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# **Workforce composition and the risk of labor market exit among older workers in Finnish companies**

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## **ABSTRACT**

This article investigates how a firm's workforce characteristics affect an individual's timing of exit from the labor market. It analyzes the relations between the age, skill and wage structures of companies and the risk of labor market exit of Finnish older workers by using the detailed longitudinal register-based Finnish Linked Employer-Employee Data. The study follows the Finnish working population born between 1942 and 1950 (N = 216,713). Multilevel discrete-time survival analysis with individuals nested in firms is applied to estimate the risk of permanent exit from work between the ages of 53 and 68. The results show that these risks differ between firms: greater diversity in age and education levels among the workforce as well as seniority-based wage systems within a firm decrease the propensity of early exit, while being employed at a firm with an older staff increases the risk of exit. The findings from interactions between individual- and firm-level characteristics further illustrate that one's individual characteristics matter in relation to the characteristics of the overall firm's workforce. Being dissimilar from one's coworkers, especially in terms of skills and education, can reduce the risk of early exit.

**Keywords:** employer-employee data, labor market exit, older workers, retirement, workplace

## **INTRODUCTION**

Labor market exit of older workers is usually treated as the outcome of a combination of national policies and individual factors. This approach tends to ignore a crucial layer between state policy-making and individual outcomes: the work organization. Often the ‘missing actor’ in retirement research (Vickerstaff, Cox, & Keen, 2003), the firm plays an important role in translating national policies into individual practice, while creating work environments where older workers would like to either stay or leave.

This role can be explicit and direct, especially in pension systems where there is no default retirement age and pension schemes are voluntary and company-based (Beck, 2013; Vickerstaff & Cox, 2005). Yet in any type of pension system, firms often have at least an implicit and indirect influence on the timing of an older worker’s exit from the labor market. Firms differ in the size, characteristics and composition of their workforces, which, on the one hand, creates a variety of resources and restrictions for employers to retain or exit older workers and, on the other, provides different possibilities and incentives to older workers in decisions about their exit from the labor market.

As workforces in most industrialized societies are not only ageing, but also feminizing and becoming more educated, relatively little is still known about how these demographic changes affect firm performance and adjustment (Boehm & Dwertmann, 2015; Vandenberghe, 2013). At the same time, as the political relevance of extended working lives has increased, the role of employers in managing and retaining an aging staff can be considered one of the pressing issues in current retirement and management research (Henkens et al., 2018; Kulick, Ryan, Harper, & George, 2014; Taylor, Loretto, Marshall, Earl, & Phillipson, 2016). In the light of the urgency of this topic, there is a growing literature on the relations between firm characteristics and retirement, focusing particularly on firm-specific human-resource (HR) policies (see, for example: Conen, Henkens, & Schippers, 2011; Fleischmann, Koster & Schippers, 2015; Lössbroek, Lancee, Van der Lippe, &

Schippers, 2017; Midtsundstad, 2011; Schröder, Muller-Camen, & Flynn, 2014; Taylor, McLoughlin, Brooke, Di Biase, & Steinberg, 2013; Van Dalen, Henkens, & Wang, 2015).

Despite the rich insights this research provides, it has several shortcomings. It is commonly based on interviews or surveys directed at managers. The risk of focusing on the attitudes of individual managers, however, is that these attitudes might be subject to a strong ‘social desirability bias’. Moreover, it reduces older workers to a homogenous group that is defined by their age, while the potentially large differences in, for example, gender and socioeconomic status are ignored (Taylor et al., 2016). Most importantly, research based on employer attitudes ignores the interaction between older workers’ agency in timing their own labor market exit and the boundaries and the possibilities provided by the context of their employment.

In this article we aim to address this research gap, by shifting the focus to the interplay between, on the one hand, older individuals and their sociodemographic differences and, on the other, the characteristics of their work environment. We investigate whether some workplaces are more conducive to retaining or exiting their older workers due to differences in their staff’s age, skill and wage structures. We address two broad research questions, which will be specified as sub-questions in the theory section. How is the structure of a firm’s workforce related to older workers’ risk of exit from the labor force (research question 1), and how do individual sociodemographic characteristics in relation to the firm’s workforce composition matter (research question 2)?

We investigate the risk of labor market exit of Finnish older workers in the private sector between the years 1997 and 2015 with the use of linked employer-employee data and multilevel models. The Finnish context is particularly appropriate, because of a flexible retirement age within the old-age pension scheme, but also because of early exit options through disability and unemployment pension schemes. As a result, there is a large dispersion in the timing of older workers’ exit from the labor market roughly between the ages 50 and 70. Whereas in recent decades effective exit ages in the public sector have risen and despite several far-reaching reforms in the

pension system, Finnish policy-makers' aims to extend working lives in the private sector have not been fulfilled.

This study makes at least two important contributions to the theoretical and empirical literature on older workers and labor market exit. First, following the sociological tradition of research on organizations, occupations and career mobility, it 'brings back in the firm' as a crucial level of analysis (Baron & Bielby, 1980; Kalleberg & Mouw, 2018). The theory and results highlight the role of the firm as a structure that can constrain and reinforce older workers' agency in their retirement decisions (Damman & Henkens, 2017). At the same time, we emphasize that the workplace can create the conditions for either exit or extended working lives for some, but not for others. Second, with the use of detailed longitudinal register-based employer-employee data and applying multilevel discrete-time survival analysis, we are able to study the dynamics of actual labor market exit and estimate the role of individual and firm characteristics and their interactions therein.

## **LABOR MARKET EXIT IN FINLAND**

We study the Finnish cohorts that reached the minimum statutory pension age after a pension reform that was introduced in 2005. This reform replaced the fixed retirement age of 65 with a flexible retirement age between 63 and 68 in the earnings-related old-age pension system. Retirement is possible at age 63, but later retirement is incentivized by a higher accrual rate. After the 2005 reform, early retirement was still possible at the age of 62 but is penalized by lower pension benefits. Certain specific occupations (e.g. farmers, military and firefighters) have more possibilities for earlier retirement.

The introduction of the flexible retirement age was accompanied with a shift of the modal retirement age from 65 to 63. Still nowadays, even if effective retirement ages have been

rising, a majority of people retire at 63 (Kannisto, 2018). Although there is no mandatory retirement age and the employer has no way of forcing an employee to retire before the age of 68, survey research shows that the retirement age norm of 63 is deeply embedded among both Finnish employees and employers (Tuominen, 2013). The same study indicated that decisions to work beyond the age of 63 heavily depended on the willingness of the employer to retain a worker, while employers were generally little supportive of recruiting and retaining workers beyond the age of 63.

Labor market exit is possible before the age of 63 through two early exit pathways: disability and unemployment. Disability pensions also fall under the earnings-related pension system and are granted on the basis of medical criteria. They have no lower age boundary, but the risk of drawing a disability pension strongly rises with age. The contributions of employers to the disability pension system are experience-rated, meaning that the higher the number of its workers' disability claims, the higher the contributions. The aim of experience rating is to invest in preventive measures and incentivize retention. In the Finnish case, firm size matters, as – to put it simply - the degree of experience rating increases with the number of employees (Kyyrä & Paukkeri, 2015).

Unemployment benefits and pensions serve as a second exit pathways out from the labor market. Before the reform of 2005, those who lost their job and received unemployment benefits at the age of 55 were able to apply for extended unemployment benefits at the age of 57, followed by an earnings-related unemployment pension at age 59. The 2005 reform abolished the unemployment pension and raised the age for applying the extended benefits to 59 for those becoming unemployed at 57. Unemployment among older workers in Finland often results from plant closings, downsizing and collectively negotiated dismissals in the private sector and has been more common in larger companies and in manufacturing (Jolkkonen et al., 2018).

Earnings-related pensions form the main pillar of the Finnish pension system and are accrued throughout the working life with contributions by employees and employers. If below a

certain amount, earnings-related pensions are topped up by a national pension, while a minimum income is secured by the so-called guarantee pension. Due to the earnings-related pension system's adequacy and broad coverage, plus the fact that there is no upper-limit in the earnings-related pension system, occupational and private pensions are virtually non-existent. The gross replacement rate of Finnish old-age pensions was 57 per cent in 2016 (OECD, 2019). The average replacement rate of unemployment and disability pensions tends to be somewhat higher due to the lower income status of its recipients and the status-levelling effects of the national and guarantee pensions (Riekhoff & Järnefelt, 2018).

Some other peculiarities of the Finnish labor market for older workers should be noted. Employment rates for women aged 55-64 are somewhat higher than for men in the same age group. Although women tend to retire slightly later than men, no substantial differences have been found in their use of the different exit pathways (Riekhoff & Järnefelt, 2017). Yet, occupational segregation of men and women in the labor market is high, with women dominating work in the public sector. Part-time work is relatively uncommon in Finland, although during the period under study there was a possibility for people aged over 59 to claim a part-time pension if the employer agreed. However, studies have found no effects on delaying retirement following the take-up of a part-time pension (Ilmakunnas & Ilmakunnas, 2006). From an international comparative perspective, wages in Finland are not strongly seniority-based (D'Addio, Keese & Whitehouse, 2010). However, differences exist between sectors and firms (Daveri & Maliranta, 2007).

## **THEORY: WORKPLACE CHARACTERISTICS AND LABOR MARKET EXIT**

On one hand, there is a large literature on how individual characteristics, such as age, gender, health, marital status and educational background, have a strong direct effect on an individual's exit behavior (for studies on Finland, see for example: Järnefelt, 2010; Leinonen, Laaksonen, Chandola



& Martikainen, 2016; Riekhoff & Järnefelt, 2017). On the other hand, there is a growing literature on how firm-level characteristics affect firm policies towards older workers (Conen et al., 2011; Fleischmann et al., 2015; Lössbroek et al., 2017; Midtsundstad, 2011; Schröder et al., 2014; Van Dalen et al., 2015). Yet, relatively little is known about the interactions between individual agency and the structure of the work organization in determining the timing of retirement (Henkens & Damman, 2017).

Theories on the role of organizations in labor market segmentation and career mobility emphasize that the work organization contributes to labor market outcomes of workers in at least two ways (Baron & Bielby, 1980; Kalleberg & Mouw, 2018). First, some companies will offer better wages, working conditions and career opportunities than others. Although not tested in this article, individual characteristics will largely determine the type of firm someone is working for. Workers with features and skills that are in demand are more likely to be matched with employers who are in need of such workers and willing to offer better conditions (Kalleberg & Mouw, 2018). Workers with skills and features that are less in demand are more likely to work for organizations that offer worse conditions.

Second, within firms, employers can differentiate their HR and wage policies between those individual workers whom the company wants to keep and those who are considered obsolete or easy to replace. Hence, it matters where an individual is positioned within the organization and in relation to co-workers. If someone's skills or features differ from the norm within an organization, that person might be more valued than when working among colleagues with similar, and thus replaceable, skills.

## **Age structure**

Whereas the economic and sociological literature on the role of the organization in labor market outcomes usually emphasizes the dualization between workers with higher and lower skills, there are other types of segmentation in which the firm-level plays a role. When studying labor market exit, segmentation by age might play a role. Although there is no conclusive evidence that productivity decreases with age (Daveri & Maliranta, 2007; Skirbekk, 2008), studies have found employers to be persistently convinced that this is the case (Conen et al. 2011; Van Dalen, Henkens, & Schippers, 2010). Especially the abilities to perform heavy physical or manual work, to keep up with new technologies and to think creatively are expected to decline (Walker, 2005). Various studies show that retaining and hiring older workers is often low on employers' priority lists (Conen et al., 2011; Oude Mulders, Henkens, & Schippers, 2017).

When looking at differences in labor market exit between organizations, there might be a selection effect: firms that perform relatively poorly are more likely to have an older workforce. This is because they tend to be situated in declining sectors where the possibilities for older workers for changing jobs are limited due to their limited chances of being rehired. Younger workers, in contrast, have better opportunities for changing jobs and reskilling and will move to the better-performing sectors (Jolkkonen et al., 2018). Due to plant closings and dismissals in the declining sector, the older workers are at greater risk of exit in firms where the concentration of older workers is higher.

Additionally, having a predominantly older workforce could limit the possibilities for employers to adapt to the needs of older workers, for example by shifting working schedules and reducing the workload (Lössbroek et al., 2017). This may lead to greater exit incentives for older workers in firms with an older workforce. Nevertheless, studies also theorized the potentially opposite effects of being employed in an aging workplace: with an aging workforce, a firm is likely

to be more conscious of the need to adapt and implement strategies to retain its workers (Lössbroek et al., 2017; Van Dalen et al., 2015).

Within firms, employers might favor younger employees when it comes to decisions about access to career advancement and training (Schröder et al., 2014). This could lead to lower incentives for older workers to stay in employment. However, being old within an organization does not always need to be a disadvantage. Ilmakunnas & Ilmakunnas (2011), for example, found that being an older worker within a younger organization is positively related to wages, indicating that the older worker is valued within the organization and simultaneously providing incentives for the older worker to postpone labor market exit.

In addition, studies have shown that the age structure within a firm affects its productivity. Grund and Westergaard-Nielsen (2008) identified an inverse U-shaped relation between mean age within the firm and its performance: neither a too young nor a too old workforce is beneficial. Moreover, firms with greater age diversity perform better, possibly because young workers' up-to-date skills and ideas complement older workers' experience and networks (Ilmakunnas & Ilmakunnas, 2011; Walker, 2005). Other studies have found this effect especially in larger firms (Meulenaere, Boone, & Buyl, 2016), firms where creative rather than routine tasks are performed (Backes-Gellner & Veen, 2013) and in sectors characterized by fast technological change (Ilmakunnas & Maliranta, 2016). Therefore, older workers may play a valuable role in diverse organizations and are therefore retained.

In the context of our research questions, we formulate one sub-question on the relation between the age structure of the organization and labor market exit: How is the age structure of a firm's workforce, in terms of average age and age diversity, related to its older workers' risk of exit from the labor force (research question 1a)?

## **Skill structure**

The effects of age on labor market exit intersect with the effects of education and skill-type (Taylor et al., 2016). Between firms, theories of labor market segmentation theory predict that high-skilled older workers are concentrated in certain firms where they are more likely to enjoy the benefits of the development, accommodation and wage policies that aim at retaining these human resources (Fleischmann et al., 2015; Lössbroek et al., 2017; Van Dalen et al., 2015). Older workers with (firm-specific) knowledge and skills might be hard to replace, especially in times when labor is scarce (Burmeister & Deller, 2016; Conen et al., 2011; Henkens, Remery, & Schippers, 2008; Midtsundstad, 2011; Taylor et al., 2013). The costs of loss and substitution of human resources is therefore higher in firms with a higher-skilled aging staff. Low-skilled workers, on the other hand, are more likely to work in organizations where retraining older staff yields limited benefits. Especially if a firm can offer only physically heavy or manual work, as in manufacturing or construction, the possibilities for job redesign or a reduced workload may be limited.

A certain degree of diversity in the skills and education structure of the company might be conducive to possibilities for accommodation and thus later exit of older workers. Within firms, however, studies have shown that age-based HR and retention policies are often applied on an *ad hoc* basis and favor workers with specific knowledge and certain skills (Conen, Henkens & Schippers, 2014; Oude Mulders & Henkens, 2019; Wainwright et al., 2018). At the same time, Hennekam and Herrbach (2013) showed that even when HR policies were specifically targeted at workers with a lower occupational status, this did not affect their intentions to retire early. Therefore, it is possible that low-skilled workers are at a higher risk of early exit even when working in organizations where the overall risk is lower.

In terms of the education and skill structure of the organization we formulate two additional sub-questions: How is the education and skill composition, as measured by the average education, education diversity and share of manual work among a firm's workforce, related to older

workers' risk of exit from the labor force (research question 1b), and how do the education level and skills of an individual matter in relation to the firm's overall workforce education and skill composition (research question 2b)?

### **Wage structure**

Finally, the age and skill structure of the firm is likely to be reflected in its wage structure. Regardless of the relation between age and productivity, wages tend to increase with experience and tenure, and thus with age. Productivity does not rise accordingly, at least not infinitely (Lazear, 1979; Skirbekk, 2008). This means that the cost of retaining an older worker tends to increase due to a rise in wages that is steeper than the rise in productivity. This provides incentives for an organization to exit its older workers.

In contrast, the wage structure may also reflect the relation between, on the one hand, skills that accumulate with age and experience and, on the other hand, the value that the firm attaches to having workers with such skills. Therefore, seniority wages can be an expression of a firm's willingness to retain its older workers. At the same time, they can be an indication that, despite the cost for the employer, these are firms with good salaries and comfortable working conditions in which older workers prefer to retire later.

Once again there can be differentiation between workers within firms. In accordance with theories of decreasing productivity and increasing costs, an organization will be least inclined to keep the older worker with the highest salary. On the other hand, within the same organization with seniority wages, low-skilled workers might be relatively 'overpaid' in comparison to high-skilled workers, even if their salary is lower at an absolute level. In that case, the organization will be more motivated to keep the high-skill, higher-salary worker rather than the low-skilled, lower-salary worker. A study by Frimmel, Horvath, Schnelzenberger and Winter-Ebmer (2018) confirmed

that seniority wages had a stronger effect on the likelihood of a blue-collar workers' than white-collar workers' early retirement.

These considerations lead to the formulation of the final set of sub-questions: How is the relation between age and wage within the organization related to older workers' risk of exit from the labor force (research question 1c), and how does the individual's level of earnings in relation to the firm's wage structure matter in predicting exit from employment (research question 2c)?

## **DATA AND METHODS**

### **Data**

The data for this study were drawn from the Finnish Linked Employer Employee Data (FLEED). FLEED combines various administrative registers on employment, education, taxation and business, as well as other censuses and surveys. It includes the entire Finnish working population between the ages of 15 and 70 and is available on a yearly basis since 1988 and, at the time of this study, until 2015. Identifiers at the individual and firm level are included, making it a uniquely rich source of information and exceptionally suitable for this study.

The study population included cohorts born between 1942 and 1950. They were followed between the ages of 53 and 68 years. There are several reasons for this selection. Those born in 1942 were the first to be affected by the reformed Finnish pension system in 2005. Hence, largely the same old-age pension regulations apply to these cohorts. The follow-up period starts at age 53, mainly due to some major changes in the structure of the data in 1995. Due to data being available only until 2015, those born in 1948, 1949 and 1950 were right-censored respectively at ages 67, 66 and 65.

Following other studies, and to be able to calculate reliable indicators on the workplace level, only establishments in the private sector with more than ten employees were included (Jolkkonen et al., 2018). Firm-level characteristics were measured at the establishment level rather than the overall firm level, because information on the former was more detailed and consistent over time. Moreover, firms can be large entities with branches across the country, for example supermarket chain stores, where each establishment has its own workforce dynamics.

The public sector was excluded because much of the information on the establishment level is missing or incomparable with firms in the private sector. Moreover, there have been some major reclassifications of public sector organizations in the data, which makes information inconsistent across time. Establishments in the agriculture sector were excluded due to the small number of units with more than 10 employees. According to these criteria, the study population included 216,713 individuals, 35,576 firms and a total of 1,346,259 observation years.

### **Dependent variable**

Our dependent variable is the event of permanent labor market exit. At the end of each year during the follow-up, a person's main activity status was recorded. If the person was employed at the end of a particular year, there was no event. If the person was unemployed or retired but returned to paid employment in one of the following years, there was also no event. The first year that a person was unemployed, inactive or retired on an old-age, disability or unemployment pension, without returning to employment in any of the following years, was marked as the year of permanent labor market exit.

## **Independent variables**

At the individual level, a person's birth year (1942 = 0 to 1950 = 8), age (a dummy for each age), gender, marital status (married or single/widowed/divorced), area of living (urban or rural), level of education (primary, secondary and tertiary) and annual earnings (log-transformed) were controlled for. These measures were all taken directly from the data. Level of education is based on the most recently attained highest level of education and therefore takes into account the possibility that individuals have formally upgraded their skills during working life. Still, as education level is an imperfect proxy for skill level, we included an additional indicator for type of work performed, distinguishing between manual and non-manual workers. This dummy was based on a variable indicating broad categories of occupational status. This variable was missing for the years 1996-1999 and 2001-2003. For these years, the manual-worker dummy was based on information available in the closest-by year. Summary statistics for each of the independent variables are presented in Table 1.

For each organization, the average age of the entire staff in each year was calculated. In the case of education, firm averages were calculated based on the individual employees' levels of education, which are included in the data on a scale from 1 (primary education only or no formal qualifications) to 8 (doctoral degree). To operationalize diversity in an organization's age and education structure, Harrison and Klein's (2007) conceptualization of 'separation' as measured by standard deviations was followed (Backes-Gellner & Veen, 2013; De Meulenaere et al., 2016; Ilmakunnas & Ilmakunnas, 2011). Standard deviations (SD) for age and education are adequate measures of diversity within organizations, as a low SD indicates high similarity among employees on a particular value, while a high SD suggests greater dispersion.

As an additional indicator of the skill-structure within the firm, the share of manual workers within each organization was calculated based on the closest-by year available, due to similar lack of information for some years as with the manual-worker dummy. As an indicator of a



seniority-based wage curve, the correlation between age and earnings within each organization was estimated. A positive and high wage curve indicates a strong relation between age and earnings within a firm. In organizations with a flat wage curve ( $r = 0$ ) there is no relation between age and earnings, while a negative wage curve means that earnings tend to decrease with age.

A control variable for firm size was included with three recoded categories: small- (10-50 employees), medium- (50-200) and large-sized firms (200+). Larger firms are more likely to have an HR department and better opportunities to shift tasks and workloads in order to retain older workers. They can also create economies of scale that will reduce the cost of such policies per older worker (Fleischmann, et al., 2015; Midtsundstad, 2011; Taylor et al., 2013). Moreover, in the Finnish experience-rated disability pension system, larger firms bear higher costs for exit on a disability pension. However, in larger firms, the exit costs related to the loss of human resources are likely to be lower because the staff is more numerous and easier to replace (Lössbroek et al., 2017; Van Dalen et al., 2015).

As large differences in exit behavior between economic sectors can be expected (De Preter, Mortelmans & Van Looy, 2012), we controlled for broad categories of industry, namely: manufacturing, transport and construction, retail, trade and hospitality, insurance, business and other services, as well as education, health and social services. Our data did not include any suitable controls for labor scarcity, firm performance and business cycle effects, each of which are strong potential explanations for labor market exit. As a proxy, based on the data we calculated for each observation year the unemployment rates for the regions (i.e., 21 Finnish provinces) where the firms reside.

**<Table 1 here>**

## Methods

We applied multilevel discrete-time survival models that use a complementary log-log generalized linear model to estimate the risk of exit at each particular age between 53 and 68 (Austin, 2017). With individual observations nested within firms, the assumption that observations are not independent but that there are unobserved characteristics at the cluster level that affect the individuals within that cluster alike is accounted for. Therefore, random intercepts at the firm level were used throughout the models. The data is structured such that, for each person year, an event either takes place or not (that is, 1 = labor market exit, 0 = no event). There is a one-year lag of the independent variables, for the simple reason that in the year of exit, a person is no longer employed and workplace characteristics cannot be measured. Due to the lagged structure of the data, the first possible age of exit is at 54.

First, we test an empty model with only the random intercept. Model 1 includes individual covariates only. In Model 2, covariates for the firm-level were added to test the potential impact of workforce characteristics on an individual's risk of exit. To test the assumption that the relative position of an individual within the organization matters, random slopes for selected individual-level covariates were introduced and interacted with the relevant firm-level covariates. The interactions between the individual's level of education and the organization's mean education (Model 3), the individual-level manual-work dummy and the share of manual workers in the organization (Model 4) and, finally, the individual's earnings and the organization's wage curve (Model 5) were tested.

## **RESULTS**

### **Descriptive analysis**

Figure 1 shows at each age the cumulative percentage of the study population that has exited the labor market. In order to provide a rough impression of the gender and socioeconomic differences in labor market exit in Finland, Panel a depicts cumulative exit percentages by gender, while Panel b shows these same rates for workers with lower, intermediate and higher levels of education. The proportion of the study population outside the labor market steadily grew between ages 53 and 59 with on average 5 per cent per year, after which the rate accelerated somewhat. At 63, there was a considerable hike in labor market exit, due to reaching the lower boundary of the flexible retirement age in the old-age pension system. After 65, the curve flattens and by age 68, around 95 per cent of the study population had exited the workforce. The differences between the curves of men and women working in the private sector are negligible. However, Panel b displays a relatively strong social gradient in workforce exit in Finland: lower-educated workers tended to exit earlier, while higher-educated workers remained longer in the labor market.

**<Figure 1 here>**

### **Multilevel models**

Table 2 includes the results of the multilevel discrete-time survival models with random intercepts. The relative risks or risk ratios (RR) indicate the probability of an event occurring at each time point. The Intraclass Correlation Coefficient (ICC) of the empty model with only random intercepts indicates that 6.2 per cent of the variance in the outcome variable can be explained by differences at the firm level (not reported in the table). The ICCs for Models 1 and 2 are presented in Table 2 but are difficult to interpret in models with binary response variables because level 1 residual variance is fixed and cannot decrease as in linear multilevel regression (Steele, 2009). The decreasing values

of the -2 log likelihood and Akaike Information Criterion (AIC) between Models 1 and 2 indicate an improving fit as more covariates are added.

Model 1, including only the individual-level covariates shows that the risk of exit remained stable across cohorts. There were no significant gender differences, while being married and living in an urban region increased the risk of exit. Level of education was a relatively strong predictor of labor market exit: in any given year, the lower educated experienced an 8.2 per cent higher risk of early exit than those with an intermediate education. The risk for higher educated was 9.5 per cent lower than for those with an intermediate education. The type of work performed also mattered: those performing manual work were at a 15 per cent higher risk of exit. There was a considerable negative relation between earnings and the risk of early labor market exit, that is, those with higher earnings tended to exit later.

**<Table 2 here>**

In Model 2 (Table 2), firm-level covariates are included. The estimates for the individual-level covariates remain largely the same. The coefficient for cohort no longer was significant. The effect of being a woman turned from negative and non-significant into positive and significant but remains small. The controls for sector show that the risk of early exit was greatest in manufacturing, as the RRs for the other sectors were all smaller than 1. Those working in education, social services and health services experienced the lowest risk of early exit. Workers in middle-sized firms had a 16 per cent higher risk and those in large-sized firms a 30 per cent higher risk of labor market exit. The positive effect of regional unemployment rates on the risk of exit indicates that in times of economic downturn the risk of early exit increased.

The small but significant positive effect of mean age of the organization shows that an older workforce increased the individual older worker's risk of exit. However, working in an organization with a greater age diversity, as measured by the SD of age, lowered the risk of early

labor market exit. A higher mean and SD in the firm's education structure contributed to a later exit. The findings suggest that a better educated workforce and, in particular, greater education diversity contribute to lower risk of exit. The effect of the share of manual workers is negative, implying that a greater proportion of manual workers within an organization is related to later exit. A steeper wage curve is associated with a lower risk of exit. This indicates that older workers were not at a higher risk of exit in organizations where they become relatively more expensive, but rather the opposite. We will elaborate on potential explanations for this finding in the discussion section.

Although Finnish older men and women's exit behavior is relatively similar, we performed the analysis separately for men and women to check whether there were differences in the mechanisms behind labor market exit. Models A1 (men) and A2 (women) in Table A1 in the Annex show some differences between men and women in the effects of individual characteristics (cohort and marital status), but no large differences in the associations between firm characteristics and risk of exit.

Only in the case of mean education within the organization, the result was not statistically significant for men, but it was for women. Considering also that the effect of the standard deviation of education among the workforce was stronger for women than for men, the results suggest that especially older women exit later when employed in better-educated and educationally diverse work environments. We also included a variable for the share of women within the organization. Although not the focus of our study, these results further support that dissimilarity in relation to co-workers matters. Men had a lower risk of exit in companies with a higher share of women, while for women the risk of exit is higher in such organizations.

### **Multilevel models with interactions**

To test whether early exit is associated with one's relative position within the organization, Table 3 presents the results for the models with random slopes introduced for selected individual-level covariates and interacted with related firm-level covariates. In these models, the same individual and firm-level covariates as in Model 2 in Table 2 were controlled for, but only the relevant covariates and their interactions are reported.

<Table 3 here>

In Model 3, the interaction of the high education dummy with the mean level of education in the firm suggests that, in firms with a higher-educated workforce, the otherwise lower risk of exit among higher-educated workers converges towards the risk-level of lower- and middle-educated workers. Although the size of this interaction effect is small, it shows that the higher educated might lose some of their retention value when they work in an organization with many similarly higher-educated workers. The results did not show a similar interaction effect for lower-educated older workers with the mean level of education of the workforce.

Model 4 indicates a significant and positive interaction effect between being a manual worker and working in an organization with a larger share of manual workers. Inspection of the marginal effects (not reported) revealed that differences in exit risks between manual and non-manual workers became significant when the percentage of manual workers within an organization was roughly between 40 and 80 per cent. These results suggest that manual workers are particularly more prone to earlier exit compared to non-manual workers in organizations where they constitute a considerable part of the workforce.

Finally, Model 5 includes the interactions of individual earnings and the wage curve within the organization. The substantial negative effect indicates that the negative effect of earning higher wages on exit was amplified by being employed by an organization with a steeper seniority

wage system. This also implies that those with low wages and working in organizations with flat or even negative wage curves were at a particularly higher risk of earlier exit.

## **DISCUSSION AND CONCLUSIONS**

This article investigates the relations between individual factors, workplace characteristics and individuals' risks of labor market exit. We moved beyond studies that focus only on either the individual or employer side and analyzed how both affect labor market exit. This was done with the help of longitudinal employer-employee data and models that account for the hierarchical nature of this data. The results confirm the importance of not just who you are (as measured by individual sociodemographic characteristics), but also where you work and who you work with (as measured by a firm's workforce characteristics). Moreover, the cross-level interaction models showed that it matters how your individual characteristics either stand out or are similar to those of your co-workers.

Unsurprisingly, the results showed a strong increasing risk of exit with age. The age structure of the workplace, however, also showed to be related with the individual risk of labor market exit. In response to research question 1a, our findings showed that the risk of exit increased with the average age within the organization. This effect was small but significant and provides some support for the theory that older workers tend to concentrate within declining sectors and are therefore at higher risk of earlier exit. This finding holds despite the substantial and significant effects of the industry, firm-size and regional unemployment-rate controls. In Finland in the 2000s, downsizing and collective dismissals have been especially common in large firms in the manufacturing sector during periods of economic recession (Jolkkonen et al., 2018).

In addition, this result could indicate that in organizations with older workforces, the possibilities for accommodation policies, e.g. through changing working-hours and workloads, are

more limited (Lössbroek et al., 2017). The small though significant negative effect of greater age diversity within the firm on labor market exit supports this finding: in organizations with a more varied mix between young and old there might be more room for accommodation policies, possibly leading to greater retainment of older workers. Moreover, a more age-diverse workforce can be an indication of a more productive organization (Backes-Gellner & Veen, 2013; Grund & Westergaard-Nielsen, 2008; Ilmakunnas & Ilmakunnas, 2011; Meulenaere et al., 2016), where the incentives are greater for the individual to remain and the employer to retain.

In line with previous studies, we found that individual's higher level of education was related to later labor market exit (Järnefelt, 2010; Riekhoff & Järnefelt, 2017). Moreover, the education structure of the firm had significant effects (research question 1b). An individual's risk of exit was lower in organizations with a higher average level of education among its workforce, yet the size of the effect was small and only significant at the  $p < 0.05$  level. It is possible that organizations with a better-educated workforce invest more in retaining it, although earlier studies produced inconclusive results regarding the relation between knowledge intensity of firms and their retention and exit policies (Fleischmann et al., 2015; Lössbroek et al., 2017; Van Dalen et al., 2015).

In further response to research question 1b, greater diversity in the workforce's educational composition were found to be conducive to later labor market exit. Again, this greater diversity might be indicative of a more productive organization (Harrison & Klein, 2007; Ilmakunnas & Ilmakunnas, 2011). Workers in organizations with greater diversity in educational backgrounds might be able to benefit from the diversity of skills and knowledge among their co-workers and it is possible that in such organizations the possibilities for reskilling and shifting tasks are greater (Schröder et al., 2014; Walker, 2005). Addressing research question 2b, the interaction model with individual education with mean education at the firm level showed that the effect of having a higher education degree on the risk of exit is reduced somewhat if employed in an



organization with an overall higher educated workforce. Hence, higher educated workers exit later especially when their co-workers are lower educated. This could be an indication that firms tend to segment HR and wage policies between those workers they want to retain and those that are dispensable.

These findings are supported by the results for the type of work that is performed by the individual and its predominance within the firm. Manual workers are at greater risk of early exit, which might be explained by the greater health risks involved with heavy physical work, fewer opportunities for skill upgrading and task shifting, and the greater ease by which the employer can replace them. Surprisingly, we found that the relation between the share of manual workers within the firm and individual labor market exit was negative, indicating that a higher share of manual workers in the firm contributes to a lower risk of exit. However, the interactions between the individual manual-work dummy and the share of manual workers at the firm level suggested that this effect is not linear but has an inverse U-shape. When there are very few or very many manual workers in the firm, there is no significant difference between the risk of exit of manual and non-manual workers. Yet, when there is a substantial number of them, the exit risk increases for manual workers. A possible explanation for this finding is that, when many manual workers perform similar tasks, the incentives for the employer of investing in their retention are lower.

In line with economic theory, as the utility derived from continuing work is more likely to outweigh the utility derived from more leisure time in retirement, higher individual earnings lowered the risk of early exit. However, economic theory also predicts that when wages increase faster than productivity, such as in seniority-wage systems, there is an incentive for employers to exit older workers. In response to research question 1c and in contrast to studies that warn against the negative employment effects of seniority wages due to the high costs of retaining older workers (D'Addio et al., 2010; Frimmel et al., 2018; OECD, 2006), the findings of this study show that in firms with a stronger positive relation between age and wages, an individual's

probability of exit decreases. In fact, the interaction models showed that the risk of early exit decreased even further for high-wage earners in steep wage-curve organizations (research question 2c).

There are at least three possible explanations for these findings. First, theories of human capital predict that wages increase with age (or rather with seniority) because of increases in (firm-specific) knowledge and skills over the years (Daveri & Maliranta, 2007). Therefore, companies, especially those that invest in firm-specific skills, pay higher wages to older workers to prevent them from leaving. Lazear (1979) explained that wages increase with age because they are usually lower than productivity at the beginning of one's career and higher at the end of the career. These 'efficiency wages' apply especially to workers whose performance is difficult to monitor.

A second explanation is that seniority wages are not a part of retention policies, but rather an outcome. Firms that have implemented age-management policies are more likely to retain their older workers, which leads to steeper wage curves if earnings are related to seniority. In firms that do not actively retain their older workers, wage curves are flatter due to these older workers being more likely to exit prematurely. Third and last, in the Finnish context of strictly enforced employment protection and anti-discriminatory legislation, employers have very limited powers in discharging older workers simply because they are too old or too expensive, as long as they have not reached the upper retirement age of 68. Hence, the power to decide on the timing of exit lies primarily with the older workers, who will defer retirement especially in those companies where they are paid well.

This study has several limitations. First, the set of explanatory covariates was limited by the possibilities that the data offered. At the individual level there was no information about workers' health situation, while poor health should be a strong predictor of exit especially through the disability pension pathway. We operationalized skill-levels by level of most recent attained education and the type of work performed, but these measures neglect the importance of skills

based on experience and informally accumulated human capital. Still, research has shown that low-educated invest less in further training (Fouarge, Schils & De Grip, 2013). Therefore, it is plausible that older workers with higher education invested more in skill upgrading throughout their working life. The inclusion of the manual-work variable aimed at controlling for additional skill features and physical strain of the job tasks but has its own limitations. Although in the data manual work predominantly falls under occupations with a high degree of routineness, it is possible that certain types of manual work require experience and specialization and can be a firm-specific asset.

At the organization level, we had no direct indicator of a firm's economic performance, although previous research shows that the risk of exit is considerably higher in poorly performing organizations (Korkeamäki & Kyyrä, 2012). Moreover, due to exclusion of the public sector, gendered practices of retirement are underexposed. We saw little difference between exit behavior of men and women, although previous studies show that in Finland women in the public sector display substantially different patterns of retirement (Riekhoff & Järnefelt, 2017).

Second, the administrative data offered a solid and detailed insight to the relations between individual and firm-level characteristics in explaining labor market exit but did not allow estimation of the exact mechanisms behind these relations. For identifying the possible mechanisms behind our findings, our research builds on the existing literature and should be considered as complementary to recent studies explaining employer behavior towards older workers based on case studies, surveys or vignettes (Lössbroek et al., 2017; Moen, Kojola & Schaefers, 2017; Oude Mulders & Henkens, 2019; Oude Mulders et al., 2017).

Finally, analysis focused on labor market exit as such, although the mechanisms behind exit through disability, unemployment and old-age pensions might differ. Korkeamäki and Kyyrä (2012), for example, found that employers did not use disability programs as a means of downsizing their workforce. Yet, other studies showed that there is at least some degree of substitutability between exit pathways in the Finnish context (Hakola & Uusitalo, 2005; Kyyrä,

2015; Riekhoff & Järnefelt, 2017). Future research will need to investigate the relation of firm characteristics with risk of workforce exit through specific programs in more detail.

Demographic change has made the Finnish government aware of the need to delay the official retirement age and encourage the extension of working lives. Work organizations will be more and more forced to adjust to an aging workforce in the foreseen future. Our results suggest that in the short-run, it is likely that firms in creative and high added-value industries where autonomous, skilled and experienced workers are more costly and difficult to replace are better at retaining older workers by offering better age-related HR and wage policies (Moen et al., 2017). Early exit is likely to continue to dominate in companies in more traditional sectors and with low-skilled staff performing routine tasks.

Whereas there is no panacea for this segmentation, policy-makers can consider a variety of policy measures to disincentivize labor market exit on both the employers' and employees' side. Based on our results, on the employees' side, life-long learning and skill-upgrading seems to be the key. On the employers' side one could consider wage subsidies to financially incentivize the retaining of older low-skilled workers (Huttunen, Pirttilä, & Uusitalo, 2013), implementing last-in-first-out rules (Böckerman, Skedinger & Uusitalo, 2018) or introducing campaigns that change the norms of employers towards an aging workforce (Oude Mulders et al., 2017). Our study could provide some guidance in identifying those companies where such measures are most needed and most likely to be effective.

## REFERENCES

- Austin, P.C. (2017). A tutorial on multilevel survival analysis: Methods, models and applications. *International Statistical Review*, 85, 185-203. doi:10.1111/insr.12214
- Backes-Gellner, U., & Veen, S. (2013). Positive effects of ageing and age diversity in innovative companies – large-scale empirical evidence on company productivity. *Human Resource Management Journal*, 23, 279-295. doi:10.1111/1748-8583.12011
- Baron, J.N., & Bielby, W.T. (1980). Bringing the firms back in: Stratification, segmentation, and the organization of work. *American Sociological Review*, 45, 737-765. doi:10.2307/2094893
- Beck, V. (2013). Employers' use of older workers in the recession. *Employee Relations*, 35, 257-271. doi:10.1108/01425451311320468
- Böckerman, P., Skedinger, P., & Uusitalo, R. (2018). Seniority rules, worker mobility and wages: Evidence from multi-country linked employer-employee data. *Labour Economics*, 51, 48-62. doi:10.1016/j.labeco.2017.11.006
- Boehm, S.A., & Dwertmann, D.J.G. (2015). Forging a single-edged sword: Facilitating positive age and disability diversity effects in the workplace through leadership, positive climates, and HR practices. *Work, Aging and Retirement*, 1, 41-63. doi:10.1093/workar/wau008.
- Burmeister, A., & Deller, J. (2016). Knowledge retention from older and retiring workers: What do we know, and where do we go from here? *Work, Aging and Retirement*, 2, 87-104. doi:workar/waw002
- Conen, W.S., Henkens, K., & Schippers, J.J. (2011). Are employers changing their behavior toward older workers? An analysis of employers' surveys 2000–2009. *Journal of Aging & Social Policy*, 23, 141-158. doi:10.1080/08959420.2011.551612

- Conen, W.S., Henkens, K., & Schippers, J.J. (2014). Ageing organisations and the extension of working lives: A case study approach. *Journal of Social Policy*, 43, 773-792.  
doi:10.1017/S0047279414000336
- D'Addio, A.C., Keese, M., & Whitehouse, E. (2010). Population ageing and labour markets. *Oxford Review of Economic Policy*, 26, 613-635. doi:10.1093/oxrep/grq035
- Damman, M., & Henkens, K. (2017). Constrained agency in later working lives: Introduction to the special issue. *Work, Aging and Retirement*, 3, 225-230. doi:10.1093/workar/wax015
- Daveri, F., & Maliranta, M. (2007). Age, seniority and labour costs: Lessons from the Finnish IT revolution. *Economic Policy*, 22, 118-175. doi:10.1111/j.1468-0327.2007.00175.x
- De Meulenaere, K., Boone, C., & Buyl, T. (2016). Unraveling the impact of workforce age diversity on labor productivity: The moderating role of firm size and job security. *Journal of Organizational Behavior*, 37, 193-212. doi:10.1002/job.2036
- De Preter, H., Mortelmans, D., & Van Looy, D. (2012). Retirement timing in Europe: Does sector make a difference? *Industrial Relations Journal*, 43, 511-526. doi:10.1111/j.1468-2338.2012.00699.x
- Fleischmann, M., Koster, F., & Schippers, J. (2015). Nothing ventured, nothing gained! How and under which conditions employers provide employability-enhancing practices to their older workers. *International Journal of Human Resource Management*, 26, 2908-2925.  
doi:10.1080/09585192.2015.1004100
- Fouarge, D., Schils, T., & De Grip, A. (2013). Why do low-educated workers invest less in further training? *Applied Economics*, 45, 2587-2601. doi:10.1080/00036846.2012.671926

- Frimmel, W., Horvath, T., Schnelzenberger, M., & Winter-Ebmer, R. (2018). Seniority wages and the role of firms in retirement. *Journal of Public Economics*, 164, 19-32.  
doi:10.1016/j.jpubeco.2018.04.013
- Grund, C., & Westergaard-Nielsen, N. (2008). Age structure of the workforce and firm performance. *International Journal of Manpower*, 29, 410-422.  
doi:10.1108/01437720810888553
- Hakola, T., & Uusitalo, R. (2005). Not so voluntary retirement decisions? Evidence from a pension reform. *Journal of Public Economics*, 89, 2121-2136. doi:10.1016/j.jpubeco.2004.12.001
- Harrison, D.A., & Klein, J.T. (2007). What's the difference? Diversity constructs as separation, variety, or disparity in organizations. *Academy of Management Review*, 32, 1199-1228. doi:10.5465/amr.2007.26586096
- Henkens, K., Remery, C., & Schippers, J. (2008). Shortages in an ageing labour market: An analysis of employers' behaviour. *The International Journal of Human Resource Management*, 19, 1314-1329. doi:10.1080/09585190802110117
- Henkens, K., Van Dalen, H., Ekerdt, D., Hershey, D., Hyde, M., Radl, J., Van Solinge, H., Wang, M., & Zacher, H. (2018). What we need to know about retirement: Pressing issues for the coming decade. *The Gerontologist*, 58, 805-812. doi:10.1093/geront/gnx095
- Hennekam, S., & Herrbach, O. (2013). HRM practices and low occupational status older workers. *Employee Relations*, 35, 339-355. doi:10.1108/01425451311320512
- Huttunen, K., Pirttilä, J., & Uusitalo, R. (2013). The employment effects of low-wage subsidies. *Journal of Public Economics*, 97, 49-60. doi:10.1016/j.jpubeco.2012.09.007
- Ilmakunnas, P., & Ilmakunnas, S. (2006). Gradual retirement and lengthening of working life. HECER Discussion Paper, No. 121. doi:10.2139/ssrn.937288.

- Ilmakunnas, P., & Ilmakunnas, S. (2011). Diversity at the workplace. Whom does it benefit? *De Economist*, 159, 223-255. doi:10.1007/s10645-011-9161-x
- Ilmakunnas, P., & Maliranta, M. (2016). How does the age structure of worker flows affect firm performance? *Journal of Productivity Analysis*, 46, 43-62. doi:10.1007/s11123-016-0471-5
- Järnefelt, N. (2010). Education and longer working lives: A longitudinal study on educational differences in the late exit from working life of older employees in Finland. Finnish Centre for Pensions, Studies, no. 2010/1. Retrieved from: <http://urn.fi/URN:978-951-691-131-4>
- Jolkkonen, A., Koistinen, P., Kurvinen, A., Lipiäinen, L., Nummi, T., & Virtanen, P. (2018). Labour market attachment following major workforce downsizings: A comparison of displaced and retained workers. *Work, Employment and Society*, 32, 992-1010. doi:10.1177/0950017017706305
- Kalleberg, A.L. & Mouw, T. (2018). Occupations, organizations, and intragenerational career mobility. *Annual Review of Sociology*, 44, 283-303. doi:10.1146/annurev-soc-073117-041249
- Kannisto, J. (2018). Effective retirement age in the Finnish earnings-related pension scheme. *Finnish Centre for Pensions, Statistics*, 03/2018. Retrieved from: <https://www.etk.fi/wp-content/uploads/effective-retirement-age-in-the-finnish-earnings-related-pension-scheme-2017.pdf>
- Korkeamäki, O., & Kyyrä, T. (2012). Institutional rules, labour demand and retirement through disability programme participation. *Journal of Population Economics*, 25, 439-468. doi:10.1007/s00148-010-0330-z.
- Kulick, C., Ryan, S., Harper, S., & George, G. (2014). From the editors: Aging population and management. *Academy of Management Journal*, 57, 929-935. doi:10.5465/amj.2014.4004



- Kyyrä, T. (2015). Early retirement policy in the presence of competing exit pathways: Evidence from pension reforms in Finland. *Economica*, 82, 46-78. doi:10.1111/ecca.12100
- Kyyrä, T., & Paukkeri, T. (2015). Incentive effects of experience rating in disability insurance. *Finnish Centre for Pensions, Reports*, 07/2015. Retrieved from: <https://www.etk.fi/wp-content/uploads/2015/10/raportti7-2015.pdf>.
- Lazear, E.P. (1979). Why is there mandatory retirement? *Journal of Political Economy*, 87, 1261-1284. doi:10.1086/260835
- Leinonen, T., Laaksonen, M., Chandola, T., & Martikainen, P. (2016). Health as a predictor of early retirement before and after introduction of a flexible statutory pension age in Finland. *Social Science & Medicine*, 158, 149-157. doi:10.1016/j.socscimed.2016.04.029
- Lössbroek, J., Lancee, B., Van der Lippe, T., & Schippers, J. (2017). Understanding old-age adaptation policies in Europe: The influence of profit, principles and pressures. *Ageing & Society*, 39, 924-950. doi:10.1017/S0144686X17001295
- Midtsundstad, T.I. (2011). Inclusive workplaces and older employees: An analysis of companies' investment in retaining senior workers. *International Journal of Human Resource Management*, 22, 1277-1293. doi:10.1080/09585192.2011.559099
- Moen, P., Kojola, E., & Schaeffers, K. (2017). Organizational change around an older workforce. *The Gerontologist*, 57, 847-856. doi:10.1093/geront/gnw048
- OECD (2006). *Live longer, work longer*. Paris: OECD Publishing. doi:10.1787/9789264035881-en
- OECD (2019). Gross pension replacement rates (indicator). doi:10.1787/3d1afeb1-en
- Oude Mulders, J., & Henkens, K. (2019). Employers' adjustment to longer working lives. *Innovation in Aging*, 3, 1-10. doi:10.1093/geroni/igy040

- Oude Mulders, J., Henkens, K., & Schippers, J. (2017). European top managers' age-related workplace norms and their organizations' recruitment and retention practices regarding older workers. *The Gerontologist*, 57, 857-866. doi:10.1093/geront/gnw076
- Riekhoff, A. J., & Järnefelt, N. (2017). Gender differences in retirement in a welfare state with high female labour market participation and competing exit pathways. *European Sociological Review*, 33, 791-807. doi:10.1093/esr/jcx077
- Riekhoff, A. J., & Järnefelt, N. (2018). Retirement trajectories and income redistribution through the pension system in Finland. *Social Forces*, 97, 27-54. doi:10.1093/sf/soy028
- Schröder, H., Muller-Camen, M., & Flynn, M. (2014). The management of an ageing workforce: Organisational policies in Germany and Britain. *Human Resource Management Journal*, 24, 394-409. doi:10.1111/1748-8583.12043
- Skirbekk, V. (2008). Age and productivity potential: A new approach based on ability-levels and industry-wide task demand. *Population and Development Review*, 34, 191-207.
- Steele, F. (2009). *Module 7: Multilevel Models for Binary Responses: Concepts*. Bristol: Centre for Multilevel Modelling.
- Taylor, P., McLoughlin, C., Brooke, E., Di Biase, T., & Steinberg, M. (2013). Managing older workers during a period of tight labour supply. *Ageing & Society*, 33, 16-43. doi:10.1017/S0144686X12000566
- Taylor, P., Loretto, W., Marshall, V., Earl, C., & Phillipson, C. (2016). The older worker: Identifying a critical research agenda. *Social Policy and Society*, 15, 675-689. doi:10.1017/S1474746416000221
- Tuominen, E. (2013). Flexible retirement age in Finland. The evaluation of the Finnish flexible retirement scheme in light of employer and employee surveys. Finnish Centre for Pensions,

Working Papers, 03/2019. Retrieved from: <https://www.etk.fi/wp-content/uploads/2015/10/WP%2003%202013.pdf>.

Van Dalen, H.P., Henkens, K., & Schippers, J. (2010). Productivity of older workers: Perceptions of employers and employees. *Population and Development Review*, 36, 309–330.  
doi:10.1111/j.1728-4457.2010.00331.x

Van Dalen, H.P., Henkens, K., & Wang, M. (2015). Recharging or retiring older workers? Uncovering the age-based strategies of European employers. *The Gerontologist*, 55, 814-824.  
doi:10.1093/geront/gnu048

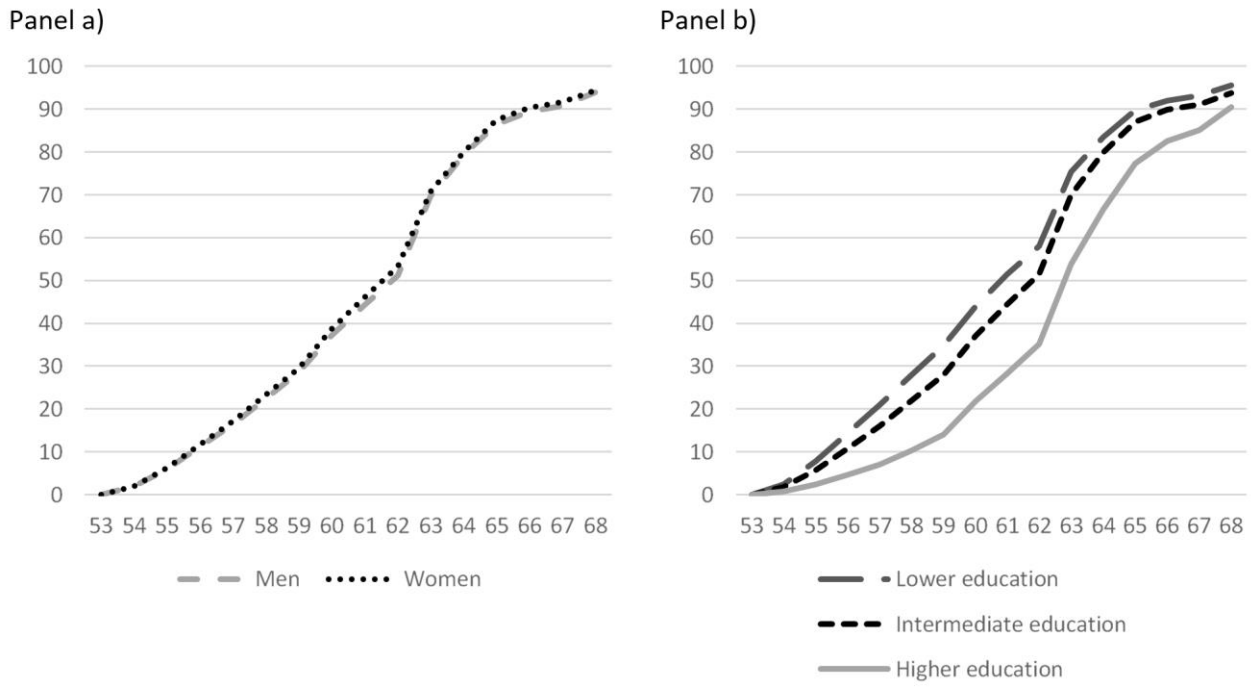
Vandenberghe, V. (2013). Are firms willing to employ a greying and feminizing workforce? *Labour Economics*, 22, 30-46. doi:10.1016/j.labeco.2012.07.004

Vickerstaff, S., & Cox, J. (2005). Retirement and risk: The individualisation of retirement experiences? *The Sociological Review*, 53, 77-95. doi:10.1111/j.1467-954X.2005.00504.x

Vickerstaff, S., Cox, J., & Keen, L. (2003). Employers and the management of retirement. *Social Policy & Administration*, 37, 271-287. doi:10.1111/1467-9515.00338

Wainwright, D., Crawford, J., Loretto, W., Phillipson, C., Robinson, M., Shepherd, S., Vickerstaff, S., & Weyman, A. (2018). Extending working life and the management of change. Is the workplace ready for the ageing worker? *Ageing & Society*, 39, 2397-2419.  
doi:10.1017/S0144686X18000569

Walker, A. (2005). The emergence of age management in Europe. *International Journal of Organisational Behaviour*, 10, 685-697.



**Figure 1. Cumulative percentages of workers having exited the labor market between ages 53-68, by gender (Panel a) and level of education (Panel b)**

**Table 1. Summary statistics of the study population**

Variable		Summary statistics
<i>Individual level</i>		
Age		57.38 (3.25)
Female		42.5%
Married		68.9%
Urban		71.3%
Education	Low	37.4%
	Intermediate	48.8%
	High	13.9%
Manual worker		42.8%
Annual earnings		€36,584 (€58,645)
<i>Firm level</i>		
Sector	Manufacturing	41.2%
	Transport and construction	14.8%
	Retail, trade and hospitality	20.2%
	Insurance, business and other services	16.7%
	Education and health and social services	7.1%
Firm size	Small (10-50 employees)	41.1%
	Middle (50-200 employees)	30.2%
	Large (200+ employees)	28.7%
Mean age		42.41 (4.18)
SD age		10.97 (1.76)
Mean education		3.50 (0.97)
SD education		1.58 (0.31)
Wage curve		0.30 (0.19)
Share of manual workers		0.47 (0.34)
Share of women		0.41 (0.29)

Unemployment rate

11.18 (3.84)

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*Note.* Reported are percentages for the categorical variables and means with standard errors in brackets for the continuous variables.

**Table 2. Results of multilevel discrete-time survival models explaining the risk of labor market exit between ages 53 and 68, risk ratios (SE)**

Variables		Model 1	Model 2
Intercept		0.014*** (0.000)	0.015*** (0.000)
<i>Individual level</i>			
Cohort		0.997** (0.001)	1.002 (0.001)
Female (ref. = Male)		0.998 (0.007)	1.020** (0.007)
Married (ref. = Single/divorced/widowed)		1.039*** (0.006)	1.034*** (0.006)
Urban domicile (ref. = Countryside/village /small town)		1.024** (0.007)	1.050*** (0.008)
Education (ref. = Intermediate)	Low	1.082*** (0.007)	1.086*** (0.007)
	High	0.905*** (0.009)	0.913*** (0.009)
Manual worker (ref. = Non-manual worker)		1.151*** (0.008)	1.123*** (0.008)
Earnings (log)		0.632*** (0.004)	0.630*** (0.004)
<i>Firm level</i>			
Sector (ref. = Manufacturing)	Transport and construction		0.826*** (0.012)
	Retail and trade		0.782*** (0.012)
	Business and services		0.875*** (0.014)

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	Education, social and		0.581***
	health services		(0.013)
Firm size			1.163***
(ref. = Small)	Middle		(0.012)
			1.310***
	Large		(0.021)
Regional unemployment rate			1.030***
			(0.001)
Mean age			1.015***
			(0.001)
SD age			0.970***
			(0.002)
Mean education			0.984*
			(0.007)
SD education			0.921***
			(0.013)
Share manual workers			0.893***
			(0.020)
Wage curve			0.829***
			(0.016)
N observations		1,346,259	1,346,259
N firms		35,576	35,576
ICC		0.185	0.154
-2 Log likelihood		819,414	816,468
AIC		819,460	816,540

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*Note.* Age dummies included but not reported. All models have random intercepts.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .



**Table 3. Interactions of individual level random slopes with firm-level covariates explaining the risk of labor market exit between the ages of 53 and 68, risk ratios (SE)**

	Model 3	Model 4	Model 5
<i>Individual level</i>			
Low education	1.083*** (0.007)		
High education	0.888*** (0.012)		
Manual worker		1.070*** (0.010)	
Earnings (log)			0.557*** (0.005)
<i>Firm level</i>			
Mean education	0.978** (0.008)		
Share manual workers		0.916*** (0.023)	
Wage curve			0.856*** (0.017)
<i>Interactions</i>			
Low education * Mean education	1.003 (0.007)		
High education * Mean education	1.029** (0.010)		
Manual worker * Share manual workers		1.107*** (0.032)	
Earnings * Wage curve			0.887*** (0.028)
Variance random slope	0.003	0.131	0.336

	(0.001)	(0.008)	(0.014)
Variance level 2	0.309	0.271	0.280
	(0.007)	(0.007)	(0.007)
-2 Log likelihood	817,078	816,282	816,267
AIC	817,152	816,354	816,339

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*Note.* Controls included but not reported. Models had random intercepts and the indicated individual-level variables had random slopes.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

## APPENDIX

**Table A1. Results multilevel discrete-time survival models, robustness checks, risk ratios (SE)**

Variables		Model A1 (men)	Model A2 (women)
Intercept		0.015*** (0.000)	0.014*** (0.000)
<i>Individual level</i>			
Cohort		1.004** (0.001)	0.997 (0.002)
Married (ref. = Single/divorced/widowed)		0.938*** (0.008)	1.149*** (0.010)
Urban domicile (ref. = Countryside/village /small town)		1.051*** (0.010)	1.078*** (0.013)
Education (ref. = Intermediate)	Low	1.060*** (0.009)	1.117*** (0.010)
	High	0.916*** (0.012)	0.878*** (0.015)
Manual worker (ref. = Non-manual worker)		1.132*** (0.011)	1.098*** (0.014)
Earnings (log)		0.647*** (0.006)	0.616*** (0.007)
<i>Firm level</i>			
Sector (ref. = Manufacturing)	Transport and construction	0.841*** (0.014)	0.678*** (0.020)
	Retail and trade	0.828*** (0.016)	0.700*** (0.016)
	Business and services	0.884*** (0.018)	0.805*** (0.018)
	Education, social and	0.699***	0.514***

	health services	(0.026)	(0.015)
Firm size		1.192***	1.171***
(ref. = Small)	Middle	(0.015)	(0.017)
	Large	1.342***	1.342***
		(0.026)	(0.029)
Regional unemployment rate		1.026***	1.035***
		(0.001)	(0.002)
Mean age		1.009***	1.016***
		(0.001)	(0.002)
SD age		0.960***	0.961***
		(0.003)	(0.003)
Mean education		0.984	0.964***
		(0.009)	(0.009)
SD education		0.944**	0.900***
		(0.018)	(0.019)
Share manual workers		0.871**	0.832***
		(0.028)	(0.027)
Wage curve		0.835***	0.845***
		(0.020)	(0.025)
Share women		0.824***	1.091**
		(0.026)	(0.034)
N observations		773,696	572,563
N firms		28,143	22,560
ICC		0.149	0.163
-2 Log likelihood		468,549	348,917
AIC		468,621	348,989

*Note.* Age dummies included, but not reported. All models have random intercepts.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .