

## **Firm Age and the Demand for Marginal Employment in Germany**

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# Firm Age and the Demand for Marginal Employment in Germany<sup>1</sup>

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## Abstract

Many empirical studies point towards an increase in non-standard employment. The reasons for this rise are mainly seen in the increasing economic internationalization or the rapid technological changes which raise the need for both flexibility and cost-cuts on behalf of firms. Yet, only little is known about the role of firm age in this context. Based on a large representative data set of establishments in Germany, this paper analyzes how establishment age impacts on the demand for marginal employment, the main form of non-standard employment in Germany. We find an inverted U-shape relationship between firms' share of marginal employment and their age indicating that the demand for marginal employment peaks during the middle ages of a firm, which can be explained by both the liabilities of newness and aging. Distinguishing between the extensive and intensive margin by using hurdle models, we find again an inverted U-shape relationship between the probability of having marginally employed workers and establishment age, which coincides with our previous results. However, a further kind of establishment seems to exist in that among those which have at least one marginal employee, young firms have most of them. Taking into account effects of the sample composition, we find that, although the very old establishments in our sample exhibit an equally low share of marginal employment as young establishments, the effect of young firms on the grand share of marginal employment is larger because of their larger number.

**JEL Classification:** J82, L26, L41, O33

**Keywords:** start-ups, firm age, job quality, flexibility, non-standard employment, marginal employment, hurdle model

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# 1 Introduction

Many studies have dealt with a notable qualitative change in employment relationships taking place for years in industrialized countries. As such, they mostly focus on the rise of non-standard forms of employment, like, e.g. short-term contracts, part-time work, marginal employment and temporary work (for an overview see Kalleberg 2000). The share of part-time employees in the German economy as a whole rose from about 25 per cent in 1999 to approximately 31 per cent in 2008.<sup>3</sup> Particularly marginal employment<sup>4</sup> is of high and increasing importance in Germany (Bellmann et al. 2005). Its share increased from 12 to 18 per cent, roughly. The proportions of fixed-term employees and temporary workers have increased substantially as well since 1991, from eight to ten per cent and from 0.4 to 2.3 per cent, respectively (Keller and Seifert 2011, p.39).

In a similar vein, self-employment plays an important role in Germany and other industrialized countries and – in the case of Germany – it continues to grow (Schulze Buschoff and Schmidt 2005). Furthermore, even inside traditional forms of dependent work, characteristic elements are increasingly often substituted for elements of more independent work forms. Studies usually indicate a “subjectification” of labor, i.e. a growing substitution of tayloristic organization of activities for project-based work. This is accompanied by the assignment of constantly increasing responsibilities to the employees as well as the flexibilization of working hours (for an overview see, e.g. Sesselmeier 2007).

However, the role of firm age within these trends has not been investigated so far – although it may be important since they are conventionally considered to be a pivotal driving force of economic growth (Schumpeter 1926 [1912]) and also play an important role for labor markets, as they induce substantial employment effects. Also, there are good reasons to believe that start-ups differ substantially from established firms regarding the kind of labor they demand. Firm age (besides, e.g., firm size) has been shown to be also an important predictor for many other characteristics such as wages, employment stability, employees’ involvement in business processes and export activity by many contributions (for an excellent overview, see Wagner 2005).

Data on non-standard employment forms, such as short-term contracts or temporary work, are usually related to small samples when taking into account information on establishment age as well. However, this is not the case for the most frequent<sup>5</sup> non-standard work form in Germany, which is marginal employment. Using a unique and large panel data set on the establishment level, which provides information on many entry cohorts and years, the purpose of the paper at hand is to analyze the effect of firm age on the demand for marginal employees and to pose the question of whether a possible difference between the demand for marginal employees by new and incumbent firms has an impact on the national rate of marginal employees, i.e. whether young firms promote marginal employment and thereby contribute to the above-mentioned change of employment structures. Thereby, we contribute to the literature by bringing together findings from labor market and entrepreneurship research. Since business start-ups are often particularly encouraged via different support activities by national and regional governments as well as economic organizations such as chambers of commerce and industry it is interesting to learn if thereby new forms of employment (which can be discussed quite controversially) are promoted as well.

This paper is organized as follows: section 2 reviews the relevant literature from the fields of labor market and entrepreneurship research and deduces the hypotheses to be tested. Section 3 introduces the data while Section 4 addresses measurement issues and deduces important control variables. Results of the descriptive and econometric analyses are given in section 5. Section 6 concludes.

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<sup>3</sup> Own calculations based on the Establishment History Panel, the data set used in this paper. See also Keller and Seifert (2011).

<sup>4</sup> Marginal employment in Germany is defined by monthly wages below a certain wage threshold (currently 450 Euros). It comprises only reduced payments to the tax authorities and the social security system (see section 2.1 for more details).

<sup>5</sup> Compare, f.i., Keller and Seifert (2007, p. 13).

## 2 Hypotheses and related literature

Employment forms have changed dramatically during the last decades in Germany. Not only do we observe rising shares of non-standard employment forms such as part-time and marginal, fixed-term and temporary employment, but also a certain movement towards employment forms which exhibit more and more traits that are characteristic of independent, self-determined activities rather than of traditional, dependent employment (Sennett 1998, Pongratz and Voß 2003, Appelbaum 2002). Not least, for the last few years entrepreneurial activities in Germany have been on the rise, a phenomenon which is mainly driven by the rise of a particular group of entrepreneurs, namely entrepreneurs without employees (see Schulze Buschoff 2006 and Koch et al. 2011). This group of entrepreneurs can be seen as a sort of mixed dependent/independent employment form. Furthermore, traditional work forms are increasingly often found to be exposed to the overall change of employment meaning that (some of) their characteristic elements are substituted for elements of more independent work forms, even if the formal employment relationship does not change.<sup>6</sup>

The described changes in employment forms and structures are not just a matter of work / economic life; they stand for a carination that embraces further areas of the economy and the society (Hoffmann and Walwei 2002, Keller and Seifert 2007). There are many reasons for it, such as technological development, economic globalization, a value change in the society that leads to individualized work-life circumstances and preferences (Inglehart 2003, Beck 1992, Kleinhenz 1998) as well as the increasing tertiarization in post-industrialized economies and growing female work participation, just to mention some of them. Two (main) micro-economic channels link these “megatrends” (Kleinhenz 1998, p. 406) to the structural change in employment: an increased demand for “flexible” labor on behalf of the firms as well as an increased interest to lower their costs (see also Kalleberg 2000 and Sesselmeier 2007). As will be shown in the following, marginal employment is, in principle, suitable for both of these purposes.<sup>7</sup> Thereafter, reasons are given for which the use of marginal employment may vary in scope with firm age.

### 2.1 Marginal employment, flexibility and cost advantages

Marginal employment in Germany can be characterized as either “marginally paid” work or short-term work. While marginally paid work must not exceed a certain wage threshold (currently 450 Euros per month), short-term work, for the sake of simplicity, is defined as a maximum of a two months working period throughout a calendar year, no matter how much money be earned. Both employment forms together, marginally paid and short-term work, form marginal employment. Generally, while marginally paid work is subject to both taxation and contributions to the social security system<sup>8</sup>, no social security payments have to be made for short-term work. Besides, only reduced all-inclusive payments have to be made for marginally paid work – to both the social security system and the tax authorities. Hence, marginal employment can help reduce the firms’ employment cost via labor cost “subsidies” by the state. This is supported by the study of Loose and Ludwig (2004) who find that marginal employment is more frequent in firms with low profitability perspectives (p. 329), indicating that indeed marginal employment constitutes a form of lowering employment costs. Furthermore, search costs are lower for marginal compared to standard employment, since the tasks that are typically performed by marginal employees often require only low skills and qualifications (Kalina and Voss-Dahm 2005). Last but not least, marginal employment implies lower uncertainty for firms in case of drops in orders, since the employment cost of a marginal employee is lower than that of a full-time employee if she does not work. A downside of marginal employment, however, is given by the fact that the costs of coordination and control rise with the number of marginal employees (see below).

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<sup>6</sup> While it is relatively easy to compute shares of employment forms such as part-time work, the magnitude of the latter trend towards more independent work forms cannot be empirically assessed in a straightforward, representative way – at least not without bearing the burden of running a specialized survey on that topic.

<sup>7</sup> Flexibility may particularly be of concern in the public sector. as results by Gerner and Hohendanner (2010) for the case of fixed-term contracts suggest, whereas “[i]n the production sector fixed-term employees are rather used as a recruiting instrument” (p. 27).

<sup>8</sup> The only exception is the unemployment insurance (Becker & Jörges-Süß 2002, p.126).

The main flexibility advantage of marginal compared to standard employment is certainly that it allows for a flexible arrangement of the working hours input.<sup>9</sup> This advantage is the larger, the more readily separable the tasks are with respect to both content and scheduling, the lower their duration is, and the more closely spaced they are (Dütsch and Struck 2007). Firms with a highly tayloristic work organization are thus good candidates for the use of marginal employment. Also, firms might opt for a 'neo-tayloristic' organization of work in order to take advantage of marginal employment, possibly displacing other employment relationships. Indeed, Dütsch and Struck (2007) find that firms with a rather tayloristic work organization resort mainly to numerical flexibilization strategies. Note that by using marginal employment efficiency gains may be obtained, too, because the increased division of labor can help the core personnel concentrate on its core competencies. Of course, firms can be expected to face a certain trade-off since the use of more marginal employees implies rising costs related to the coordination of work. This is particularly the case when marginal employees' tasks overlap with those of other marginal employees or the core personnel (see also Dütsch and Struck 2007). Finally, marginal employment can be used to widen a firms opening hours, for example in the retail trade sector.

Note that the role of marginal employment in the context of hire and fire strategies is somewhat ambiguous. In general, dismissal protection in Germany is only effective in firms that exceed a certain size threshold (currently ten full-time equivalent employees) making dismissals easier for small firms. Thus, to hire and fire people in standard employment relationships is as easy for them as to hire and fire marginal employees. Once the critical firm size is exceeded, the same dismissal protection laws apply to employees in marginal and standard employment relationships. Thus, for large firms it is as difficult to dismiss a marginally employed person as to dismiss someone in a standard employment relationship.<sup>10</sup> Hence, at least in theory, marginal employment should not be contributing to hire and fire strategies – either because they could also be practiced with standard employment relationships (small firms) or because the same dismissal protection laws as for standard employment apply to it (large firms). However, firms were reported to frequently break this law in practice in order to lower their costs (Ochs 1999, p. 227). The reasons might be that marginally employed persons are not (fully) aware of their rights according to the employment protection legislation, and that bringing one's former employer to court is not very worthwhile for a job in which one earns merely 450Euros per month.

## **2.2 Start-ups, incumbents and the demand for marginal employees**

Young firms have often been considered irreplaceable for economic growth, the innovative process of an economy and the mobility between sectors and regions (Fritsch 2007, Shane 2009, van Stel and Storey 2004). As such, they promote structural economic change. Since young firms have important effects<sup>11</sup> on employment, they could be an important factor concerning the structural change of employment as well. However, concerning the quality of employment, the question remains of what direction the effects of start-ups, if any, are pointing into: do they raise or do they lower the share of marginal employees in the German economy? The answer to this question depends, first of all, on whether young firms demand more or less marginal employees than older ones. This involves resorting to the literature on the process of firm aging.

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<sup>9</sup> Generally, we refer to Atkinson et al. (1984) for the concept of flexibility. The authors distinguish between numerical, functional and financial flexibility (the latter two are not of concern in this paper). *Numerical* flexibility stands for a firm's ability to adapt the number of workers rapidly as the environmental conditions (e.g. concerning the demand for its products and activities) change.

<sup>10</sup> As a side aspect to this paper, there is considerable concern that the existence of whatever kind of statutory rules that come into effect once a critical firm size threshold is exceeded has a substantial negative impact on the number of jobs provided by the firms. An overview of the related empirical research can be found in Koller et al. (2011). Concerning the dismissal protection law threshold they state that none of the existing empirical studies were able to find such a negative impact (p.177).

<sup>11</sup> Usually, a distinction is made between direct and indirect employment effects induced by start-ups. The former refer to employment effects inside the newly founded firms themselves, i.e. the number of initial employees and its development when the firm ages (for an important contribution in this field see Fritsch and Weyh 2006); the latter comprise the effects that entering businesses (or the pure possibility of business entry) exert on the incumbent firms, threatening them by increasing competition. The incumbents may react to this challenge by adapting the number of employees (see Fritsch and Müller 2004) or by altering the structure of their workforce etc.

Concerning this process, a first distinction of the literature can be made according to whether possible differences between young and old firms are conceived as the result of a selection process (population ecology literature) or as the result of changes inside the surviving firms (rational adaptation and random transformation literature) – for an overview of studies on the different subjects see Hannan and Freeman (1984). While there has been quite some dispute between these lines of research, we do not see a categorical incongruity between them, but rather treat them as complementary. Also, there is much work dedicated to the deduction of a firm (or organizational) life cycle. These studies come to roughly the same conclusions on the aging process as the literature on the liabilities of newness and aging described below, thus giving additional support for our hypotheses. Especially, they state that firm strategies differ substantially between the phases in a firm's life cycle (for overviews see Stepanyan 2012 or Lester et al. 2003).

Many studies from the context of organizational ecology have found that a firm's risk of exiting the market is, among others, a function of its age (although the shape of this relationship has been subject to quite some discussion). Thus, several contributions find evidence for a liability of newness<sup>12</sup>, i.e. hazard rates which are highest when the firms are young and rapidly decaying afterwards (Stinchcombe 1965, Freeman et al. 1983). This means start-ups may experience higher exit risks than incumbent businesses as they face particular challenges – due to less developed resources (Penrose 1959, Garnsey 1998) such as immature internal structures, lack of reputation, imperfect channels of distribution, insufficient access to knowledge and networks: “Since it takes some years to develop specific knowledge, trust and appropriate routines, it follows that newly founded firms are less likely to be able to cope with environmental challenges than established organizations” (Baptista et al. 2007, p. 7).

A totally different view of a firm's aging process is given by studies that propel a liability of aging hypothesis. Their basic argument is that there is substantial inertia inside old, incumbent firms, which can<sup>13</sup> lead to higher exit rates (see, f.i., Barron et al. 1994, Thornhill and Amit 2003, Bellone et al. 2008 as well as Jensen et al. 2008; these studies also provide empirical assessments of the liability of aging hypothesis; particularly, Fackler et al. 2012 as well as Koch et al. 2012 find evidence for both the liability of newness and of aging using the same dataset as ours).<sup>14</sup> According to Ranger-Moore (1997), the reasons behind the structural inertia of old firms can be separated into reasons at the individual, firm and environmental level. At the individual level, the degree of rejection in the face of a planned, upcoming change inside the firm among those who reject it is shown to be higher than the degree of approval among those who approve it. As the firm ages, this becomes more prevalent as “vested interests increase” (Ranger-Moore 1997, p. 906). At the firm level, sunk costs accumulate over time and hamper organizational change. Besides, routines are believed to accumulate, since people tend not to throw them away (not even the least adaptable ones), and older firms are said to resort to those old routines rather than to learn new ones, and to apply them even when they are not adequate. Eventually, old firms may have a rest on their past successes, which makes them inadvertent (Ranger-Moore 1997, p. 906). At the environmental level Ranger-Moore (1997) mentions the structure-conserving effects of external commitments (p. 906).

At a first glance, this literature suggests that both new and old firm would want to adopt special strategies in order to overcome their specific challenges and to survive, and that flexibilization of their work force in terms of marginal employment could be one of those strategies (see also Cohen and Levinthal 1989, 1990). In that case, young and old firms would contribute to the structural change of employment via a relatively high use of

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<sup>12</sup> The liability of newness must not be confounded with the liability of smallness which states that many new firms fail to grow to the minimum efficient size in their respective industry necessary to be successful (e.g. Aldrich and Auster 1986, Strotmann 2007). This aspect has to be taken into account in the following regression analyses.

<sup>13</sup> Note that this need not necessarily be the case. While the concept of the liability of obsolescence emphasizes that old firms may not be as able to cope with changing environmental conditions as young firms, the notion of the liability of senescence describes the causal effect of aging on exit rates. While in the latter literature the main argument is that a firm's efficiency decreases with its age leading to higher risk of firm failure, they need not increase according to the liability of obsolescence if the environmental conditions of the firm remain unchanged.

<sup>14</sup> Hannan and Freeman (1984) also mention an opposite effect of aging: according to them firm age is correlated with reliability and accountability and thus, older firms should have *lower* exit rates.

marginal employment, trying to absorb their relatively high risk of failure by adjusting the number of marginally employed persons. If this was the case, we should observe a U-shape relationship between firm age and the fraction of marginal employees, where the demand for marginal employment rises with the firms' hazard rate.

However, the demand for marginal employment depends crucially on the availability of tasks for marginal employees, which can, but need not be, a function of firm age, depending on the purpose that marginal employees are used for. And there are at least five such purposes: (1) substitute employees liable to social security for marginal employees, (2) supplement and exonerate the core personnel, (3) obtain numerical flexibility, (4) prolongate opening hours and (5) obtain more flexible arrangement capabilities of working hours.

Concerning (1) the complete substitution of employees liable to social security, the availability of tasks for marginal employees is not supposed to be dependent on firm age, since it is an integral part of the firm's business activity: Imagine, f.i., a juice bar or any other type of business, preferably in the consumer service sector, where the owner / manager is entitled to tackle the essential problems of the firm as are postulated by the liability of newness hypothesis and the rest of the work, to keep it simple, consists of low-skill tasks that can be performed by marginal employees. Both a young and an incumbent juice bar would have tasks for marginal employees readily available, and unless the firm's business activity changes, there will be no differences regarding the availability of low-skill jobs in its earlier or later stages.<sup>15</sup>

There is one difference, however, when a firm aims (2) at improving its internal processes and tries to gain efficiency from the supplemental use of marginal employees. Thereby, the low-skill tasks of the core personnel are sourced out to the marginal employees, such that the core personnel can concentrate on its core competencies and tackle more fundamental issues. Yet, in order to realize that, there is a certain potential for optimization the firm needs to age, since internal structures and routines evolve slowly and at the very beginning, there are only few of them, if any. Thus, the potential for shifting low-skilled tasks from the core personnel to marginal employees is lower for young firms.

Concerning the use of marginal employment for (3) raising a firm's numerical flexibility, it is not only necessary that enough tasks for marginal employees exist, but that their amount varies over time. Thereby, the only volatility that is decisive is their *upward* volatility. (In case of a drop in the amount of low-skill tasks, marginal employees can only help via lower employment costs compared to employees liable to social security, but are not able to improve the firm's numerical flexibility, since the same dismissal protection laws as for employees liable to social security apply to them). Yet, the role of a firm's age for its upward volatility in the amount of low-skill tasks is theoretically not clear: consider an unexpected boom in one client industry. While older firms are usually more differentiated internally and do not depend only on a few clients, a younger firm should have a lower probability of being subject to that boom.<sup>16</sup> Also, young firms face greater financial restrictions than incumbent ones and have, *ceteris paribus*, smaller marketing budgets. Hence, they cannot create as much upward volatility on their own as incumbent businesses. Thus, young firms should have lower shares of marginal employees. Additionally, the use of marginal employment competes with other strategies of numerical flexibilization, mainly adjusting the working hours of the core personnel. This has an important advantage in that it is suited for downward flexibility as well; and downward volatility is the main problem young establishments are confronted with as postulated by the liability of newness hypothesis. Thus, young firms can be expected to experience greater profits from extra (and minus) hours than from marginal employment, since full-time employees can help overcome the fundamental problems lying behind the liability of newness, while marginal employees cannot. And it is far more important to solve these essential issues, as otherwise the young firm ceases to exist, while in case of untackled upward volatility the consequences are less severe.

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<sup>15</sup> A further specialty about start-ups is that they could prefer to have business partners rather than employees, particularly when they have scarce financial resources. This should lower the number of all employees, at first. However, if the number of marginally employed persons is lowered equally as that of employees liable to social security remains an open question.

<sup>16</sup> But, if it is, the impact can be supposed to be much greater than for a comparable incumbent firm.



With regard to, (4), the use of marginal employment in order to prolongate the firm's opening hours, quite the same deliberations apply as for the case of perfect substitution of employees liable to social security. The result is that there should not be any systematic differences between young and incumbent firms, since this kind of use of marginal employment depends on the business activity rather than on the age of the firm. The same holds, (5), for the use of marginal employment have a more flexible input of working hours.

To summarize, according to the liability of newness, young firms can be expected to have a lower share of marginal employees than older ones. By a similar token, one of the reasons behind the liability of aging is seen in a certain complacency that old firms are concerned with. Such complacency could result in foregone internal optimization potentials, such as too little use of marginal employment in order to supplement the core personnel. And since complacency is nurtured by past successes and accumulates over time, some time is needed for the effect to appear.

Another point is that older establishments could have a higher inertia due to rules and routines than younger ones. This can have at least two effects. First, young firms could be more innovative than older ones (see also Ranger-Moore 1997, p. 906). The consequence is that – according to the theoretical contribution by Nienhüser (2007) – young establishments would pursue an entirely different employment strategy than incumbent firms. In essence, they would hire high-skilled employees in order to increase their functional flexibility and innovational power, and use strategies of numerical flexibilization other than marginal employment. Second, although these routines may be quite costly, they may not be easy to abolish. In fact, it may be more costly to abolish them than to cut down the processes or tasks that rely on them most heavily. One downside of marginal employment is that it requires quite some communication, coordination and control costs. These costs are likely to be much higher in older establishments, since they are directly and substantially affected by the rules and routines that apply within a firm. Again, as rules and routines accumulate over time, the effect should increase the older an establishment is. Thus, putting the various arguments altogether, we should expect an inverted U-shape relationship between the fraction of marginal employment and firm age.

### 3 Data

This study uses the weakly anonymous Establishment History Panel (Years 1999 – 2008, “Betriebs-Historik-Panel” – BHP). Data access was provided via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) and remote data access. The BHP provides information on all establishments (local units) in Germany as long as they employ at least one employee liable to social security (for details see e.g. Hethey-Maier and Seth 2011). While East German establishments have been covered since 1991, establishments from West Germany have been included in the data since 1975. Since 1999, establishments without employees liable to social security, but with at least one marginal part-time employee, are also included. In this paper we use a random sample of about 400,000 establishment-year observations stratified by establishment size.<sup>17</sup> The BHP data can be considered as of very high quality, because they were generated by the administrative processes underlying the employment notifications that must be sent to the data collecting authorities by the employers. Especially, there is no panel attrition due to refused interviews or the like. The BHP is by far the best data set available for the purposes of this paper, as it provides information on both marginal employment and establishment age for various entry cohorts and a long observation period, while ensuring large enough case numbers.<sup>18</sup>

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<sup>17</sup> This allows a greater ease of computation, especially as the latter regressions include in part bootstrapped standard errors. A robustness check using the full sample revealed almost no differences compared to the results presented here.

<sup>18</sup> With other non-standard employment forms this would not have been the case, see also section 1.

Considering the identification of firm entries, we take the year in which an establishment appears for the first time as a starting point for its year of foundation. More precisely, we take the year in which an establishment reported its first employee liable to social security. In order to reduce several uncertainties stemming from temporal disappearances from the data, e.g. due to a temporary interruption of production, changes of ownership or of legal status (in which case new establishment IDs may be generated as well), mergers of existing companies or differences between local employment agencies during the assignment of IDs (see Bender et al. 2000, Brixy and Fritsch 2002, Koch and Späth 2009) we follow different steps of refinement. (1) Establishment IDs that exhibit temporal disappearances from the data are considered one establishment as long as the disappearance does not last longer than two years; otherwise it is treated as two different establishments under the same ID (closing plus subsequent re-founding).<sup>19</sup> (2) As there is information on the origin of new IDs, we are able to distinguish better between start-ups and mergers and acquisitions. This is achieved by looking at the fraction of employees that are reported in the first year of a possibly new establishment and that can be found to have worked jointly in another establishment the year before. If this fraction is low enough, we take this ID as an ordinary business entry (for details, see Hethey and Schmieder 2010). (3) Since this additional information is not available for closures with subsequent re-founding, we follow the suggestion by Brixy and Fritsch (2002) and restrict them to a maximum size of 20 employees in the year of foundation. As the use of the Hethey and Schmieder (2010) classification scheme defines the year of entry to be the year for which the first employee *liable to social security* is reported, information on the leading and trailing years of an establishment is discarded when the whole personnel in those years consists solely of marginal employees. This ensures we have the same definition of entering and exiting firms, independent of the point in time it occurs in our sample.<sup>20</sup>

By the implementation of these identification “rules” the problem of misclassification of entries can be mitigated, but not completely solved. Beyond, after implementing them, we have three categories of establishment entries: ordinary entries (i.e. establishments deemed a result of some rearrangement of production facilities), non-ordinary entries like mergers and acquisitions or spin-offs and, at last, remaining entries which cannot be classified at all. The latter category is formed mostly by establishments that appear for the first time in our data in 1975, which is the beginning of our data set, in addition to some other, special cases.<sup>21</sup> While it surely makes sense to calculate the age of ordinary entries (although it may not be exactly their true age, see above), the age of non-ordinary establishment entries may not be very meaningful as in the case of mergers and acquisitions the establishments concerned may already have been part of the market for quite a long time. Furthermore, spin-offs, which are also subsumed in the non-ordinary entries category, can be expected to receive fundamental support from their origin companies (Koster 2009, p. 40 f., Bernardt et al. 2002, p. 5) and therefore, although we have the necessary indications to compute their age, it would not be a very sensible measure. This is especially true as they would implicitly fall into the same age categories as the ordinary entries, although they are surely not comparable to them. Likewise, it is immediately clear that we cannot calculate the age of establishments which we cannot classify as ordinary or non-ordinary entries. Since

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<sup>19</sup> This proceeding was suggested by Brixy and Fritsch (2002). Choosing a concrete cutoff requires, in principle, an a priori information (or opinion) by the researcher after what time span without establishment records an establishment number should be considered a business entry and not mere noise from establishments that fall out of the data source but continue to survive without any employees. The cutoff here is chosen by looking at the distribution of the duration of the disruptions in the establishment histories which shows a sharp decline after three years, which is taken as an indication that the noise ends there and real business entry begins. This three-year rule can be considered a conservative approach to identify the correct number of start-ups since it does not count about 85% of all perforations as start-ups. For the suitability of the BA data for identifying firm start-ups and closures see also Bellmann et al. (1997). While they choose a different reference point for judging the possible over-/underestimation of start-ups and closures with the BA data, they also find that controlling for more than three previous years while identifying start-ups leads to only few improvements regarding the extent of overestimation avoided.

<sup>20</sup> Although this implies a certain underestimation of marginal employment in the sample it is necessary if one wants to use cohorts of entries founded before 1999 as well. Particularly, industries that rely heavily on marginal employees such as the trade sector, hotels and restaurants and social care can be expected to lose observations. A robustness test estimating the demand for marginal employees with and without those industries, however, reveals that the results do not depend on this procedure (see table 7 in the appendix).

<sup>21</sup> These are establishment entries with personnel exclusively working in the second job as well as establishment entries in East Germany in 1990 and 1991, after the fall of the Iron Curtain.

these establishments without a valid age entry are part of the German economy during the sample period, we chose to not discard them completely from the analyses, though.<sup>22</sup>

Another possible problem relates to the fact that the BHP data contain information on establishments (local units) and not on firms (legal units). Thus, despite the outlined corrections, some of the start-ups in our sample may be spurious in the sense of being newly established dependent subsidiaries of established firms. However, as there are only about 2 % multi-site companies in Germany (see Koch and Krenz 2010) and as we tackle this problem by the two classification rules described above, this should be of minor relevance.

A further aspect that must be taken into account when analyzing entry and exit with the BHP is that the dataset provides information merely on an annual basis, meaning that the number of entering and exiting businesses may be biased downwards due to invisible, short-lived businesses entering and exiting the market between two data points. However, the actual employment contribution of those short-lived firms should be very small. On the contrary, the number of entries and exits may also be biased upwards as the data come from June 30<sup>th</sup>, when employment rates are typically higher than in the rest of the year. As a sidenote, the aggregation of the underlying individual data onto the establishment level discards information on multiple jobs of an employee if they take place in the same establishment as the “main” job (which is defined as liable to social security). In case of multiple marginal employment relationships of an employee within the same establishment, only the one that provides the highest daily wage or the longest endurance is kept during the aggregation (see Hethy-Schmieder and Seth 2011, p. 15f.). However, information on multiple jobs in different establishments held by the same employee are not discarded, which means that the above proceedings should be of minor relevance regarding the estimation of the number and the share of marginally employed workers in Germany<sup>23</sup> and despite the described limitations the BHP can be considered as the best suitable data set for the following analyses.

## 4 Measurement issues and estimation strategy

To measure the demand for marginal employees, we pursue two different approaches. The first one uses shares of marginal employees as the dependent variable in a fractional logit model (see Papke and Wooldridge 1996). This may pose some problems since young firms largely consist of very few employees. For the period 1999-2008, Table 2 shows that about 50% of all establishments aged less than five years consist of a maximum of two employees, whereas only one third of the establishments aged five or more years falls into this size class (see also Koch et al. 2012).<sup>24</sup> The other size classes show similar differences between establishments aged less than five years and five years or more, although they are not always as substantial as in the class with the least employees.

This means that for a large part of the young establishments, shares of marginal employees are not really a continuous variable as they would typically take the values 0%, 50% and 100%. Therefore, we additionally use the *number* of marginal employees rather than their share as the dependent variable in a hurdle model. This allows us also to differentiate between the extensive and the intensive margin of the demand for marginal employees (via a logit and zero-truncated count<sup>25</sup> model, respectively). This helps shed some more light on two rather different employment decisions of the firms, namely whether to have marginal employees at all, and if

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<sup>22</sup> For further information see section 4.

<sup>23</sup> About one third of marginal employees in Germany still have another job, while for the remaining two thirds it is their only job (Keller et al. 2012, p. 2). As Keller et al. 2012 point out this smaller group of employees with marginal employment as a side-job is responsible for the largest part of the rise of marginal employment in Germany since 2003 (p. 2).

<sup>24</sup> The size distribution for establishments whose age cannot be sensibly calculated – see section 3 – is not of concern here since they do not enter the calculations regarding the demand for marginal employees at different firm ages. It is merely given for the sake of completeness.

<sup>25</sup> We use both the zero-truncated poisson and negative binomial model dependent on which one fits the data better.

so, how many of them. Furthermore, we perform separate regressions by classes of firm size in order to better assess the validity of our results.

**Table 1: Size distribution of establishments (in %)**

| size <sup>a</sup> | establishment age < 5<br>(n = 119,619) | establishment age ≥ 5<br>(n= 178,738) | non-originary /<br>not classified entry<br>(n= 101,432) | total<br>(n= 399,789) |
|-------------------|--|---------------------------------------|---|-----------------------|
| 1-2               | 55.5                                   | 36.2                                  | 22.1  | 38.4                  |
| 3-5               | 24.1                                   | 28.5                                  | 20.2  | 25.1                  |
| 6-10              | 10.9                                   | 18.2                                  | 20.8  | 16.7                  |
| 11-20             | 5.2                                    | 9.1                                   | 15.4  | 9.5                   |
| >20               | 4.3                                    | 7.9                                   | 21.5  | 10.3                  |
| <b>total</b>      | 100.0                                  | 100.0                                 | 100.0   | 100.0                 |

<sup>a</sup>total number of employees. Establishment age can only be calculated for (former) originary entries. Totals may differ from 100 per cent due to rounding errors.

Source: Establishment History Panel, author's calculations.

To allow for a flexible age profile, we chose to measure the impact of establishment age on the dependent variables of our two-stage model via dummy variables taking on unity if a certain age is reached and zero otherwise. The reference category is set to five years, which is motivated by studies that found that it takes a start-up only few years to become an incumbent (see e.g. Brixy et al. 2005). To identify the effect of establishment age, we control for the influence of several variables which are known or supposed to be correlated with both establishment age and the dependent variables in our two-stage regression model. These variables are explained in the following.

A particular challenge arises due to the need to isolate the effect of establishment age from time and cohort effects. Obviously, controlling for all three dimensions leads to a multicollinearity problem which is also known as the age-period-cohort problem. Since age equals time (period) minus cohort, one cannot separate the three effects.<sup>26</sup> In principle, there are many ways to deal with this issue:

1. One could constrain one or more coefficients in the model to be equal. This breaks up the exact collinearity of the age, period and cohort variables and facilitates the estimation of the model. The crucial question of this approach is how to decide if there are some coefficients that can convincingly be set equal to each other. This could be done by either using a priori information (see e.g. Hall et al. 2005) or by experimenting with different constraints as robustness checks. However, in our case, there is no a priori information which could help identify the model, and experimenting with different coefficient restrictions led to overwhelming differences in the results.
2. A similar possibility is to use the *Intrinsic Estimator* (Fu et al. 2011, O'Brien 2011). This corresponds – again – to imposing a restriction on the model in the sense of constraining coefficients to be equal. In contrast to using (arbitrary) constraints the Intrinsic Estimator uses a special constraint that can be derived from the data themselves and hence does not rely upon the (perhaps subjective) interaction from the researcher. However, the Intrinsic Estimator can so far only be used in the context of a linear model, which would be inadequate for our data.
3. Some scholars argue that although the first differences of the age-period-cohort model are not identified, the second differences are, i.e. one could still measure the deviations of the age effect from a linear trend (McKenzie 2002, de Ree and Alessie 2010). The linear trend itself, however, would remain unidentified. Since it is in our interest to estimate this linear trend for establishment age, this approach is simply not appropriate.
4. Another possibility is to build a different model that is not additive and separable with respect to age, period and cohort effects (see e.g. Schulhofer-Wohl and Yang 2011, Arbeev et al. 2005). F.i., one could assume the cohort effects not to be persistent over time, but instead to vanish or accumulate. This

<sup>26</sup> This multicollinearity problem impedes also the use of establishment-fixed effects as this would mean holding the cohorts constant, too.

procedure, however, would imply substantial a priori modeling that is not free of subjective decisions by the researcher either.

5. Last but not least, another solution proposed by the literature is to replace one or more sets of dummy variables for the relevant underlying economic quantities. This relies on the insight by Heckman and Robb (1985) who remark that the sets of age, period and cohort dummies are just proxy variables for some other, underlying quantities (see also Rodgers 1982). This approach is pursued in the present paper. To be concrete, we substitute the set of cohort dummies for three macro-economic quantities measured at the start-up year of each establishment in our estimation sample: the interest rate, the GDP growth rate and the rate of unemployment. The use of the interest rate relies on a large body of literature stating that (the lack of) venture capital is one of the most decisive difficulties of new firms (see e.g. Mayer and Goldstein 1961, May 1981). The interest rate, of course, is of utmost importance when applying for, obtaining and restituting venture capital. Since higher interest rates imply a larger need to reduce costs on behalf of the firms, one outcome could be to substitute regular for marginal employees (at least to some extent). Thus, we expect the interest rate at the time of start-up to be positive in our regression models. GDP growth, on the other hand, is used to catch the economic environment at the time of start-up and is expected to be positive in our regressions. Finally, the unemployment rate at the time of start-up absorbs the labor market situation and is expected to have a negative sign. Time effects are controlled for in our regression models by using yearly dummy variables.

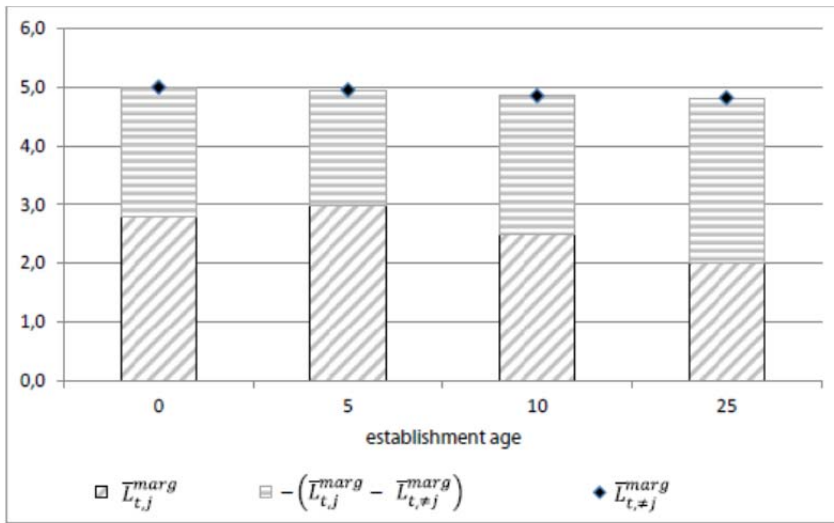
Furthermore, it is well-known that the service industries account for more marginal employment than the manufacturing industries (Hohendanner & Bellmann 2007, p. 35; see also Wanger 2006). Therefore, we include 1-digit industry dummy variables as regressors in our model. Likewise, East German establishments have always had less marginal employment than their West German counterparts (Loose and Ludwig 2004). This is most likely a supply-side rather than a demand-side effect, since women have a greater labor market participation rate in East Germany (perhaps due to different roles of gender and life models). As most newly founded establishments start small, size is an important covariate of establishment age. Furthermore, it is one of the main drivers of the number of marginal employees in an establishment, since marginal employees constitute a subset of all employees. Therefore, establishment size is included as a regressor in our models. In order to make sure that our results are not biased by the fact that establishments differ with respect to their structure of the workforce, we control for the number of several groups of employees which are likely to work as marginal employees. These are female employees, employees performing tasks that require a low qualification level only, and employees at certain stages of their life cycle (students and retirees). Since we do not have information on the number of students and retirees in an establishment we approximate them by using the number of employees aged 20-24 and 65 years or more, respectively. Concerning low-qualified employees, we control for the number of employees in unskilled manual occupations, unskilled services and unskilled communicative and administrative occupations. Furthermore, we control for the (contemporaneous) number of employees whose qualification is unknown, which is a particularity of our data set.<sup>27</sup> Eventually, in order to assert that our regressions measure the total demand for marginal employees (and not only the one that could be realized by the establishments), we include the yearly unemployment rates at the NUTS 3-level to account for different labor market situations.

So far, we have been merely concerned with the estimation of the pure demand for marginal employees. In order to investigate further the question of what the (possible) impact of establishment age on the national rate of marginal employment looks like, a second, compositional effect comes into play. It refers to the relative importance that firms at different ages (and those with unknown age) have. Imagine we had already run our

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<sup>27</sup> Although the declaration of qualification is mandatory for employers, reporting it incorrectly has no consequences. The information about the employees' qualifications can, in principle, be improved using the imputation proposed by Fitzenberger et al. (2005). However, this requires access to the individual spell data which we do not have. Across the BHP, the total share of employees with unknown qualifications amounts to about 16 % in 1999 and 23 % in 2008, respectively.

models for the demand for marginal employees, which would have given us an age profile for the demand for marginal employment. However, since we cannot calculate every establishment's age due to data shortcomings (see section 3) we do not know where to “put” this age profile in a graph with the number of marginal employees on the vertical axis *where all establishments – even those with unknown age – enter*. It could be shifted upwards or downwards ad libitum, since no absolute “anchor” information is given. Hence, we cannot conclude thus far if there is any impact of demanding more marginal employees than incumbent establishments at all (which would not be so surprising either, as there are quite many establishments with unknown age – see section 5). Figure 1 schematically depicts one possible situation of such a graph where the diagonally striped bars stand for the average number of marginal employees demanded by establishments aged 0, 5, 10 and 25 years as an example ( $\bar{L}_{t,j}^{margin}$ ). The points, in turn, represent the average number of marginal employees demanded by all remaining establishments ( $\bar{L}_{t,\neq j}^{margin}$ ).



Source: author's drawing, example data.

**Figure 1: Schematic derivation of the contribution to marginal employment**

F.i., the point above the diagonally striped bar for establishments aged zero years is constituted by the joint demand for marginal employees by all establishments aged one or more years, plus all establishments with unknown age. Then, the difference between the points and the diagonally striped bars measures how far the demand for marginal employees at different establishment ages is from the demand by the remaining establishments in the economy. This difference is given by the horizontally striped bars. There may exist larger differences, as figure 1 depicts for the zero-, ten- and 25-aged establishments. Thus, in our example, establishments at these ages should “contribute” less to the grand average of marginal employees than five year-old ones. But this conclusion is somewhat premature since it does not take into account the compositional effect. The case could be that there are far more zero-aged establishments in the economy than establishments at age 25. This compositional effect is taken into account by defining

$$contrib_{itj} := \phi_{tj} \cdot (L_{itj}^{margin} - \bar{L}_{t,\neq j}^{margin})$$

where  $L^{margin}$  stands for the number of marginal employees and  $\phi$  for the share of  $j$  year-old firms at time  $t$  in establishment  $i$ .<sup>28</sup>

<sup>28</sup> By doing so we moved from the aggregate contribution of all establishments aged  $j$  years to the micro level as we have  $L_{itj}^{margin}$  instead of  $\bar{L}_{tj}^{margin}$ .

## 5 Results

### 5.1 Descriptives

As a starting point, table 2 gives an overview of the cohorts of business entries used in the paper.<sup>29</sup> As already noted, we make use of the years 1999-2008 for the period of observation, yet without discarding information from earlier cohorts. Thus, we are using entry cohorts that track back until 1976 as the year of foundation. Each cohort of establishment entries founded in 1991 and before makes up about 1% of all observations in our sample, while the shares of businesses founded after 1991 vary between 1.0% and 5.7%. This discrete jump in the share of observations stems from the fact that from 1992 onwards establishment entries from East Germany are covered as well.<sup>30</sup> Of course, towards the end of our observation period, the share of observations belonging to a particular entry cohort decreases as time goes on. Remarkably, those establishments whose age cannot be sensibly calculated amount to more than one fifth of all observations, constituting thus a large part of the German economy.<sup>31</sup> For the cohorts 1999 until 2008, survival patterns can also be deduced from table 2. They show a very strong market mechanism: while between 3,100 and 4,500 establishments enter our sample in these years, more than one fourth of them exits the market after only one year. Only 60% survive until two years after entry; half of the establishments founded in 1999 or thereafter do not survive more than three years and after five years there are only less than two fifths left.

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<sup>29</sup> As already seen in table 1, the size distribution of the establishments with a sensibly calculable age is very right-skewed. In what follows, we will present results for establishments with up to 20 employees as using a dummy variable for the existence of marginal employees in an establishment in the latter regressions is less sensible for large establishments. The establishments covered under this threshold amount to about 93% of all establishments. Also, the bulk of marginal employees is situated in small establishments (see Bellmann et al. 2005, p.51). Robustness checks revealed that the regression results do not depend on this size threshold.

<sup>30</sup> Originally they are included in the data already since 1991. To avoid a mistaken classification of entries due to the transformation processes after the German reunification we do not assign an age to the cohort 1991 (see also section 3).

<sup>31</sup> See section 3 for more information on the establishments without a valid entry in the age variable.

**Table 2: Distribution of entry cohorts**

| year of foundation  | year of observation |        |        |        |        |        |        |        |        |        | Total   | per cent of all obs. |
|---------------------|---------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|----------------------|
|                     | 1999                | 2000   | 2001   | 2002   | 2003   | 2004   | 2005   | 2006   | 2007   | 2008   |         |                      |
| 1976                | 551                 | 500    | 475    | 418    | 396    | 358    | 327    | 305    | 278    | 258    | 3,866   | 1.1%                 |
| 1977                | 474                 | 447    | 406    | 368    | 346    | 325    | 300    | 270    | 245    | 218    | 3,399   | 0.9%                 |
| 1978                | 509                 | 465    | 424    | 395    | 344    | 320    | 294    | 271    | 246    | 229    | 3,497   | 1.0%                 |
| 1979                | 532                 | 473    | 441    | 403    | 365    | 350    | 326    | 310    | 283    | 255    | 3,738   | 1.0%                 |
| 1980                | 581                 | 547    | 509    | 467    | 424    | 386    | 363    | 333    | 306    | 281    | 4,197   | 1.2%                 |
| 1981                | 514                 | 482    | 437    | 410    | 368    | 337    | 312    | 295    | 274    | 263    | 3,692   | 1.0%                 |
| 1982                | 536                 | 503    | 463    | 424    | 376    | 342    | 317    | 299    | 280    | 262    | 3,802   | 1.1%                 |
| 1983                | 482                 | 444    | 405    | 382    | 346    | 321    | 300    | 278    | 258    | 233    | 3,449   | 1.0%                 |
| 1984                | 630                 | 591    | 550    | 515    | 466    | 428    | 408    | 377    | 346    | 316    | 4,627   | 1.3%                 |
| 1985                | 629                 | 588    | 541    | 515    | 475    | 440    | 413    | 393    | 367    | 344    | 4,705   | 1.3%                 |
| 1986                | 708                 | 642    | 595    | 557    | 502    | 470    | 431    | 402    | 374    | 347    | 5,028   | 1.4%                 |
| 1987                | 707                 | 652    | 601    | 551    | 506    | 478    | 447    | 409    | 377    | 346    | 5,074   | 1.4%                 |
| 1988                | 767                 | 696    | 638    | 582    | 518    | 494    | 458    | 428    | 398    | 361    | 5,340   | 1.5%                 |
| 1989                | 773                 | 694    | 644    | 601    | 548    | 511    | 478    | 449    | 406    | 394    | 5,498   | 1.5%                 |
| 1990                | 941                 | 863    | 785    | 723    | 653    | 608    | 553    | 516    | 481    | 445    | 6,568   | 1.8%                 |
| 1991                | 1,002               | 914    | 836    | 763    | 688    | 631    | 587    | 546    | 510    | 468    | 6,945   | 1.9%                 |
| 1992                | 2,728               | 2,479  | 2,246  | 2,074  | 1,893  | 1,728  | 1,568  | 1,452  | 1,370  | 1,261  | 18,799  | 5.2%                 |
| 1993                | 1,753               | 1,577  | 1,426  | 1,284  | 1,150  | 1,039  | 975    | 908    | 852    | 788    | 11,752  | 3.3%                 |
| 1994                | 1,894               | 1,681  | 1,521  | 1,359  | 1,222  | 1,113  | 1,014  | 950    | 868    | 804    | 12,426  | 3.5%                 |
| 1995                | 1,803               | 1,564  | 1,402  | 1,251  | 1,109  | 990    | 897    | 811    | 769    | 684    | 11,280  | 3.1%                 |
| 1996                | 1,869               | 1,623  | 1,395  | 1,236  | 1,104  | 984    | 902    | 828    | 762    | 694    | 11,397  | 3.2%                 |
| 1997                | 2,154               | 1,814  | 1,550  | 1,317  | 1,165  | 1,051  | 951    | 874    | 798    | 728    | 12,402  | 3.5%                 |
| 1998                | 2,777               | 2,281  | 1,919  | 1,624  | 1,388  | 1,223  | 1,080  | 975    | 911    | 823    | 15,001  | 4.2%                 |
| 1999                | 4,541               | 3,216  | 2,595  | 2,166  | 1,791  | 1,534  | 1,336  | 1,191  | 1,089  | 981    | 20,440  | 5.7%                 |
| 2000                | 0                   | 3,909  | 2,789  | 2,205  | 1,791  | 1,554  | 1,344  | 1,201  | 1,097  | 1,002  | 16,892  | 4.7%                 |
| 2001                | 0                   | 0      | 3,413  | 2,445  | 1,938  | 1,630  | 1,397  | 1,251  | 1,105  | 992    | 14,171  | 4.0%                 |
| 2002                | 0                   | 0      | 0      | 3,202  | 2,324  | 1,850  | 1,564  | 1,337  | 1,184  | 1,025  | 12,486  | 3.5%                 |
| 2003                | 0                   | 0      | 0      | 0      | 3,052  | 2,204  | 1,818  | 1,555  | 1,350  | 1,143  | 11,122  | 3.1%                 |
| 2004                | 0                   | 0      | 0      | 0      | 0      | 3,126  | 2,290  | 1,879  | 1,619  | 1,383  | 10,297  | 2.9%                 |
| 2005                | 0                   | 0      | 0      | 0      | 0      | 0      | 3,403  | 2,503  | 2,033  | 1,698  | 9,637   | 2.7%                 |
| 2006                | 0                   | 0      | 0      | 0      | 0      | 0      | 0      | 3,491  | 2,514  | 1,981  | 7,986   | 2.2%                 |
| 2007                | 0                   | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 3,554  | 2,493  | 6,047   | 1.7%                 |
| 2008                | 0                   | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 3,488  | 3,488   | 1.0%                 |
| w/o valid age entry | 10,450              | 9,981  | 9,518  | 9,063  | 7,582  | 7,160  | 6,841  | 6,612  | 6,339  | 6,102  | 79,648  | 22.2%                |
| Total               | 40,305              | 39,626 | 38,524 | 37,300 | 34,830 | 33,985 | 33,694 | 33,699 | 33,643 | 33,090 | 358,696 | 100.0%               |

Source: Establishment History Panel, author's calculations. Cell entries denote absolute frequencies unless otherwise noted. Only establishments with up to 20 employees (see footnote 29).

Regarding the sectoral distribution of the establishments in our sample (results not reported), the largest part of our data belongs to wholesale and retail trade, a sector with high use of marginal employment. Still, one fifth of the observations come from real estate, renting and business activities. Only about nine per cent belong to hotels and restaurants. Not surprisingly, mining and quarrying, the energy sector and education account for the smallest part of observations.



Table 3 gives descriptive statistics for the further model variables. Largely one fifth of our observations come from East Germany. The average establishment size is about 4.1 employees and the average age amounts to about eight years. The average number of marginal employees is 1.0, and thus, the overall share of marginal employees in this sample of establishments amounts to 24.3% during the period 1999-2008.<sup>32</sup> More than half of the employees are women (56.1%), and about two fifths are employees in unskilled occupations. Young employees aged 20-24 years amount to 11.0% on average, whereas there are only 2.5% persons in the average establishment that are aged 65 or more years. The regional unemployment rate amounts to 10.6% on average, with quite some variation (standard deviation nearly half the mean) reflecting very different conditions on the respective labor markets. The interest rate at start-up amounts to 5.5% with a standard deviation of two percentage points. The average GDP growth rate at the time of start-up lays at 1.9% and the average national unemployment rate at 9.9%.

**Table 3: Descriptive statistics of model variables**

| variable  | n                    | mean   | median | sd    |
|---|----------------------|--------|--------|-------|
| D(East Germany)   | 279.029 <sup>a</sup> | 0,234  | 0,000  | 0,423 |
| establishment size  | 279.048              | 4,071  | 3,000  | 3,889 |
| establishment age   | 279.048              | 8,266  | 6,000  | 7,525 |
| no. of marginal employees   | 279.048              | 0,951  | 0,000  | 1,723 |
| no. of female employees   | 279.048              | 2,330  | 1,000  | 2,828 |
| no. of employees in unskilled manual occupations                        | 279.048              | 0,266  | 0,000  | 1,152 |
| no. of employees in unskilled service activities                        | 279.048              | 0,736  | 0,000  | 1,802 |
| no. of employees in unskilled commercial and administrative occupations | 279.048              | 0,604  | 0,000  | 1,728 |
| no. of employees with unknown qualification                             | 279.048              | 1,393  | 0,000  | 2,411 |
| no. of employees aged 20-24   | 279.048              | 0,450  | 0,000  | 0,892 |
| no. of employees aged 65 or more  | 279.048              | 0,099  | 0,000  | 0,371 |
| regional <sup>c</sup> unemployment rate                                 | 276.227 <sup>b</sup> | 10,672 | 9,391  | 4,985 |
| interest rate at start-up   | 279.048              | 0,055  | 0,050  | 0,020 |
| GDP growth rate at start-up   | 279.048              | 0,019  | 0,019  | 0,015 |
| unemployment rate at start-up   | 279.048              | 0,100  | 0,106  | 0,022 |

<sup>a</sup> A few observations of this variable are missing. <sup>b</sup> Some observations are missing due to non-classifiable districts. <sup>c</sup> Computed at the NUTS3-level. Only establishments with a valid age entry and up to 20 employees are considered. Sample period is 1999-2008.

Source: Establishment History Panel, author's calculations.

## 5.2 Regression analyses

Table 4 shows the results of the fractional logit model for the demand for marginal employees. While in column (1) all establishments are included in the regression, we restrict the sample to establishments with not more than 20 employees in column (2) in order to provide results that are comparable to the latter estimation of a hurdle model for the demand for marginal employees. As the dependent dummy variable in the logit part of the hurdle model should evaluate to 1 almost always for the larger establishments it would not be very sensible to include them in the regressions. But since the establishments covered under this size threshold amount to about 93% of all establishments, this should not be of much concern (see also footnote 29). Indeed, a comparison of columns (1) and (2) reveals that our regression results do not depend on this size threshold. As using shares of marginal employees may not be without problems either, as for the very small establishments they are not really continuous, additional robustness checks are provided in columns (3) to (5) where we estimate the fractional logit model for different size classes of firms.

<sup>32</sup> The fact that this number does not match the overall share of marginal employment in the economy is due to the fact that only establishments with up to 20 employees and with a valid value in the age variable are considered.

First of all, we can see in all regressions a negative and strongly significant coefficient for establishments that are located in East Germany, which is in line with previous research (see section 4.3). The effect increases for larger classes of establishment size. Second, establishment size is negative and highly significant indicating that larger firms have lower shares of marginal employees, which is also in line with previous research. Considering columns (3) to (5) the size-class specific regressions indicate that this relationship is not linear, with the share of marginal employment rising for small establishments with up to five employees and (sharply) decreasing for those with six to ten and 11-20 employees. Intuition suggests that in smaller establishments at least someone has to do the essential work and these persons cannot be substituted for marginal employees.

Concerning the structure of the firms' workforce, we find the usually expected effects: higher shares of women, unskilled personnel and elderly employees are correlated with a higher share of marginal employees. In contrast to our expectations, the share of younger employees (aged 20-24) is negatively correlated with the share of marginal employees in regression (2) using only establishments with up to 20 employees, whereas its coefficient is significant and positive in the model with all establishments (column 1). This suggests that there is some nonlinearity in this relationship as well, which can also be seen from columns (3) to (5), where the small and medium-sized establishments exhibit a negative coefficient for younger employees, yet the larger establishments a positive one. An explanation therefore could be that in the smaller establishments young employees are used in other positions / for other tasks. They could be former apprentices, f.i., that now have become part of the team / the core personnel, while in the larger establishments, the young employees could be students carrying out their side-job.

Regarding the regional unemployment rate, we obtain mixed results: while in column (1) its coefficient is significant and positive, significance is lost in the subsample of establishments with up to 20 employees in column (2). Accordingly, in the size-class specific regressions it is only scarcely significant. These results suggest that while for the subsample of establishments with up to 20 employees the supply of marginal employment does not pose obstacles for the firms that demand this kind of low-skilled labor, there is some restriction for the larger establishments in that higher rates of unemployment are associated with a higher share of marginal employees.

Referring to the macro variables at the time of start-up, the interest rate and the unemployment rate are mostly significant whereas the GDP growth rate is not. Contrary to our expectations, the interest rate at the time of start-up is negative and significant for most of the count part equations (columns 5 to 7), indicating that higher interest rates at business start-up lead to *lower* numbers of marginal employees today. Perhaps this is due to the managerial strategies of the business owners / managers that could decide to go "full risk" and hire full-time employees anyway because they are more productive, which could be a strategy especially for the smaller establishments as they may need somebody to do the heavy and complex work. Larger establishments could be assumed to already have employees who do precisely that. Likewise, higher unemployment rates at start-up are associated with a lower fraction of marginal employees. Thus, the easier it was to find (marginal) employees when the firm was founded, the less marginal employees a firm has today. Perhaps it may serve as an explanation that during times of high unemployment firms have greater bargaining power and can thus afford to pay lower wages in general and as a result profit relatively more from a full-time employee (who consented to earn relatively little but is able to cope with more sophisticated tasks) than from one or more marginal employees. The fact that the GDP growth rate at firm foundation is not significant might be considered a sign that marginal employment is mainly used for cost rather than for flexibility reasons.

Concerning the key variable, establishment age, figure 2 depicts results from the fractional logit models. The first graph displays the age profile for all establishments, the second one for the subsample with up to 20 employees, and the remaining columns give those for establishments with one to five, six to ten and 11-20 employees. Clearly, an inverted U-shape relationship between the share of marginal employees and establishment age can be found in the regressions for all establishments as well as for the subsample of establishments with up to 20 employees. This corresponds to our hypotheses that, among others, there are not so many tasks for marginal employees in young firms, and that young firms can profit a lot more from regular,

full-time employees, because they are able to cope with the substantial difficulties typical of young firms. Similarly, the decreasing share of marginal employees beyond the age of, say, nine years could reflect a certain complacency that grows larger as the firms mature and could result in foregone optimization potentials. Either this could be the case, or the use of marginal employees becomes less profitable for older firms as it induces costs for communication, coordination and control that may be higher than for young firms, because they are very much related to the firms' internal rules and routines (which also accumulate over time).

Looking at the size-class specific regressions, we find different age profiles. While small establishments with up to five employees exhibit the same firm age-marginal employment relationship as the whole sample, we find shares of marginal employment that decrease with firm age for establishments with six to ten and 11-20 employees. Our results are thus driven by the small establishments in the sample.

There are at least three possible answers to the question of why we find different age profiles for small, medium-sized and larger establishments. The first one is rather technical, as there could be concern that shares of marginal employees in small firms may not be a truly continuous variable and therefore might be inadequate for them. Instead, using numbers of marginal employees could be more promising. Another, closely related possibility could be differing extensive and intensive margins between size classes, i.e. differences regarding the inclination to use marginal employment and the number / share of marginal employees, if any. As a matter of fact, firms with more employees can be suspected to have a higher probability that at least one of their employees is marginally employed (this is indeed the case in our sample, where 32% among the establishments with one to five employees, 72% among those with six to ten employees and 75% among those with 11-20 employees have at least one marginally employed worker). This should greatly affect the fraction of marginal employment. Additionally, according to our own, as well as previous results<sup>33</sup>, shares of marginal employment tend to decrease with firm size. A third possibility could arise from the fact that medium-sized and larger firms typically have more hierarchical structures compared to small ones, and also a more pronounced division of labor, even at a very young age. Therefore, the availability of tasks for marginal employees might play no role at all and, besides, there may already be a certain portion of employees who are struggling against the liability of newness, which makes the use of marginal employees more favorable than is the case for the smallest establishments in our sample. Due to the liability of aging and its implications described above, the share of marginal employment should decline with firm age.

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<sup>33</sup> See section 2.

**Table 4: Fractional logit models for the share of marginal employees**

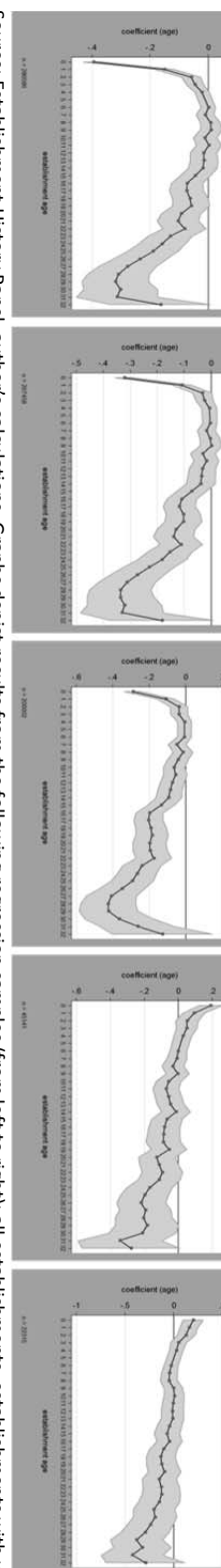
|                                      | dependent variable: share of marginal employees |                      |                      |                      |                      |
|--------------------------------------|---|----------------------|----------------------|----------------------|----------------------|
|                                      | (1)   | (2)                  | (3)                  | (4)                  | (5)                  |
|                                      | all establishments                              | 1-20 emp.            | 1-5 emp.             | 6-10 emp.            | 11-20 emp.           |
| East Germany                         | -0,565***<br>(0,027)                            | -0,478***<br>(0,027) | -0,387***<br>(0,034) | -0,512***<br>(0,045) | -0,674***<br>(0,071) |
| size                                 | -0,049***<br>(0,007)                            | -0,132***<br>(0,004) | 0,075***<br>(0,009)  | -0,220***<br>(0,008) | -0,163***<br>(0,006) |
| no. female emp.                      | 0,034***<br>(0,007)                             | 0,159***<br>(0,004)  | 0,282***<br>(0,008)  | 0,139***<br>(0,006)  | 0,096***<br>(0,005)  |
| no. emp. unskilled manual occup.     | 0,013***<br>(0,005)                             | 0,096***<br>(0,006)  | 0,187***<br>(0,014)  | 0,095***<br>(0,009)  | 0,062***<br>(0,007)  |
| no. emp. unskilled serv.             | 0,006<br>(0,005)                                | 0,139***<br>(0,005)  | 0,274***<br>(0,010)  | 0,156***<br>(0,007)  | 0,106***<br>(0,006)  |
| no. emp. unskilled comm./admin. occ. | 0,018***<br>(0,004)                             | 0,096***<br>(0,005)  | 0,172***<br>(0,010)  | 0,102***<br>(0,007)  | 0,075***<br>(0,006)  |
| no. emp. with unknown qualification  | 0,029***<br>(0,004)                             | 0,122***<br>(0,003)  | 0,252***<br>(0,007)  | 0,107***<br>(0,004)  | 0,061***<br>(0,004)  |
| no. emp. aged 20-24                  | 0,036***<br>(0,012)                             | -0,064***<br>(0,007) | -0,179***<br>(0,011) | -0,044***<br>(0,009) | 0,027***<br>(0,010)  |
| no. emp. aged 65 or more             | 0,508***<br>(0,055)                             | 0,702***<br>(0,015)  | 0,906***<br>(0,020)  | 0,533***<br>(0,018)  | 0,428***<br>(0,019)  |
| regional unemployment rate           | 0,006***<br>(0,002)                             | 0,002<br>(0,002)     | 0,000<br>(0,003)     | -0,006*<br>(0,004)   | 0,002<br>(0,005)     |
| interest rate at start-up            | -1,342***<br>(0,472)                            | -1,073**<br>(0,493)  | -1,042*<br>(0,628)   | -1,822**<br>(0,767)  | -0,249<br>(1,201)    |
| GDP growth at start-up               | 0,279<br>(0,511)                                | 0,066<br>(0,517)     | -0,128<br>(0,646)    | -1,028<br>(0,835)    | 0,200<br>(1,326)     |
| unemployment rate at start-up        | -2,138***<br>(0,647)                            | -2,215***<br>(0,624) | -3,077***<br>(0,817) | -0,937<br>(1,021)    | -1,768<br>(1,562)    |
| establishment age dummies            | Yes   | Yes                  | Yes                  | Yes                  | Yes                  |
| industry dummies                     | Yes   | Yes                  | Yes                  | Yes                  | Yes                  |
| N                                    | 286,586 <sup>a</sup>                            | 267,458 <sup>a</sup> | 200,002              | 45,141               | 22,315               |
| log likelihood                       | -   | -                    | -63812,5             | -17700,1             | -7934,4              |
| p-value (industry dummies)           | 0,000   | 0,000                | 0,000                | 0,000                | 0,000                |

<sup>a</sup> The number of observations differs slightly from that of the hurdle models and the contribution models because of establishments with 0 employees at some point in time.

\* p < 0.1, \*\* p < 0.05, \*\*\*, p < 0.01

Source: Establishment History Panel, authors' calculations. GDP in 2005 prices. Standard errors in parentheses, bootstrapped with 1000 replications and clustered at the establishment level. Regressions included dummies for year, industry (1-digit) and establishment age as well as constant.

Source: Establishment History Panel, author's calculations. Graphs depict results from the following regression samples (from left to right): all establishments, establishments with one to five, six to ten and 11-20 employees.  
**Figure 2: Marginal employment as a function of establishment age, fractional logit model**



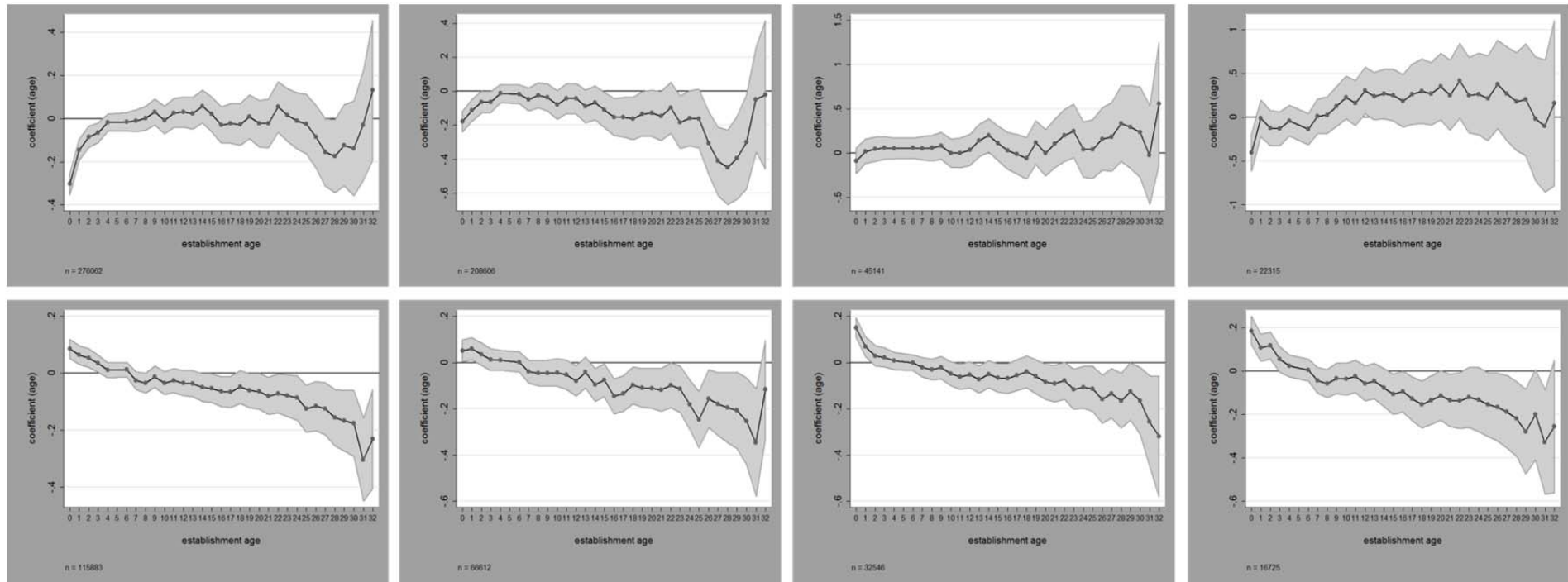
To shed some more light on the demand for marginal employees, we proceed to the estimates of a hurdle model that uses a dummy variable for the existence of marginal employees in the first stage and the number of marginal employees in the second stage. Since establishment size is controlled for, this can still be interpreted as the share of marginal employment. Figure 3 depicts the age profiles obtained from the hurdle model.<sup>34</sup> The first row depicts the results for the first (logit) stage and the second one those for the second (zero-truncated count) stage. The rows (from left to right) refer to the subsamples of establishments with up to 20, one to five, six to ten and 11-20 employees. For establishments with up to 20 employees, we find that the probability of having marginal employees follows roughly an inverted U-shape whereas the number (or the share) of marginal employees decreases with establishment age quite continuously in the subsample of establishments that dispose of at least one marginal employee. Thus, middle-aged establishments have the highest probability of having marginal employees, whereas younger (and older ones) have lower probabilities.

But *if* young firms have marginal employees, they have more of them than older ones. Thus, there is a considerable distinction between the age profiles depending on whether one looks at the extensive or the intensive margin. The fact that younger establishments display lower probabilities of having marginal employees could reflect the fact that they do not have enough tasks for marginal employees and/or prefer to hire full-time instead of marginal employees because they can also help to tackle the fundamental problems that firms at young ages have to face. However, there are other establishments as well, and those have even more marginal employees than older ones, indicating that tasks for marginal employees are available – at least in those establishments that do dispose of marginal employees. According to our earlier hypotheses, one possibility could be that these are establishments where the use of marginal employees is an integral part of the business activity, e.g. in juice bars, where the owner-manager tries to overcome the existential problems posited by the liability of newness and where there are only low-skill activities remaining, which are left to marginal employees. Again, the fact that the share of marginal employees among those establishments declines with their age is in line with the liability of aging hypothesis and the arguments derived thereof. The same arguments apply to the size-class specific regressions.

Note that in the fractional logit model, the logit part of the hurdle model clearly dominates the count part. Thus, as a whole, we have an inverted U-shape relationship between the fraction of marginal employees and firm age. As for the different firm size classes, this is not always the case: while it holds for establishments with one to five employees (where only 32% of the establishments have marginal employees at all), it does not hold for the medium-sized and larger establishments in our sample, since the share of establishments with at least one marginal employee is much higher for them (72% and 75%, respectively).

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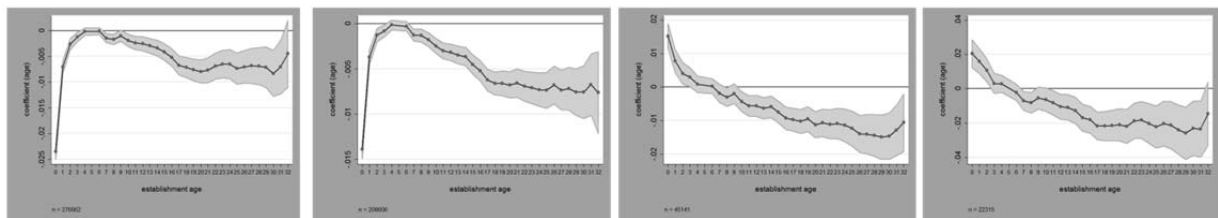
<sup>34</sup> The full results can be seen from table 5 in the appendix.



Source: Establishment History Panel, author's calculations. The first row shows the results from the logit part, the second row from the zero-truncated count part. The first column refers to establishments with up to 20 employees and the remaining ones to establishments with one to five, six to ten and 11-20 employees (from left to right). For establishments with up to 20 and one to 5 employees the number of observations is slightly higher than in the fractional logit model because an establishment is temporarily allowed to have zero employees.

**Figure 3: Marginal employment as a function of establishment age, hurdle model**

So far, we have found an overall inverted U-shape relationship between firm age and the share of marginal employees. But as age cannot be sensibly calculated for all establishments in our sample, we still cannot be sure of how firms at different ages actually contribute to the grand share of marginal employment in the economy, e.g. we do not know whether young firms raise (lower) it more than old ones. This is because we have not taken into account the composition of the sample so far (see section 4.2). Figure 4 presents results from an OLS regression of the contribution to marginal employment as defined above on the same explanatory variables as before.<sup>35</sup> In the overall regression with establishments with up to 20 employees, young establishments lower the grand share of marginal employment more so than older ones (or raise it less).<sup>36</sup> This is due to the fact that although the oldest establishments exhibit marginal employment shares that are as low as those of young establishments, they are simply less numerous. Thus, the contribution to the grand share of marginal employment exhibits a decline with establishment age that is not as sharp as in the fractional logit model. As in the fractional logit model, the medium-sized and larger establishments in our sample exhibit the opposite pattern: there, the demand for marginal employment decreases monotonically with firm age, a fact that is even more strengthened when the sample composition is considered. Not only do young firms in those size classes demand more marginal employment, they are also more numerous than the older ones.



Source: Establishment History Panel, author's calculations. The graph represents results from a linear regression of the establishments' contribution to the average number of marginal employees on the regressors explained in section 4.2. The first column refers to establishments with up to 20 employees, the second one to establishments with 1-5, the third one to establishments with 6-10 and the fourth one to establishments with 11-20 employees.

**Figure 4: The contribution to marginal employment**

## 6 Summary and conclusions

The present paper analyzed (1) whether young establishments demand more marginal employees than older ones and (2) to what extent differences in the demand for marginal employees between young and old establishments impact on the grand share of marginal employment in the German economy. Thereby, we use a representative panel data set on the establishment level covering the period 1999-2008 (however making use of cohorts founded before 1999 as well). We control for important covariates, e.g. establishment size, industry affiliation and the internal structure of the establishments' workforce. Specifically, we resolve the age-period-cohort identification problem by substituting the set of cohort dummies for underlying macro-economic variables measured at the time of start-up. To measure the demand for marginal employees we estimate both a fractional logit and a hurdle model, distinguishing between the extensive and intensive margins. We find an inverted U-shape relationship between the establishments' share of marginal employment and their age. This result is in line with both the liability of newness and the liability of aging literature, in that the problems that lie behind the liability of newness are so fundamental that using marginal employees should be of no use for most of the young establishments. Also, it is argued that young firms do not (yet) possess tasks that are suitable to marginal employees since their internal structures have to be developed first.

As for the liability of aging, several points are made to explain our results, among them that older firms suffer from a structural inertia that they have acquired in their life course, and that this inertia can lead to foregone optimization potential, among others. Distinguishing between the extensive and intensive margin by using

<sup>35</sup> The full regression results can be seen in the appendix.

<sup>36</sup> Note that this needs not necessarily implicate young establishments lower the grand share of marginal employment in absolute terms.

hurdle models we find an inverted U-shape relationship between the probability of having marginally employed workers and establishment age, which coincides with our previous results. However, a further kind of establishment seems to exist in that among those which have at least one marginal employee young firms have most of them. For these establishments, the above considerations derived from the liability of newness hypothesis seem to be irrelevant. There are possibly many explanations of what kind of establishment this could be, but to keep things simple, we conceptualize it as a sort of a juice bar, i.e. an establishment with many jobs suitable to marginal employees and where the owner-manager(s) tackle the “serious stuff”.

To answer the second question, we measure weighted differences between a  $j$  year-old firm’s demand for marginal employees and the demand for marginal employees pursued by all remaining firms in the economy and perform linear regressions of this “contribution” to the grand share of marginal employment on the same explanatory variables as above in order to take into account the effect of sample composition. We find that, although the very old establishments in our sample exhibit an equally low share of marginal employment as young establishments, young firms contribute more to the grand share of marginal employment because they are more numerous. Thus, young firms are found to raise the grand share of marginal employment less than older ones or to lower it more.

We performed several robustness tests to check if the results are sensitive to the choice of a dependent variable and to the definition of firm start-ups. Interestingly, our results differ between size classes of establishments indicating that larger establishments may follow different deliberations than smaller ones regarding the demand for marginal employees. As for future analyses, it could be a promising way to investigate further into the precise nature of the marginal employment-firm age relationship and to distinguish, f.i., between different strategic deliberations. Also, it would be interesting to learn whether the age profiles for the demand for marginal employees in German establishments are the result of a selection process (only specific firms survive) or rather of a transformation process that takes place inside the establishments themselves while they age. Last, but not least, a promising way for future research could be to investigate further which are the establishments that, despite being young, demand more marginal employees than their older counterparts.



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## Appendix

**Table 5: Hurdle model for the demand for marginal employees**

|                                      | dependent variable: have marginal emp. yes/no<br>(logit model) |                      |                      |                      | dependent variable: no. of marginal emp.<br>(zero-truncated count data model <sup>a</sup> ) |                      |                      |                      |
|--------------------------------------|--|----------------------|----------------------|----------------------|---|----------------------|----------------------|----------------------|
|                                      | (1)  | (2)                  | (3)                  | (4)                  | (5)   | (6)                  | (7)                  | (8)                  |
|                                      | 1-20 emp.  | 1-5 emp.             | 6-10 emp.            | 11-20 emp.           | 1-20 emp.   | 1-5 emp.             | 6-10 emp.            | 11-20 emp.           |
| East Germany                         | -0,588***<br>(0,037)   | -0,557***<br>(0,045) | -0,726***<br>(0,084) | -0,839***<br>(0,128) | -0,308***<br>(0,027)  | -0,179***<br>(0,031) | -0,241***<br>(0,032) | -0,350***<br>(0,049) |
| establishment size                   | -0,001<br>(0,006)  | 0,399***<br>(0,011)  | -0,130***<br>(0,015) | -0,128***<br>(0,011) | 0,050***<br>(0,003)   | 0,468***<br>(0,008)  | 0,020***<br>(0,006)  | -0,025***<br>(0,004) |
| no. female emp.                      | 0,379***<br>(0,010)  | 0,505***<br>(0,013)  | 0,273***<br>(0,012)  | 0,171***<br>(0,010)  | 0,065***<br>(0,003)   | 0,081***<br>(0,007)  | 0,056***<br>(0,004)  | 0,052***<br>(0,003)  |
| no. emp. unskilled manual occup.     | 0,086***<br>(0,012)  | 0,170***<br>(0,020)  | 0,060***<br>(0,014)  | 0,031***<br>(0,011)  | 0,048***<br>(0,004)   | 0,139***<br>(0,010)  | 0,074***<br>(0,006)  | 0,044***<br>(0,005)  |
| no. emp. unskilled serv.             | 0,301***<br>(0,016)  | 0,515***<br>(0,019)  | 0,277***<br>(0,017)  | 0,144***<br>(0,012)  | 0,063***<br>(0,003)   | 0,095***<br>(0,007)  | 0,074***<br>(0,004)  | 0,060***<br>(0,004)  |
| no. emp. unskilled comm./admin. occ. | 0,072***<br>(0,013)  | 0,189***<br>(0,018)  | 0,022*<br>(0,013)    | 0,038***<br>(0,011)  | 0,055***<br>(0,003)   | 0,107***<br>(0,007)  | 0,073***<br>(0,004)  | 0,051***<br>(0,004)  |
| no. emp. with unknown qualification  | 0,259***<br>(0,009)  | 0,395***<br>(0,012)  | 0,170***<br>(0,009)  | 0,074***<br>(0,007)  | 0,048***<br>(0,002)   | 0,094***<br>(0,005)  | 0,049***<br>(0,003)  | 0,033***<br>(0,002)  |
| no. emp. aged 20-24                  | -0,076***<br>(0,014)   | -0,235***<br>(0,018) | -0,020<br>(0,017)    | 0,056***<br>(0,018)  | -0,012**<br>(0,005)   | -0,117***<br>(0,010) | -0,030***<br>(0,006) | 0,014**<br>(0,006)   |
| no. emp. aged 65 or more             | 2,321***<br>(0,047)  | 2,221***<br>(0,056)  | 2,332***<br>(0,109)  | 2,170***<br>(0,128)  | 0,229***<br>(0,009)   | 0,261***<br>(0,012)  | 0,179***<br>(0,010)  | 0,198***<br>(0,012)  |
| regional unemployment rate           | -0,001<br>(0,003)  | -0,002<br>(0,004)    | -0,011<br>(0,007)    | -0,003<br>(0,011)    | -0,001<br>(0,002)   | -0,003<br>(0,003)    | -0,002<br>(0,002)    | 0,002<br>(0,004)     |
| interest rate at start-up            | -0,284<br>(0,731)  | -0,449<br>(0,922)    | -0,072<br>(1,572)    | 1,024<br>(2,317)     | -0,868*<br>(0,461)  | -1,086*<br>(0,613)   | -1,166**<br>(0,543)  | 0,015<br>(0,803)     |
| GDP growth at start-up               | 0,274<br>(0,714)   | 0,162<br>(0,863)     | -0,005<br>(1,662)    | 0,898<br>(2,556)     | -0,019<br>(0,471)   | -0,101<br>(0,567)    | -0,745<br>(0,532)    | 0,125<br>(0,866)     |
| unemployment rate at start-up        | -0,294<br>(0,929)  | -1,540<br>(1,154)    | 1,641<br>(2,178)     | 3,130<br>(3,177)     | -0,797<br>(0,604)   | -1,899**<br>(0,758)  | -0,251<br>(0,694)    | -1,494<br>(1,105)    |
| establishment age dummies            | Yes  | Yes                  | Yes                  | Yes                  | Yes   | Yes                  | Yes                  | Yes                  |
| industry dummies                     | Yes  | Yes                  | Yes                  | Yes                  | Yes   | Yes                  | Yes                  | Yes                  |
| N                                    | 276062   | 208606               | 45141                | 22315                | 115883  | 66612                | 32546                | 16725                |
| log likelihood                       | -130759,0  | -87529,0             | -20290,7             | -9319,7              | -150753,2   | -52627,1             | -52362,0             | -35686,6             |
| p-value (industry dummies)           | 0,000  | 0,000                | 0,000                | 0,000                | 0,000   | 0,000                | 0,000                | 0,000                |

\* p < 0.1, \*\* p < 0.05, \*\*\*, p < 0.01

<sup>a</sup> Either a zero-truncated poisson or negative binomial model was fit depending on their adequacy for the data.

Source: Establishment History Panel, authors' calculations. GDP in 2005 prices. Standard errors in parentheses, clustered at the establishment level. Regressions included dummies for year, industry (1-digit) and establishment age as well as constant.

**Table 6: Models for the contribution to the average number of marginal employees, 1999-2008**

|                                      | dependent variable: contribution to the average number of marginal employees |                      |                      |                      |
|--------------------------------------|--|----------------------|----------------------|----------------------|
|                                      | 1-20 emp.  | 1-5 emp.             | 6-10 emp.            | 11-20 emp.           |
| East Germany                         | -0,015***<br>(0,001)   | -0,008***<br>(0,001) | -0,023***<br>(0,002) | -0,045***<br>(0,004) |
| size                                 | -0,001***<br>(0,000)   | 0,007***<br>(0,000)  | -0,000<br>(0,000)    | -0,003***<br>(0,000) |
| no. female emp.                      | 0,007***<br>(0,000)  | 0,007***<br>(0,000)  | 0,006***<br>(0,000)  | 0,006***<br>(0,000)  |
| no. emp. unskilled manual occup.     | 0,004***<br>(0,000)  | 0,004***<br>(0,000)  | 0,003***<br>(0,000)  | 0,003***<br>(0,000)  |
| no. emp. unskilled serv.             | 0,012***<br>(0,000)  | 0,009***<br>(0,000)  | 0,007***<br>(0,000)  | 0,007***<br>(0,000)  |
| no. emp. unskilled comm./admin. occ. | 0,008***<br>(0,000)  | 0,006***<br>(0,000)  | 0,005***<br>(0,000)  | 0,005***<br>(0,000)  |
| no. emp. with unknown qualification  | 0,008***<br>(0,000)  | 0,008***<br>(0,000)  | 0,005***<br>(0,000)  | 0,004***<br>(0,000)  |
| no. emp. aged 20-24                  | 0,004***<br>(0,001)  | -0,002***<br>(0,000) | -0,001***<br>(0,000) | 0,002***<br>(0,001)  |
| no. emp. aged 65 or more             | 0,024***<br>(0,001)  | 0,020***<br>(0,001)  | 0,023***<br>(0,001)  | 0,028***<br>(0,002)  |
| regional unemployment rate           | -0,000<br>(0,000)  | -0,000<br>(0,000)    | -0,000*<br>(0,000)   | 0,000<br>(0,000)     |
| interest rate at start-up            | 0,023<br>(0,017)   | 0,004<br>(0,010)     | -0,045<br>(0,031)    | 0,039<br>(0,067)     |
| GDP growth at start-up               | -0,047***<br>(0,018)   | -0,033***<br>(0,011) | -0,032<br>(0,032)    | -0,010<br>(0,079)    |
| unemployment rate at start-up        | 0,009<br>(0,023)   | -0,032**<br>(0,014)  | -0,039<br>(0,040)    | -0,075<br>(0,093)    |
| establishment age dummies            | Yes  | Yes                  | Yes                  | Yes                  |
| industry dummies                     | Yes  | Yes                  | Yes                  | Yes                  |
| N                                    | 276062   | 208606               | 45141                | 22315                |
| log likelihood                       | 353411,0   | 365744,0             | 69239,0              | 24990,5              |
| p-value                              | 0,000  | 0,000                | 0,000                | 0,000                |

\* p < 0.1, \*\* p < 0.05 \*\*\*, p < 0.01

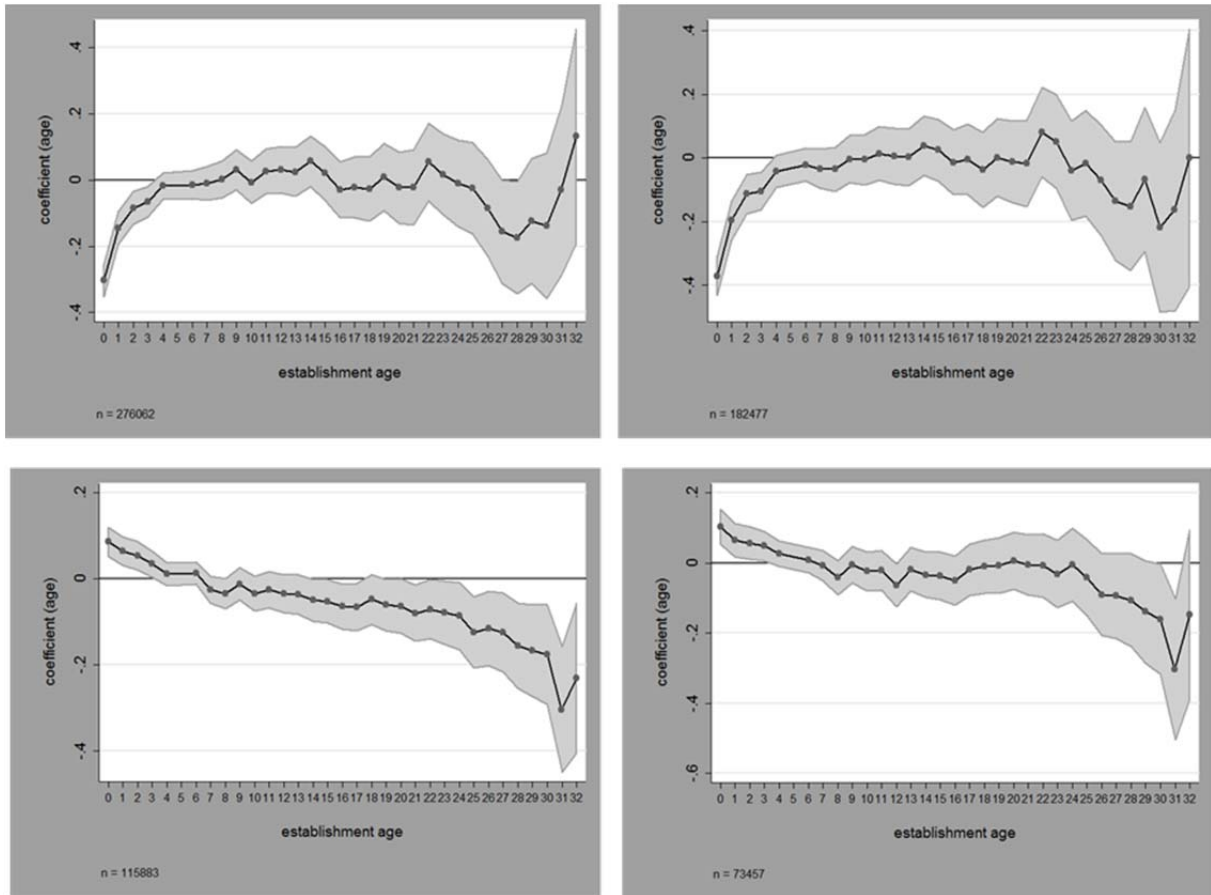
Source: Establishment History Panel, authors' calculations. GDP in 2005 prices. Standard errors in parentheses, clustered at the establishment level. Regressions included dummies for year, industry (1-digit) and establishment age as well as constant.

**Table 7: Hurdle model estimates with and without branches with heavy use of marginal employees**

|   | 1-20 emp.  |                      | 1-20 emp.   |                      |
|---|--|----------------------|---|----------------------|
|   | dependent variable: have marginal emp. yes/no<br>(logit model) |                      | dependent variable: no. of marginal emp.<br>(zero-truncated count data model <sup>a</sup> ) |                      |
|   | incl. Trade and Hotels   | w/o Trade and Hotels | incl. Trade and Hotels  | w/o Trade and Hotels |
| East Germany                            | -0,588***<br>(0,037)   | -0,529***<br>(0,045) | -0,249***<br>(0,037)  | -0,308***<br>(0,027) |
| size                                    | -0,001<br>(0,006)  | -0,008<br>(0,007)    | 0,056***<br>(0,004)   | 0,050***<br>(0,003)  |
| no. female emp.                         | 0,379***<br>(0,010)  | 0,397***<br>(0,013)  | 0,065***<br>(0,004)   | 0,065***<br>(0,003)  |
| no. emp. unskilled manual occup.        | 0,086***<br>(0,012)  | 0,076***<br>(0,013)  | 0,046***<br>(0,005)   | 0,048***<br>(0,004)  |
| no. emp. unskilled serv.                | 0,301***<br>(0,016)  | 0,342***<br>(0,021)  | 0,068***<br>(0,004)   | 0,063***<br>(0,003)  |
| no. emp. unskilled comm./admin.<br>occ. | 0,072***<br>(0,013)  | 0,225***<br>(0,036)  | 0,087***<br>(0,006)   | 0,055***<br>(0,003)  |
| no. emp. with unknown<br>qualification  | 0,259***<br>(0,009)  | 0,214***<br>(0,011)  | 0,050***<br>(0,003)   | 0,048***<br>(0,002)  |
| no. emp. aged 20-24                     | -0,076***<br>(0,014)   | -0,065***<br>(0,017) | -0,030***<br>(0,007)  | -0,012**<br>(0,005)  |
| no. emp. aged 65 or more                | 2,321***<br>(0,047)  | 2,331***<br>(0,054)  | 0,243***<br>(0,011)   | 0,229***<br>(0,009)  |
| regional unemployment rate              | -0,001<br>(0,003)  | -0,004<br>(0,004)    | -0,005<br>(0,003)   | -0,001<br>(0,002)    |
| interest rate at start-up               | -0,284<br>(0,731)  | 0,230<br>(0,884)     | -0,656<br>(0,598)   | -0,868*<br>(0,461)   |
| GDP growth at start-up                  | 0,274<br>(0,714)   | 0,438<br>(0,893)     | -0,344<br>(0,625)   | -0,019<br>(0,471)    |
| unemployment rate at start-up           | -0,294<br>(0,929)  | 0,202<br>(1,137)     | -0,201<br>(0,822)   | -0,797<br>(0,604)    |
| establishment age dummies               | Yes  | Yes                  | Yes   | Yes                  |
| industry dummies                        | Yes  | Yes                  | Yes   | Yes                  |
| N                                       | 276062   | 182477               | 73457   | 115883               |
| log likelihood                          | -130759,0  | -86094,7             | -88761,1  | -150753,2            |
| p-value                                 | 0,000  | 0,000                | 0,000   | 0,000                |

\* p < 0.1, \*\* p < 0.05, \*\*\*, p < 0.01

Source: Establishment History Panel, authors' calculations. GDP in 2005 prices. Standard errors in parentheses, clustered at the establishment level. Regressions included dummies for year, industry (1-digit) and establishment age as well as constant.



Source: BHP, author's calculations. The graph represents results from hurdle models for the demand for marginal employees. The first row shows the results from the logit part, the second one those from the zero-truncated count part. The left column refers to an estimation including the trade and hotel sectors, the right one to another estimation without them. In both models establishments with up to 20 employees were used.

**Figure 5: Age profiles, hurdle model**



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