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by Antje Schimke

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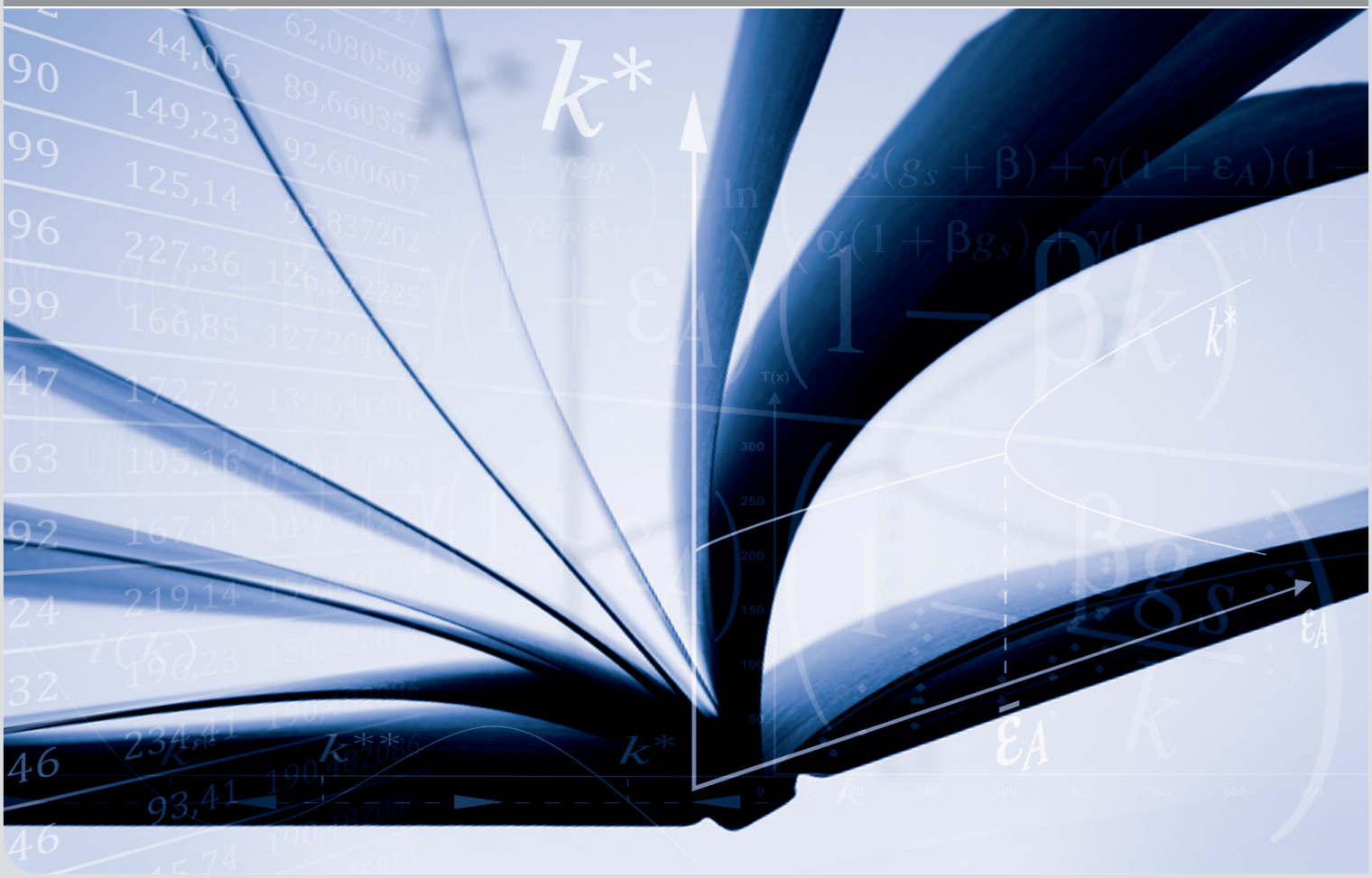

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Entrepreneurial aging and employment growth in the context of extreme growth events

Antje Schimke[*$]

May, 2012

** Institute for Economic Policy Research, Karlsruhe Institute of Technology, Germany*

Abstract

This paper investigates empirical evidence on the linkage between entrepreneurial aging of the workforce and firm growth. More precisely, it aims to analyse the impact of aging on employment growth in the context of extreme growth events. Basically, the study is conducted to capture the overall impact of the average age structure and aging effect on employment growth. For the empirical estimation we apply a linked employer-employee dataset providing 2.100 German firms covering the time period from 2001 to 2006. Using quantile regression techniques, the specific quantiles θ of extremely growing ($\theta_{0.90}$), medium growing ($\theta_{0.50}$) or shrinking firms ($\theta_{0.10}$) can be explicitly analysed. The results show, on average, that employment growth seems to decline as the workforce is getting older. Put differently, extreme growth events seem to be less likely when the average aging of the workforce rapidly accelerates. Firm-specific characteristics such as size, industry affiliation and location matter hereby.

Keywords Entrepreneurial aging, firm growth, employment growth, extreme growth events, age, workforce

JEL codes **J11, J21, L26, O33**

$ *Corresponding author: Antje Schimke, Institute for Economic Policy Research, Karlsruhe Institute of Technology, Waldhornstraße 27, Bldg. 01.96, 76131 Karlsruhe, Germany, Tel: +49 721 60845759, Fax: +49 721 608 48429, e-Mail: schimke@kit.edu*

1 Introduction

The growth of firms has positive macro- and micro-economic effects. Therefore, firm growth, the related factors and its explanation is a well studied field of research in the economic literature (e.g., Metcalfe 1993, Hannan and Freeman 1977, Penrose 1959, Coase 1988). There exists a wide range of factors that are found to affect firm growth such as firm-internal and firm external factors (e.g., Acar 1993). Usually the impacts of firm characteristics on firm growth are studied without explicitly considering the socio-demographic characteristics of the entrepreneurs and employees. Put differently, our study focuses on the influence of entrepreneurial aging on employment growth. In general, the implications of demographic aging for economic growth (Börsch-Supan et al. 2007) and regional disparities are repeatedly studied (e.g., Ludwig 2005). The age distribution of the workforce (i.e. aging of the employees and workers) can be expected to be important for firms' activities (e.g. Lévesque and Minniti 2005). However, it has been put too much emphasis on the macro-economic effects of demographic aging (e.g., Gonzalez-Eiras and Niepelt 2012) by neglecting the micro-economic effects such as firm growth. Furthermore, entrepreneurial issues have further characteristics that make them a perfect factor for our study. First, entrepreneurial activities, competencies and socio-demographic characteristics can influence firm growth in many different ways. It can be expected that younger and older workers and employees work differently and, as a consequence, engender different strategies and competencies in the way firms grow (e.g., Friedberg 2003). However, it is very difficult to disentangle the socio-demographic structure of the workforce and its impact on firm growth. Second, it can be expected that some firms do not show any impact of entrepreneurial aging on firm growth, meaning that firms usually remain completely independent of the age structure of the workforce (e.g., small-sized firms). But, studying these relationships within different firm size classes, we observe different relationships implying that smaller and larger firms are affected by age and aging in completely different ways. We therefore aim to obtain a clearer picture of the impact of entrepreneurial aging on employment growth.

The purpose of our paper is to understand why employees and workers offer and enable different strategies and competencies to the firm and to highlight the important implications of the phenomenon of entrepreneurial aging. In addition, we will also examine the overall impact of the age structure, because it is impossible to study the explicitly entrepreneurial structure without knowing the latter. The overall impact of demographic aging on firm growth has been repeatedly studied in the literature (e.g., Ludwig 2005). However, the findings vary. We repeat this analysis in order to see which results from the literature are confirmed and in order to obtain a comparison basis for our estimations. The analysis is divided into two major parts: First, we set up estimations where we analyse the impact of average age structure of workforce on employment growth. Second, we study the impact of the average ageing effect on firm growth in terms of employment growth. The study is based upon a sample of 2100 firms operating in Germany. The unique micro-data are recorded in the 'Federal Statistical Office and the statistical offices of the Länder', in the period from 2001 to 2006. The collected micro-data provides information on individual characteristics of the workforce as well as information on firms' activities (e.g., employees). We set up quantile regression to identify entrepreneurial characteristics that also come together with firms' employment growth in terms of extreme growth events. Especially, we study the impact of age and aging on highly shrinking and highly growing firms.

The structure of the paper is as follows. Section 2 derivates the theoretical implications on the empirical evaluation of age and aging as well as their relevance for employment growth. The hypotheses are subsequently developed in the same section. Section 3 focuses on the

methodology, the employed data, and the discussion of the empirical variables. The findings are presented and discussed in Section 4. Section 5 concludes the paper.

2 Theoretical derivation and hypotheses

It can be suggested that firm growth and its explanations are an important and well studied topic in the existing economic and geographic literature. Yet, firm growth is considered as a heterogeneous process with high complexity, individual characteristics and various combinatorial and strategic issues (i.e. additive and multiplicative contributions) and can be regarded as idiosyncratic for several reasons that also emphasize the author's motivation. First of all, there is a wide range of theories and empirical approaches that deal with firm growth and its growth related factors (for an overview see Coad 2009) that address the topic from very different perspectives. Within neoclassical approach the theories of 'optimal size' (Coase 1937) and 'nature of a firm' state that the "limit to the size of the firm is set when the scope of its operations had expanded to the point at which the costs of organizing additional transactions within the firm exceeded the costs of carrying out the same transactions through the market or in another firm" (Coase 1988b: p. 19). Therefore, the transaction cost theory presents exclusively the optimal size of a firm but the explanation for endogenous firm growth is neglected. Another approach can be found within "evolutionary economics that embraces the phenomenon of innovation in a way that other perspectives are not able to do" (Coad 2009: p. 6). Thus, evolutionary concepts emphasize the importance of firm-internal innovation activities. Nevertheless, it is debatable whether the contribution of innovation activities does exclusively explain the process of growth in firms. Penrose theory and the sociological concepts focus on the availability of resources and highlight them as a central source of firm growth (e.g., Penrose 1959, Metcalfe 1993, Hannan and Freeman 1977). Although there is a discussion on resources that might influence growth, the theory and empirical studies put not much emphasize on the contribution of socio-demographic (e.g. age, aging) resources and characteristics of the workforce that might affect firm growth.

Thus, one important fact of which the reader must certainly be aware is the discussion around current social developments such as the demographic changes. For instance the changing age distribution of the population and workforce may be important for the rate of new firm formation (e.g. Lévesque and Minniti 2005) or especially firm growth that has not been studied so far. Because of the complexity in this domain, there is a need for further and additional research for key dimensions, related factors and strategic knowledge sources. This paper tries to improve the understanding of current developments and generates an informational value by updating the existing knowledge in the domain of firm growth and aging workforce. Put differently, this work is motivated by the linkage between the issues of entrepreneurial aging and firm growth (i.e. employment growth) exploring the joint effect and the complementary effect of both. A special focus is dedicated to different growth level. We therefore distinguish between different firm growth events such as extreme high-growth, median growth and extreme shrinking growth. Previous empirical studies often deal with the impact of demographic change on the macro-level (e.g., Gonzalez-Eiras and Niepelt 2012, Weber 2010). There are several studies dealing with the overall importance of employment and the availability of qualified labour for innovation (e.g. Acs and Audretsch 1990, Pianta 2005, López-García and Puente 2009).

To best of our knowledge, there is hardly any empirical literature analysing the impact of aging workforce on employment growth. Therefore, our work especially deals with the consequences of aging at the micro-level (i.e. firm-level). A few studies have already dealt with discussion on aging implications and firm performance (e.g., Ilmakunnas and Maliranta 2007). As such, Liu et al. (2010) study the relationship between workforce composition and

firm productivity and conclude that the middle-aged with higher education contributes significantly to productivity. Ashworth (2006) investigates workforce in the electric power industry (i.e. knowledge intensive industry) and finds that workforce aging could cause short-term and permanent loss of knowledge. Moreover, Meyer (2011) presents some empirical evidence on the relationship between age structure of the workforce and the adoption of new improved technologies. She found out that a homogenous workforce in terms of age is positively related to the probability of technology adoption. There are several other studies dealing with individual characteristics of older workers and their competencies and strategy skills. As such, Malo and Munoz-Bullon (2003) analyse the employment mobility of different age cohorts and suggest that younger cohorts are more mobile. More precisely, "older cohorts have fewer spells and less changes of employment status between successive spells. On the contrary, younger cohorts have more spells, they are more mobile" (Malo and Munoz-Bullon 2003 p: 150). Furthermore, Tijdens and Steijn (2005) conclude that older workers have lower level of mastery of technical equipment and software. Likewise, Borghans and ter Weel (2006) suggest that the relationship between older workers and industries with advanced ICT skills (i.e. ICT) remains difficult. Hence, a bulk of studies tries to explain firms' productivity with the characteristics (e.g., competencies and strategies) of the workforce (e.g., Ilmakunnas and Ilmakunnas 2001). Furthermore, some studies highlight the linkage between the age structure and technological innovativeness. Schneider (2008) finds significant coefficients of the age structure of the workforce on technological innovativeness. In this vein, Nishimura et al. (2004) pointed to the fact that a higher share of older workers decreases the rate of technological progress in firms. Rouvinen (2002) investigates that an increasing average age of workforce within a firm reduces the probability of process innovation. Therefore a strong focus already exists in the discussion on the relationship between workforce age and innovation activity (Frosch 2011). Some other studies highlight firm-internal organisational issues such as the age discrimination and its performance consequences (e.g., Kunze et al. 2011) and discuss practical implications for the effective management of an increasingly age diverse workforce. With regard to the letter, some studies discuss aging problems and its consequences on public policy (e.g., Schmähl 2003). Additional studies focus on question whether aging workforce hampers the innovativeness of firms (e.g., Verworn and Hipp 2009). However, most of empirical studies do not put its emphasis on the linkage between aging and firm growth in terms of employment growth. This means, we are especially interested in the question whether entrepreneurial aging (in terms of workforce) do really has an impact on employment growth of firms. Therefore, it might be that firms acquire new (younger) workers to compensate for the negative aging effects. Therefore, we investigate:

H1: The average age of the workforce affects employment growth. This generally due to the fact that employment growth tends to increase more slowly as the workforce is getting older. Firm-specific characteristics matter hereby.

The empirical considerations on the average age structure and employment growth leads to the discussion on the duration of employment. Generally speaking, Lazear (1998) already states that younger and older workers can be attributed to different properties and characteristics. Therefore, younger workers are more comfortable with the use of technological issues (e.g., computer), while older employees have better knowledge of firm strategies and structures. We suggest that the average duration of employment does also matter. Therefore, workers are reaching their peak efficiency not before they have reached their threshold job tenure. Put differently, employees most presumably cannot reach their peak efficiency before they work in their positions for a minimum acclimatisation period. With respect to the study by Malo and Munoz-Bullon (2003 p: 150) who suggested that "the mobility in employment status has increased along the twentieth century", we therefore formulate:

H2: Employment growth might be superior as the average duration of employment increases. Firm-specific characteristics matter hereby.

Finally, we analyse the impact of aging on employment growth. Thus, we investigate whether the aging effect (i.e. age shift) might interfere with employment growth rates. We therefore suggest that an extremely rapid change of the age effect causes a corresponding shift in competencies (i.e. depending on younger and older workers), which might affect the firms employment growth. A few studies analyse the linkages and interrelations between age heterogeneity and group performance (Pelled et al. 1999, Simons et al. 1999), we therefore more technically assume that:

H3: Employment growth tends to decline when the average aging effect of the workforce rapidly accelerates. Firm-specific characteristics matter hereby.

Generally speaking, the previous literature points to the fact that extreme growth events are not just mere outliers but a fundamental phenomenon of firm growth (e.g., Bottazzi et al. 2007). This holds especially true for employment growth: since employees are discrete in nature, they change in numbers rather abruptly in a lumpy fashion (Bottazzi et al. 2007). In respect to this issue, the discussion on extreme growth events comes into focus: most firms do not grow (or only slightly), whilst a small, however non-negligible part of firms experiences very rapid growth or decline. It might be that the firms with extreme growth rates (highly shrinking and highly growing) exhibit a significant different growth behavior. This theoretical consideration on the emergence of extreme growth events motivates us to estimate the contribution of socio-demographic characteristics on growth of firms, identifying differences in their employment growth activities.

3 Data source, variables and regression approach

3.1 Data source

The data used in our study originate from the Federal Statistical Office and the statistical offices of the Länder, the so-called "AFiD-Modul Gehalts- und Lohnstrukturerhebung im produzierenden Gewerbe und im Dienstleistungsbereich"[1]. The study is based upon a sample of 2098 firms (manufacturing firms and service firms) operating in Germany in the time periods 2001 and 2006. The collected micro-data, a linked employer-employee database, provides information on the individual employee (e.g., age, year of entry) as well as information on the individual firm (e.g., number of employees, industry affiliation, location). Several additional conditions are applied that should be taken into account. First, we find that 61.9 percent of the firms are active in the manufacturing sector (NACE-2-digit classification: 15 - 36) and less than the half of the sample (38.1 percent) are identified as service firms (NACE-2-digit classification: 40 – 93). Second, our sample covers different firm size classes ranging from small-sized to large-sized enterprises. Therefore, we split the sample according to the European Commission (2003) into the three size bins small [10-50), medium [50-250) and large [250-1000) on basis of the average annual firm size. Thus, the distribution of firm size is presented as follows: (i) small-sized enterprises: 5.3 percent (ii) medium-sized enterprises: 32.1 percent and (iii) large-sized enterprises: 62.6 percent. Hence, most of the firms in our sample are considered as large-sized firms (more than 250 employees). Put

[1] The research data centres are to enable the scientific community to use anonymised micro-data of official statistics. For that purpose, selected statistics are processed successively for use in the research data centres and documented by metadata. Thus a data offer is prepared which is geared towards the requirements of the scientific community and can be used via different access channels.

differently, the small-sized firms (with less than 11 employees) are clearly underrepresented in our study. Third, we receive the information on the firms' location. This variable might be able to reflect the structural differences between East and West Germany. We therefore explore that 70.7 percent of sample firms are located in West Germany and 29.3 percent in East Germany.

3.2 Variables

With regard to the data availability from the federal Statistical Office and the statistical offices of the Länder, we use employment number as the dependent growth measure. The growth rates (*EMP*) are calculated by taking the differences of the natural logarithms of the size of firm *i* between the first year size and the last-year size *t*:

$$EMP_{i,t} = \ln(size_{i,t+1}) - \ln(size_{i,t})$$

Regarding our hypotheses, we employ several independent variables. These variables display (1) socio-demographic characteristics of the employees and (2) firm-specific characteristics. The socio-demographic variables for instance shall reflect the individual employee/worker characteristics that are specific to the overall workforce within the firm. The firm-specific variables indicate rather usual factors found to influence employment growth, such as firm size, industry affiliation and location. An overview of the description of explanatory variables is given in Table 2 and the descriptive statistics of all variables are presented in Table A1 (in the appendix).

(1) Socio-demographic characteristics

The socio-demographic variables refer to the individual role of workforce, particularly to possible competencies and strategies of the employees and workers. With *AGE*, we introduce an *AGE*-variable referring to whether a firm shows a certain share of older employees, measured by the average age structure of the employees. We suggest that the average age structure is not independent of the different subgroups. Some results can be seen as standard results (so-called 'stylized facts') for instance, we hence assume that the average age of the workforce decreases as the firms become smaller. Table 1 shows the average age structure of the workforce within the different subgroups. Contrary to our expectations, the average age of the small-sized firms is slightly higher than the mean value for firms with more than 50 employees. This finding might be captured by the small number of observations for the subgroup due to the selection bias of the sampling. Furthermore, Table 1 clearly shows that the lowest average age is pointed out for the employees/workers in the service sector. The *AGING* variable, by contrast, displays the age shift (i.e. *AGING* effect) of employees in the firms. The variable is calculated by taking the differences of the average age of employees in the first year of observation and the average age of employees in the last year of observation. In both, the *AGE* and *AGING* we hence implicitly assume that the socio-demographic characteristics of the workforce displays firm-internal knowledge resources, which is commonly done, as knowledge can be considered as incorporated in individuals who are able to process it (e.g., Grund and Westergard 2008). The distinction between these two variables is very useful, as the *AGE* is average measure of the age structure in the firm, whereas *AGING* is more dynamic, pointing to the actual strength of the firm's aging. We expect both to have a direct impact on firm growth in terms of employment growth. *TENURE* displays a strategic component of the firm measured by the average duration of the employment. It is constructed to highlight the discussion on the impact of the duration of employment on firm growth. We suggest that the average duration of employment (*TENURE*) does also matter indicating that employees and workers most presumably cannot reach their peak efficiency before they work in their positions for a minimum acclimatisation period.

Table 1: Average age structure of the workforce within subgroups (rounded values)

Subgroups	Obs.	Mean	Std. Dev.	Min	Max
All firms	2098	40.52	4.798292	19	60
Small-sized firms	112	41.28	6.813379	27	60
Medium-sized firms	673	40.24	5.437826	19	59
Large-sized firms	1313	40.56	4.199341	25	56
Industry sector	1236	41.09	4.550781	23	60
Service sector	762	39.41	4.914714	19	56
East Germany	612	41.16	5.289078	23	60
West Germany	1486	40.22	4.554269	19	59

(2) Firm-specific characteristics

The *SIZE* variable controls for the size of the firm, as smaller firms (*SIZE=1*) more intensively and more frequently rely on creative knowledge spilling over for generating new knowledge and innovative activity (especially in the start-up phase) than larger firms (Audretsch 1998). We hence assume small-sized firms to benefit differently from socio -demographic characteristics than medium-sized and larger ones. *INDUSTRY* is a dummy, indicating whether a firm belongs to a particularly manufacturing sector within the sample (*INDUSTRY*=1) or to service sector (*INDUSTRY=0*). *INDUSTRY* is constructed by the simple NACE-2-digit classification. We use this dummy in order to be able to distinguish between firms that are operating in manufacturing sector or in service sector. We investigate whether firm location (*EAST*) is an initial trigger for employment growth in firms. This variable might be able to reflect the structural differences between East (*EAST=1*) and West (*EAST=0*) Germany. We hence assume that firms located in East Germany are more likely to be affected by socio-demographic characteristics than firms located in the West Germany.

Table 2: Description of explanatory variables

Category	Variable	Description
Socio-demographic characteristics	AGE	measured by the average age of the employees
	AGING	calculated by taking the differences of the average age of employees in the first year and in the last year of observation
	TENURE	measured by the average duration of the employment
Firm-specific characteristics	SIZE	small enterprises, defined as those with less than 11 employees (SME=1); medium-sized: 50-250 employees and large-sized: >250 employees
	INDUSTRY	industry classification: 15 - 36; service classification: 40 – 93
	EAST	structural differences between East and West Germany

3.3 Regression approach

We assume that high growth firms (and shrinking firms), a dominant feature of firm growth, rely differently on socio-demographic (*AGE* and *AGING*) properties among other factors. Focusing on the average employment growth firms may obscure these relationships (Coad and Rao 2008). Using quantile regression techniques, the specific conditional quantiles θ of extremely growing or shrinking firms can be highlighted explicitly (Chernozhukov 2005). Hence, we identify socio-demographic variables (*AGE*, *AGING*) that stimulate highly expanding ($\theta_{0.90}$) and highly shrinking firms ($\theta_{0.10}$). Furthermore, the results are compared with the median firm ($\theta_{0.50}$) to gain an estimation basis. Two further features make quantile

regression techniques suitable to study the growth dynamics of firms (Buchinsky 1998). First, it is not sensitive to outliers on the dependent variable. This is especially relevant here, because the previous analysis of the stochastic properties (i.e. growth rates distribution) highlights the high frequency of extreme growth events which would strongly influence OLS estimates. Therefore, we analyse the stochastic properties of the firms' growth rates, because it yields to substantial information about the growth process. To deal with that issue we use the distributional model (introduced by Bottazzi et al. 2002) that describes the observed stochastic properties of the employment growth rates (i.e. Subbotin family of distributions). By the way, values of *b* smaller than one indicate super-Laplace tails and values of *b* larger that 1 recover a Gaussian distribution (for an overview see Fagiolo et al. 2006). The shape parameter *b* is the crucial one for our analyses, because it gives information about the fatness of the tails. This means once again the larger b, the thinner are the tails (i.e. if *b* decreases the tails of the density become fatter). Small values of *b* point to the fact that extreme growth events are not just mere outliers but a fundamental phenomenon of firm growth. This holds especially true for employment growth: the shape parameter *b= 0.5887 (Std.err= .0392)*. Secondly, no distributional assumption on the error term is made. Thus, quantile regression techniques are more appropriate to study heavy-tailed phenomena (extreme growth and extreme decline) than regression techniques, which assume normal distributed errors (Coad and Hölzl 2009). We already know from the literature that growth-related variables might impact the different firm samples differently. Therefore, we set up different estimations (see equation 1) for different firm size classes, different sectors (i.e. industry and service) as well as for the location dummy (i.e. east and west). We only want to focus on the coefficient estimates that can be interpreted in the same way as OLS regression coefficients, more precisely as a partial derivate of the conditional quantile of the dependent variable $EMP_{i,t}$:

$$(1)\quad (\log(EMP_{2006}) - \log(EMP_{2001}))_j = a_o + a_1 AGE_j / a_1 AGING_j + a_2 TENURE_j + \sum_{k=3}^{5} a_k SIZE_{kj} + \sum_{k=4}^{7} a_k INDUSTRY_{kj} + \sum_{k=5}^{9} a_k EAST_{kj} + \varepsilon$$

Finally, we test for multicollinearity (see appendix correlation matrix in Table A2) and endogeneity. Moreover, to avoid endogeneity problems we use the first year value in 2001 as independent variables. Then, some of explanatory variables are correlated such as *TENURE* and *AGE* (r=0.5635***) but we hence suspect multicollinearity is not a major problem here. Nevertheless, in the case of *AGE* and *AGING* we find that the variables are strongly correlated with r=-0.7095***. Therefore, we set up different regression models for these explanatory variables (i.e. *AGE* and *AGING*).

4 Estimations and interpretation

In the following section we will discuss the main findings of the estimations and present the interpretation. The complete estimations are reported in Tables A3 – A20.

4.1 Average age structure (hypothesis 1)

As we want to especially gain information on the socio-demographic characteristics of the workforce that might contribute to employment growth of firms, we basically differentiate between the average age of workforce and the aging (see hypothesis 3). Our hypothesis 1 states that '*The average age of the workforce affects employment growth. This generally due to the fact that employment growth tends to increase more slowly as the workforce is getting older.*' The results for the estimations are presented in Table A3. We find significantly negative coefficients for the independent socio-demographic variable of *AGE* for all firms in the different quantiles ($\theta_{0.10,}$ $\theta_{0.5}$ and $\theta_{0.90}$). The results indicate that employment growth tends

to decline as the workforce is older. This holds for the lower quantile of employment growth ($\theta_{0.10}$), for median growth ($\theta_{0.50}$) as well as for the higher quantile ($\theta_{0.90}$). This finding points to the fact that, irrespective of the growth event, a higher average age of the workforce is less likely to show firm growth in terms of employment growth. Nevertheless, we can see in Table A3 that the coefficient for median growth ($\theta_{0.50}$) disappears to be economically relevant reflecting the fact that the average age of the workforce is much more decisive for firms in the context of extreme growth events ($\theta_{0.10 \text{ and } }\theta_{0.90}$). We therefore can partially confirm our hypothesis 1. Indeed we find a strong impact of the average age of the workforce on employment growth. However, the effect appears to be negatively correlated with growth. We hence formulate an alternative hypothesis stating that '*employment growth seems to decline as the workforce is getting older'*. Furthermore, Tables A4 – A11 clearly show that the findings differ across firm size classes (*SIZE*), industry affiliation (*INDUSTRY*) and location (*EAST*). Let us start with the results for different firm size classes (see Tables A5 - A7). For small-sized firms, we only find a negative effect for *AGE* in highly growing firms ($\theta_{0.90}$). Interestingly, this also holds for large-sized firms. Therefore, small firms as well as larger firms seem less likely to experience strong (employment) growth as the workforce becomes older. This supports the above findings that especially small and large firms need a younger workforce to be able to increase their employment growth strongly (to be high growing). In the case of medium-sized firms, we find statistically significant coefficients for medium growing ($\theta_{0.50}$) and highly shrinking ($\theta_{0.10}$) firms, implying that an older workforce (on the average) makes firms more vulnerable with respect to extreme negative employment growth events. Furthermore, the results strongly vary with the two industry measures (*INDUSTRY*). In the context of firms in the industry sector (see Table A8), we find a very weak negative relationship at the higher quantile of employment growth. We interpret this as a statistical support for the assumption that the average age structure of the workforce in the industry sector plays a minor role in the context of employment growth. We receive completely different results for firms in the service sector (see Table A9). Here we find statistically significant coefficients for medium growing ($\theta_{0.50}$) and highly shrinking ($\theta_{0.10}$) firms. Although there is some indication that a higher average age make firms in the service sector even more susceptible with respect to (extreme) negative employment growth events. Finally, let us look at the results for the two different location variables (*EAST*). We find strong evidence that the average age structure influences employment growth (i.e. medium growing ($\theta_{0.50}$) and highly shrinking ($\theta_{0.10}$) firms) negatively, by being located in Eastern Germany. The negative *AGE* effect does also hold for extremely growing firms ($\theta_{0.90}$) in Western Germany.

Concerning the impact of the average age structure the estimations present standard results: The statistically negative coefficient for *AGE* is consistent with the so-called 'stylized fact', indicating two general results: In the case of medium growth ($\theta_{0.50}$) and high growth ($\theta_{0.90}$) employment growth tends to decline as the workforce is getting older. In the case of highly shrinking firms ($\theta_{0.90}$) the results point to the fact that an older workforce makes these firms more susceptible with respect to extreme negative employment growth.

4.2 Duration of employment (hypothesis 2)

Remember we suppose that the average duration of employment (*TENURE*) displays a strategic component of the firm. It hence is constructed to highlight the discussion on whether the duration of employment influences firm growth. It might be the average duration of employment enables firms for doing better or not (in terms of employment growth). Hence, hypothesis 2 states that '*employment growth might be superior as the average duration of employment increases. Firm-specific characteristics matter hereby'*. The results for the estimations are presented in Table A4 – A20. As we already know the independent variables of *AGE* and *AGING* are highly correlated with r=-0.7095***. Therefore, we set up different

regression models. Let us start with the estimations for *AGE* and *TENURE* (see Tables A4 – A11). Most important in the context of multicollinearity is the correlation between *AGE* and *TENURE* (r=0.5636***). Accordingly, the average age structure of the workforce does not *necessarily* result in an increase of the average duration of employment. Two further issues should be taken into account: First, this correlation is likely being impacted by different firm-specific characteristics. Second, the effect of *TENURE* might be captured by the impact of *AGE* on employment growth. Actually, we do not find any statistically significant coefficient for *TENURE* across the different firm size classes. We therefore conclude that there is no evidence that the average duration of employment influences employment growth rates within different firm size classes. While the negative and statistically significant coefficient of *TENURE* indicates that medium employment growth ($\theta_{0.50}$) in the industry sector tends to decline with duration of employment, the slightly positive coefficients of *TENURE* in the service sector suggest that firm growth in terms of medium growth ($\theta_{0.50}$) and high growth ($\theta_{0.90}$) seems to increase more slowly as the duration of employment increases. In the case of the location differences (*EAST*), we find a statistically significant coefficient for highly growing firms ($\theta_{0.90}$) in Eastern Germany (see Table A10) representing a positive impact on employment growth as the duration of employment increases.

Furthermore, we set up regressions where we include *AGING* and *TENURE* in the model (see Table A12 – A20). The explanatory variables are weakly correlated with r=-0.3656***. Thus, we do not see a strong problem of multicollinearity; hence, it is not necessary to set up different regression models. For the different firm size samples we find different results. In the case of larger firms in Western Germany, the coefficients indicate that firm growth is negatively influenced as the average duration of employment increases especially for medium growth ($\theta_{0.50}$) and high growth ($\theta_{0.90}$). For firms in the industry sector, we find statistically negative coefficients for all growth levels ($\theta_{0.10,}$ $\theta_{0.50,}$ $\theta_{0.90}$). In the case of service sector, we again find slightly positive coefficient of *TENURE* for high growth ($\theta_{0.90}$) indicating that firm growth seems to increase as the duration of employment increases

Summarising, we hence state that the average duration of employment does have a mostly negative impact on employment growth, even though not for all firms similarly but depending on their firm-specific characteristics. However, in case of highly growing firms at $\theta_{0.90}$ in the service sector, employment growth might be superior as the average duration of employment increases. Our hypotheses 2 can therefore be partially confirmed.

4.3 Average aging effect (hypothesis 3)

Furthermore, we distinguish between two variables socio-demographic variables: *AGE* (see discussed above) and *AGING* as a more dynamic explanatory variable, indicating the actual strength of the firm's aging process. We expect AGING to have a direct impact on employment growth. We therefore suggest in hypothesis 3 that *'employment growth tends to decline when the average aging (age shift) of the workforce quickly accelerates. Firm-specific characteristics matter hereby'*. Let us first consider the results for all firms irrespective of the firm-specific characteristics (see Tables A12 and A13). We again receive statistically significant coefficients with a negative sign for *AGING*. As in the case of the *AGE* estimations the findings reflect that the firm growth indeed declines when average aging of the workforce accelerates. This result especially holds for medium-sized firms and firms in the industry sector across the different growth levels (i.e. highly growing ($\theta_{0.90}$), medium growing ($\theta_{0.50}$) and highly shrinking ($\theta_{0.10}$) firms). With regard to the small-sized firms, we find no evidence that the average aging of the workforce influences the employment growth rates. This result might lead to the general property of smaller firms to employ on average younger workers than their larger counterparts (Hölzl and Friesenbichler 2008). Furthermore, previous

literature presents evidence that younger and smaller firms (such as start-ups) are more likely to hire younger employees. At the start up stage, the firm has to deal with the availability of seed capital and the process of incubation (e.g., Hölzl and Friesenbichler 2008). As a result, the cost-reducing effects, even in the start-up stage, are of much higher importance than hiring cost-intensive and older workers enriched in experiences. We find confirmation for the finding from the literature that especially larger firms are more affected by the shortage of skilled workers. Continuous growth requires adequate skills and explicit management (e.g., Hölzl and Friesenbichler 2008). The mixture between younger and older workers and talented entrepreneurs is highly important. The regional dummy (*EAST*) representing structural differences between East and West Germany is statistically significant. While we receive negative statistically coefficients for medium growth ($\theta_{0.50}$) and extreme positive employment growth ($\theta_{0.90}$) in East Germany, the negative coefficient for extreme negative growth event ($\theta_{0.10}$) in West Germany strengthens our assumption. We therefore can confirm our hypothesis 3 and conclude that growth events seem to be less likely when the average aging of the workforce rapidly accelerates.

Generally spoken, the analysis presents the impact of aging on employment growth in different subgroups. We find some important results that can be interpreted as stylized facts. For small-sized firms there is no evidence that *AGING* effect influences employment growth, while the *AGING* effect appears as the firm evolves over its life cycle (e.g. Audretsch and Dohse 2007). More precisely, the negative effects of *AGING* are more pronounced for the median growing firms at $\theta_{0.50.}$ With regard to extreme highly growing firms at $\theta_{0.90}$, the strong negative linkage suggests that firm growth appears less likely when the average aging of the workforce rapidly accelerates.

5 Conclusion

Our analysis complements existing literature on firm growth with that literature on the impact of entrepreneurial aging. It therefore discusses the general implications of age and aging for firm growth. Most important in the context of our investigation is the impact of the variables representing socio-demographic characteristics. There are different prominent features to highlight. First, the paper suggests that it is useful to bring socio-demographic characteristics and firm growth in terms of extreme growth events together. In particular, employment growth does appear to be influenced by socio-demographic properties. In fact, the empirical investigation clearly shows that the average age structure indeed has a strong effect on employment growth. In the case of medium growth ($\theta_{0.50}$) and high growth ($\theta_{0.90}$) employment growth tends to decline when the average age of the workforce increases. In the case of highly shrinking firms ($\theta_{0.90}$) the results point to the fact that an older workforce makes these firms more susceptible with respect to extreme negative employment growth. Second, we can state that the average duration of employment does have a mostly negative impact on employment growth, even though not for all firms similarly but depending on their firm-specific characteristics. Put differently, employees most presumably cannot reach their peak efficiency before they work in their positions for a minimum acclimatisation period. Third, the aging effect of firms strongly depends on the firm-specific characteristics. For instance, while we find strong negative linkages between employment growth and aging in firms with more than 50 employees, the aging effect entirely disappears in terms of smaller firms. For future work, the study can be easily transmitted and extended to firms that not directly are affected by aging but by aging of the region where the firm is located in.

We also want to mention that our study is limited to only some socio-demographic characteristics (i.e. *AGE*, *AGING*, and *TENURE*) due to the availability of data. Therefore,

some other features (embedded in datasets) of the socio-demographic consequences should be taken into account such as information on labour turnover rate and contract periods. Basically, the study is limited to the overall impact of the average age structure on firm growth. Further studies should provide case analyses to capture the individual and idiosyncratic characteristics and activities of firms aging. Considering the theoretical discussion on the knowledge complementarities between older and younger employees and workers, further studies should focus on the heterogeneity or even homogeneity of workforce and their impact on firm growth. We therefore suggest that an extremely rapid change of the age effect might causes a corresponding shift in competencies (i.e. depending on younger and older workers), which might affect the firms employment growth consequently. As one of the next steps, we will link the employer-employee database to location-specific and region-specific characteristics such as the share of employees between different age groups; share of first-year students and graduates, birth rates and migration measures. To sum up, we aim to gain a deeper insight in the consequences of the demographic aging to identify predicted changes in firms' activities.

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Appendix

Table A1: Descriptive statistics (rounded values)

Variable	Obs.	Mean	Std. Dev.	Min	Max
EMP	2098	-0.0334432	0.7983919	-5	4
AGE	2098	40.50048	4.798292	19	60
AGING	2098	-2.824444	4.161982	-24.30769	19.2939
TENURE	2098	10.89466	6.230577	0	36
SIZE	2098	909.3716	2397.819	3	51669
INDUSTRY	2098	39146.44	18472.66	10101	74848
EAST	2098	0.2882713	0.4530647	0	1

Table A2: Correlation matrix

	EMP	AGE	AGING	TENURE	SIZE	INDUSTRY	EAST
EMP	1.0000						
AGE	-0.0678 (0.0019)	1.0000					
AGING	-0.0502 (0.0058)	-0.7095 (0.0000)	1.0000				
TENURE	-0.0644 (0.0032)	0.5635 (0.0000)	-0.3656(0.0000)	1.0000			
SIZE	-0.1045 (0.0000)	0.0229 (0.2942)	-0.0270 (0.2169)	-0.1062 (0.0000)	1.0000		
INDUSTRY	-0.0317 (0.1468)	-0.1837 (0.0000)	-0.1370(0.0000)	-0.1173 (0.0000)	-0.0096 (0.6609)	1.0000	
EAST	-0.0503 (0.0205)	0.0886 (0.0000)	-0.0627 (0.0041)	-0.0491 (0.0245)	-0.1307 (0.0000)	-0.0589 (0.0070)	1.0000

Table A3: Estimations for all firms (AGE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGE	-0.0160***	-0.00672***	-0.0149***
	(0.00588)	(0.00172)	(0.00523)
SIZE	-1.25e-05	-3.74e-06	-1.46e-05
	(6.89e-05)	(4.03e-06)	(9.09e-06)
INDUSTRY	-5.26e-06***	-4.80e-07	7.31e-06***
	(1.87e-06)	(5.36e-07)	(2.20e-06)
EAST	0.0913	0.0723***	0.206***
	(0.0790)	(0.0140)	(0.0684)
Constant	0.147	0.231***	0.766***
	(0.238)	(0.0753)	(0.226)
R^2	0.01	0.01	0.03
Observation	2.098	2.098	2.098

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A4: Estimations for all firms (AGE/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGE	-0.0157**	-0.00596***	-0.0169***
	(0.00707)	(0.00211)	(0.00503)
TENURE	-0.00404	-0.00181	0.00199
	(0.00912)	(0.00197)	(0.00448)
SIZE	-1.15e-05	-3.84e-06	-1.46e-05
	(5.07e-05)	(6.53e-06)	(1.31e-05)
INDUSTRY	-4.63e-06***	-6.13e-07	6.86e-06***
	(1.74e-06)	(3.98e-07)	(1.85e-06)
EAST	0.0979	0.0697***	0.208***
	(0.0752)	(0.0193)	(0.0334)
Constant	0.144	0.225***	0.844***
	(0.272)	(0.0749)	(0.203)
R^2	0.01	0.01	0.03
Observations	2.098	2.098	2.098

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A5: Estimations for small-sized firms (AGE/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGE	-0.0120	-0.0335	-0.0428**
	(0.0183)	(0.0211)	(0.0208)
TENURE	0.0161	0.0288	0.0161
	(0.0225)	(0.0328)	(0.0379)
INDUSTRY	3.33e-06	1.18e-05	2.30e-05
	(7.15e-06)	(1.02e-05)	(1.42e-05)
EAST	-0.0377	0.103	-0.900*
	(0.205)	(0.180)	(0.480)
Constant	0.0923	1.325	3.312**
	(0.737)	(0.852)	(1.501)
R^2	0.02	0.02	0.06
Observations	112	112	112

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A6: Estimations for medium-sized firms (AGE/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGE	-0.0354***	-0.00971***	0.00944
	(0.0132)	(0.00220)	(0.00927)
TENURE	0.0199	0.00354	0.0119
	(0.0139)	(0.00300)	(0.00997)
INDUSTRY	-1.82e-06	1.06e-06*	1.63e-05**
	(3.64e-06)	(5.83e-07)	(7.39e-06)
EAST	-0.0258	0.108***	-0.0773
	(0.101)	(0.0225)	(0.149)
Constant	0.711	0.276***	-0.225
	(0.486)	(0.0862)	(0.467)
R^2	0.02	0.02	0.06
Observations	673	673	673

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A7: Estimations for large-sized firms (AGE/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGE	-0.00698	-0.00147	-0.0144***
	(0.0110)	(0.00197)	(0.00373)
TENURE	-0.0128	-0.00230	-0.00289
	(0.00839)	(0.00141)	(0.00401)
INDUSTRY	-3.54e-06	-4.99e-07	4.03e-06***
	(3.36e-06)	(4.31e-07)	(1.54e-06)
EAST	0.181*	0.0174	0.141***
	(0.0952)	(0.0211)	(0.0449)
Constant	-0.247	0.0145	0.702***
	(0.483)	(0.0888)	(0.156)
R^2	0.01	0.001	0.04
Observations	1.313	1.313	1.313

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A8: Estimations for firms in industry sector (AGE/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGE	-0.00727	-0.00317	-0.00860*
	(0.0216)	(0.00245)	(0.00507)
TENURE	-0.00519	-0.00560**	-0.00956
	(0.0140)	(0.00250)	(0.00625)
SIZE	-1.46e-05	-2.83e-06**	-1.07e-05***
	(1.97e-05)	(1.16e-06)	(3.73e-06)
EAST	0.117	0.0616**	0.186**
	(0.0897)	(0.0269)	(0.0802)
Constant	-0.301	0.150*	0.773***
	(0.793)	(0.0809)	(0.155)
R^2	0.004	0.02	0.04
Observations	1.236	1.236	1.236

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A9: Estimations for firms in service sector (AGE/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGE	-0.0290***	-0.00934***	-0.0232
	(0.00814)	(0.00328)	(0.0178)
TENURE	0.00152	0.00616*	0.0347*
	(0.0142)	(0.00367)	(0.0184)
SIZE	-0.000262***	-8.93e-05**	-9.26e-05
	(9.40e-05)	(4.15e-05)	(8.00e-05)
EAST	0.168	0.00537	0.0381
	(0.122)	(0.0351)	(0.259)
Constant	0.431	0.292**	1.409**
	(0.278)	(0.130)	(0.568)
R^2	0.03	0.01	0.04
Observations	762	762	762

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A10: Estimations for firms in Eastern Germany (AGE/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGE	-0.0302**	-0.00772***	-0.0169
	(0.0137)	(0.00204)	(0.0104)
TENURE	-0.00286	0.00191	0.0134**
	(0.0131)	(0.00152)	(0.00583)
SIZE	-0.000102	-0.000122*	-0.000197**
	(0.000170)	(6.31e-05)	(9.48e-05)
INDUSTRY	-3.36e-06	-6.35e-07	5.16e-06
	(2.53e-06)	(9.44e-07)	(4.65e-06)
Constant	0.832*	0.372***	1.083**
	(0.460)	(0.0938)	(0.483)
R^2	0.03	0.02	0.03
Observations	612	612	612

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A11: Estimations for firms in Western Germany (AGE/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGE	-0.0116	-0.00337	-0.0173***
	(0.0115)	(0.00229)	(0.00643)
TENURE	-0.00158	-0.00325	0.000969
	(0.0157)	(0.00222)	(0.00651)
SIZE	-1.28e-05	-2.90e-06	-1.45e-05*
	(7.54e-05)	(2.77e-06)	(8.05e-06)
INDUSTRY	-5.16e-06*	-2.72e-07	6.87e-06***
	(2.75e-06)	(5.45e-07)	(2.31e-06)
Constant	-0.0191	0.123	0.866***
	(0.456)	(0.0839)	(0.206)
R^2	0.01	0.003	0.04
Observations	1.486	1.486	1.486

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A12: Estimations for all firms (AGING)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGING	-0.0225**	-0.00760***	-0.0109
	(0.0108)	(0.00262)	(0.00766)
SIZE	-2.32e-05	-5.50e-06	-1.63e-05
	(5.27e-05)	(4.86e-06)	(1.30e-05)
INDUSTRY	-3.47e-06	6.52e-07*	8.75e-06***
	(2.58e-06)	(3.52e-07)	(1.42e-06)
EAST	0.0807	0.0645***	0.138*
	(0.0694)	(0.0106)	(0.0768)
Constant	-0.618***	-0.112***	0.132**
	(0.0965)	(0.0196)	(0.0550)
R^2	0.01	0.01	0.03
Observations	2.098	2.098	2.098

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A13: Estimations for all firms (AGING/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGING	-0.0277***	-0.0138***	-0.0117*
	(0.00827)	(0.00208)	(0.00654)
TENURE	-0.0135**	-0.00805***	-0.00593
	(0.00587)	(0.00170)	(0.00628)
SIZE	-2.01e-05	-4.38e-06	-1.62e-05*
	(3.26e-05)	(3.67e-06)	(9.85e-06)
INDUSTRY	-3.76e-06*	-5.66e-09	8.77e-06***
	(1.93e-06)	(3.46e-07)	(1.73e-06)
EAST	0.0561	0.0511**	0.128**
	(0.0875)	(0.0220)	(0.0566)
Constant	-0.477***	-0.0125	0.179**
	(0.127)	(0.0280)	(0.0870)
R^2	0.02	0.01	0.03
Observations	2.098	2.098	2.098

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A14: Estimations for small-sized firms (AGING/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGING	0.00121	0.00183	0.00545
	(0.0140)	(0.0171)	(0.0397)
TENURE	0.00877	0.0118	0.0108
	(0.0146)	(0.0236)	(0.0302)
INDUSTRY	2.91e-06	1.25e-05	2.76e-05**
	(6.83e-06)	(9.99e-06)	(1.13e-05)
EAST	-0.0344	-0.0117	-0.691**
	(0.167)	(0.248)	(0.328)
Constant	-0.303	0.0638	1.403***
	(0.525)	(0.266)	(0.511)
R^2	0.01	0.05	0.19
Observations	112	112	112

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A15: Estimations for medium-sized firms (AGING/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGING	-0.0282**	-0.0115**	-0.0421***
	(0.0128)	(0.00503)	(0.00990)
TENURE	-0.0137	-0.00430	0.00936
	(0.00919)	(0.00402)	(0.00844)
INDUSTRY	-1.11e-06	1.28e-06	1.66e-05***
	(2.77e-06)	(9.41e-07)	(5.43e-06)
EAST	-0.108	0.118***	-0.0292
	(0.0969)	(0.0290)	(0.107)
Constant	-0.401**	-0.0855*	0.0305
	(0.159)	(0.0448)	(0.171)
R^2	0.01	0.01	0.09
Observations	673	673	673

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A16: Estimations for large-sized firms (AGING/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGING	-0.0239	-0.0151***	-0.00785
	(0.0147)	(0.00285)	(0.00626)
TENURE	-0.0165	-0.00734***	-0.0105***
	(0.0107)	(0.00193)	(0.00394)
INDUSTRY	-4.16e-06*	-2.22e-07	4.28e-06***
	(2.45e-06)	(6.10e-07)	(1.37e-06)
EAST	0.143*	0.0146	0.121***
	(0.0841)	(0.0259)	(0.0386)
Constant	-0.532***	-0.0384	0.168**
	(0.123)	(0.0365)	(0.0652)
R^2	0.01	0.01	0.03
Observations	1.313	1.313	1.313

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A17: Estimations for firms in industry sector (AGING/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGING	-0.0425***	-0.0179***	-0.0257***
	(0.00788)	(0.00226)	(0.00888)
TENURE	-0.0170**	-0.0119***	-0.0231***
	(0.00795)	(0.00193)	(0.00700)
SIZE	-2.29e-05	-2.31e-06	-6.22e-06
	(2.52e-05)	(2.75e-06)	(4.53e-06)
EAST	0.0626	0.0504**	0.191***
	(0.0846)	(0.0225)	(0.0579)
Constant	-0.582***	0.0262	0.483***
	(0.0909)	(0.0239)	(0.0520)
R^2	0.03	0.03	0.05
Observations	1.236	1.236	1.236

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A18: Estimations for firms in service sector (AGING/TENURE)

VARIABLES	(EMP) q10	(EMP2) q50	(EMP) q90
AGING	0.0156	-0.00405	-0.00373
	(0.0222)	(0.00460)	(0.0195)
TENURE	-0.00861	-0.000319	0.0249*
	(0.0148)	(0.00402)	(0.0145)
SIZE	-0.000257**	-6.65e-05**	-8.98e-05*
	(0.000108)	(3.36e-05)	(4.67e-05)
EAST	0.148	0.00329	-0.0306
	(0.182)	(0.0294)	(0.219)
Constant	-0.540***	-0.0292	0.586***
	(0.185)	(0.0416)	(0.133)
R^2	0.02	0.01	0.03
Observations	762	762	762

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A19: Estimations for firms in Eastern Germany (AGING/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGING	-0.0113	-0.00886**	-0.0168**
	(0.0112)	(0.00414)	(0.00742)
TENURE	-0.0236**	-0.00436	0.00498
	(0.0109)	(0.00343)	(0.00696)
SIZE	-0.000160	-0.000108**	-0.000168*
	(0.000236)	(4.91e-05)	(0.000101)
INDUSTRY	-3.93e-06	-5.43e-07	9.88e-06***
	(4.28e-06)	(1.31e-06)	(3.36e-06)
Constant	-0.115	0.0844	0.213
	(0.246)	(0.0711)	(0.152)
R^2	0.02	0.02	0.03
Observations	612	612	612

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A20: Estimations for firms in Western Germany (AGING/TENURE)

VARIABLES	(EMP) q10	(EMP) q50	(EMP) q90
AGING	-0.0288*	-0.0157***	-0.0112
	(0.0164)	(0.00218)	(0.00964)
TENURE	-0.0140	-0.00940***	-0.0129*
	(0.00968)	(0.00255)	(0.00722)
SIZE	-2.04e-05	-4.49e-06	-1.56e-05*
	(3.49e-05)	(2.86e-06)	(8.62e-06)
INDUSTRY	-3.84e-06*	1.73e-07	9.01e-06***
	(2.19e-06)	(4.60e-07)	(3.21e-06)
Constant	-0.469***	-0.00824	0.213
	(0.100)	(0.0369)	(0.146)
R^2			
Observations	1.486	1.486	1.486

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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