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**Working Paper**

## Age, occupations, and opportunities for older workers in Germany

Thünen-Series of Applied Economic Theory - Working Paper, No. 86

**Provided in Cooperation with:**

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*Suggested Citation:* Henseke, Golo; Tivig, Thusnelda (2008) : Age, occupations, and opportunities for older workers in Germany, Thünen-Series of Applied Economic Theory - Working Paper, No. 86, Universität Rostock, Institut für Volkswirtschaftslehre, Rostock

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**Thünen-Series of Applied Economic Theory**  
**Thünen-Reihe Angewandter Volkswirtschaftstheorie**

Working Paper No. 86

**Age, Occupations, and Opportunities for Older Workers in  
Germany**

by

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2008

# Age, Occupations, and Opportunities for Older Workers in Germany

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September 8, 2008

## Abstract

Improvement of the labor market situation for the elderly is a declared target in the EU. In this study we derive a model of occupational age structure, its determinants and their impact on employment and re-employment opportunities for older workers. The empirical analysis is based on data from German microcensus and conducted on the level of occupations. We show, firstly, that the compensation and the compensation structure affect employment and re-employment of workers aged 50 and above, though detailed impact differs by gender. And, secondly, working conditions and arrangements are found to exert a clear-cut influence on employment and re-employment at older ages. Our findings suggest that future labor market policies should focus on working conditions and arrangements in order to improve employment opportunities for older workers.

Keywords: labor force aging, employment, re-employment, gender  
JEL: J21, J14, J16

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# Age, Occupations, and Opportunities for Older Workers in Germany

*Golo Henseke and Thusnelda Tivig*

## **1. Introduction**

Employment rates of older persons (50-64 years) in Germany have increased substantially, from 49 percent in 1996 to 59 percent in 2006 (Eurostat). However, not all socio-demographic groups profited equally from positive developments on the labor market. The most distinct differences are found along qualification and gender. Around three quarter of academics but not even half of low-qualified persons aged 50 to 64 years worked in 2006 and the discrepancy is even more pronounced in age group 55-64. Furthermore, employment rates of women, albeit significantly rising, are still below men's level and recent gains are almost exclusively the result of more minijobs<sup>1</sup> and expanding part-time employment (Cornelißen 2005). At the same time, unemployment periods for the elderly are longer (Frosch 2007a), such that incidence of long-term unemployment is much higher at the elderly as compared to younger persons. As a consequence, unemployment at higher ages has become a direct path to early retirement for a substantial minority, despite significantly reduced pension benefits compared to levels attainable at the legal retirement age of 65 years (see Chan and Stevens 2001 for a general comprehensive study on this topic and Brussig 2007 for empirical evidence in Germany). Older working-age persons thus seem to split up into two groups. On the one hand, a growing number is able to benefit from the recent increase in employment opportunities for older workers. On the other hand, an also increasing number find themselves in the precarious situation of having to choose between "official" long-term unemployment, "unofficial" hidden unemployment and early retirement.

Employment and re-employment possibilities for older workers will undergo important changes in the next decades caused by the ongoing demographic development. On the one hand, will the bulk of Baby-boomers reach age 50 and above while on the other hand the number and share of younger workers is going to decrease. On an individual level, the Baby-boomers who enjoy increasing longevity will have to stay longer in the labor market to ensure themselves a certain standard of living during retirement - much

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<sup>1</sup> Minijobs are a special legal construct. The term relates to jobs with a net average wage or salary of EUR 400 per month and reduced social benefits, according to the German law, see <http://www.minijob-zentrale.de/> for details

in contrast to their parents. They benefited from generous pension programs, being allowed and even encouraged to leave the labor market at relatively young ages without incurring financial drawbacks. On the market level, the decreasing number of younger workers will render the labor force of the elderly indispensable. Demographic effects on labor availability are thus expected to increase both the supply of and the demand for workers aged 50+. Fuchs and Dörfler (2003), for example, estimate that the proportion of age group 50+ in the labor force will have increased to over 30 percent by 2020. However, employment and re-employment of older workers vary heavily along socio-demographic characteristics on the level of individuals (Frosch 2007a), firms (Bellmann et al. 2006), as well as on the level of occupations and industries (Henseke et al. 2007). Our research interest is in whether we can expect improving labor-market conditions in terms of growing employment, to also accommodate older workers' preferences as revealed in current employment arrangements. Additionally, we are interested in whether the above mentioned split into two groups of the elderly, those with increased chances and those left behind, occurs along occupational lines.

Henseke et al. (2007) analyze the age-structure and aging processes in German industries and selected occupations. Their results show that changes in the age-structure of the workforce follow distinct patterns by subgroups. However, they have not analyzed the determinants of the age-structures found within industries or occupations. Here we try to narrow this gap by identifying factors influencing occupational age-structures. More precisely, we focus on the occupation-specific employment share of workers aged 50 and above. Together with determinants of re-employment, we will be able to derive conclusions about the labor market opportunities of older workers. We thus ask which characteristics of jobs promote (i) employment and (ii) re-employment of workers aged 50+ in Germany. Our central hypothesis is that from macro-perspective labor market opportunities of older workers and hence age-structures of occupations depend strongly on occupational compensation profiles, educational and skill requirements, and working conditions in a broad sense. Boockmann and Zwick (2004) and Bellmann et al. (2006) undertake a similar endeavor for employment and the latter also for re-employment chances of older workers on the firm level. Their study includes employees subject to social security contributions, only, and does not differentiate for gender. Additionally, a major drawback of their results is reverse causality. Here we take a broader perspective and manage to avoid reverse causality to a certain extent.

The remainder of the paper is organized as follows. In Section 2 we briefly survey previous literature dealing with aging in the context of labor markets. Drawing on it, we develop in Section 3 a theoretical framework for explaining occupational age-structures that will serve as the basis for our empirical specification. The dataset is presented in Section 4, descriptive statistics and regression results in Section 5. In Section 6 we summarize, discuss the main findings and give an outlook to future research.

## **2. Literature Review and Recent Evidence**

The starting point for the present study is projected population and labor force aging in Germany. Currently (2006), the proportion of working-age population (20-64 years) is about 60 percent of total population. The ratio will remain almost constant until 2020, but is declining afterwards to approximately 50 % in 2050. Workforce aging is caused by shifts in the age-composition of total population. Projected figures reflect the dominant impact of the baby-boomer cohorts on the age-structure of the workforce until around 2020. The share of older persons (50-64) within the working-age population amounted to 30 percent in 2006 and is expected to increase to 40 percent by 2020 followed by a slight drop to 37 percent until 2050. During the same period, the proportion of the higher age group, 55-64, in working-age population, which was 19 percent in 2006, is projected to rise to roughly 26 percent in 2020 and marginally decline to around 25% until 2050 (Destatis 2006, scenario 3-W1). Demographic change and its impact on the labor force are common to all OECD countries, although timing and magnitudes differ (Auer and Fortuny 2000, Tivig et al. 2008). It thus underlines the need for a better understanding of labor market preferences and opportunities of older workers.

Workers vary inter-individually (cross-section) and intra-individually (over time) by their skills and abilities. Consequently, their job matches will differ in both dimensions. Regarding the latter, there is ample evidence that cognitive abilities like memory, reasoning and information-processing speed change with age (see Skirbekk 2003, for an overview and, more recently, Bopp and Verhaegen 2005). General preferences, the valuation of leisure and consumption, spatial and social mobility as well as market-valuation of one's vintage of human capital are changing with age, too (e.g. Dixon 2003). It thus seems natural to suppose that jobs and occupations differ by age-structure requirements as they differ by skill requirements. Henseke et al. (2007) present

descriptive evidence on this matter, showing clear cross-sectional differences in the age structure between occupations and distinct patterns of aging within occupations over time. Scientists as a group, for example, were younger and remained younger during the period of observation, 1980-2000, but aged faster than total workforce while engineers remained older and aged slower than average. Interestingly, some occupation like, for instance, construction trades, even grew younger over time. Similar results were derived for industries.

Studies on the determinants of job choice and occupational age structure are sparse. Boskin (1974) reports for US data that individuals choose occupations which offer the highest present value of potential future earnings, lowest relative training costs and lowest expected costs through foregone earnings from unemployment. This is in accordance with implications from human capital theory. Job preferences and employer selection play an important role in inter-gender and inter-racial variations of job choice, too (Gupta 1993). Constant and Zimmermann (2003) present similar evidence for the German labor market. Employment and re-employment patterns of older and younger workers differ significantly. Frosch (2007a) finds clear evidence of age-dependent relative re-employment risks in Germany. Persons aged 50 to 54 have a considerable lower chance of re-employment than younger persons and it further declines for age group 55 to 59 and 60 to 65. In addition, there are significant variations in re-employment rates between industries of former employment, educational level, nationality, income groups, unemployment experience, time and place. Another strand of the literature considers observed labor market outcomes of older workers as partly resulting from rigidities. Theoretically, shifts from employment to retirement should be gradual; from full-time over part-time to retirement in accordance with changes in preferences concerning work and leisure. However, the existence of rigidities may render gradual reductions of the working time on a given job impossible. As a consequence, employees would choose to change the job or retire, both decisions being likely to lead to skill loss, low re-training intensity and hence reduced earnings (potential) (see Hurd 1993 and for more evidence Hurd and McGarry 1993).

Recent empirical studies on determinants of the workforce's age structure in Germany have concentrated on the firm level (Bockmann and Zwick 2004, Bellman et al. 2006). In addition to general variations between the Eastern and Western part of Germany,

significant differences in employment patterns of older workers across companies are found. In the Western part of the country (old Länder) companies with a high share of older workers tend to be older (exist since longer) and bigger than the average company, operating mainly on local markets, paying above average wages, showing a pronounced hierarchy, have a workers' council and widely spread part-time arrangements. In the East (new Länder), pronounced hierarchies, workers' council, firm size, and part-time arrangements promote employment of older workers, too. Additionally, export orientation, the share of high skilled employees, investments (albeit not in ICT) positively influence employment of workers 50+. Training activities<sup>2</sup> and the share of minijobs within a firm correlate, to the contrary, negatively with the presence of older workers all over Germany (Bellmann et al. 2006). As hypothesized from theory, recruitment and employment decisions depend on the same determinants; though the impact may differ. Recruitment of older workers is positively linked to general labor turnover rates, mean age of workforce, and size. Surprisingly, the authors find that product innovation and organizational change are positively correlated with recruitment of older workers (the latter link being significant in the West, only). Though the study is very comprehensive, some points, like the role of self-employment for older workers and gender differences in factors influencing employment and re-employment, remain unanswered. Additionally, findings and their explanatory power suffer from reverse causality due to data limitations such that merely a descriptive analysis of results seems appropriate.

The determinants of job-specific age distributions have not been analyzed with German data yet, but there are a couple of studies for the US and UK. Hutchens (1988) finds evidence for restricted employment possibilities of elderly workers in the US, in general, and even less chances for unemployed persons aged 50+. Both phenomena are caused by age segregation along occupations and a subsequent concentration of older workers on comparably few jobs. He points towards job-specific fixed-costs of hiring and training expenditures as major reasons for the observed variation. Companies possibly employ formerly hired older workers, but won't recruit new older workers on the same positions (Hutchens 1988, 2006). Further support for the fixed-costs hypotheses is provided by Scott et al. (1995) and Garen et al. (1996). They present evidence on the effect of job-related health insurance and defined pension plans.

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<sup>2</sup>Training in the sense of traineeships/apprenticeships.



Specifically, health insurance results in reduced likelihood of hiring older workers in the US, while defined pension plans, as a further fixed-cost component, only have a negative impact on recruitment of older workers into entry-level positions. Disney et al. (2001) derive similar findings for the labor market in the UK. Like in the US, employment and re-employment possibilities decline with age and the set of potential occupations shrinks. Varying training requirements by job explain the bulk of differences, especially for the male workforce. The most comprehensive study in this context is conducted by Hirsch et al. (2000). Based on Hutchens' previous work, they develop an extended analytical framework and apply it to US data, separately by gender. Three of the dependent variables are of special interest for us: the share of workers aged 50 and above per occupation, the share of recently hired workers aged 50+ and the proportion of recently hired to already employed older workers. The latter measure is an indicator of the openness of occupations towards older new employees as compared to the existing stock. The authors argue that the age structure of occupations mainly depends on compensation structures, skill requirements, and working conditions. Compensation structures encompass the occupational wage profile over the life cycle and across ages, and fringe benefits like, for instance, pension plans and health insurances. Skill requirements subsume training intensities, the average educational level and necessary abilities. Working conditions include information on labor contracts' designs and physical requirements. Additionally, industry-specific rents, the degree of unionization and the company's size are taken into account. Estimation results extend previous findings and support most of their hypotheses. Furthermore, their study reveals significant gender differences in job choice, access and impact of single determinants. This is the framework we adopt for Germany and outline in more detail in the next Section.

### **3. Analytical Framework**

Job choice is an individual decision of both, heterogeneous workers and employers. Workers maximize their net present value of expected utility while firms maximize present value of future profit streams. Labor supply and demand decisions are based on criteria like preferences, the value of time in alternative activities, the wage rate, the structures of company, private and governmental pension schemes and entitlements, health, product demand, technology, productivity, costs and valuation of work place amenities, tax rules and government regulations of the workplace. On the firms' side,

employment decisions are made jointly with decisions about the wage profile, work organization, and technology. The observable labor market outcomes represent both supply and demand factors, and neither is mapped out (Hirsch et al. 2000). There are different theoretical approaches trying to explain job choices and recruitment decisions by recurring to the factors just enumerated.

### **3.1 *Earnings and Age-Earning Profiles***

From theory and previous literature we are able to identify several relevant determinants of occupational age structures. First, we conjecture that *earnings* and *age-earning profiles* will have a major impact. Wage growth can result from past human capital investments as well as from delayed payments. In the latter case employers and employees enter implicit contracts in which wage-increases with seniority. Such contracts serve as a motivational tool to prevent workers from shirking and from leaving the firm. Initial wage levels are below marginal product; with growing tenure they eventually reach levels above productivity (Lazear 1979). On the firm's side, delayed payment contracts are seen as a useful tool to increase loyalty and productivity among workers. As a consequence, employees tend to remain longer in the workforce than under a regime of competitive wage. Early retirement measures may then be seen as a method to restore optimal outcomes, as they provide incentives to terminate employment (Lazear 1986). Thus, steep wage profiles are likely to be associated with the provision of company pension schemes that encourage workers to leave the company (Hirsch et al. 2000). However, employees will enter such contracts only if the risk of (i) opportunistic firm behavior<sup>3</sup> and (ii) bankruptcy is low (Hutchens 1989). Accordingly, if occupational wage growth partly results from delayed payment, we expect a reduced likelihood in recruitment of older workers. Laid-off older workers will have a higher reservation wage rates (and higher unemployment benefits) than under a regime of competitive wages. Since new jobs will start again at wages below productivity, recruitment possibilities will be limited. Additionally, wage profiles must be steeper for older workers and the point at which wages exceed productivity is thus reached faster (Bellmann, Brüssig 2007). In a similar vein, the provision of private defined pension plans is conjectured to have a negative impact on the recruitment of older workers (Disney et al. 2001). The link between employment of older workers and

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<sup>3</sup>Companies have an incentive to lay-off workers as soon as wages exceed marginal productivity.

delayed payment components is hence ambiguous: loyalty to job increases but early retirement depresses labor market participation of the elderly.

### 3.2 *Skill Requirements and Education*

Second, besides earnings, *skill requirements* and *education* are assumed to influence employment and re-employment decisions. Occupations are associated with certain skill requirements. Every worker is equipped with a particular amount of human capital, which is itself composed of general traits and more specific components on firm, job or industry level. Older workers have acquired a substantial amount of specific knowledge during their career, for instance through learning-by-doing, learning-on-the-job and past investments. The importance and demand of job-specific knowledge is generally proxied by tenure. We conjecture that employment of older workers and average tenure are positively linked. Job change is generally costly since it implies depreciation of specific skills in at least one dimension<sup>4</sup>. Older unemployed persons will thus either try to re-enter the same occupation as before job loss, in which case they can transfer most of their skills, or change to occupations with lower training requirements and low average tenure, since potential pay-off periods of *training* investments is short (Hirsch et al. 2000). This holds for general training financed by each worker through foregone wages in training periods and paid back by increases in marginal labor productivity and higher wages later on. Equal costs, but a shorter pay-off horizon makes training investments less attractive for older workers, as compared to young ones. Similar reasoning applies to firm-specific training (Hutchens 1989). Firms will bear costs since they reap most of the benefits. Firm-specific training can be seen as fixed costs incurred for every person newly hired. Again, the younger a new employee is, the longer the potential period of amortization (Beckmann 2004). We therefore expect reduced recruitment of elderly into occupations with high training intensity and high average tenure.

The general component of human capital is proxied by education. A high occupational level of *university education* is expected to be positively correlated with employment of older workers. First of all, it is connected to a higher level of absorptive capacity and hence flexibility concerning technical and organizational changes. Secondly, higher education and professional training are strongly related. Finally, formal education is

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<sup>4</sup> Some jobs, managers and scientists, for instance, are probably an exception to this assertion.

positively connected to the underlying level of ability (Blundell et al. 1999). The effect on re-employment is indeterminate, since on the one hand general knowledge should ease recruitment, but on the other hand job-changes seriously threaten the acquisition of specific skills. A high occupational incidence of *lower education*, on the contrary, facilitates job access and is expected to have a positive impact on staff turnover in general and on re-employment of older workers, in particular. A further issue is the vintage of human capital. Under conditions of (fast) technological change, human capital may become obsolete, the absorptive capacity reduced and the adaptation of new technologies and organizational innovations slow down. We proxy such barriers by *pc-usage* and expect a negative correlation to employment as well as to recruitment of older workers.

### **3.3 Working Conditions and Further Influences**

Third, with age, preferences towards leisure and work are changing such that a mismatch between workers and jobs may occur over time. Since working conditions like, for example, *working hours*, *overtime*, *shift work* and *stress* are often fixed for a certain job, employees can either change job or retire early (Hurd 1993). Consequently, we expect an effect of working conditions on employment but even more so on recruitment in the sense that with increasing age a movement towards less demanding and more flexible working conditions takes place.

Forth, there are several other factors that presumably effect the age composition of occupations. The share of employees in *East Germany* per occupation is, for example, relevant to the extent that employment patterns in East and West Germany still differ. *Foreign* employees are, on average, younger than Germans. Additionally, age profiles in employment exhibit clear *industry*-specific patterns (Henseke et al. 2007). Findings by Frosch (2007a) indicate that the same holds true for re-employment. *Firm size* is expected to exhibit a positive impact on employment of workers aged 50+ because of better possibilities to allocate older workers to most productive tasks within a big company (Bellmann et al. 2006). Furthermore, we need to include a measure that controls for the age-structure of younger worker in order to secure that possible findings are not results of shifts in the lower end of the age distribution.

### 3.4 Empirical Model

Based on the outlined framework we derive a reduced form model of employment and re-employment of older workers subject to occupational characteristics. We concentrate on two dependent variables suggested by Hirsch et al. (2000): The proportion of workers aged 50 years and above per occupation ( $Share50+_{ij}$ ), and the share of recently hired (recruited within the last three years) workers 50 and older to all hires ( $New50+_{ij}$ ). The first measure represents the age structure of employment, while the second one offers insight into the age composition of recent hires. The implied estimation models can be formalized as follows.

$$Share50+_{ij} = Comp_{ij}\beta + EduSkill_{ij}\gamma + Cond_{ij}\delta + Controls_{ij}\theta + \varepsilon_{ij} \quad (1)$$

$$New50+_{ij} = Comp_{ij}\beta + EduSkill_{ij}\gamma + Cond_{ij}\delta + Controls_{ij}\theta + \varepsilon_{ij} \quad (2)$$

$$New50+_{ij} = Comp_{ij}\beta + EduSkill_{ij}\gamma + Cond_{ij}\delta + Controls_{ij}\theta + Share50+_{ij} \rho + \varepsilon_{ij} \quad (2a)$$

with  $i$  indicating occupation and  $j$  gender. Job characteristics are captured by vectors of variables, which are grouped into compensation structure, education and skill requirements, working conditions and controls according to our models. To learn more about opportunities of older workers and job accessibility we follow Heywood et al. (1999), modify model (2) and include the employment share of workers 50+. Thus, the re-specified model (2a) conditions the flow ( $New50+_{ij}$ ) on the existing stock ( $Share50+_{ij}$ ) of older workers. The dataset and the applied empirical methodology are described in the next Section. Controls

## 4. Dataset and Methodology

Our dataset consists of four waves of the *scientific use file* of the German microcensus from 2001 to 2004. The microcensus is an annual survey of one percent of Germany's population. We restricted our analysis to the Labor Force Survey (LFS), which is conducted as part of the microcensus by on average 0.45 percent of German population. The reason is that many work-related pieces of information and characteristics are only subject of the LFS-subsample. We have firstly harmonized the different waves, following suggestions by Lengerer et al. (2007) and have then matched and aggregated the data on occupational level for men and women, separately. Hence, we allow the

characteristics of occupations to differ by gender. The coding of educational variables into the International Standard Classification of Educations 1997 has been done according to Schroedter et al. (2006).

#### **4.1 *Dependent Variables***

In the previous section we derived two dependent variables: (i) the occupation-specific share of workers aged 50 and above differentiated by gender ( $Share50_{+ij}$ ) and (ii) the share of recent older hires in all new recruitments ( $New50_{+ij}$ ), again distinguished by occupation and gender. As recent hires, we define all workers with less than 3 years of tenure.

#### **4.2 *Independent Variables***

We include the following regressors into our analysis.  $Comp_{ij}$  is a vector of the log of monthly average real income, the ratio of average income at age 50+ to income at ages below 50, and the provision of company pensions schemes with or without own contributions. The income measure of in the German microcensus has however few drawbacks. First, income subsumes besides earnings also transfers from further sources like insurances, rental and/or social security benefits. And second, it is ordinal scaled on the individual level. Nevertheless, we believe that it contains enough information for our study.  $EduSkill_{ij}$  measures skill and knowledge demands and includes the percentage (%) of higher education, the % of lower education, the % of professional training, % of pc-usage and average tenure in each occupation. As measure of working conditions ( $Cond_{ij}$ ) we include the % of overtime work, the % of shift work, the % of temporary workers, the % of minijobs and part-time employment, the % of out-work, the % of flexible working hours and finally the % of self-employed, as well as the incidence of occupational sickness and accidents at work. As control variables ( $Controls_{ij}$ ) we considered the % of employees in East Germany, the % in manufacturing, the % of foreign workers and the % of workers in firms with 20 employees and above. Additionally in model (1), we include *the average age of workers* aged 50 and below per occupation to control for changes at the lower end of the age distribution.

Certain variables like computer use, accidents at work, occupational sickness, flexible working hours, and company pension schemes are only periodically part of the survey.<sup>5</sup> We assumed that these variables were constant during the period of investigation. Because of low frequencies we calculated common accidents and sickness rates for both genders. All other characteristics are averaged over the four years.

### **4.3 Method**

The empirical analysis follows a two-step procedure. First we descriptively compare variable values among younger (<50) and older workers and identify and discuss differences between the age groups. Statistically significance of observed differences is checked by common t-tests. In the next step we run a regression of our models (1), (2) and (2a). The major problem of previous work has been possible endogeneity of supposed to be independent variables. The significance of results suffers and the outcome is rather descriptive. For example, the incidence of part-time in an occupation may promote employment of older workers; but older workers may simply work more often part-time and thus raising the incidence. In order to avoid such problems, independent variables are defined as job-specific averages and proportions of worker *younger than 50 years* in our study. In other words, observed labor force dynamics of older workers are explained by job characteristics that depend on structures and composition of persons younger than 50. Our estimation method is weighted least squares as suggested by Hirsch et al. (2000). As weights we use gender-specific numbers of persons per occupation. Hence more common occupations gain higher importance on regression outcomes. The method implies that each job-specific observation is treated as a representation of an average individual on that job. Besides single coefficients, we are testing overall significance for groups of variables via Wald-tests.

## **5. Results**

Our estimations reveal a strong influence of working conditions on the labor force dynamics of older workers. First support is already provided by comparison of descriptive statistics among younger and older workers.

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<sup>5</sup> Pc-usage in 2004, accidents at work and occupational sickness in 2003, company pension schemes in 2001, flexible working hours in 2004 and 2001.

### 5.1. Descriptive Statistics

A first glance at the data already gives some impression of the differences between male and female as well as younger and older workers. All variables and weighted descriptive statistics by gender and age can be found in Tables 1 (males) and 2 (females) below. With the exception of the shaded lines containing variables that are either not calculated by age group or logically referring to both age groups, all other values are displayed separately for workers below age 50 (left hand) and aged 50 and above (right hand). Overall, we have 323 observations for males and 295 for females.

**Table 1: Descriptive Statistics on Male Age Structure and Explanatory Variables**

Variable	Workers <50				Workers ≥50			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Share50+	23.6	8.9	0.0	60.0	23.6	8.9	0.0	60.0
New50+	12.7	6.8	0.0	65.5	12.7	6.8	0.0	65.5
Avr. income	1598.9	577.4	186.7	4235.4	1958.4	791.9	139.3	7433.7
Income50+/income<50	1.2	0.2	0.6	6.9	1.2	0.2	0.6	6.9
% pension scheme (with contribution)	9.2	6.6	0.0	60.0	13.6	9.9	0.0	100.0
% pension scheme (without contribution)	10.7	7.3	0.0	50.0	17.4	10.4	0.0	100.0
% training	11.0	7.1	0.0	60.0	7.0	5.9	0.0	50.0
% higher education	27.4	25.9	0.0	98.5	30.5	24.0	0.0	100.0
% lower education	13.6	10.1	0.0	55.7	11.4	9.7	0.0	100.0
% pc usage	57.9	32.5	0.0	100.0	54.5	32.7	0.0	100.0
Avr. tenure	8.5	2.3	1.6	19.2	19.4	4.5	3.0	32.5
% work overtime	8.5	2.6	0.0	40.0	9.0	2.9	0.0	30.8
% shift work	14.7	17.3	0.0	100.0	11.8	15.0	0.0	77.6
% part-time	5.2	7.8	0.0	71.4	7.0	7.2	0.0	100.0
% minijobs	3.2	5.0	0.0	48.0	4.3	5.0	0.0	100.0
% temporary employed	14.5	12.2	0.0	99.8	3.6	3.7	0.0	60.0
% self-employed	10.7	16.9	0.0	100.0	16.9	22.3	0.0	100.0
% outwork	3.3	5.8	0.0	57.1	5.2	7.6	0.0	62.3
% flexible working hours	7.1	5.1	0.0	38.1	7.0	5.4	0.0	50.0
% accident at work	0.3	0.6	0.0	14.3	0.4	0.8	0.0	10.0
% occupational illness	1.0	0.8	0.0	10.0	0.5	0.6	0.0	11.1
% employed in east	19.1	8.5	0.0	58.6	17.8	8.2	0.0	61.3
% employed in firm20+	63.6	22.3	0.0	100.0	62.8	23.1	0.0	100.0
% foreigners	7.0	6.2	0.0	50.0	5.6	5.8	0.0	40.0
% manufacturing	44.1	35.9	0.0	99.2	44.2	34.8	0.0	100.0
Avr. Age <50	37.0	3.7	20.6	54.9	37.0	3.7	20.6	54.9

Source: microcensus 2004-2001, own calculations



### *5.1.1 Results for males*

Our dependent variables are highly volatile for the male workforce. Almost one quarter of male employees and around 13 percent of recent hires are aged 50 and above. The range of values is large over occupations and spans from 0 to 60 percent for employment and 0 to 66 percent for recruitment. Average income is significantly higher among older workers. The comparison of pension schemes reveals clear age differences as well. About 20 percent of younger workers have access to and use company pension plans, while the same figure is about 10 percentage points higher for older workers. Furthermore, we observe significantly lower training intensities and slightly reduced computer use for the age group 50+, while average education is higher. As expected, tenure is much higher among older workers, too, the difference between groups amount to roughly 10 years. Most remarkable are, however, the differences in working conditions. Self-employment differs by 6 percentage points, being higher for the older. The proportion of part-time and minijobs is, taken together, 3 percentage points higher for employed men aged 50+. Temporary employment is definitely a domain of younger workers: 14.5 percent of those under 50 years are temporarily employed as compared to only 3.6 percent of workers aged 50+. Finally, the incidence of shift work is lower in the older age group, and the one of outwork higher. The remaining variables vary little with age. All reported differences are significant at least at the 5 percent level.

### *5.1.2 Results for females*

Table 2 reports statistics for women. The average share of older women in the (female part of the) workforce is around 22 percent and 12 percent among the recently hired. The range is rather wide, it spans from 0 to 52 percent, and even from 0 to 100 percent in recruitment. Average income of the older is 13 % higher than for women in general and spreads widely. Some 17 % of women under 50 years and 24 % of those aged 50 plus participate in company pension plans. Training, average education, pc use and tenure vary with age group. Whereas in the first three respects women under 50 clearly perform better, average tenure is more than double as high for the older as it is for the younger. The big differences between younger and older female workers concern again, working conditions. According to our dataset, some 50 percent of women under age 50 and 58 percent of those 50 and above work either part-time or are employed in minijobs. The incidence of work overtime and especially temporary work is (much) higher for the younger, whereas the opposite is true for self-employment and flexible

working hours. Occupational illness is lower among the older (probably a selection effect). All other variables do not show pronounced age effects.

### 5.1.3 Comparison of results for males and females

The general picture for males and females in the workforce is similar; yet, in detail they show some important differences. Young and old are roughly equally represented in the respective subgroup of the workforce but the span is wider for women, especially for the older ones. Income of women is on average much lower than for men and it grows less pronounced over age. A major explanation for the observed income differences are variations in the proportion of minijobs and part-time employment which is 5-6 times higher for women than for men. Another explanation resides in gender-specific variations of education. In the age group below 50, variations are still minor, though the share of women with low educational level is significantly greater. Among the age group 50+ however, women have a clearly lower level of education on average. Firstly, the share of higher education is reduced and secondly the percentage of lower education is raised as compared to men. The situation is thus exactly opposite for men and women: education is lower for younger men and older women as compared to old men and younger women, respectively. And finally, income differences may result from the low incidence of women in manufacturing, too. Most interestingly, pc use is clearly higher for women than for man - at all ages. Gender differences with respect to the share of workers with access to pension schemes, tenure and training are not pronounced for the younger but existent for the older age group in two respects: older women participate much less in company pension schemes and have less tenure than older men. Reported differences between gender and age groups are, once again, at least significant at the 5 percent level.

**Table 2: Descriptive Statistics on Female Age Structure and Explanatory Variables**

Variable	Workers <50				Workers ≥50			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Share50+	21.5	7.6	0.0	52.3	21.5	7.6	0.0	52.3
New50+	12.0	7.1	0.0	100.0	12.0	7.1	0.0	100.0
Avr. Income	982.3	337.5	110.8	2943.6	1109.8	427.2	0.0	3941.8
Income50+/income<50	1.1	0.1	0.0	4.4	1.1	0.1	0.0	4.4
% pension scheme (with contribution)	8.3	6.9	0.0	100.0	11.4	10.1	0.0	66.7
% pension scheme (without contribution)	9.0	7.2	0.0	100.0	12.7	10.2	0.0	100.0
% training	11.6	7.9	0.0	41.2	7.7	7.2	0.0	50.0

% higher education	23.4	24.2	0.0	97.1	20.9	24.0	0.0	100.0
% lower education	14.5	12.1	0.0	63.6	18.1	14.9	0.0	100.0
% pc usage	62.5	34.8	0.0	100.0	57.4	35.8	0.0	100.0
Avr. tenure	7.6	2.1	2.1	18.0	15.9	4.0	2.0	35.0
% work overtime	10.2	2.9	0.0	23.5	7.7	3.7	0.0	100.0
% shift work	11.5	16.3	0.0	77.8	9.3	14.7	0.0	100.0
% part-time	37.7	17.1	0.0	89.9	44.4	18.1	0.0	92.1
% minijobs	12.4	11.9	0.0	65.2	13.7	11.9	0.0	65.8
% temporary employed	14.4	8.8	0.0	96.2	4.1	5.9	0.0	100.0
% self-employed	5.5	12.5	0.0	97.0	9.3	18.0	0.0	98.0
% outwork	4.0	6.2	0.0	78.3	6.2	8.2	0.0	86.8
% flexible working hours	7.7	4.5	0.0	66.7	8.2	5.1	0.0	100.0
% accident at work	0.1	0.3	0.0	14.3	0.3	0.5	0.0	10.0
% occupational illness	0.9	0.7	0.0	10.0	0.4	0.4	0.0	11.1
% employed in east	19.9	6.6	0.0	75.0	21.0	11.4	0.0	100.0
% employed in firm20+	55.9	24.7	0.0	100.0	52.4	25.1	0.0	100.0
% foreigners	5.6	5.1	0.0	36.4	3.7	4.9	0.0	100.0
% manufacturing	17.1	23.3	0.0	100.0	17.1	23.2	0.0	100.0
Avr. Age <50	37.0	3.4	21.3	58.8	37.0	3.4	21.3	58.8

Source: microcensus 2004-2001, own calculations

Besides uncovering gender related differences, the descriptive evidence allows two basic conclusions: First, age differences exist in many respects. Second, a movement towards more flexible and less demanding working conditions takes place with age, in accordance to Hurd's (1993) hypotheses and findings; it is the higher proportions of part-time employment, minijobs and self-employment and the lower proportions of temporary employment and shift work that point into this direction.

## 5.2. Estimation Results

Regression results further support descriptive findings and give deeper insides. Table 3 displays the results from estimation of model (1), (2) and (2a). For ease of comparison, findings for both genders are jointly presented. The overall fit of the models is rather good, with R-squared ranging from 0.47 to 0.83. Results should be read as follows. An increase of regular overtime by 10 points will result in a reduction of male employment by more than 5 percentage points. Similarly, a 10 point rise in the proportion of temporary contracts jobs will lead to roughly 1.5 percentage points more female employment in age group 50+. The only exceptions are coefficients of income and tenure, which are given as semi-elasticity; 1 % higher average income or tenure lead to

$\beta$  percentage points change of employment and re-employment. The discussion of the coefficients in this section follows the underlying model structure.

### *5.2.1 Earnings and Age-Earning Profiles*

Occupation-specific compensation patterns have a clear impact on employment as well as on job openness of both genders. Male employment is greater if age-earning profiles are steeper and declines with growing incidence of company pension schemes (employer-financed). Effects on female employment are slightly different. First, unlike for men, earnings have no direct influence, but provision of company pension schemes reveals, secondly, a negative and even broader impact. The effect of earnings and income growth on job openness is similar for men and women. Higher income and steeper growth is in both cases associated with a reduction in openness. Yet, provision of jointly financed company pension schemes on the other hand raises job openness, at least for older women. Influences of earnings on recruitment are minor. However, there is a highly significant negative effect of income growth on the proportion of recently hired women aged 50 and above.

The negative effect of earnings on job access shows that occupations with steep age earning profiles are relatively closed for re-employment, which is in line with our hypotheses. A possible explanation is that highly paid jobs are mainly distributed among “insiders”, such that the existing stock may be relatively big but the access for outsiders restricted. Furthermore, our findings on employment effects of company pension schemes support the idea that these measures are in fact tools that raise the incentive of early retirement.

Overall, we find gender specific effects of the compensation structure on the dependent variables. The support of our hypotheses rests, however, mixed. On the one hand, average income has no direct effects on the labor market situation of older workers, while income growth with seniority reduces job accessibility for both genders. The proportion of pension plans, on the other hand, impacts both male and female employment and points towards early retirement policies; at the same time it increases job access for women.

### 5.2.2 *Skill Requirements and Education*

Findings for education and skill requirement are no less mixed. As before, we find clear impacts on employment and openness of occupations, whereas the overall effect on recruitment of older workers remain insignificant. The single most influential variable is average tenure. Firstly, tenure positively correlates with the employment share of older workers. Secondly, job access for outsiders markedly declines. Explanatory power of the remaining determinants is rather low. The occupation-specific share of higher education increases recruitment possibility of older men, but surprisingly reduces the employment opportunities for older women. Incidence of company provided training impacts job access of older men negatively.

Average occupational tenure, which means low labor turnover rates and longer experience, is highly important for employment of older workers. A one percent increase in average tenure leads for example to a jump in employment of older men by almost 5 percentage points. But accessing such jobs from outside proves to be difficult for older workers. Recruitment does not replicate existing age structure but concentrates on younger workers. The significant negative effects of training on job access of male workers aged 50 and above correspond to conclusions derived in Section 2. If incidence of company provided training is high, the share of new older hires as compared to the existing stock of older workers will be low. Effects of higher education partially support our conjectures. Greater proportion of higher education eases knowledge transfers and thus enhances recruitment of older (male) workers. However, the negative observed impact of higher education on female employment is counter-intuitive. It might result from the on average lower educational attainment of older women and hence reduced opportunities in knowledge intensive occupations as compared to younger cohorts of women. Thus, the finding points more to data limitation than to actual behavioral differences. Our results are mixed. On the one hand we find clear and plausible effects of tenure on employment and job access. On the other hand, the remaining variables are, with the exception of training on job access of men and higher education on male recruitment and female employment, not significant.

### 5.2.3 *Working Conditions*

The major impact of working arrangements and conditions on employment and re-employment of older worker for both genders was already visible and pointed out in the discussion of descriptive statistics. Regression results strongly support the first

evidence. A movement towards more flexible and less demanding working conditions takes place – in our opinion this is *the* finding of our study.

**Table 3: WLS Regression Results**

	Male Workers			Female Workers		
	(1) Share50+	(2) New50+	(2a) New50+	(1) Share50+	(2) New50+	(2a) New50+
log(avr. income)	-0.687 (1.81)	-0.511 (1.98)	-3.287** (1.49)	0.471 (2.23)	-7.403* (4.02)	-9.644*** (3.30)
income>50/income<50	7.866*** (1.84)	-2.566 (3.01)	-4.385** (2.07)	2.481 (1.54)	-5.200** (2.43)	-4.544** (2.06)
% company pension scheme, with contributions	0.00810 (0.049)	0.0977* (0.059)	0.0621 (0.047)	-0.131** (0.056)	0.0480 (0.066)	0.105** (0.050)
% company pension scheme, without contributions	-0.122** (0.057)	-0.0379 (0.083)	0.0795 (0.063)	-0.105** (0.047)	0.0552 (0.072)	0.0880 (0.059)
% training	0.104 (0.084)	-0.144 (0.11)	-0.225*** (0.071)	0.0311 (0.083)	-0.0379 (0.14)	-0.0995 (0.079)
% higher education	0.00202 (0.020)	0.0462** (0.023)	-0.00397 (0.020)	-0.0733*** (0.026)	0.00733 (0.040)	0.0307 (0.031)
% lower education	-0.0598 (0.058)	0.0759 (0.081)	0.0529 (0.076)	-0.0102 (0.066)	0.0789 (0.092)	-0.0116 (0.069)
% pc usage	-0.0148 (0.020)	-0.0403 (0.026)	-0.00343 (0.018)	0.00769 (0.016)	-0.00931 (0.025)	-0.00694 (0.019)
log(avr. tenure)	4.993** (2.05)	0.746 (2.41)	-5.676*** (1.76)	7.608*** (1.78)	-4.246 (2.97)	-8.939*** (2.10)
% overtime	-0.560*** (0.14)	-0.594*** (0.22)	-0.0693 (0.16)	-0.237* (0.14)	-0.516*** (0.19)	-0.0200 (0.14)
% shift work	-0.00953 (0.018)	-0.0521** (0.026)	-0.0346* (0.019)	-0.0178 (0.016)	-0.0361 (0.029)	-0.00684 (0.020)
% part-time	-0.126 (0.12)	-0.0179 (0.15)	-0.0558 (0.12)	0.0862* (0.051)	0.142** (0.062)	-0.0829 (0.055)
% minijobs	0.284 (0.18)	0.0891 (0.21)	0.166 (0.18)	-0.0921 (0.077)	-0.211** (0.095)	0.0766 (0.083)
% temporary employed	0.0999* (0.057)	-0.222*** (0.057)	-0.0915** (0.046)	0.155*** (0.048)	-0.239*** (0.073)	-0.160*** (0.050)
% self-employed	0.0688* (0.039)	0.157*** (0.049)	0.0437 (0.038)	0.0686* (0.041)	0.0589 (0.056)	-0.0191 (0.039)
% out-work	0.169 (0.11)	0.0777 (0.098)	-0.123 (0.081)	0.177* (0.099)	0.357*** (0.100)	0.0842 (0.091)
% flexible working hours	0.126 (0.086)	0.243** (0.10)	0.0395 (0.084)	0.165** (0.083)	-0.0316 (0.11)	-0.132 (0.084)

% accidents	-0.0778 (0.45)	0.198 (0.46)	0.243 (0.38)	-0.488 (0.72)	0.396 (0.88)	0.496 (0.76)
% occupational illness	-0.530* (0.28)	-0.0990 (0.39)	0.268 (0.31)	-0.915** (0.37)	0.0961 (0.64)	0.431 (0.45)
% East	-0.105** (0.042)	0.156*** (0.052)	0.102*** (0.036)	-0.00203 (0.042)	0.154** (0.064)	0.0650 (0.052)
% company >=20	0.0239 (0.030)	0.117*** (0.030)	0.0225 (0.025)	0.0433** (0.019)	0.0745** (0.030)	0.00544 (0.020)
% foreigners	-0.0397 (0.070)	-0.148* (0.090)	-0.0989 (0.074)	0.119 (0.093)	0.0651 (0.12)	-0.0754 (0.10)
% manufacturing	0.00268 (0.013)	-0.0355** (0.018)	-0.0176 (0.012)	-0.0249 (0.015)	-0.00789 (0.021)	0.000128 (0.014)
Avr. Age <50	2.348*** (0.17)			1.881*** (0.15)		
Share50+			0.562*** (0.048)			0.606*** (0.061)
Constant	-74.35*** (13.0)	16.55 (13.6)	40.98*** (11.3)	-71.92*** (15.7)	72.98** (29.5)	91.08*** (23.9)
Observations	324	323	323	295	295	295
R-squared	0.81	0.47	0.67	0.83	0.59	0.73

The incidence of overtime in jobs negatively impacts employment and re-employment of older male and female workers. Shift-work has a statistically significant negative influence on the re-employment and job access of older men. The proportion of part-time and minijobs on the other hand only affects the female share of the labor-force in a significant way. In occupations characterized by higher density of part-time contracts, employment and re-employment of women aged 50 and above is higher, too. Minijobs, to the contrary, effect re-employment of age group 50+ negatively. Occupations with large proportion of temporary contracts will on the one hand employ relatively more men and women aged 50 and above, while recruitment and job access on the other hand suffer. These findings are somewhat counter-intuitive. The next variable, self-employment, coincides with a higher share of male and female employment and male re-employment for those aged 50+ at a statistical significant level. Self-employment appears to be a channel for older workers to realize adequate working conditions and to optimally apply acquired knowledge (Frosch 2007b). The proportion of older female workers is also greater in jobs that offer the possibility to conduct work partly from home. Out-work is positively associated with employment and re-employment of women. Furthermore, flexible working hours raise (i) re-employment of older men and (ii) employment of older women. The occupational incidence of accidents at work

reveal no significant impacts, neither on male nor on female workers, while occupational illness is negatively correlated to employment of older men and women (the former at the 10 percent level only). Both were included to proxy stress and hazardous levels. The lack of more concrete findings is, however, in accordance to e.g. Hurd and McGarry (1993) and Hirsch et al. (2000). It might, at least partly, be caused by the very low frequency of such events.

Summing up, working conditions are an important determinant of older workers' labor market opportunities. Employment and re-employment tend to be higher in occupations which offer more flexible working and labor conditions and a higher degree of self-determination. It appears that particular recruitment of older workers benefits from more flexible environments. Older women tend to choose jobs with part-time contracts and more out-working option while men become self-employed or choose job that offer flexible working hours.

#### *5.2.4 Control Variables*

Finally, our controls are overall statically significant. However, individual signs and significance changes from model to model. Re-employment in general and job access for older men is higher in Eastern Germany, while the share of employed men aged 50 and above is lower on average. The latter effect reflects to a certain extent the still lower employment opportunities in the East. The former effects are more the result of tighter labor markets with more unstable work relations for all age-groups than because of higher willingness to recruit older workers. As expected, the share of employment in larger companies is positively associated with the (female) stock and recruitment of older workers. The share of foreigners on a job weakly coincides with lower re-employment of older men at the 10 % level. The proportion of employment in manufacturing has a negative impact on re-employment of male workers, only.

To control for effects which are caused rather by changes in the lower end of the age distribution than by variations in the employment opportunities of older worker, we have included the average age of employees aged 50 and less. In other words, we condition our estimation results on a given age structure among younger workers. Estimated effects should in this case just reflect actual changes among older workers. The coefficient of the variable itself is highly significant for males and females. An



increase of average age by one year raises employment by 2.3 percentage points for men and 1.9 points for female, respectively.

Job access is estimated by model (2a). Compared to the pure recruitment model (2), it additionally includes the occupation-specific share of older employees as explanatory variable. Estimation results are then conditioned on a given occupational age structure. The coefficients are highly significant and reveal a similar magnitude for both genders. An increase in the employment of older workers in an occupation by, for instance, 10 percentage points, will lead to a jump in recruitment of older workers as compared to all hires by roughly six percentage points. Furthermore, results uncover that recent hires don't replicate the existing age structure of the workforce; the share of older workers is generally lower among hires than in the work force. The figures are surprisingly close to the results reported in Heywood et al. (1999) for Hong Kong, though their cutting point between young and old is substantially lower, namely at the age of 35.

### **5.3 Summary**

In a nutshell, our univariate analyses and regressions yield some very insightful findings. Most importantly, we find (i) clear differences between the age-groups in terms of income situation, human capital endowment and working conditions and (ii) evidence of a movement towards more flexible, more self-determined working arrangements over age with different pattern for men and women. The single most influential variable on employment and re-employment of both genders is tenure. On the one hand, employment shares are higher, and on the other hand, job access is reduced with raising average tenure. Fast income growth decreases job access opportunities, while employment of older men benefits. It appears that steep age-earnings profiles raise the incentive to remain longer in the labor force as conjectured from theory on seniority wages (at least for men). The theory is further supported by the negative effect of company pensions on employment of older workers.

The overall support of our hypotheses is mixed. On the one hand, we are able to disclose clear effects of working conditions and earning and age-earning profiles on the labor market situation of older workers. On the other hand, human capital variables, with the exception of tenure, show only little effects in the multivariate context. However, two main findings remain: (i) the clear impact of working conditions and (ii) the support for the conjectures and predictions from the theory on seniority wages.

## 6. Conclusion

The aim of our paper was to derive determinants of occupational age-structures and to investigate the effects on employment and re-employment of men and women aged 50 and above. We are able to contribute to the existing literature in two ways. Firstly, our study confirms previous international results with respect to the varying impact of job-characteristics on occupational age-structures and hence employment and re-employment possibilities for older workers. Secondly, we derive comprehensive new findings on the influence of working conditions on employment of older workers in Germany. Studies on the labor market opportunities of older workers in Germany have concentrated on the firm level and neglected some important channels like self-employment and factors for instance flexible working and training intensities (compare e.g. Bellmann et al. 2006). We find a gender independent movement towards more flexible, less demanding and more self-determined working conditions takes place; this supports findings in Hurd (1993) and Hurd and McGarry (1993) for the US. They have conjectured that preferences towards leisure and work change slowly with age. Since working conditions are often fixed for a given job, either job change or early retirement is left as solution. Our results add a further option: self-employment. We however cannot neglect that the observed phenomena may partly result from demand side measures as well, like early retirement policies. Eurostat figures, for example, reveal that around 19% of women aged 50 to 64 and above 31% of men in the same age-group worked involuntarily part-time in 2005.

Our study has, of course, limitations. Firstly, we use cross-sectional data. Thus, findings may reflect rather cohort and period than actual age effects. Another problem comes from the design of the original dataset. The microcensus and thus the Labor Force Survey are clustered and stratified samples and not purely random draws. Hence, standard errors may not be assumed to be normally distributed and should be corrected for the so-called design effect. Unfortunately, the scientific use file of the microcensus offers no information to correct for the different sampling weights of units of observation in the LFS. From a methodological viewpoint, our approach suffers from the lack of clearly identified agents. Though, estimation procedure treats every observation as the outcome of a representative individual. However, despite the described shortcoming we believe that our study enhance the understanding of labor market dynamics of older workers.

The relevance of our findings is grounded on the growing share of older workers and follows from the fact that our most influential variables are sensitive to policy measures. Till 2020 the share of persons aged 50 to 64 years in the labor force will reach levels above 30% (Fuchs and Dörfler 2003). Today only jobs dominated by self-employment show a comparable high proportion. Promotion of part-time, flexible working hours, more flexible choice of work place, and self-employment will positively affect employment of older workers and help to keep them as long as possible as active participants within the labor force.

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