while paying wages below the workers' productivity. Taking into account the costs of mobility, search costs, or wage losses due to losses of firm-specific human capital, it is conceivable that, despite paying wages under the level of productivity, the employee stays within the firm.

With the *skill-weights approach*, *Lazear* (2004) introduced a new concept for explaining training dispositions as well as the distribution of resulting costs and benefits. The approach takes on previous human capital theories yet questions the possibility of strictly separating general from firm-specific human capital. Initially, *Lazear* (2004) understands most of the acquired qualifications in firms as general. On this basis, he defines the weighted combination of different general qualifications of an employee in a particular firm as firm-specific skills. In *Lazear's* approach (2004), apprenticeship training in the crafts sector is regarded as providing a lot of various general skills which—considered in isolation—can be productively adopted by the training firm and any other firm. However, considering the whole qualification profile of an apprentice, the trainee is optimally adapted to the

training firms' needs and thus can be used with the highest productivity only in the apprenticeship firm. Thereby, "the acquired skill combination and the resulting skill cluster, rather than the occupation per se, crucially determines mobility" (Geel & Backes-Gellner, 2011, p. 21). Concerning the financing of training measures, Lazear (2004) refers to Becker's (1962) proposition for firm-specific human capital: In order to avoid mutual dependencies, both contract parties have to share the costs (Lazear, 2004).

Based on the work of Chang & Wang (1996), Katz & Ziderman (1990), and Smits & Stromback (2001), the apprenticeship behavior of (craft) firms can also be explained by information advantages resulting from their own apprenticeship training. By providing their own vocational training, the firm knows the training quality and thereby the apprentices' skill level. Moreover, after the apprenticeship training, the training firm is able to select the best apprentices for further employment as they have an information benefit concerning the apprentices' productivity (Franz & Soskice, 1995). In addition, empirical studies have revealed that the employment of "apprentices in trade, commercial, craft and construction occupations instead of unskilled or semi-skilled employees has a positive impact on contemporary establishment performance" (Mohrenweiser & Zwick, 2009, p. 631). A further training motive results from reputational issues (Sadowski, 1980), which firms expect to strengthen toward customers, business partners, and the external labor market (Schönfeld et al., 2010). For some firms, commitment to social responsibility also plays an important role when providing training positions (Schönfeld et al., 2010).

Taking a closer look at the apprenticeship decisions of firms under investment aspects, it is often calculated that firms have to bear high net costs when providing apprenticeship positions (e.g., Dionisius et al., 2008; Muehleemann et al., 2007; Pfeifer et al., 2009). This assumption may result from the cross-sectional costs and benefits design of those studies (Mohrenweiser & Zwick, 2009). However, the findings reveal that the existence of net costs is related to the apprenticeship strategy. In this context, Mohrenweiser & Backes-Gellner (2008) empirically identified three different training strategies which contain a specific investment policy: (1) firms that follow an investment strategy; (2) firms that pursue a substitution strategy; and (3) firms that mix both strategies or are undetermined. The characteristic of the investment strategy is that the firm is long-term oriented and wants to gain the apprentices' retention beyond the vocational training (Mohrenweiser & Backes-Gellner, 2008). Thus, possibly arising net investment costs can be re-earned, for example, from wages below the market rate because of labor market imperfections (Acemoglu & Pischke, 1998a). In Germany, about 43% of firms seem to follow the investment strategy (Mohrenweiser & Backes-Gellner, 2008). "In contrast, the substitution strategy does not require that apprenticeship graduates stay within the training company, because offering apprenticeships is driven by the unit labour costs of apprentices" (Mohrenweiser & Backes-Gellner, 2008, p. 2). The substitution or synonymous productivity orientation aims at zero net costs of apprenticeship training (Lindley, 1975). In this case, the

apprentice is seen as cheap labor, which is true for about 18% of German training contracts (Mohrenweiser & Backes-Gellner, 2008).

For the crafts sector, whose drop-outs are analyzed in the present study, Wenzelmann et al. (2009) estimated an amount of about 2,500 Euro net costs per apprentice per year. Thus, the crafts sector is in third position in Germany regarding the cost intensity of apprenticeship training. Compared with Switzerland, which has a very similar apprenticeship system, Germany shows higher net costs. This can be attributed to the poor distribution of tasks to apprentices in German firms. In their study, Dionisius et al. (2008) found a lower share of productive activities which German firms delegate to their apprentices compared with other countries. Based on the net costs perspective, assignment of the crafts sector to investment-driven apprenticeship decisions is possible.

Concerning training quality, however, Wagner & Zwick (2013) found using empirical analysis that the crafts sector can be allocated mainly to low-quality training programs. Based on Soskice's (1994) quality determinants, Wagner & Zwick (2013) used apprentices' average schooling level, net costs of apprenticeships, apprenticeship wages, and the retention rate after finishing apprenticeship training to evaluate training quality. In addition, they directly included the apprentices' point of view by implying data from a survey that gives information on the apprentices' satisfaction with the current employer and vocational training. By taking into account 15 different occupations, they finally did a cluster analysis to figure out occupational groups of high versus low training quality. Thereby, all considered craft occupations (electronics technician, hairdresser, motor vehicle mechatronic, painter/varnisher, plant mechanic) were analyzed as being among the cluster with lower training quality (Wagner & Zwick, 2013).

Whereas the training quality might differ within and above an occupational cluster and even from training firm to training firm (Goeggel & Zwick, 2012), it is generally perceived to be inferior in the crafts sector compared with "one in a larger company in industry or services" (Soskice, 1994, p. 58). Nevertheless, training quality is seen to be a major factor for apprentices' satisfaction. Kristensen & Westergård-Nielsen (2004) found using Danish data that low overall job satisfaction increases the probability of changing job. This mechanism is also supposed to occur in the crafts sector when the training quality is perceived to be low.

Regarding the timing of the drop-out, it is assumed that poor or lacking training quality in the crafts sector is not as easy to detect for apprentices right from the start of the training because it is their first experience of work. Furthermore, apprenticeship quality can deteriorate during the apprenticeship period and thereby also affects drop-out decisions in the later phases of training. Hence, it is assumed that drop-outs for this reason significantly occur in the later phases of apprenticeship training.

*H<sub>4</sub>: Drop-outs in the crafts sector due to a lack of training quality will be positively related to later phases in apprenticeship training.*

## 2.4 Perceived (mis-)fit during apprenticeship training

As already mentioned in section 2.2, the dual apprenticeship consists of two fundamental parts: The provision of work-based training in training firms and of vocational education in public training schools. Thus, retention in apprenticeship training depends on the progress of the apprenticeship without arising conflicts in either training part. In this section, the focus is on the work-based training where conflicts may result from different backgrounds. Nevertheless, these conflicts have a common basis—a lack of “fit” between the firm and the apprentice.

Person-organization fit can be defined as “the compatibility between people and organizations that occurs when: (a) at least one entity provides what the other needs, or (b) they share similar fundamental characteristics, or (c) both” (Kristof, 1996, p. 4–5). Thereby, person-organization fit has various dimensions such as “value congruence”, “goal congruence”, “needs-supplies fit”, or “demands-abilities fit” (Hoffman & Woehr, 2006; Kristof, 1996). Although employees can develop an idea of their person-organization fit in the pre-entry recruitment phase, the crucial phase for evaluating the fit actually begins after they have started work at the firm (Cable & Judge, 1996). This also applies to apprenticeship training in the crafts sector when, for example, a misfit concerning the demands of the training firm and the abilities of the apprentice emerges from working together (Greilinger, 2013).

When organizations and employees fit together in one or more dimensions, this is accompanied by different effects. Empirical and formal analytical studies have analyzed the consequences of compatibility and found strong correlations with employees’ job satisfaction, organizational commitment, and quit intentions (Jovanovic, 1979; Kristof-Brown et al., 2005; Lauver & Kristof-Brown, 2001; Westerman & Cyr, 2004). Moreover, perceived fit with an organization influences employees’ concrete behavior and attitudes at work. Hoffman & Woehr (2006) showed that workers’ person-organization fit perception is related to task performance. Based on these studies, for premature apprenticeship terminations in the crafts sector—as a consequence of inadequate fit between firms and apprentices—it is also assumed that non-compatibility becomes visible from the apprentices’ behavior and work performance.

Regarding the timing of the drop-out, it is assumed that inadequate behavior and performance of the apprentice could be noticed quickly by firms because of the need to work together very closely right from the start of the apprenticeship training (Glasl, 2007; König, 2006). Thus, it is supposed that drop-outs for this reason occur at an early phase in apprenticeship training.

*H<sub>5</sub>: Drop-outs in the crafts sector due to inadequate behavior and performance of apprentices will be positively related to early phases in apprenticeship training.*

### 3 Methods

#### 3.1 Data acquisition and sample characteristics

To analyze the question concerning the reasons for drop-outs during different time periods of apprenticeship training in the crafts sector, two cross-sectional data sets were collected from (1) affected apprenticeship firms and (2) these firms' former apprentices. Both survey groups suffered premature apprenticeship terminations in the years 2009, 2010, or 2011 in the crafts sector in Upper Bavaria. As the data collection was in 2012, the data set could be biased due to different as well as quite long (maximum three years) time periods between the realized drop-out and survey participation. Nevertheless, drop-outs are a decisive experience for firms as well as for apprentices. Thus, it could be assumed that, even after a certain period of time, the relevant problems which led to the drop-out are still very present.

Access to the postal addresses of both participant groups was provided by the crafts chamber of Upper Bavaria. Before using the postal addresses to distribute written questionnaires, the original address file of the crafts chamber with addresses for 3,408 apprenticeship firms and 3,408 related former apprentices was prepared. Related addresses of firms and apprentices with more than one drop-out from 2009 to 2011 were deleted from the file, leaving only the latest drop-out address pair in the survey list. Finally, 3,321 addresses remained in the survey list. Doing this ensured that an apprenticeship firm or a former apprentice only received one questionnaire. To prevent "general" or "mixed" answers on the drop-out reasons for all drop-out cases experienced, both respondents were requested to fill in the questionnaires in relation to the last drop-out situation.

In April 2012, written questionnaires were sent to the 3,321 firms and former apprentices. Thereby, no random sampling methods were used because all possible respondents from the revised address list should be used for data collection. On a voluntary basis, firms and apprentices were asked to complete and send back the questionnaires within a period of three weeks. The questionnaires for both respondent groups were structured similarly: First, the questionnaires offered an introductory page with general notes on the research project and indications for the completion of the questionnaire. For the *firms*, the questionnaire started with questions about the firm (e.g., firm size). Next, craft firms were asked questions on the premature apprenticeship termination (e.g., the initiator of the drop-out). Questions on the reasons for the drop-out followed. Then, the firms could specify what measures they took to avoid the threat of premature apprenticeship termination. Thereby, the firms assessed the meaning of the applied measures for preventing drop-outs. After the introductory page, the questionnaire for the *apprentices* started with general questions on the premature apprenticeship termination (e.g., the initiator of the drop-out) and did not include questions about the apprenticeship firm. Then, questions on the reasons for the drop-out and the measures used to forestall apprenticeship termination were raised. The last questions for the apprentices focused on personal data (e.g.,

educational background). Concerning the questions on the reasons for drop-outs, which are analyzed in the present study, the formulations were almost identical in both questionnaires with only minor differences. For both participant groups, the questionnaires took approximately 20 minutes to complete.

The survey induced a high response rate: About 25% (841 questionnaires) of the contacted apprenticeship firms and 17% (560 questionnaires) of the former apprentices participated in the survey. Nevertheless, a few questionnaires showed missing data on important variables. Whereas Wooldridge (2009) takes a critical view on neglecting incomplete questionnaires, for the present study, only complete questionnaires were used. In conclusion, this led to a sample of  $n = 453$  apprenticeship firms from the crafts sector and  $n = 305$  former craft apprentices. Owing to data protection regulations, it was not allowed to link addresses from the address list with the questionnaires and to combine the questionnaires between firms and corresponding apprentices. Thus, the returned questionnaires from both participant groups could not be matched for the analysis. Moreover, it was impossible to verify whether possible systematic differences between the contacted craft firms (or apprentices) from Upper Bavaria and the actual respondents exist. In addition, it could only be assumed that in the respondent groups some pairs of firms and corresponding apprentices from the same drop-out situation appear.

In consideration of the representativeness of both data sets, the statistics of the BIBB (2014) for Germany could be used as a reference group. In these statistics, the crafts sector was registered with about 53,000 (31.5%) drop-outs in 2012, of which 31.2% took place in the probationary period, 30.7% in the first, 26.4% in the second, and 11.8% after the second apprenticeship year (BIBB, 2014). Compared with these official statistics, the sample of former apprentices from the present study reflects similar distributions (see Table 2), whereas premature terminations at a later apprenticeship period (second year or later) are much more represented in the sample of apprenticeship firms (see Table 1).

Concerning descriptive statistics in detail, the data set of  $n = 452$  *apprenticeship firms* has most apprenticeship drop-outs in the second year (32.23%). Although the probationary period and the first year of apprenticeship training contain about 25% of the drop-outs, very late terminations after the second year are reduced to 17.00%. Moreover, firms stated in the survey that 48.56% ( $n = 220$ ) of the drop-outs could be ascribed to the apprentices' initiative. Looking at the cross-tabulation given in Table 1, the drop-outs requested by the apprentices are evenly distributed, whereas drop-outs requested by the firms show a stronger accumulation in the probationary period ( $n = 61$ , 13.47%) compared with other periods. In addition, the data set of the apprenticeship firms shows a predominance of premature apprenticeship terminations with male apprentices ( $n = 366$ , 80.79%). Most frequently represented are craft firms from the construction trade ( $n = 149$ , 32.89%) as well as from the metal and electric trade ( $n = 147$ , 36.86%). Concerning firm size, about 70% of the craft

firms from the firm sample can be allocated to very small enterprises (1–4 employees:  $n = 98$ , 21.62%; 5–19 employees:  $n = 222$ , 49.01%).

Table 2 focuses on the *apprentices' sample* ( $n = 305$ ). In this participant group, the probationary period shows the highest absolute number of drop-outs ( $n = 112$ , 36.72%). Similar to the firm sample, the apprentices questioned also confirmed themselves predominantly as the initiators of the drop-outs ( $n = 160$ , 52.45%). Drop-outs at the request of the firms mainly happened in the probationary period ( $n = 39$ , 12.79%), which is analogous to the firms' sample. Concerning gender, female respondents are also less represented in the apprentices' sample ( $n = 108$ , 35.42%). To avoid incorrect answers to the specific crafts sector in which the apprenticeship took place, the apprentices were asked to name only their apprenticeship occupation. When recording the data, the apprenticeship occupation was transferred into the apprenticeship sector. In the apprentices' sample, drop-outs in the metal and electric trade occurred most frequently ( $n = 109$ , 35.74%) followed by drop-outs from the construction, food as well as health and personal care trade, which stand at approximately the same level.

Table 1: Cross-tabulation of drop-out periods and important characteristics of the apprenticeship firms' sample

	Time of drop-out				Total:
	Probationary period	First year	Second year	After second year	
<b>Total:</b>	<b>119 (26.27%)</b>	<b>111 (24.50%)</b>	<b>146 (32.23%)</b>	<b>77 (17.00%)</b>	<b>n = 453</b>
<b>Initiator:</b>					
Drop-out apprentice	46 (10.15%)	55 (12.14%)	77 (17.00%)	42 (9.27%)	<b>220 (48.56%)</b>
Drop-out firm	61 (13.47%)	20 (4.41%)	24 (5.30%)	20 (4.42%)	<b>125 (27.60%)</b>
Drop-out both	12 (2.65%)	36 (7.95%)	45 (9.93%)	15 (3.31%)	<b>108 (23.84%)</b>
<b>Sex Apprentice:</b>					
Male	92 (20.31%)	87 (19.20%)	121 (26.71%)	66 (14.57%)	<b>366 (80.79%)</b>
Female	27 (5.96%)	24 (5.30%)	25 (5.52%)	11 (2.43%)	<b>87 (19.21%)</b>
<b>Apprenticeship Sector:</b>					
Construction trade	38 (8.39%)	37 (8.17%)	45 (9.93%)	29 (6.40%)	<b>149 (32.89%)</b>
Wood trade	8 (1.77%)	2 (0.44%)	11 (2.43%)	8 (1.77%)	<b>29 (6.41%)</b>
Metal and electric trade	41 (9.05%)	42 (9.27%)	57 (12.58%)	27 (5.96%)	<b>167 (36.86%)</b>
Food trade	15 (3.31%)	16 (3.53%)	20 (4.42%)	5 (1.10%)	<b>56 (12.36%)</b>
Health and personal care trade	17 (3.75%)	14 (3.09%)	13 (2.87%)	8 (1.77%)	<b>52 (11.48%)</b>
<b>Firm Size:</b>					
Firm size: 1–4 employees	25 (5.52%)	19 (4.19%)	33 (7.28%)	21 (4.63%)	<b>98 (21.62%)</b>
Firm size: 5–19 employees	64 (14.13%)	57 (12.58%)	66 (14.57%)	35 (7.73%)	<b>222 (49.01%)</b>
Firm size: 20–49 employees	17 (3.75%)	24 (5.30%)	37 (8.17%)	10 (2.21%)	<b>88 (19.43%)</b>
Firm size: 50–250 employees	11 (2.43%)	10 (2.21%)	9 (1.99%)	9 (1.99%)	<b>39 (8.62%)</b>
Firm size: >250 employees	2 (0.44%)	1 (0.22%)	1 (0.22%)	2 (0.44%)	<b>6 (1.32%)</b>

Table 2: Cross-tabulation of drop-out periods and important characteristics of the former apprentices' sample

	Time of drop-out				Total:
	Probationary period	First year	Second year	After second year	
<b>Total:</b>	<b>112 (36.72%)</b>	<b>83 (27.21%)</b>	<b>86 (28.20%)</b>	<b>24 (7.87%)</b>	<b>n = 305</b>
<b>Initiator:</b>					
Drop-out apprentice	48 (15.73%)	51 (16.72%)	52 (17.05%)	9 (2.95%)	<b>160 (52.45%)</b>
Drop-out firm	39 (12.79%)	10 (3.28%)	15 (4.92%)	8 (2.62%)	<b>72 (23.61%)</b>
Drop-out both	25 (8.20%)	22 (7.21%)	19 (6.23%)	7 (2.30%)	<b>73 (23.94%)</b>
<b>Sex Apprentice:</b>					
Male	73 (23.93%)	53 (17.37%)	54 (17.71%)	17 (5.57%)	<b>197 (64.58%)</b>
Female	39 (12.79%)	30 (9.84%)	32 (10.49%)	7 (2.30%)	<b>108 (35.42%)</b>
<b>Apprenticeship Sector:</b>					
Construction trade	20 (6.56%)	23 (7.54%)	15 (4.92%)	4 (1.31%)	<b>62 (20.33%)</b>
Wood trade	6 (1.97%)	1 (0.33%)	10 (3.28%)	2 (0.66%)	<b>19 (6.24%)</b>
Metal and electric trade	41 (13.44%)	27 (8.85%)	30 (9.84%)	11 (3.61%)	<b>109 (35.74%)</b>
Food trade	27 (8.85%)	17 (5.57%)	13 (4.26%)	4 (1.31%)	<b>61 (19.99%)</b>
Health and personal care trade	18 (5.90%)	15 (4.92%)	18 (5.90%)	3 (0.98%)	<b>54 (17.70%)</b>

### 3.2 Empirical strategy

In the present study, drop-out reasons for premature apprenticeship terminations in the crafts sector are analyzed with reference to drop-out timing. Thereby, the dependent variable  $y = \text{“drop-out period”}$  consists of  $m = 4$  categories: Drop-outs in the probationary period ( $y = 1$ ), in the first year ( $y = 2$ ), in the second year ( $y = 3$ ), or after the second year ( $y = 4$ ). In this context, drop-outs in the probationary period and in the first apprenticeship year are considered as early drop-outs, whereas drop-outs after the first apprenticeship year are defined as late drop-outs. Accounting for the structure of the dependent variable, a multinomial logit model is used for the regression analysis (Wooldridge, 2009). In the regression, category  $y = 3$  (drop-out in the second year) acts as reference category for the other drop-out periods. In so doing, it is possible to oppose early against very late drop-outs. The estimation model for the regression of the remaining  $m-1$  categories in the present study shows the following basic equation:

$$\ln \left( \frac{P(y_i=m)}{P(y_i=3)} \right) = a_m + \sum_{k=1}^K \beta_{mk} X_{ik} + \sum_{l=1}^L \gamma_{ml} W_{ik} + u_{ijk}$$

The equation contains vector  $X$  which reflects drop-out reasons integrated into major factors. The vector  $W$  reflects all other independent variables with a possible influence on the timing of drop-outs in apprenticeship training. In the regression with the data set of the respondent *craft firms*, the

vector  $W$  captures the craft firms' sector, the firms' tradition in apprenticeship training, the number of drop-outs previously occurring at the firm, the firms' size, the number of apprentices employed, information on the initiator of the drop-out, the duration of the vacancy after the drop-out, the gender of the former apprentices, and their educational background. In the regression with the data set of the *former craft apprentices*, the vector  $W$  includes the sector of the apprentices' previous training firms, information on the initiator of the drop-out, the respondents' gender, educational background, and nationality as well as information about former internships before starting the apprenticeship. For both samples, Table 3 presents the means and standard deviations of the independent control variables in combination with a short description of each variable. As both questionnaires were adapted from the assumed knowledge that the former contract parties might have about each other, both data sets exhibit different control variables, which are used for the regression analyses (see Table 3). For example, the respondent apprentices were thought to have no information on their former apprenticeship firms' tradition in vocational training.

Table 3: Description of independent control variables in the firms' and apprentices' samples

Variable	Description	Firms' sample		Apprentices' sample	
		Mean	SD	Mean	SD
Sector	Specific sector of the craft firm in 5 categories; Reference category: "Construction trade"	3.30	1.77	3.88	1.67
Firm size	Establishment size in 5 categories; Reference category: "Firm size: 1–4 employees"	2.19	.92	--	--
Tradition of vocational training	Tradition of the craft firm in apprenticeship training in 4 categories; Reference category: "Tradition vocational training: <3 years"	3.21	.92	--	--
Frequency drop-out	Previous number of drop-outs occurring in the craft firm in 4 categories; Reference category: "Frequency drop-out: First time"	1.81	.76	--	--
Drop-out initiator	Contract party, to which the drop-out can be ascribed in 3 categories; Reference category: "Drop-out apprentice"	1.75	.82	1.71	.83
Duration of vacancy	Dummy = 1 if period of vacancy in the craft firm was short after the drop-out, 0 otherwise	0.13	.33	--	--
Sex	Dummy = 1 if former apprentice is female, 0 otherwise	0.19	.39	0.35	.48
Educational background	Formal school qualifications of the former apprentice in 5 categories; Reference category: "Without leaving certificate"	2.09	1.42	2.48	1.48
Internship before apprenticeship	Dummy = 1 if former apprentice performed an internship before starting the apprenticeship, 0 otherwise	--	--	0.83	.37
Nationality: German	Dummy = 1 if former apprentice holds German nationality, 0 otherwise	--	--	0.89	.32

All numbers are based on the sample of craft firms ( $n = 453$ ) and former apprentices ( $n = 305$ ). "--" indicates that the variable is not included as a control variable in the regression of the respective sample group.

The control variables contain the respective sector in which the training craft firms are active as well as their firm size. As the descriptive analysis of the data set in section 3.1 (Tables 1 and 2) shows that the majority of premature apprenticeship terminations in both samples occur in specific sectors, control for systematic sector characteristics with influence on the drop-out and its timing has to be ensured.

Concerning the craft firms' size, empirical studies revealed the size as an important characteristic for job seekers' evaluation of potential employers (Belfield, 1999). Schank (2011) showed for potential apprentices that the perceived employer attractiveness correlates with the firm size. He revealed that the bigger the apprenticeship firm, the more attractively it is assessed by young job seekers. Lievens et al. (2001) also confirmed this relationship using a sample of students. Particularly for apprenticeship training, it could be assumed that firm size determines the vocational training as well as the drop-out decision and timing. In small craft firms, for example, apprenticeship training is very personal and often executed by the firm owner himself (Glasl, 2007). Furthermore, apprentices are very important in maintaining the production process. In contrast, huge firms often employ full-time trainers who also give intensive support beyond the production process (König, 2006). Thus, these firm size differences, with possible influence on drop-out timing, have to be controlled for the regression analysis.

As further control variables in the firms' sample, the firms' tradition in vocational training, the previous number of drop-outs occurring, the duration of the vacancy after the drop-out, and the initiating party in the drop-out are included. By controlling for the tradition of the craft firms in vocational training, it is considered that different expertise levels in the training of apprentices might lead to different expectations toward the young people and thus to drop-outs at different phases during the apprenticeship. Furthermore, the model is controlled for firms that had repeated drop-outs in contrast to firms with only a few cases of premature terminations. This results from the assumption that these firms differ systematically in certain characteristics, which, in turn, also leads to specific selections of apprenticeship beginners in those firms. Thus, it can be supposed that the firms differ in their response to problems during apprenticeship training and also in their contract quit behavior and timing of the drop-out.

Bessey & Backes-Gellner (2007, 2008) found that local labor market conditions are relevant for drop-out decisions. Thus, the regression analysis contains a dummy variable that acts as proxy for local labor market conditions. This control variable captures the duration of the vacant apprenticeship position. Moreover, the regression model considers the contract party that initiated the drop-out because each of the parties might have other motives for continuing or terminating an apprenticeship contract at a certain time. For example, craft firms can include their business expectations or business cycle in their decision on drop-out timing (Dietrich & Gerner, 2007; Mühlemann et al., 2009).

The former apprentices' gender, educational background, nationality, and performance of an internship before starting the apprenticeship training are included as additional controls in the

regression analysis. The decision to terminate an apprenticeship at a certain time can vary by gender, as male and female employees show different risk aversion (Dohmen et al., 2005). On the basis of the findings of Büchel & Neubäumer (2001), who revealed that apprenticeship graduates with a low educational background are less likely to work in an occupation similar to their trained occupation after the apprenticeship, it could be assumed that the educational background of apprenticeship beginners also determines their behavior in terms of changing occupation before completing an apprenticeship training program. Therefore, a control variable reflecting the school leaving certificate was included in the regression analysis. Concerning nationality, the Vocational Education Report (“Berufsbildungsbericht”) reveals that young school leavers of foreign nationality are underrepresented in the dual apprenticeship system for various reasons. Moreover, during training, foreign apprentices are more often affected by premature apprenticeship terminations than German young people (BIBB, 2014). For the period after apprenticeship training, Seibert & Solga (2005) investigated how non-German apprenticeship graduates have unequal opportunities compared with trained German apprentices in getting qualified occupational positions. They detected, however, that this applies to young adults of certain nationalities. Considering these results, it is necessary to control for the possible influence of nationality on the timing of the drop-out. Furthermore, it could be assumed that apprentices face different training courses depending on former internships. As an internship can also influence the drop-out decision and timing of both contract parties, a dummy variable controlling for this characteristic was included in the regression analysis.

### 3.3 Measures

In the *craft firms’ sample*, the reasons for drop-outs were measured using 26 items based on the EMNID study (2002) as well as the work of Kristensen & Westergård-Nielsen (2004). An overview of the items is given in Table A1 in the appendix. The firms were asked to assess the relevance of the given drop-out reasons to their experienced premature apprenticeship termination. Sample items are “Previous knowledge from school was insufficient for the profession” or “Performance of the apprentice was insufficient at work”. Thereby, respondents could answer on a Likert scale ranging from 1 = *does not apply* to 5 = *does totally apply*.

To identify common factors of drop-out reasons, an exploratory factor analysis with varimax rotation was calculated. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to determine whether the data were suitable for exploratory factor analysis. With KMO = .85, they showed meritorious adequacy. The principal component analysis yielded seven factors with eigenvalues above 1.0 (factor 1 = 7.28; ...; factor 7 = 1.04). Factor 1, for example, reflects drop-out reasons related to educational background and training school performance of the prior apprentices.

Before integrating the items to the relevant drop-out factors, the item convergence was analyzed. Thereby, the factors showed reliability coefficients ranging from excellent ( $\alpha = .90$  for factor 1) to acceptable ( $\alpha = .69$  for factor 5) values. For factor 6 ( $\alpha = .44$ ) and factor 7 ( $\alpha = .43$ ), the reliability analyses revealed critical, but still acceptable, values (Cortina, 1993). To avoid excluding relevant content from the regression analysis, factors 6 and 7 were still be processed to drop-out factors.

In the *former apprentices' sample*, the reasons for premature apprenticeship terminations were measured using 32 items also based on EMNID (2002) as well as Kristensen & Westergård-Nielsen (2004). An overview of the items is given in Table A2 in the appendix. The apprentices were asked to evaluate the relevance of the given drop-out reasons to their experienced premature apprenticeship termination on a Likert scale ranging from 1 = *does not apply* to 5 = *does totally apply*. Sample items are “Lack of sufficient communication between owner/foreman/supervisor/the other apprentices” or “Problems within the family/partnership”.

As the KMO measure of sampling adequacy showed a value of .83 for the apprentices' sample, these data were also appropriate to conduct an exploratory factor analysis with varimax rotation. Regarding the aggregation of factors, the principal component analysis proposed eight factors that revealed eigenvalues above 1.0 (factor 1 = 6.09; ...; factor 8 = 1.02). Factor 2, for example, reflects drop-out reasons related to the behavior and performance of the prior apprentices at the apprenticeship firm. The proposed factors were also analyzed with respect to their item convergence. Thereby, the factors showed reliability coefficients ranging from good ( $\alpha = .85$  for factor 1) to acceptable ( $\alpha = .61$  for factor 6) values. For two factors (factor 7 ( $\alpha = .59$ ); factor 8 ( $\alpha = .56$ )), the item convergence was at a critical, but still acceptable, level (Cortina, 1993). However, as noted in the firms' sample, the items from factors 7 and 8 were also integrated and used in the regression analysis in order not to eliminate important drop-out information.

Before including the received drop-out factors in the regression analysis of the *craft firms and apprentices*, adaptations regarding the coding of the drop-out factors were made. Thereby, on the basis of the primary, ordinal Likert scales, factors with means ranging from three to five were considered as variables with relevance for the realized drop-out. Then, binary drop-out factors were calculated, which take the value of 1 if the variable was assumed to have influence on the drop-out decision by the respective respondent group and the value of 0 otherwise.

## 4 Results

### 4.1 Summary statistics

Tables A3 (firms' sample) and A4 (apprentices' sample) in the appendix display the means, standard deviations, and correlations between the dependent (line 1) and independent variables in the regression analysis. The independent variables in both samples show correlation coefficients far below the critical value of .70 (Anderson et al., 1996). Only for a few categorical variables, which were inserted in the summary statistic tables with all categories to get a comprehensive overview of possible multicollinearity problems, categories from the same variable show high correlations with each other. In the present study, two categories of the variable that measures the frequency of previous drop-outs in the respondent craft firms show the highest absolute and significant correlation coefficient of -.78 (see Table A3). However, as the categories did not show high correlations with other independent variables or single categories of other independent variables from the regression, multicollinearity problems were not expected for the regressors in the present study.

### 4.2 Hypotheses tests, robustness checks, and discussion of the results of the firms' sample

In the following, the derived hypotheses regarding the occurrence of drop-outs in early versus later stages of apprenticeship training for certain reasons were analyzed from the *perspective of the craft firms*. Thus, the presented results are based on the firms' sample and are calculated with multinomial logit models. As the dependent variable  $y = \text{"drop-out period"}$  consists of  $m = 4$  categories—with the category  $y = 3$  "drop-out in the second year" as reference category—the remaining three categories are presented in three columns in the regression output table (see Table 4). As already mentioned, in the present study, early drop-outs are defined as those premature apprenticeship terminations that happened in the probationary period or in the first year of the apprenticeship. Later drop-outs are considered as terminations from the second apprenticeship year.

In *Hypothesis 1*, it was assumed that drop-outs because of an inadequate educational background of the apprentices in the crafts sector would occur particularly in the early phases of apprenticeship training. Thereby, Table 4 shows that the educational background and current school performance (factor 1) of the young people has a significant influence on drop-outs at a very advanced stage of the apprenticeship training. In the firms' sample, only terminations after the second apprenticeship year are significantly correlated with this reason. Thus, Hypothesis 1 has to be rejected. A possible explanation for this finding might be that apprentices have already passed the intermediate examinations and are close to the final examinations at the public training schools at this

apprenticeship stage. Related to this, they may realize having extensive knowledge gaps and drop-out from the apprenticeship before the examinations. Another possibility might be that they entered but eventually did not pass the examination.

Furthermore, it was supposed that the insufficient physiological and mental requirements of the former apprentices might lead to drop-outs in the early phases of apprenticeship training (*Hypothesis 2*). As presented in Table 4, this reason appears to be relevant for terminations in the early phases of apprenticeship training. Thus, *Hypothesis 2* was confirmed. As already mentioned, apprentices in the crafts sector were involved in the production processes of the apprenticeship firms (König, 2006). Given that good physical condition is a precondition in many occupations in the crafts sector, for example when working with machines or on a building site, it quickly becomes apparent in the probationary period whether an apprentice fulfills the physiological and mental requirements of the job. Therefore, it is obvious that this drop-out reason is mainly applied in the probationary period.

*Hypothesis 3* assumed that drop-outs as a result of wrong occupational choices of the craft apprentices will significantly happen in the early phases of apprenticeship training. Table 4 shows that occupational choice plays a role in premature apprenticeship terminations in the probationary period and in the first apprenticeship year. Thus, *Hypothesis 3* was confirmed. Interestingly, the probationary period is not sufficient for correcting occupational “missteps”. In this context, it is likely that terminations for this reason were consciously prolonged by the apprentices beyond the probationary period—because of better possibilities of changing employer or occupation at the beginning of a new apprenticeship term.

*Hypothesis 4* predicted that premature apprenticeship terminations due to a lack of training quality significantly happen in the later phases of apprenticeship training. With the firms’ data set, the findings reveal that drop-outs due to a lack of training quality are negatively related to premature apprenticeship terminations after the second apprenticeship year. In comparison with drop-outs in the second apprenticeship year (reference category), premature apprenticeship terminations after the second apprenticeship year have significantly declined (see Table 4). Thus, *Hypothesis 4* has to be rejected. An explanation for this result might be the temporal proximity to the final examination and the completion of the training at this apprenticeship stage. If the apprenticeship training moves on beyond the second apprenticeship year, it seems plausible for apprentices not to terminate the contract in order to receive the formal qualification degree.

*Hypothesis 5* supposed that the apprentices’ inadequate behavior and performance at the firm would be positively related to drop-outs in the early phases of apprenticeship training. In contrast to this assumption, *Hypothesis 5* cannot be confirmed. This possible reason for premature apprenticeship terminations did not show significant effects in any of the drop-out periods. Thus, in comparison with the reference category “drop-out in the second year”, the other apprenticeship periods did not stand out

with significantly higher or lower numbers of drop-outs due to the apprentices' behavior and performance.

Beyond the hypotheses tests, the regression analysis with the firms' sample reveals further interesting results by considering other possible drop-out reasons. Table 4 shows that the former apprentices' private circumstances occur as a drop-out factor at the advanced stages (after the second apprenticeship year) of apprenticeship training. In other periods of the apprenticeship training, this positive correlation did not occur. In addition, the regression analysis displays an effect for firms that employ between 50 and 250 people. Interestingly, firms from this size category are significantly more affected by drop-outs after the second apprenticeship year. Moreover, drop-outs on the initiative of the firms are positively correlated with the probationary period, whereas drop-outs reflecting the wishes of both parties show a negative correlation with drop-outs after the second apprenticeship year. However, the regression analysis does not reveal effects for the included craft sectors, the tradition of the craft firms in vocational training, the frequency of previous drop-outs in the firms, or the formal school graduation certificate of the former apprentices on the timing of the drop-out.

To test the dependence of the results on the specification of the dependent variable and the regression method, a *robustness check* was calculated *with the firms' sample*. Therefore, the dependent variable was recoded as a dummy: The drop-out period was reduced to only two categories and takes the value of 1 if the drop-out was in the probationary period or the first apprenticeship year (early drop-outs) and the value of 0 for drop-outs after the first apprenticeship year (including drop-outs in the second or after the second year) (late drop-outs). Then, a probit regression was conducted, which is illustrated in Table A5 in the appendix. The results of the probit regression confirmed the influence of the apprentices' educational background and current school performance on the drop-out decision. In this context, the analysis reveals that this drop-out factor is negatively related to early drop-outs compared with drop-outs after the first apprenticeship year. In addition, the behavior and performance of the apprentices at the firm showed no effect in the probit regression. This is also in line with the findings of the multinomial regression analysis. Furthermore, the occupational choice was confirmed in the robustness test as a significant reason for early drop-outs. However, not all the results remain stable under the new regression strategy. In contrast to the multinomial logit regression, the robustness analysis revealed that the private circumstances, the quality of the apprenticeship training as well as the physiological and mental requirements as three possible drop-out reasons exhibit insignificant coefficients.

Table 4: Estimates of the multinomial logit regressions of the firms' sample

Variables:	$\ln\left(\frac{P(y_i = 1)}{P(y_i = 3)}\right)$	$\ln\left(\frac{P(y_i = 2)}{P(y_i = 3)}\right)$	$\ln\left(\frac{P(y_i = 4)}{P(y_i = 3)}\right)$
Educational background and current school performance	-0.307 (0.161)	-0.010 (0.143)	0.530*** (0.164)
Behavior and performance at firm	-0.116 (0.201)	-0.129 (0.168)	0.089 (0.218)
Occupational choice	0.453*** (0.157)	0.394*** (0.142)	-0.378 (0.197)
Behavior at school	-0.664*** (0.230)	-0.117 (0.139)	-0.205 (0.154)
Private circumstances	-0.073 (0.155)	0.078 (0.124)	0.342** (0.143)
Quality of apprenticeship training	0.009 (0.208)	-0.242 (0.196)	-0.592** (0.294)
Physiological and mental requirements	0.378** (0.177)	0.283 (0.167)	0.380 (0.209)
Wood trade	-0.192 (0.611)	-1.517 (0.842)	0.053 (0.605)
Metal and electric trade	-0.283 (0.388)	-0.222 (0.333)	-0.251 (0.400)
Food trade	0.083 (0.472)	-0.096 (0.473)	-0.689 (0.646)
Health and personal care trade	0.534 (0.606)	0.341 (0.599)	0.385 (0.685)
Firm size: 5–19 employees	0.090 (0.420)	0.274 (0.408)	0.067 (0.414)
Firm size: 20–49 employees	0.101 (0.567)	0.167 (0.490)	-0.574 (0.531)
Firm size: 50–250 employees	0.708 (0.724)	0.811 (0.758)	1.590** (0.736)
Firm size: >250 employees	3.822 (2.826)	1.147 (2.636)	3.698 (2.524)
Tradition vocational training: $\geq 3$ years, <10 years	-0.315 (0.634)	0.499 (0.752)	0.432 (0.886)
Tradition vocational training: $\geq 10$ years, <25 years	-0.478 (0.593)	0.813 (0.734)	1.025 (0.836)
Tradition vocational training: $\geq 25$ years	-0.015 (0.608)	0.808 (0.744)	1.138 (0.833)
Frequency drop-out: 2–5 times	-0.092 (0.362)	-0.199 (0.331)	-0.296 (0.355)
Frequency drop-out: 6–10 times	-0.066 (0.638)	0.070 (0.543)	-0.409 (0.656)
Frequency drop-out: >10 times	-1.225 (1.033)	0.272 (0.675)	-2.657 (1.748)
Drop-out firm	2.526*** (0.437)	0.610 (0.420)	-0.016 (0.436)
Drop-out both	-0.307 (0.413)	0.215 (0.325)	-0.923** (0.441)
Duration of vacancy	0.377 (0.435)	0.164 (0.392)	-0.288 (0.570)
Sex	-0.311 (0.457)	0.182 (0.454)	-0.218 (0.567)

Mittelschule leaving certificate	-0.327 (0.341)	0.063 (0.325)	0.256 (0.377)
Realschule leaving certificate	-0.387 (0.537)	-0.003 (0.471)	0.699 (0.631)
Gymnasium leaving certificate	0.992 (0.761)	-0.811 (1.185)	-0.042 (1.120)
Other school leaving certificates	0.824 (0.800)	0.731 (0.690)	0.162 (0.695)
Constant	0.060 (0.934)	-1.833** (0.935)	-2.185 (1.143)
Observations	453		
Pseudo R-squared	0.176		
Wald chi-squared (90)	174.23		

Multinomial logit regression, robust standard errors in parentheses  
 Estimates show changes in the log odds for the categories  $y = 1$ ,  $y = 2$ , and  $y = 4$  with  
 reference to  $y = 3$  (“Drop-out during second year”)  
 All models are significant ( $p < .00$ ); \*\*\*  $p < .01$ , \*\*  $p < .05$

### 4.3 Hypotheses tests, robustness checks, and discussion of the results of the former apprentices’ sample

In the following, the results based on the *former apprentices’ perspective* are provided. First, the findings of the multinomial logit regression are presented. Consistent with the regression analysis of the firms’ sample, the dependent variable  $y =$  “drop-out period” consists of  $m = 4$  categories. The category  $y = 3$  “drop-out in the second year” acts as reference category. The remaining categories “drop-out in the probationary period”, “drop-out in the first year”, and “drop-out after the second year” are displayed in three columns in the regression output table (see Table 5).

*Hypothesis 1* supposed that drop-outs due to an inadequate educational background of the apprentices would be positively related to the early phases of apprenticeship training. As the factor “educational background and current school performance” shows a significantly negative effect on drop-outs in the probationary period, however, Hypothesis 1 has to be rejected. In contrast to the reference category, drop-outs in the probationary period are less likely to be affected by educational reasons. This result is in accordance with the findings in the firms’ sample.

*Hypothesis 2* aimed at the effects of insufficient physiological and mental requirements on the timing of the drop-out. Thereby, it was assumed that insufficient physiological and mental requirements of the former apprentices lead to drop-outs in the early phases of apprenticeship training. The results (see Table 5) for the apprentices’ sample showed that, compared with drop-outs in the second apprenticeship year, no significant differences could be detected for early drop-outs. Thus, Hypothesis 2 has to be rejected. This finding is in contrast to the results of the firms’ sample where insufficient physiological and mental requirements appeared to be a reason for early drop-outs. A possible explanation for the different results in the two samples could be the inability of the

apprentices to assess their physiological and mental condition in comparison with other young people and thereby to estimate the relevance of this factor in the drop-out decision.

Furthermore, a wrong occupational choice by the apprentices was predicted to be a relevant reason for early drop-outs in the crafts sector (*Hypothesis 3*). In contrast to the analysis with the firms' sample, the regression based on the former apprentices' data shows no effects on early drop-outs (Table 5). Based on the apprentices' perspective, however, Hypothesis 3 has to be rejected. The different view of the respondent groups on the realized drop-out may occur because of the firm respondents' extensive professional experience in contrast to the young apprentices. Thus, it could be assumed that the firm representatives could better assess the fit of the young people with the occupational choice, which explains the mention of a wrong occupational choice as being jointly responsible for early drop-outs.

*Hypothesis 4* assumed that a lack of quality in a craft firms' apprenticeship training might be related positively to drop-outs in the later phases of apprenticeship training. In the exploratory factor analysis of the apprentices' sample, training quality was not detected as a single factor. The quality aspects of apprenticeship training were loaded on a common factor together with items regarding the working atmosphere at the craft firms. The items in this common factor were integrated to the factor "Working atmosphere and quality of apprenticeship training" and included in the regression analysis. Table 5 shows that this factor is not significantly related to drop-outs in the probationary period or in the first apprenticeship year. However, as Hypothesis 4 does not match with this factor, it is not possible to give concluding notes on the persistence or rejection of the hypothesis in the apprentices' sample.

*Hypothesis 5* supposed that the apprentices' inadequate behavior and performance at the firm would be positively related to drop-outs in the early phases of apprenticeship training. In contrast to this assumption, Hypothesis 5 has to be rejected. This result is in line with the findings in the craft firms' sample where Hypothesis 5 also cannot be confirmed. With regard to the explanation of the findings in both samples, it can be assumed that this drop-out reason might occur at every phase of apprenticeship training, but not specifically emerge as a reason for early drop-outs.

In addition to the results of the hypotheses tests, it should be noted that, in the apprentices' sample, the drop-out factor "working conditions and contractual reasons" (Table 5) shows significantly negative effects on drop-outs in the early stages of apprenticeship training (probationary period, first apprenticeship year). This means that working conditions and contractual reasons are less likely to be relevant as drop-out reasons in the earlier stages of apprenticeship training compared with drop-outs in the second apprenticeship year (reference category). Two possible explanations might be given for this finding: On the one hand, this result might indicate that working conditions and contractual reasons are bad from the beginning of the apprenticeship training, but the apprentices have a high level of tolerance toward them and terminate their apprenticeships only after repeated

appearance. On the other hand, it is possible that working conditions constantly deteriorate during the apprenticeship training or contractual agreements are not respected in the course of the apprenticeship training, which explains why the early phases are less likely to be affected by this drop-out reason.

The apprentices also mentioned private circumstances as being crucial for drop-out decisions. In contrast to the firms' sample, where this reason appears to be relevant at the very late stages of apprenticeship training, the analysis of the apprentices' sample shows that this reason is positively related to drop-outs in the probationary period (see Table 5). The factor reflecting behavior at school shows no correlation with any drop-out period. Furthermore, drop-out decisions that can be attributed to the apprenticeship firms were positively related to drop-outs in the probationary period (see Table 5). This finding is consistent with the results of the firms' sample. In addition, controlling for the formal schooling of the former apprentices reveals that drop-outs in the probationary period are negatively related to apprentices with "Mittelschule" graduation certificates.

With the *data set of the apprentices*, it was also tested whether the findings of the multinomial logit regression depend on the specification of the dependent variable or the regression method. Thus, a *robustness check* was conducted by recoding the dependent variable as a dummy with early (probationary period, first apprenticeship year) and late (second and after the second apprenticeship year) drop-outs. This variable takes the value of 1 for early and the value of 0 for late drop-out decisions. Then, a probit regression was calculated, which is illustrated in Table A6 in the appendix. The results of the probit regression analysis revealed a positive relation of the apprentices' behavior at school and the apprentices' private circumstances with early drop-outs. The private circumstances as an early drop-out reason are in accordance with the results of the multinomial logit regression. Furthermore, the robustness check confirmed the influence of working conditions and contractual reasons on drop-out decisions. Thereby, as in the multinomial logit regression analysis, the negative relation of working conditions and contractual reasons with early drop-outs occurred. The control variable for the formal schooling of the former apprentices confirmed in the robustness test that apprentices with "Mittelschule" graduation certificates are significantly less affected by early drop-outs. The robustness check also revealed that, in the apprentices' sample, pupils with German nationality are significantly less affected by drop-outs in early apprenticeship phases.

Table 5: Estimates of the multinomial logit regressions of the apprentices' sample

Variables:	$\ln\left(\frac{P(y_i = 1)}{P(y_i = 3)}\right)$	$\ln\left(\frac{P(y_i = 2)}{P(y_i = 3)}\right)$	$\ln\left(\frac{P(y_i = 4)}{P(y_i = 3)}\right)$
Educational background and current school performance	-0.646** (0.290)	0.016 (0.266)	0.244 (0.375)
Behavior and performance at firm	-0.369 (0.325)	-0.397 (0.284)	-0.596 (0.538)
Occupational choice	0.159 (0.203)	0.167 (0.208)	0.485 (0.358)
Behavior at school	0.431 (0.311)	0.501 (0.293)	-0.470 (0.404)
Private circumstances	0.521*** (0.200)	0.348 (0.199)	0.348 (0.295)
Working atmosphere and quality of apprenticeship training	0.263 (0.222)	0.327 (0.229)	0.129 (0.301)
Physiological and mental requirements	0.083 (0.184)	0.139 (0.188)	-0.242 (0.322)
Working conditions and contractual reasons	-0.616*** (0.246)	-0.858*** (0.227)	0.616 (0.357)
Wood trade	-0.653 (0.723)	-3.370*** (1.228)	-0.006 (0.956)
Metal and electric trade	0.592 (0.487)	-0.241 (0.492)	0.527 (0.814)
Food trade	0.557 (0.597)	0.015 (0.649)	-0.643 (0.851)
Health and personal care trade	-0.303 (0.707)	-0.705 (0.748)	-1.059 (1.092)
Drop-out firm	1.299*** (0.492)	-0.327 (0.541)	1.497 (0.852)
Drop-out both	0.241 (0.457)	-0.096 (0.460)	0.871 (0.660)
Sex	0.265 (0.518)	0.268 (0.627)	0.712 (0.620)
Mittelschule leaving certificate	-1.045** (0.467)	-0.634 (0.490)	-0.599 (0.651)
Realschule leaving certificate	-0.084 (0.562)	-0.107 (0.547)	-2.069 (1.141)
Gymnasium leaving certificate	0.579 (0.792)	0.140 (0.849)	-0.675 (1.301)
Other school leaving certificates	-1.580 (0.953)	-1.552 (1.051)	-1.820 (1.128)
Internship before apprenticeship	-0.204 (0.505)	-0.033 (0.568)	0.055 (0.670)
Nationality: German	-0.502 (0.605)	0.583 (0.663)	0.081 (0.688)
Constant	2.859** (1.276)	1.163 (1.289)	-3.890** (1.825)
Observations		305	
Pseudo R-squared		0.202	
Wald chi-squared (69)		163.11	

Multinomial logit regression, robust standard errors in parentheses  
Estimates show changes in the log odds for the categories  $y = 1$ ,  $y = 2$ , and  $y = 4$  with reference to  $y = 3$  ("Drop-out during second year")  
All models are significant ( $p < .00$ ); \*\*\*  $p < .01$ , \*\*  $p < .05$

#### 4.4 Comparison and assessment of results across both samples

In sections 4.2 and 4.3, the analyses of drop-out reasons and the timing of drop-outs were conducted separately for the data set of the craft firms and for the data set of the former apprentices. Thereby, the drop-out reasons found with exploratory factor analyses were included in the regressions. For the apprenticeship firms, the factor analysis revealed seven factors; for the former apprentices' sample, eight drop-out factors were detected (see Table 6). Finally, assumptions regarding the influence of these factors on the timing of premature apprenticeship termination were tested with multinomial logit and probit regressions.

In the *firms' sample* under the multinomial logit analysis, several relevant drop-out reasons could be found with influence on different stages of the apprenticeship training. For example, an insufficient educational background and private circumstances of the former apprentices were identified with effects on drop-outs after the second apprenticeship year. In contrast, a wrong occupational choice or lacking physiological and mental requirements of the apprentices significantly stand out as drop-out reasons in the early phases of apprenticeship training. Moreover, quality aspects of the apprenticeship training are significantly less relevant for drop-out decisions at a very advanced stage. In addition, behavioral problems at school are negatively related to drop-outs in the probationary period. Compared with the reference category, this means that drop-outs for behavioral reasons at school are less significant in the early phases of apprenticeship training.

Compared with the firms, the *craft apprentices' perspective* reveals a slightly different picture on the bases of premature apprenticeship terminations at different apprenticeship stages. This may be due to various reasons. First, the respondents in both samples could not be matched. Thus, there was no possibility of detecting whether and how many of the respondents refer to the same realized drop-out. In the worst case, the sample has no overlaps concerning the respondents. Second, despite an assumed overlap of the sample respondents, they might have widely differing views on the reasons for the occurred drop-out. Nevertheless, the use of both samples is seen as enrichment in the present study, which is then able to provide broad insights into the backgrounds of premature apprenticeship terminations.

The multinomial regression analysis with the apprentices' data shows that only three drop-out factors remain with significant effects. In accordance with the firms' perspective, the educational background and current school performance are significantly less relevant for apprenticeship termination at an early stage (see Table 6). In contrast to the firms' sample, the private circumstances of the apprentices show an influence on drop-outs in the probationary period. Moreover, the drop-out factor "working conditions and contractual reasons", which is only included in the regression analysis of the apprentices, shows that this reason is negatively related to drop-outs in the probationary period and first apprenticeship year.

However, the fact has to be regarded more critically that both regression methods—the multinomial logit and probit analyses—sometimes caused substantial differences in the results. This indicated the dependence of the findings on the regression method and the specification of the dependent variable. In the case of the multinomial logit regression, the dependent variable “drop-out period” exhibits four categories, whereas the dependent variable was recoded as a dummy for the probit analysis. To compare the findings of both regression methods and to draw final conclusions on the relevance of the reasons for drop-outs in the crafts sector at different times, Table 6 should offer an overview.

Table 6: Estimates of the regression analyses in comparison

Drop-out reasons	Firms' sample		Apprentices' sample	
	<i>Multinomial logit model</i>	<i>Probit model</i>	<i>Multinomial logit model</i>	<i>Probit model</i>
Educational background and current school performance	√	√	√	n.s.
Behavior and performance at firm	n.s.	n.s.	n.s.	n.s.
Occupational choice	√	√	n.s.	n.s.
Behavior at school	√	n.s.	n.s.	√
Private circumstances	√	n.s.	√	√
Working atmosphere and quality of apprenticeship training	--	--	n.s.	n.s.
Physiological and mental requirements	√	n.s.	n.s.	n.s.
Working conditions and contractual reasons	--	--	√	√
Quality of apprenticeship training	√	n.s.	--	--

Table 6 is based on the results of the regression analyses in Tables 4, 5, A5, and A6. “√” denotes significant effects, “n.s.” denotes no significant effect, and “--” means that this variable is not included in the regression of the respective sample group.

Table 6 provides a comprehensive overview of the regression analyses. Thereby, four groups of drop-out reasons could be identified including both samples and both regression strategies. The first group (Table 6, marked in red) contains drop-out reasons that did not show significance in any of the regression models. Among them, there is the behavior and performance at the firm and the working atmosphere and quality of the apprenticeship training. Hence, these reasons are not relevant for the timing of drop-outs in the crafts sector. The next group (Table 6, marked in grey) of findings is characterized by showing one significant effect in one model. Among the grey marked drop-out reasons, there are, for example, the physiological and mental requirements of the apprentices. As this

reason showed no stability between the samples and regression methods, the influence of this drop-out reason on early drop-outs can be regarded as negligible.

Yellow (stability within or above one sample group) and green (stability within at least one sample group) marked factors indicate findings with high stability and thus confirm the importance of the respective reason for drop-outs within a certain period of the apprenticeship training. First, the “educational background and current school performance” is within these reasons. Across the samples as well as the regression methods, the findings for this reason tend in the same direction: The educational background and current school performance is relevant rather for late drop-outs. Second, wrong occupational choice of the young people occurred as an early drop-out reason. In addition, behavior at school as well as the private circumstances of the apprentices showed significance in the early and late drop-out phases in the different regression analyses. Thus, the importance of these factors is confirmed even if no distinct drop-out phase could be detected. Finally, working conditions and contractual reasons are negatively related to drop-outs in the early phases of apprenticeship training in both regression analyses of the apprentices’ sample.

Regarding its findings, the present study contributes to the field of research in several ways. Whereas the study of Jordan & Lamamra (2010) qualitatively investigated the question of reasons for drop-out of Swiss apprentices, the present analysis invokes quantitative methods to detect results that are generalizable for premature apprenticeship terminations in the German crafts sector. Moreover, the seven (firms’ sample) and eight (apprentices’ sample) drop-out factors that were included in the present study together with several control variables cover drop-out grounds over a wider range than previous work on premature apprenticeship terminations (Bessey & Backes-Gellner, 2007, 2008; Jordan & Lamamra, 2010).

Compared with the work of Bessey & Backes-Gellner (2008), which linked three different exit strategies of young people with their drop-out reasons, the present study concentrated on the connection between drop-out timing and certain drop-out reasons. This connection is especially important for firms in order for them to be aware of critical stages during apprenticeship training. Thereby, firms are able to develop suitable measures to guard against the emergence of these problems or, at least, are able to react quickly before the problems become too big. Moreover, to prevent a one-sided approach, the present study included perspectives on the realized drop-out from apprenticeship firms and former apprentices. This is in contrast to previous studies (e.g., Bessey & Backes-Gellner, 2007), in which often only one contract party is analyzed.

Regarding the transferability of the results to drop-outs beyond the crafts sector, this has to be distinguished according to the respective drop-out reason. Thereby, in any other industry, drop-outs due to a wrong occupational choice might similarly occur in the early phases of apprenticeship training. In contrast to this, drop-outs based on the educational background and current school performance of the young people may happen earlier in other industries than in the crafts sector, for

example when it comes to knowledge-intensive professions with high requirements on prior education and schooling during the apprenticeship training. Moreover, the results of the present study are limited to premature apprenticeship terminations only and cannot make a contribution to the job mobility literature. This is because of the setting of the study, in which apprentices are included. Apprentices are exposed to a different environment (vocational school, workplace, first step in career orientation) than other workers. Therefore, change behavior of apprentices includes very specific drop-out reasons, such as the wrong occupational choice.

Despite the relevance and strengths of the present study, it has some limitations. Taking the structure of the data set into account (lack of control group, cross-sectional data), the findings merely allow correlative interpretations. Furthermore, the data collection took place retrospectively. In 2012, firms and apprentices were asked about the reasons for their realized drop-outs, which occurred a maximum of three years before survey participation. As already mentioned, it could also be assumed that, after a certain time period, the relevant problems associated with the drop-out decision are still very present because of the decisive experience for both apprenticeship parties. Nevertheless, this strongly applies for the main reasons. For the reproduction of drop-out causes besides the main reasons, the temporal lag may cause biased data. In addition, the data may be biased if only firms or apprentices with extremely difficult problems in their prior apprenticeship training were motivated to fill in the questionnaires.

## 5 Conclusion and practical implications

The aim of the present paper was to empirically identify relevant drop-out reasons at different drop-out stages of apprenticeship training in the crafts sector. As premature apprenticeship terminations have rarely been processed in scientific studies so far, this paper contributes to secure the supply of skilled labor in several ways. First, a current and broad data-base reflecting two perspectives—the views of apprenticeship firms as well as former apprentices—on realized drop-outs makes it possible to detect verified factors with influence on drop-out phases. Thereby, firms and former apprentices agree on the relevance of the educational background and current school performance of the apprentices in drop-out decisions. Furthermore, a wrong occupational choice was highlighted as a drop-out cause.

A second benefit of the present study is given by a detailed analysis of the timing of the drop-out. Thereby, the present paper is able to connect critical stages during the apprenticeship period with corresponding reasons. In this regard, e.g., the private circumstances of the former apprentices could be detected as significant for drop-outs in the very late stages of apprenticeship training. Moreover, lacking physiological and mental requirements of the apprentices can already lead to drop-outs in the probationary period. Concerning the private circumstances and mental weaknesses of their apprentices, training firms should pay particular attention and be aware of external contact points that are able to give professional support. This may help to solve temporary problems and thus prevent premature apprenticeship terminations.

Third, SMEs from the crafts sector—which play a major role regarding the quantity of provided apprenticeship training in Germany and again highlights the high economic relevance of the present paper—are included in this study to gain information about opportunities for enhancing their apprenticeship situation. The results of the present paper show that a main reason for drop-outs in the crafts sector is given by educational weaknesses of the apprentices. Thus, an issue to think about is additional teaching lessons that the firms offer to their apprentices during the apprenticeship period to secure the long-term supply of skilled labor. In this context, institutions from the crafts sector can support their member firms in combining together apprentices from different firms for joint private lessons. Another possibility may be that crafts chambers include educational support for weaker apprentices in their own course portfolio.

Moreover, the study reveals that craft firms are not aware of particular drop-out reasons. Whereas they confirm a lack of training quality as being responsible for premature apprenticeship terminations, firms have been criticized by former apprentices for their working conditions and non-compliance with contractual agreements. Thus, craft firms have to be aware of possible problems in this context and work on achievements (e.g., paying for overtime hours). Compared with large enterprises, many craft firms also lack appropriate instruments for recruitment and personnel selection.

With aptitude tests or mandatory internships, craft firms can improve the fit of their apprentices with the firm as well as the profession and thereby avoid, for example, drop-outs based on missing physiological and mental requirements of the apprentices.

Among the drop-out reasons, there are also causes related to prior schooling or schooling during the apprenticeship. Thus, educational politics might also benefit from the present study through confirmation that educational problems significantly influence drop-outs in dual apprenticeship training in Germany. A major problem of apprentices in the crafts sector results from the educational background acquired in their former schools. Thus, an essential step in enhancing the apprenticeship training situation is given by an improvement in basic education as well as training maturity in secondary schools. With appropriate teaching measures, secondary schools also have to ensure that pupils are able to transfer their theoretical knowledge from school into vocational tasks. Moreover, the vocational training schools have to respond to apprentices with different levels of knowledge and abilities. In addition, the results indicate that the transition from school to work is a critical phase that needs specific support. Despite the efforts concerning career guidance in schools, educational politics should strengthen the measures to acquaint school leavers with possible occupations as too many drop-outs can be traced back to wrong occupational choices.

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## Appendix

Table A1: Survey items underlying the drop-out factors in the firms' sample

<p><i>How crucial were the following reasons for the decision to terminate the apprenticeship prematurely?</i></p> <p><u>Original text in German:</u> <i>Wie ausschlaggebend waren folgende Gründe für den Ausbildungsabbruch?</i></p>	
All items were rated on a Likert scale (1 = does not apply, 3 = does partly apply, 5 = does totally apply).	
<b>Factor 1: Educational background and current school performance</b>	
<i>Variable</i>	<i>Survey item</i>
Educational background	<p><i>Previous knowledge from school was insufficient for the profession</i></p> <p><u>Original item in German:</u> Für den Beruf nicht ausreichende schulische Vorkenntnisse</p>
Learning motivation school	<p><i>Lack of motivation to learn</i></p> <p><u>Original item in German:</u> Fehlende Motivation zum Lernen</p>
Excessive demand school	<p><i>Mental overload at vocational school</i></p> <p><u>Original item in German:</u> Überforderung in der Berufsschule</p>
Poor performance school	<p><i>Poor performance at vocational school</i></p> <p><u>Original item in German:</u> Schlechte Leistungen in der Berufsschule</p>
Poor performance intermediate examination	<p><i>Poor performance at the intermediate examination</i></p> <p><u>Original item in German:</u> Schlechte Leistungen in der Zwischenprüfung</p>
<b>Factor 2: Behavior and performance at firm</b>	
<i>Variable</i>	<i>Survey item</i>
Poor performance firm	<p><i>Performance of the apprentice was insufficient at work</i></p> <p><u>Original item in German:</u> Nicht ausreichende Leistungen des Auszubildenden im Unternehmen</p>
Capacity for teamwork	<p><i>At the firm, the apprentices' ability to work in a team was insufficient</i></p> <p><u>Original item in German:</u> Nicht ausreichende Teamfähigkeit des Auszubildenden im Betrieb</p>
Social behavior	<p><i>Manners/social behavior of the apprentice toward the other employees</i></p> <p><u>Original item in German:</u> Sozialverhalten/Umgangsformen des Auszubildenden gegenüber anderen Mitarbeitern</p>

Table A1: Survey items underlying the drop-out factors in the firms' sample (continued)

Unpunctuality	<i>Unpunctuality of the apprentice</i> <u>Original item in German:</u> Unpünktlichkeit des Auszubildenden
Absenteeism	<i>Apprentices' absenteeism without valid excuse</i> <u>Original item in German:</u> Unentschuldigte Fehlzeiten des Auszubildenden
Conflicts with co-workers/boss	<i>Conflicts and personal discrepancies with the business owner/foreman/supervisor/the other apprentices</i> <u>Original item in German:</u> Konflikte und persönliche Unstimmigkeiten zwischen dem Inhaber/Meister/Ausbilder/den anderen Auszubildenden und dem Auszubildenden
Lack of motivation training	<i>Lack of motivation/interest for the apprenticeship</i> <u>Original item in German:</u> Mangelnde Motivation/Interesse an der Ausbildung
<b>Factor 3: Occupational choice</b>	
<i>Variable</i>	<i>Survey item</i>
Wrong job perception	<i>Wrong job perception regarding chosen apprenticeship</i> <u>Original item in German:</u> Falsche Berufsvorstellungen bezüglich der gewählten Ausbildung
Non-desired profession	<i>The chosen apprenticeship did not correspond with the desired profession of the apprentice</i> <u>Original item in German:</u> Der gewählte Ausbildungsberuf entsprach nicht dem Wunschberuf des Auszubildenden
Change occupation	<i>The apprentice later found another apprenticeship, which better matches his/her requests</i> <u>Original item in German:</u> Der Auszubildende hat nachträglich eine andere Ausbildungsstelle gefunden, die seinen Wünschen eher entsprochen hat
Moral concepts	<i>Training activities were not consistent with the apprentices' moral values</i> <u>Original item in German:</u> Ausbildungstätigkeiten waren nicht mit den Wertvorstellungen des Auszubildenden vereinbar
<b>Factor 4: Behavior at school</b>	
<i>Variable</i>	<i>Survey item</i>
Conflict teacher	<i>Conflicts with teachers at vocational school</i> <u>Original item in German:</u> Konflikte mit den Lehrern in der Berufsschule

Table A1: Survey items underlying the drop-out factors in the firms' sample (continued)

Conflict classmate	<i>Conflicts with classmates</i>  <u>Original item in German:</u> Konflikte mit den Klassenkameraden
Discipline problems school	<i>Discipline problems/misbehavior at vocational school</i>  <u>Original item in German:</u> Disziplinprobleme/Fehlverhalten in der Berufsschule
<b>Factor 5: Private circumstances</b>	
<i>Variable</i>	<i>Survey item</i>
Family problems	<i>Problems within the family/partnership</i>  <u>Original item in German:</u> Probleme im familiären Bereich/in der Partnerschaft
Financial problems	<i>Difficult financial situation</i>  <u>Original item in German:</u> Schwierige finanzielle Lage
Criminality/addictive behavior	<i>Problems regarding criminality and/or addictive behavior</i>  <u>Original item in German:</u> Probleme in Bezug auf Kriminalität und/oder Suchtverhalten
<b>Factor 6: Quality of apprenticeship training</b>	
<i>Variable</i>	<i>Survey item</i>
Communication to co-workers/boss	<i>Lack of sufficient communication between owner/foreman/supervisor/other apprentices and the former apprentice</i>  <u>Original item in German:</u> Nicht ausreichende Kommunikation zwischen dem Inhaber/Meister/Ausbilder/den anderen Auszubildenden und dem Auszubildenden
Non-demanding tasks	<i>Mostly inferior and non-demanding tasks were assigned to the apprentice</i>  <u>Original item in German:</u> Der Auszubildende hat vorwiegend "mindere" und wenig anspruchsvolle Tätigkeiten übertragen bekommen
<b>Factor 7: Physiological and mental requirements</b>	
<i>Variable</i>	<i>Survey item</i>
Physical overload	<i>Physical overload of the apprentice regarding work activities</i>  <u>Original item in German:</u> Körperliche Überforderung des Auszubildenden durch die Arbeitstätigkeit
Pressure of time and performance	<i>Pressure of time and performance</i>  <u>Original item in German:</u> Zeit- bzw. Leistungsdruck

Table A2: Survey items underlying the drop-out factors in the apprentices' sample

<p><i>How crucial were the following reasons for your decision to terminate your apprenticeship prematurely?</i></p> <p><u>Original text in German:</u> <i>Wie ausschlaggebend waren folgende Gründe für den Ausbildungsabbruch?</i></p>	
All items were rated on a Likert scale (1 = does not apply, 3 = does partly apply, 5 = does totally apply).	
<b>Factor 1: Educational background and current school performance</b>	
<i>Variable</i>	<i>Survey item</i>
Educational background	<p><i>My previous knowledge from school was insufficient for the profession</i></p> <p><u>Original item in German:</u> Meine schulischen Vorkenntnisse waren für den Beruf nicht ausreichend</p>
Learning motivation school	<p><i>Lack of motivation to learn</i></p> <p><u>Original item in German:</u> Fehlende Motivation zum Lernen</p>
Excessive demand school	<p><i>Mental overload at vocational school</i></p> <p><u>Original item in German:</u> Überforderung in der Berufsschule</p>
Poor performance school	<p><i>Poor performance at vocational school</i></p> <p><u>Original item in German:</u> Schlechte Leistungen in der Berufsschule</p>
Poor performance intermediate examination	<p><i>Poor performance at the intermediate examination</i></p> <p><u>Original item in German:</u> Schlechte Leistungen in der Zwischenprüfung</p>
<b>Factor 2: Behavior and performance at firm</b>	
<i>Variable</i>	<i>Survey item</i>
Poor performance firm	<p><i>My performance at work was insufficient</i></p> <p><u>Original item in German:</u> Meine Leistungen im Unternehmen waren nicht ausreichend</p>
Capacity for teamwork	<p><i>At the firm, my ability to work in a team was insufficient</i></p> <p><u>Original item in German:</u> Meine Teamfähigkeit im Betrieb war nicht ausreichend</p>
Social behavior	<p><i>My manners/social behavior toward the other employees</i></p> <p><u>Original item in German:</u> Meine Umgangsformen/mein Sozialverhalten gegenüber anderen Mitarbeitern</p>

Table A2: Survey items underlying the drop-out factors in the apprentices' sample (continued)

<b>Factor 3: Occupational choice</b>	
<i>Variable</i>	<i>Survey item</i>
Lack of motivation training	<i>Lack of motivation/interest for the apprenticeship</i>  <u>Original item in German:</u> Mangelnde Motivation/Interesse an der Ausbildung
Wrong job perception	<i>Wrong job perception regarding the chosen apprenticeship</i>  <u>Original item in German:</u> Falsche Berufsvorstellungen bezüglich der gewählten Ausbildung
Non-desired profession	<i>The chosen apprenticeship did not correspond with my desired profession</i>  <u>Original item in German:</u> Der gewählte Ausbildungsberuf entsprach nicht meinem Wunschberuf
Change occupation	<i>I later found another apprenticeship, which better matches my requests</i>  <u>Original item in German:</u> Ich habe nachträglich eine andere Ausbildungsstelle gefunden, die meinen Wünschen eher entsprochen hat
Moral concepts	<i>Training activities were not consistent with my moral values</i>  <u>Original item in German:</u> Ausbildungstätigkeiten waren nicht mit meinen Wertvorstellungen vereinbar
<b>Factor 4: Behavior at school</b>	
<i>Variable</i>	<i>Survey item</i>
Conflict teacher	<i>Conflicts with teachers at vocational school</i>  <u>Original item in German:</u> Konflikte mit den Lehrern in der Berufsschule
Conflict classmate	<i>Conflicts with classmates</i>  <u>Original item in German:</u> Konflikte mit den Klassenkameraden
Discipline problems school	<i>Discipline problems/misbehavior at vocational school</i>  <u>Original item in German:</u> Disziplinprobleme/Fehlverhalten in der Berufsschule
<b>Factor 5: Private circumstances</b>	
<i>Variable</i>	<i>Survey item</i>
Family problems	<i>Problems within the family/partnership</i>  <u>Original item in German:</u> Probleme im familiären Bereich/in der Partnerschaft
Too long distance to workplace	<i>Workplace too far away/difficult to reach</i>  <u>Original item in German:</u> Wegstrecke zur Arbeit war zu lang/Arbeitsstätte schlecht erreichbar

Table A2: Survey items underlying the drop-out factors in the apprentices' sample (continued)

Financial problems	<i>Difficult financial situation</i>  <u>Original item in German:</u> Schwierige finanzielle Lage
<b>Factor 6: Working atmosphere and quality of apprenticeship training</b>	
<i>Variable</i>	<i>Survey item</i>
Conflicts with co-workers/boss	<i>Conflicts and personal discrepancies with the business owner/foreman/supervisor/the other apprentices</i>  <u>Original item in German:</u> Konflikte und persönliche Unstimmigkeiten mit dem Inhaber/Meister/Ausbilder/den anderen Auszubildenden
Mobbing	<i>Mobbing by colleagues</i>  <u>Original item in German:</u> <i>Mobbing durch Kollegen</i>
Communication to co-workers/boss	<i>Lack of sufficient communication between owner/foreman/supervisor/the other apprentices</i>  <u>Original item in German:</u> Es fehlte an ausreichender Kommunikation mit dem Inhaber/Meister/Ausbilder/den anderen Auszubildenden
Non-demanding tasks	<i>Most of the time I had to handle inferior and non-demanding tasks</i>  <u>Original item in German:</u> Ich musste überwiegend "mindere" und wenig anspruchsvolle Tätigkeiten erledigen
Performing tasks not related to vocational training	<i>I frequently had to handle tasks, which were not correlated to my apprenticeship</i>  <u>Original item in German:</u> Ich musste häufig Tätigkeiten erledigen, die nichts mit meiner Ausbildung zu tun hatten
<b>Factor 7: Physiological and mental requirements</b>	
<i>Variable</i>	<i>Survey item</i>
Physical overload	<i>I felt physically overwhelmed by my work activities</i>  <u>Original item in German:</u> Ich habe mich durch die Arbeitstätigkeit körperlich überfordert gefühlt
Pressure of time and performance	Pressure of time and performance  <u>Original item in German:</u> Zeit- bzw. Leistungsdruck
<b>Factor 8: Working conditions and contractual reasons</b>	
<i>Variable</i>	<i>Survey item</i>
Unfavorable working hours/breaks	<i>Inconvenient working hours and/or breaks during the work day</i>  <u>Original item in German:</u> Ungünstig liegende Arbeitszeiten und/oder Pausen während des Arbeitstages

Table A2: Survey items underlying the drop-out factors in the apprentices' sample (continued)

Frequent/unpaid overtime	<i>Frequently fulfilled and/or unpaid overtime</i>  <u>Original item in German:</u> Häufig geleistete und/oder unbezahlte Überstunden
Leave provisions	<i>Problems with leave provisions</i>  <u>Original item in German:</u> Probleme mit der Urlaubsregelung
Apprenticeship quality	<i>Professional content (according to official training regulations) was not taught sufficiently at firm</i>  <u>Original item in German:</u> Fachliche Inhalte (laut Ausbildungsordnung) wurden durch den Betrieb nicht ausreichend vermittelt
Late training pay	<i>Late payment of apprenticeship wages</i>  <u>Original item in German:</u> Verspätete Zahlung der Ausbildungsvergütung
Youth employment law	<i>Violation of regulations regarding youth employment law</i>  <u>Original item in German:</u> Nichteinhaltung der Regelungen des Jugendarbeitsschutzgesetzes

Table A3: Descriptive statistics for study variables (firms)

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
<b>Dependent variable:</b>														
1. Drop-out period	2.40	1.05	1											
<b>Independent variables:</b>														
2. Educational background and current school performance	.44	.50	.27*	1										
3. Behavior and performance at firm	.44	.50	.11*	.47*	1									
4. Occupational choice	.31	.46	-.10*	.15*	.21*	1								
5. Behavior at school	.28	.45	.26*	.53*	.53*	.07	1							
6. Private circumstances	.26	.44	.19*	.20*	.34*	-.03	.39*	1						
7. Quality of apprenticeship training	.10	.31	-.04	.16*	.24*	.21*	.09*	.03	1					
8. Physiological and mental requirements	.16	.37	-.06	.12*	.16*	.24*	-.00	-.04	.34*	1				
9. Construction trade	.33	.47	.02	.05	.15*	.03	.13*	.08	-.03	-.02	1			
10. Wood trade	.06	.25	.06	.08	-.01	.01	-.01	-.06	.09	.12*	-.18*	1		
11. Metal and electric trade	.37	.48	.01	.06	-.06	.08	-.04	-.06	-.00	-.01	-.54*	-.20*	1	
12. Food trade	.12	.33	-.05	-.09*	-.06	-.07	-.05	.03	-.03	-.07	-.26*	-.10*	-.29*	1
13. Health and personal care trade	.11	.32	-.06	-.13*	-.06	-.10*	-.08	-.02	.01	.02	-.25*	-.09*	-.28*	-.14*
14. Firm size: 1–4 employees	.22	.41	.06	.12*	-.01	-.10*	.07	.01	.03	.04	.01	.10*	-.15*	-.12*
15. Firm size: 5–19 employees	.49	.50	-.07	-.12*	.05	.08	-.12*	.01	-.04	.03	.06	-.00	-.01	-.01
16. Firm size: 20–49 employees	.19	.40	.03	.08	-.01	.04	.05	-.05	.01	-.05	-.05	-.04	.10*	.09
17. Firm size: 50–250 employees	.09	.28	.00	-.09	-.07	-.06	.04	.03	-.00	-.03	-.03	-.08	.09	.05
18. Firm size: >250 employees	.01	.11	.01	.04	.01	.02	.04	.02	.01	-.02	-.04	-.03	-.01	.02
19. Tradition vocational training: <3 years	.05	.22	-.05	.03	.05	-.07	-.00	-.01	.07	.09	.02	.06	-.08	-.06
20. Tradition vocational training: ≥3 years, <10 years	.18	.39	-.02	.03	.01	-.04	.02	.08	-.03	-.04	-.02	-.05	.03	-.06
21. Tradition vocational training: ≥10 years, <25 years	.26	.44	.07	.04	.06	.09*	.07	-.04	.14	.04	.08	.05	-.04	-.02
22. Tradition vocational training: ≥25 years	.50	.50	-.03	-.07	-.09	-.02	-.07	-.02	-.13*	-.04	-.07	-.03	.05	.09
23. Frequency drop-out: First time	.36	.48	.01	.01	-.10*	-.05	-.10*	-.12*	-.07	.01	.07	.05	-.04	-.13*
24. Frequency drop-out: 2–5 times	.52	.50	.01	-.02	.10*	.08	.11*	.11*	.09*	-.01	-.05	-.00	.05	.05
25. Frequency drop-out: 6–10 times	.08	.27	-.01	.02	.01	-.06	.00	.01	-.04	.05	-.04	-.04	.02	.04
26. Frequency drop-out: >10 times	.04	.21	-.03	-.01	-.03	-.02	-.03	-.02	-.02	-.05	.01	-.06	-.05	.12*

Table A3: Descriptive statistics for study variables (firms) (continued)

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
28. Drop-out apprentice	.49	.50	.11*	-.21*	-.39*	.09	-.23*	-.15*	-.06	-.06	-.00	.03	.01	.02
29. Drop-out firm	.28	.45	-.22*	.03	.27*	-.20*	.08	.10*	-.02	-.02	.04	-.02	-.03	-.04
30. Drop-out both	.24	.43	.10*	.21*	.17*	.11*	.18*	.08	.09	.09	-.04	-.02	.02	.01
31. Duration of vacancy	.13	.33	-.07	-.07	-.05	-.01	-.12*	-.10*	-.04	-.06	-.03	-.02	.06	-.00
32. Sex	.19	.39	-.08	-.23*	-.14*	-.08	-.19*	-.05	-.11*	-.04	-.23*	-.04	-.28*	.21*
33. Without leaving certificate	.45	.50	.06	.30*	.14*	-.04	.17*	.12*	-.01	.06	.12*	-.11*	-.11*	.07
34. Mittelschule leaving certificate	.34	.47	.01	-.10*	.05	.03	-.01	-.02	.07	-.04	-.08	.00	.13*	-.04
35. Realschule leaving certificate	.13	.34	-.03	-.32*	-.17*	.06	-.19*	-.10*	-.01	.01	-.09	.11*	.03	-.07
36. Gymnasium leaving certificate	.03	.16	-.09	-.17*	-.17*	-.02	-.12*	-.10*	-.07	-.04	.06	.07	-.07	-.02
37. Other school leaving certificates	.05	.22	-.04	.16*	-.06	-.05	.03	-.03	-.04	-.03	.01	.02	-.03	.04

Table A3: Descriptive statistics for study variables (firms) (continued)

Variable	Mean	SD	13	14	15	16	17	18	19	20	21	22	23
13. Health and personal care trade	.11	.32	1										
14. Firm size: 1–4 employees	.22	.41	.25*	1									
15. Firm size: 5–19 employees	.49	.50	-.06	-.52*	1								
16. Firm size: 20–49 employees	.19	.40	-.14*	-.26*	-.48*	1							
17. Firm size: 50–250 employees	.09	.28	-.09	-.16*	-.30*	-.15*	1						
18. Firm size: >250 employees	.01	.11	.08	-.06	-.11*	-.06	-.04	1					
19. Tradition vocational training: <3 years	.05	.22	.10*	.21*	-.07	-.07	-.07	-.03	1				
20. Tradition vocational training: ≥3 years, <10 years	.18	.39	.08	.14*	.04	-.13*	-.06	-.05	-.11*	1			
21. Tradition vocational training: ≥10 years, <25 years	.26	.44	-.07	.04	-.01	.03	-.06	-.02	-.14*	-.28*	1		
22. Tradition vocational training: ≥25 years	.50	.50	-.04	-.24*	.02	.11*	.13*	.08	-.24*	-.48*	-.60*	1	
23. Frequency drop-out: First time	.36	.48	.05	.29*	.01	-.18*	-.15*	-.09	.23*	.25*	.06	-.35*	1
24. Frequency drop-out: 2–5 times	.52	.50	-.06	-.17*	.05	.14*	-.02	-.04	-.19*	-.13*	-.01	.19*	-.78*
25. Frequency drop-out: 6–10 times	.08	.27	.03	-.11*	-.05	.09	.15*	-.03	-.03	-.14*	-.04	.16*	-.22*
26. Frequency drop-out: >10 times	.04	.21	-.01	-.11*	-.08	-.02	.20*	.35*	-.05	-.10*	-.05	.15*	-.16*
27. Drop-out apprentice	.49	.50	-.06	-.08	.03	.04	.00	.04	-.09	-.03	.07	.00	.02
28. Drop-out firm	.28	.45	.04	.07	-.01	-.09	.06	-.03	.10*	.09	-.04	-.08	-.01
29. Drop-out both	.24	.43	.03	.02	-.02	.05	-.06	-.02	.01	-.06	-.04	.08	-.01
30. Duration of vacancy	.13	.33	-.03	-.11*	.12*	-.07	.05	-.04	-.00	-.04	-.02	.05	.06
31. Sex	.19	.39	.58*	.11*	.04	-.13*	-.05	-.01	.03	.09	-.11	.01	.03
32. Without leaving certificate	.45	.50	.00	.04	-.02	.01	-.03	-.03	-.04	.04	-.04	.02	-.01
33. Mittelschule leaving certificate	.34	.47	-.04	-.00	-.06	.06	.01	-.00	-.00	-.05	-.03	.07	-.03
34. Realschule leaving certificate	.13	.34	.07	-.08	.07	-.02	-.00	.07	.08	-.06	.08	-.06	.04
35. Gymnasium leaving certificate	.03	.16	-.02	-.05	.06	-.05	.05	-.02	-.04	.06	-.07	.03	-.01
36. Other school leaving certificates	.05	.22	-.02	.07	.01	-.09	.00	-.03	-.01	.07	.07	-.11*	.04

Table A3: Descriptive statistics for study variables (firms) (continued)

Variable	Mean	SD	25	26	27	28	29	30	31	32	33	34	35	36	37
25. Frequency drop-out: 2–5 times	.52	.50	1												
26. Frequency drop-out: 6–10 times	.08	.27	-.30*	1											
27. Frequency drop-out: >10 times	.04	.21	-.22*	-.06	1										
28. Drop-out apprentice	.49	.50	.04	.02	.03	1									
29. Drop-out firm	.28	.45	.01	.04	-.06	-.60*	1								
30. Drop-out both	.24	.43	.03	-.06	.03	-.54*	-.35*	1							
31. Duration of vacancy	.13	.33	-.04	.01	-.05	.06	-.04	-.03	1						
32. Sex	.19	.39	-.01	-.02	-.02	.05	-.03	-.04	-.02	1					
33. Without leaving certificate	.45	.50	-.03	.03	.04	-.07	.01	.07	.02	-.10*	1				
34. Mittelschule leaving certificate	.34	.47	.05	-.01	-.04	-.00	.05	-.05	.01	-.03	-.65*	1			
35. Realschule leaving certificate	.13	.34	-.03	-.01	.01	.10*	-.09*	-.02	.01	.14*	-.35*	-.28*	1		
36. Gymnasium leaving certificate	.03	.16	.02	.00	-.04	.11*	-.10*	-.03	-.06	.13*	-.15*	-.12*	-.06	1	
37. Other school leaving certificates	.05	.22	-.02	-.02	-.00	-.06	.08	-.01	-.03	-.04	-.21*	-.17*	-.09	-.04	1

Means, standard deviations, and pairwise correlation coefficients for all variables

Cross-sectional data with n = 453 firms

\* p&lt;.05

Table A4: Descriptive statistics for study variables (apprentices)

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
<b>Dependent variable:</b>														
1. Drop-out period	2.07	.98	1											
<b>Independent variables:</b>														
2. Educational background and current school performance	.13	.34	.15*	1										
3. Behavior and performance at firm	.07	.25	.02	.34*	1									
4. Occupational choice	.27	.45	-.00	.28*	.31*	1								
5. Behavior at school	.06	.23	.04	.54*	.15*	.10	1							
6. Private circumstances	.12	.32	-.02	.20*	.18*	.12*	.26*	1						
7. Working atmosphere and quality of apprenticeship training	.50	.50	.08	-.01	.23*	.16*	-.04	.02	1					
8. Physiological and mental requirements	.40	.49	.01	.19*	.35*	.35*	.05	.13*	.30*	1				
9. Working conditions & contractual reasons	.25	.44	.17*	.06	.09	.14*	.10	.14*	.57*	.35*	1			
10. Construction trade	.20	.40	-.01	.01	.06	.02	.04	-.02	-.06	-.01	-.09	1		
11. Wood trade	.06	.24	.09	.13*	.10	.11*	.15*	.10	-.03	.07	-.10	-.13*	1	
12. Metal and electric trade	.36	.48	.02	.12*	-.09	-.03	-.05	-.03	-.07	-.11	-.02	-.38*	-.19*	1
13. Food trade	.20	.40	-.09	-.12*	-.03	.02	-.10	-.02	.05	.08	.14*	-.25*	-.13*	-.37*
14. Health and personal care trade	.18	.38	.02	-.12*	.01	-.07	.03	.02	.11	.02	.03	-.23*	-.12*	-.35*
15. Drop-out apprentice	.52	.50	.07	-.11	-.09	.15*	-.13*	-.09	.17*	.13*	.15*	-.07	-.03	-.08
16. Drop-out firm	.24	.42	-.10	-.02	.07	-.21*	-.02	.02	-.07	-.13*	-.07	.03	.02	.07
17. Drop-out both	.24	.43	.02	.15*	.03	.03	.17*	.08	-.12*	-.02	-.11*	.06	.01	.03
18. Sex	.35	.48	-.01	-.16*	-.02	-.05	-.05	.02	.09	.07	.06	-.25*	.01	-.48*
19. Without leaving certificate	.30	.46	-.06	.09	-.03	-.06	.04	.01	-.05	-.05	.01	.18*	-.17*	-.14*
20. Mittelschule leaving certificate	.38	.49	.09	.11*	.10	-.04	.03	.01	.11	-.00	.01	-.21*	.05	.18*
21. Realschule leaving certificate	.21	.41	-.05	-.24*	.00	.10	-.11*	-.09	.04	.13*	.00	.04	.10	-.03
22. Gymnasium leaving certificate	.07	.25	-.02	-.12*	-.08	.09	-.01	.01	-.07	-.02	-.03	-.04	.10	-.06
23. Other school leaving certificates	.04	.20	.03	.15*	-.08	-.08	.06	.11*	-.14*	-.14*	.00	.05	-.05	.01
24. Internship before apprenticeship	.83	.37	.01	.06	.05	-.13*	.04	.00	-.09	.07	-.10	.05	.01	.04
25. Nationality: German	.89	.32	.02	-.10	.02	-.01	-.08	-.04	.02	-.16*	-.13*	.05	.05	.00

Table A4: Descriptive statistics for study variables (apprentices) (continued)

Variable	Mean	SD	12	13	14	15	16	17	18	19	20	21	22	23	24	25
12. Metal and electric trade	.36	.48	1													
13. Food trade	.20	.40	-.37*	1												
14. Health and personal care trade	.18	.38	-.35*	-.23*	1											
15. Drop-out apprentice	.52	.50	-.08	.07	.13*	1										
16. Drop-out firm	.24	.42	.07	-.03	-.10	-.58*	1									
17. Drop-out both	.24	.43	.03	-.05	-.06	-.59*	-.31*	1								
18. Sex	.35	.48	-.48*	.30*	.55*	.18*	-.12*	-.09	1							
19. Without leaving certificate	.30	.46	-.14*	.08	.01	-.15*	.07	.11*	-.04	1						
20. Mittelschule leaving certificate	.38	.49	.18*	-.00	-.04	.12*	-.02	-.12*	.00	-.52*	1					
21. Realschule leaving certificate	.21	.41	-.03	-.08	.01	.07	-.06	-.02	.07	-.34*	-.40*	1				
22. Gymnasium leaving certificate	.07	.25	-.06	-.07	.12*	.04	-.08	.04	-.00	-.18*	-.21*	-.14*	1			
23. Other school leaving certificates	.04	.20	.01	.06	-.10	-.12*	.11	.03	-.05	-.14*	-.16*	-.11	-.06	1		
24. Internship before apprenticeship	.83	.37	.04	-.17*	.07	-.06	-.02	.09	-.15*	-.03	.06	.02	-.06	-.04	1	
25. Nationality: German	.89	.32	.00	-.01	-.08	.10	-.02	-.09	.00	-.06	-.11	.18*	-.03	.07	-.05	1

Means, standard deviations, and pairwise correlation coefficients for all variables

Cross-sectional data with n = 305 former apprentices

\* p&lt;.05

Table A5: Estimates of the robustness check (probit regression) of the firms' sample

Variables:	Early drop-outs
Educational background and current school performance	-0.533*** (0.157)
Behavior and performance at firm	-0.150 (0.153)
Occupational choice	0.542*** (0.149)
Behavior at school	-0.270 (0.166)
Private circumstances	-0.217 (0.150)
Quality of apprenticeship training	-0.071 (0.213)
Physiological and mental requirements	0.289 (0.182)
Wood trade	-0.373 (0.279)
Metal and electric trade	-0.007 (0.158)
Food trade	0.047 (0.227)
Health and personal care trade	0.089 (0.277)
Firm size: 5–19 employees	0.253 (0.191)
Firm size: 20–49 employees	0.207 (0.264)
Firm size: 50–250 employees	0.123 (0.324)
Firm size: >250 employees	0.102 (0.586)
Tradition vocational training: $\geq 3$ years, <10 years	-0.115 (0.303)
Tradition vocational training: $\geq 10$ years, <25 years	-0.122 (0.293)
Tradition vocational training: $\geq 25$ years	-0.015 (0.296)
Frequency drop-out: 2–5 times	-0.018 (0.152)
Frequency drop-out: 6–10 times	0.169 (0.267)
Frequency drop-out: >10 times	0.392 (0.391)
Drop-out firm	0.847*** (0.169)
Drop-out both	0.221 (0.168)
Duration of vacancy	0.206 (0.191)
Sex	0.133 (0.223)

Table A5: Estimates of the robustness check (probit regression) of the firms' sample (continued)

Mittelschule leaving certificate	-0.041 (0.151)
Realschule leaving certificate	-0.211 (0.223)
Gymnasium leaving certificate	0.350 (0.415)
Other school leaving certificates	0.466 (0.313)
Constant	-0.115 (0.325)
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Observations	453
Pseudo R-squared	0.130
Wald chi-squared (31)	74.88

Probit regression, robust standard errors in parentheses

Estimates show marginal effects for early drop-outs (probationary period and first apprenticeship year) with reference to drop-outs occurring later in the apprenticeship training (second apprenticeship year or later)

The model is significant ( $p < .00$ ); \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$

Table A6: Estimates of the robustness check (probit regression) of the apprentices' sample

Variables:	Early drop-outs
Educational background and current school performance	-0.188 (0.130)
Behavior and performance at firm	-0.179 (0.143)
Occupational choice	0.057 (0.096)
Behavior at school	0.314** (0.145)
Private circumstances	0.209** (0.097)
Working atmosphere and quality of apprenticeship training	0.139 (0.107)
Physiological and mental requirements	0.095 (0.090)
Working conditions and contractual reasons	-0.492*** (0.109)
Wood trade	-1.083*** (0.371)
Metal and electric trade	0.031 (0.234)
Food trade	0.145 (0.295)
Health and personal care trade	-0.288 (0.338)
Drop-out firm	0.201 (0.228)
Drop-out both	-0.038 (0.214)
Sex	0.106 (0.260)
Mittelschule leaving certificate	-0.428* (0.222)
Realschule leaving certificate	0.126 (0.272)
Gymnasium leaving certificate	0.385 (0.373)
Other school leaving certificates	-0.729 (0.463)
Internship before apprenticeship	-0.099 (0.236)
Nationality: German	-1.218*** (0.219)
Constant	-1.492*** (0.250)
Observations	305
Pseudo R-squared	0.209
Wald chi-squared (23)	77.90

Probit regression, robust standard errors in parentheses

Estimates show marginal effects for early drop-outs (probationary period and first apprenticeship year) with reference to drop-outs occurring later in the apprenticeship training (second apprenticeship year or later)

The model is significant ( $p < .00$ ); \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$