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Conference Paper

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Beiträge zur Jahrestagung des Vereins für Socialpolitik 2014: Evidenzbasierte Wirtschaftspolitik - Session: Aging and Retirement, No. D03-V3

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Wunsch, Conny; Huber, Martin; Lechner, Michael (2014) : The effect of firms' partial retirement policies on the labour market outcomes of their employees, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2014: Evidenzbasierte Wirtschaftspolitik - Session: Aging and Retirement, No. D03-V3, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

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The effect of firms' partial retirement policies on the labour market outcomes of their employees

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This version: September 2013

Date this version has been printed: 04 September 2013

Comments are very welcome

Abstract: In this paper, we assess the impact of firms introducing part-time work schemes for gradual labour market exit of elderly workers on their employees' labour market outcomes. The analysis is based on unique linked employer-employee data that combine high-quality survey and administrative data. Our results suggest that partial or gradual retirement options offered by firms are an important tool to alleviate the negative effects of low labour market attachment of elderly workers in ageing societies.

Keywords: part-time work, elderly employees, treatment effects, matching

JEL classification: J14, J26, C21.

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1 Introduction

The low labour market attachment of the elderly has far-reaching consequences for the sustainability of the public welfare system in general and the pension system in particular, as well as important implications for future labour supply in ageing societies. Despite increasing longevity, the average effective age at which older workers withdraw from the labour force has declined in almost all OECD countries since the 1970s (OECD, 2009). Even though this trend has been slightly reversed since the turn of the millennium, the effective retirement ages in all but two OECD countries remain substantially lower than in the 1960s and 1970s. For Germany, Börsch-Supan and Jürges (2011) report that the labour force participation of elderly men aged 60 to 64 has dropped from more than 80% in 1966 to less than 35% in 1980s and 1990s. Since about the year 2000, the participation rate has been increasing again, arguably as a response to a sequence of cost cutting reforms after 1992, but it was still just over 40% in 2005. Also female labour force participation in this age group has dropped sharply in the 1970s and only started to recover in the mid-1990s, reaching approximately 25% in 2005.

Germany introduced partial and gradual retirement options in 1996 under the name of part-time work for elderly employees (henceforth PWE). It was intended as a means to smooth the transition from work life to retirement for individuals of age 55 and older.¹ Employees and employers were given the choice between a part-time work schedule during the entire PWE period, and a full-time work schedule in the first half and a leave of absence in the second half of the PWE period, which is called the block model.

Over the entire PWE period, the employers were obliged to pay 50% of the gross wage. However, if the employer filled the vacancies created by PWE with unemployed or young job seekers, Germany's Federal Employment Agency (FEA) provided a supplement

¹ Indeed, multiple surveys that have been conducted in various countries suggest that workers have an interest in reducing their working hours as they get older, see for instance Abraham and Houseman (2004) and Drago, Wooden, and Black (2009).

payment such that employees in PWE effectively received 70% of their prior net salary and 90% of their pension contribution. The aim of PWE was to decrease costs in the public pension and unemployment schemes through an increase in the labour force attachment of elderly workers that would have otherwise withdrawn from work life completely via unemployment and/or early retirement. The political discussion of PWE has been highly controversial, despite a legal revision in 2004 that reduced the generosity of supplement payments. Critics argue that the block model, which accounts for the vast majority of PWE agreements, has a similar character as "regular" early retirement schemes (see the discussion in Brussig, Knuth, and Wojtkowski, 2009) and that PWE, in contrast to its initial intention, creates unjustifiable public costs through the supplement payments of the FEA.

Motivated by the challenges of the negative effects of low labour market attachment of elderly workers in ageing societies and the ambiguity of the merits of PWE in the political discussion, this paper investigates the effects of the availability of PWE in German firms on the labour market outcomes of their employees. Most of the existing literature has focused on studying the determinants of partial retirement (e.g. Gustman and Steinmeier, 1984; Honig and Hanoch, 1985; Ruhm, 1990; Hurd and McGarry, 1993; Haider and Loughran, 2001; Hutchens, 2003; Even and Macpherson, 2004; Hutchens and Grace-Martin, 2006; Hutchens and Chen, 2007; Robinson and Clark, 2010). Comparably few studies investigate the effect of these schemes on the age at which workers completely withdraw from the labour market. Using the 2006 Portuguese Labour Force Survey and a hazard model, Machado and Portela (2012), for example, investigate the effect of a voluntary reduction in hours of work on the timing of full retirement. The authors find that reductions are associated with earlier retirement in their data and conclude that reducing hours of work appears to signal the desire to retire sooner rather than to remain in the labour market (at reduced hours).

This paper contributes to the existing literature in several dimensions. Firstly, we not only investigate how the availability of PWE affects labour market participation, but also consider other outcomes of interest. We study the effects on employment and tenure as alternative measures of labour market attachment and worker retention. Additionally, we investigate the effects on unemployment as alternative pathways to (early) retirement, which may be substituted for PWE. Our findings can therefore serve as inputs to a cost-benefit analysis of PWE in terms of public costs. Secondly, we analyse effect heterogeneity with respect to regions with different labour market conditions and gender.

Finally, relative to the existing literature, we also make some methodological improvements. We exploit unique linked employer-employee data that combine high-quality survey and administrative data. These data allow us to follow individual labour market outcomes for up to 6.5 years, such that both short and longer-term effects can be assessed. We explicitly address the selection problems involved in the estimation of the effects of PWE on workers' labour market outcomes. The richness of the data allows us to plausibly control for employers' selection into offering PWE. Moreover, in addition to conditioning on a comprehensive set of observed characteristics, we use an empirical design that also controls for unobserved time-constant confounders. Also in contrast to much of the literature, we use rather flexible econometric methods, namely semiparametric radius matching on the propensity score with bias adjustment as proposed in Lechner, Miquel, and Wunsch (2011) and analyzed in terms of finite sample properties in Huber, Lechner, and Wunsch (2013). Contrary to parametric estimators, these robust methods have the advantage that they do not rely on tight functional form assumptions that are likely to be violated in real world applications, and they allow for effect heterogeneity.

We find that PWE does not affect the time at which elderly workers withdraw from the labour market. Instead, the availability of PWE reduces unemployment on the way to-

wards (early) retirement. For East Germany, in contrast to West Germany, we find positive effects on employment and tenure as measures of labour market attachment and worker retention by firms. These findings suggest that partial or gradual retirement options offered by firms can be an important tool to alleviate the negative effects of low labour market attachment of elderly workers in ageing societies.

The remainder of the paper is organized as follows: Section 2 provides background information on PWE in Germany. In Section 3, we introduce the database and define the sample used in the estimation. Section 4 presents descriptive statistics. Identification and estimation are outlined in Section 5. Section 6 discusses the effect estimates for the various groups defined by age, gender, and region. Section 7 concludes. Appendix A provides the specifications and results of the estimations of the various propensity scores.

2 Background information on part-time employment for elderly in Germany

2.1 *Institutional background*

In 1996, the “Altersteilzeitgesetz” (henceforth PWE Act), which provided a legal framework for partial or gradual retirement agreements, came into force in Germany. Employers and employees could choose between two options (see German Federal Employment Agency 2003): a part-time work schedule during the entire PWE period, and the so-called block model that comprises a full-time work schedule in the first half and a leave of absence in the second half. Over the entire PWE period, employers were required to pay 50% of the gross wage. If the vacancies created by PWE were filled with unemployed or young job seekers, Germany's Federal Employment Agency (FEA) provided a supplement payment such that employees in PWE effectively received 70% of their prior net salary and 90% of their pension contribution. Smaller companies with up to 50 employees were also allowed to hire apprentices instead of unemployed and/or young job seekers. To be eligible for the supplement, which was granted for at most 6 years (even if the PWE agreement covered a longer period),

employees had to be 55 or older and had to work for at least 18 hours per week after reducing their working time by half. In 2000, eligibility was extended to individuals in part-time employment (even before switching into PWE).

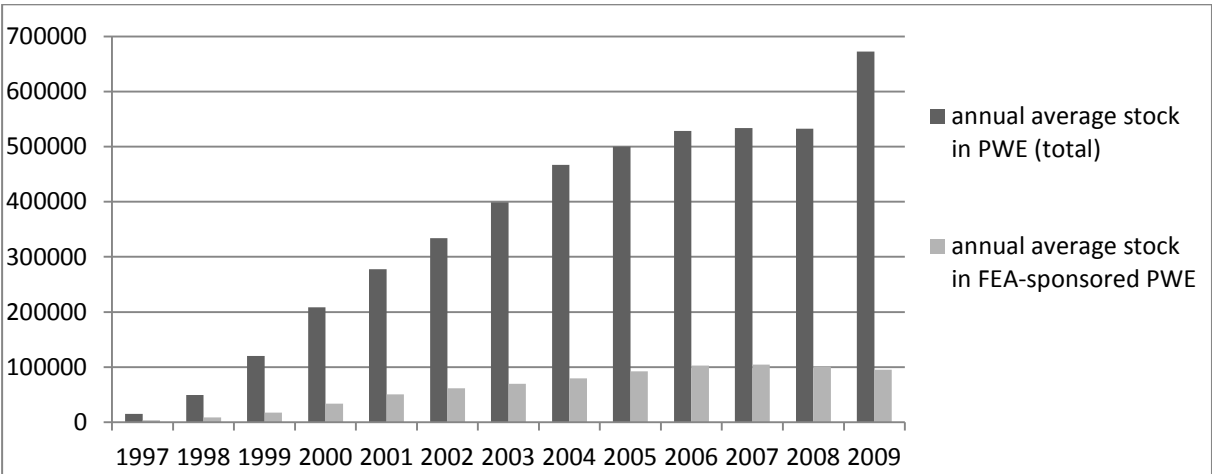
It is important to note that the PWE Act did not create a general legal claim to PWE for all employees in Germany. The adoption of PWE was conditional on the employer's decision to offer these options and formally required the consideration in the collective wage agreement (if applicable) or some form of internal agreement, see Brussig, Knuth, and Wojtkowski (2009). Furthermore, the PWE Act only set the legal minimum standards (that were subject to potential supplement payments by the FEA), but several collective wage agreements provided higher wages, see Wanger (2009). Descriptive statistics in Ellguth and Koller (2000) suggest that (in 1998) larger firms were considerably more likely to offer PWE than smaller ones, which the authors suspect to result from the higher flexibility of the former in terms of human resource policies as well as the involvement of employee organizations/works committees.

In 2004, the PWE regulations were revised in the course of the so-called Hartz III legislation that reduced the generosity of the FEA-sponsored components (see German Federal Employment Agency, 2008). Firstly, for all PWE agreements starting on July 1, 2004 or later, a 20% wage supplement to the PWE gross salary (50% of the prior full time gross salary) was granted, however, excluding single or irregular payments. This could generally entail a net salary lower than 70% of the prior full time net salary. Secondly, the pension contributions were reduced. Thirdly, for the block model, employers were obliged to insure against loss in case of bankruptcy. Finally, by the beginning of 2010, the entitlement to FEA supplements for new PWE agreements expired altogether implying that no new supplement payments were granted from 2010. However, the PWE Act remains a valid legal framework for employers and employees, even if FEA sponsoring does no longer apply to new agreements.

2.2 Utilization of PWE

As shown in Figure 2.1, the utilization of PWE increased steadily in the 10 years after its introduction in 1996, reaching an annual average stock of almost 530,000 elderly workers in 2006. In the subsequent two years, PWE utilization remained quite stable. According to Brussig, Knuth, and Wojtkowski (2009), almost one in five employees aged 55 to 64 was in PWE in 2007 when considering total employment subject to obligatory social security contributions in this age group. In 2009, PWE experienced a sharp rise to more than 672,000 workers, very likely as a reaction to the economic crisis. Disentangling the stock by gender and region shows that males in West Germany accounted for 48%, females in West Germany for 31%, males in East Germany for 8%, and females in East Germany for 13% of PWE in 2009 according to the German Pension Insurance Fund (2012).

Figure 2.1: Annual average stock of total and FEA-sponsored PWE



Sources: Statistics of the German Pension Insurance Fund (<http://www.deutsche-rentenversicherung.de>, 2012) and of the German Federal Employment Agency (<http://statistik.arbeitsagentur.de>, 2012).

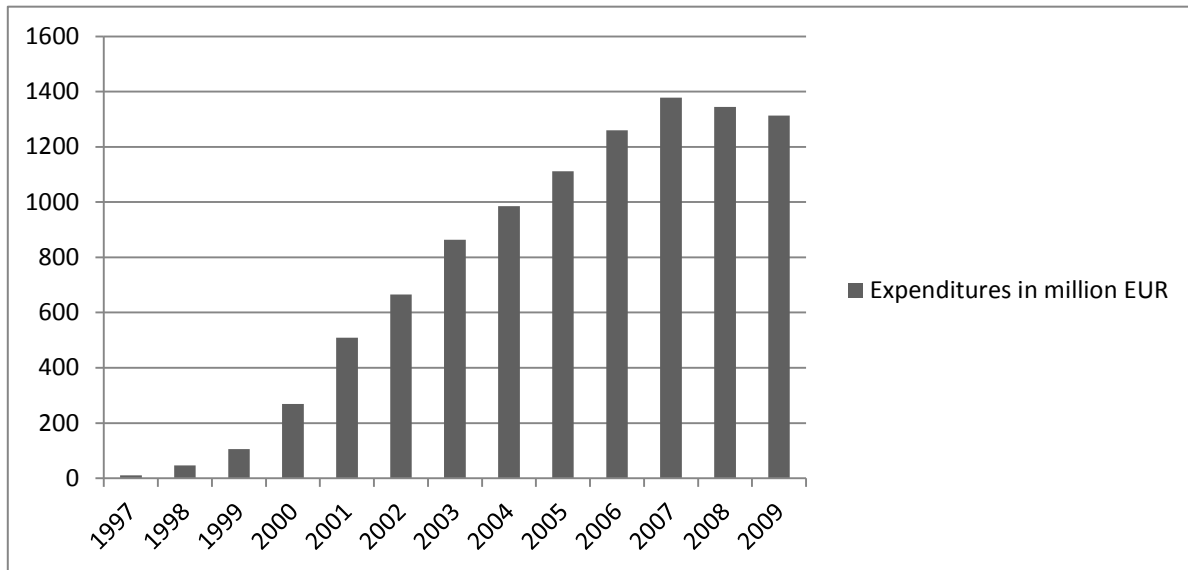
Interestingly, only a minor part of total PWE in any given period was supported by the FEA. This suggests that many employers, albeit adopting PWE, preferred foregoing the FEA supplement payments at the benefit of remaining unconstrained in their hiring policies. After a continuous rise it passed 100,000 beneficiaries in 2006 and has been declining slowly ever since 2008. Note that the statistic only considers cases that received FEA transfers in the re-

spective year, irrespective of the total time frame of the PWE agreement. For the block model, this implies that the individuals only enter these statistics during their leave of absence, i.e., in the second half of the PWE, as FEA payments only start after the full-time work phase. Disentangling the shares of the two PWE models, namely part-time work over the entire time frame versus the block model, reveals that the latter is by far the more popular option and has become more important over time. Already in 2005, 84.6% of all FEA-sponsored PWE agreements were based on the block model, and its share increased to 89.1% (90.2%) in 2008 (2011) (see German Federal Employment Agency, 2012).

The predominance of the block model seems to be contrary to the initial political desire to truly smooth the work-retirement transition rather than having separate periods of full and no employment. Wanger (2009) notes that it was the employer and employee organizations that demanded the consideration of the block model in the PWE Act, as it arguably provided employers with a socially acceptable means to rejuvenate the workforce and enabled employees to de facto retire without large financial losses. The usage of the block model as a tool to reshape the firms' staff could therefore be an important reason for the popularity of PWE, also in the light of the low take-up of FEA supplements which apparently were not the driving force in this development.

The costs of FEA-sponsoring were nevertheless far from being negligible. Figure 2.2 shows that expenditures raised dramatically since the PWE Act came into force, therefore causing much controversy in political and public debates in Germany. They climbed from just 10.6 million Euros in 1997 for 3,286 cases to a staggering 1.38 billion in 2007 when FEA-sponsored PWE reached its peak (104,350 cases). In 2010, PWE still accounted for 1.34 billion or roughly 3% of the FEA's total expenditures.

Figure 2.2: Annual PWE-related expenditures of the Federal Employment Agency



Sources: Statistics of the German Federal Employment Agency (<http://statistik.arbeitsagentur.de>, 2012)..

3 Data and definition of the sample

3.1 Data

Our empirical analysis relies on unique linked employer-employee data that combine different administrative and survey data sets from the FEA's Institute of Employment Research (IAB). The data is based on the IAB Establishment Panel, which is a representative survey of German establishments. It covers a broad spectrum of firm level information including firm size, industry, legal form, biographical data, structure of the work force (e.g. education, occupation, share of males/females), employee turnover, vacancies and labour demand, working hours, and human resource policies (e.g. flexible work time, inclination to recruit older workers). Furthermore, there is information on training activities, financial revenues and profits, investment activities, usage rate, technological and organizational factors, and use of financial support or subsidies, among many others. The survey was first conducted in 1993 and is annually repeated. It is an unbalanced panel due to attrition and the inclusion of new companies over time.

The information from the EP has been linked to the so-called IAB Establishment History Panel that includes a rich set of aggregate information on the firm's employees. The variables describe the composition of a firm's work force, for example in terms of age, education, tenure, and earnings. They are based on the employees' social insurance records and are constructed, for each year, from the cross section of all workers employed in the firm on June 30.

For the firms in our sample, which is described in more detail below, the social insurance records of their employees with full employment, unemployment and earnings histories and a rich set of personal characteristics for the years 1990-2008 have been merged to the firm data. These data have been used, for example, by Wunsch and Lechner (2008), Biewen et al. (2013), Wunsch (2013), and Lechner and Wunsch (2013). Finally, the data also contains a rich set of regional characteristics such as the federal state, urbanization, and local labour market conditions that have been linked via county identifiers from regional statistics.

3.2 Sample and treatment definition

Our empirical analysis is based on the 13,931 firms included in the IAB Establishment Panel in 2000. As described in more detail below, the design of our study requires that we also observe the firms in the 1999 and 2002 waves of the survey. Due to relatively high attrition rates in the EP,² this reduces the original firm sample by 57%. We furthermore exclude all firms with less than 100 or more than 1000 employees in the year 2000 (which reduces the sample size by another 28%) to increase homogeneity and, more importantly, to avoid common support problems. The latter arise if for some firms that offer PWE no comparable (in terms of observed characteristics) firms that do not offer PWE can be found. In particular, small firms are rarely offering PWE and, therefore, a size of less than 100 employees would almost perfectly predict selection into treatment. Furthermore, firms that neither have a collective wage agreement, nor tie pay to collective agreements were discarded due to similar

² See http://fdz.iab.de/de/FDZ_Establishment_Data/IAB_Establishment_Panel/IAB_Establishment_Panel_Working_Tools.aspx#Weitere%20Arbeitshilfen, 03.09.2013.

common support issues. For similar reasons, we exclude firms in specific sectors, in particular agriculture, forestry, mining, power/water supply, children's/retirement homes, laundry/cleaning services, grooming, rental activities (e.g. cars), public administration, and social insurance. Firm that could not be attributed to any industry are deleted as well. Thus, the sample is restricted to private companies that are representative for firms in the manufacturing and service sectors. The reduction in sample size due to these last selection steps is small.

Information about PWE comes from two sources. Firstly, the 1999 and 2002 waves of the firm survey include a question whether the firms offers PWE. Secondly, the social insurance records of the employees indicate whether there is any worker on a PWE contract. For identification, we will exploit the introduction of PWE in some firms between 2000 and 2002. Therefore, our baseline sample consists of firms that do not offer PWE in 1999 and 2000 (measured in the 1999 survey and the administrative data from 1999 and 2000), which is the case for 80% of the firms that remained after the selection steps explained in the last paragraph. Treatment status is defined based on the availability of PWE in 2002: The treated pool consists of all firms that have switched to offering PWE according to the survey data, while those not offering PWE in 2002 according to both the survey data and to the administrative data constitute the nontreated sample. The very few cases where PWE is offered according to the administrative data but not according to the survey data are discarded from our sample.

In our analysis, we focus on the effects of offering PWE on the firms' work force in the year 2000. Thus, our estimation sample consists of the workers who are employed by the sampled firms in June 2000 with at least three years of tenure. The conditions prevents that identification is jeopardized, for example, by employees entering a firm in reaction to the (expected) introduction of PWE. Furthermore, we select only workers of age 31 to 60 years (June 2000). This condition ensures that workers are sufficiently away from educational choices and statutory retirement age (65).

Table 3.1: Number of firms and individuals per stratum

	West						East					
	Males			Females			Males			Females		
Age	31-40	41-50	51-60	31-40	41-50	51-60	31-40	41-50	51 plus	31-40	41-50	51-60
Firms	179	178	176	178	178	174	166	167	171	172	201	182
Individuals	4098	4269	3390	3323	3412	2227	4145	4894	2902	4339	4953	2454

We conduct our evaluation within 12 distinct strata. They are defined by region (West and East Germany) to account for differences in selection into treatment, as well as age groups (elderly: 51-60, intermediate: 41-50, and young: 31-40) and gender, to account for the possibility of heterogeneous treatment effects and, as regards the youngest group, to assess the validity of our identification strategy (see the last paragraph of Section 5.2 for details). Table 3.1 summarizes the number of observations (firms and individuals) that are available in each of the 12 strata.

4. Descriptive statistics

This section presents descriptive statistics for the key group of elderly workers (aged 51-60) and their employers. In Table 4.1, we present characteristics of the firms in which the elderly workers were employed in June 2000, separately by PWE status, gender, and region. Table 4.2 displays the characteristics of employees in those groups.³

³ Information on the younger groups that are also considered in the econometric analysis (aged 41-50 and 31-40, respectively) is available from the authors upon request. Also, due to the very large number of variables in the data (several hundred) we abstain from presenting statistics on all variables. They are available on request. The information available in administrative data is well documented in Wunsch and Lechner (2008) and Lechner and Wunsch (2013). For a detailed documentation of the variables available in the IAB Establishment Panel see http://fdz.iab.de/de/FDZ_Establishment_Data/IAB_Establishment_Panel/IAB_Establishment_Panel_Working_Tools.aspx, for those in the IAB Establishment History Panel see http://fdz.iab.de/de/FDZ_Establishment_Data/Establishment_History_Panel/Establishment_History_Panel_Working_Tools.aspx.

Table 4.1: Mean characteristics of firms of elderly workers, by gender and region

	PWE	<i>Men West</i>		<i>Women West</i>		<i>Men East</i>		<i>Women East</i>	
		no	yes	no	yes	no	yes	no	yes
Basic firm characteristics									
Log number of employees		5.65	5.87	5.48	5.90	5.53	5.71	5.56	5.90
Number of newly hired employees		0.16	0.13	0.16	0.15	0.12	0.09	0.13	0.12
Number of employees leaving the firm		0.28	0.29	0.33	0.27	0.17	0.15	0.13	0.09
Mean age of employees		40	40	40	39	41	40	41	39
Share of employees being 55 or older		0.14	0.13	0.13	0.12	0.13	0.12	0.12	0.11
Normalized mean earnings		1.22	1.34	0.93	1.12	0.94	1.09	0.75	0.91
Share of female employees		0.26	0.21	0.55	0.51	0.34	0.26	0.65	0.66
Share of employees w/o German citizenship		0.13	0.13	0.13	0.11	0.00	0.01	0.00	0.00
Share of part-time employees		0.09	0.06	0.23	0.20	0.08	0.06	0.26	0.25
Human capital									
Share of apprentices		0.03	0.05	0.03	0.06	0.05	0.05	0.04	0.07
Share of unskilled workers		0.28	0.29	0.33	0.27	0.17	0.15	0.13	0.09
Share of skilled workers		0.30	0.27	0.15	0.13	0.41	0.45	0.22	0.17
Share of clerks		0.29	0.33	0.26	0.33	0.29	0.28	0.34	0.42
Share of employees without vocational degree		0.26	0.27	0.34	0.28	0.10	0.08	0.09	0.10
Share of employees with vocational degree		0.61	0.64	0.48	0.61	0.74	0.75	0.72	0.76
Share of college/university graduates		0.05	0.07	0.03	0.06	0.11	0.15	0.07	0.11
Industry									
Manufacturing		0.66	0.88	0.57	0.60	0.59	0.78	0.28	0.26
Construction		0.13	0.01	0.02	0.01	0.00	0.00	0.05	0.01
Trade/sales/retail		0.08	0.06	0.13	0.19	0.06	0.08	0.19	0.22
Service industry		0.14	0.05	0.28	0.20	0.35	0.14	0.49	0.51
Organization									
Foreign ownership >50%		0.37	0.14	0.19	0.06	0.13	0.04	0.07	0.03
No working-time accounts		0.21	0.25	0.39	0.36	0.25	0.19	0.44	0.50
No works council		0.14	0.04	0.32	0.04	0.18	0.05	0.27	0.04
Profit sharing		0.16	0.24	0.14	0.18	0.07	0.17	0.09	0.12
Pay tied to collective agreement		0.24	0.11	0.21	0.18	0.20	0.18	0.23	0.13
Recent reorganization of corporate structure		0.33	0.55	0.23	0.34	0.44	0.27	0.39	0.29
Staff-related issues									
Looking for staff right now		0.60	0.67	0.52	0.67	0.27	0.45	0.34	0.50
Hard to find skilled workers		0.59	0.67	0.51	0.66	0.42	0.53	0.30	0.50
Staff shortage		0.30	0.15	0.29	0.12	0.06	0.04	0.06	0.07
High rate of absences		0.38	0.21	0.34	0.33	0.22	0.25	0.15	0.21
Regional characteristics									
Firm in city		0.38	0.29	0.30	0.31	0.19	0.11	0.12	0.30
Deviation from mean unemployment rate '02		8.37	8.39	8.24	9.25	13.60	14.98	15.67	15.79
Number of observations		1167	2223	951	1276	1365	1537	1307	1147

Note: All variables are measured in 2000 or relative to June 30, 2000.

Table 4.1 shows that the introduction of PWE is selective with respect to a range of firm characteristics. In particular, establishments providing PWE are on average substantially larger and pay higher wages than those that do not. Moreover, they differ considerably from

non-providers of PWE in terms of the distribution of industries. Organizational characteristics also seem to matter. Foreign-owned firms or companies that tie wages to a collective agreement are less likely to offer PWE, while firms with a works council or profit sharing arrangement are more likely to do so. The incidence of recent corporate reorganizations is also related to the treatment, however, in opposite directions for West and East Germany. A further important dimension concerns staff-related issues such as difficulties in hiring or retaining employees, because PWE could potentially be used to alleviate such problems. Indeed, the data suggest that firms reporting searching for employees and having trouble in finding skilled personnel are more likely to offer PWE, arguably to prevent experienced elderly employees from leaving the firm too early.

Table 4.2: Mean characteristics of elderly workers, by gender and region

	Men West		Women West		Men East		Women East		
	PWE	no	yes	no	yes	no	yes	no	yes
Age		55.2	55.2	55.1	54.6	55.5	55.3	54.8	54.8
No vocational degree		0.18	0.20	0.46	0.38	0.05	0.04	0.08	0.06
Vocational degree		0.68	0.71	0.42	0.56	0.72	0.72	0.76	0.82
College/university degree		0.06	0.05	0.01	0.01	0.19	0.23	0.07	0.08
Tenure in years		3.49	3.34	3.24	3.39	2.66	2.82	2.64	2.79
Share employed in 2 years before 2000		1.00	1.00	0.86	0.94	0.36	0.48	0.36	0.38
Share unemployed in 2 years before 2000		0.00	0.00	0.03	0.01	0.02	0.01	0.06	0.03
Share out of labour force in 2 years before 2000		0.00	0.00	0.12	0.05	0.62	0.51	0.58	0.59
Gross earnings per month in 2000		3060	3240	1760	2080	2180	2480	1660	1920
Unskilled worker		0.24	0.26	0.42	0.32	0.16	0.13	0.14	0.08
Skilled worker		0.39	0.34	0.06	0.01	0.50	0.53	0.12	0.09
Clerk		0.37	0.40	0.25	0.30	0.34	0.34	0.49	0.54
Job in engineering		0.30	0.33	0.03	0.03	0.27	0.36	0.04	0.07
Job in construction		0.09	0.03	0.02	0.02	0.00	0.00	0.00	0.00
Job in manufacturing		0.15	0.26	0.20	0.16	0.16	0.21	0.06	0.06
High-skilled job in services		0.27	0.24	0.37	0.49	0.28	0.22	0.55	0.69
Low-skilled job in services		0.09	0.07	0.19	0.12	0.18	0.12	0.21	0.13
Other job		0.10	0.08	0.19	0.18	0.10	0.06	0.14	0.04
No German citizenship		0.12	0.14	0.11	0.11	0.00	0.00	0.00	0.00
Number of observations		1167	2223	951	1276	1365	1537	1307	1147

Note: All variables are measured in 2000 or relative to June 30, 2000.

Table 4.2 indicates that the firms offering PWE also differ in terms of the composition of their work force. Their employees appear to have on average somewhat more favourable

labour market histories. For example, the proportion of time in employment prior to the treatment period is higher (apart from West German men, who were fully employed in any case), while among West German women and East German men, the time out of labour force is lower. Furthermore, the average earnings of elderly employees in firms with PWE are somewhat higher, which is in line with the higher average earnings among firms with PWE in general. Finally, the composition of jobs differs substantially across elderly workers in firms with and without PWE, which appears intuitive given the differences in the distribution of industries mentioned before.

5. Empirical strategy

5.1 Identification

Identification of the effect of PWE requires solving three selection problems. Firstly, workers self-select into PWE. Gustman and Steinmeier (1984), for example, find using the Retirement History Study (RHS) on men aged 58 to 63 provided by the US Social Security Administration, that partial retirement varies systematically with individual characteristics such as age, health, family status as well as pension coverage, mandatory retirement provisions, and wage offers in the main and partial-retirement jobs. Similarly, Honig, and Hanoch (1985) use the same data source and identify health, age, education, expected social security income, nonwage income, self-employment, labour force experience, and pension coverage as key determinants of retirement, partial retirement, and full employment.⁴ More recently, Robinson and Clark (2010) combined the HRS with the Rand HRS database to estimate the effect of retiree health insurance on the retirement decision by means of a Cox proportional hazard model and propensity score matching. Insurance is found to increase the likelihood to

⁴ Furthermore, Kim and DeVaney (2005) estimate a multinomial logit based on the RHS. In line with previous findings, their results suggest that the more educated and self-employed more likely choose partial retirement over full-time work, while those with more financial assets, pensions, health insurance, poor health, and less education have an increased probability to fully retire. Also see Ruhm (1990) and Haider and Loughran (2001).

disengage from the job considerably. Many of these variables, especially health and pension coverage are unobserved in most data sets.

We tackle the problem of self-selection of workers into PWE as follows: Firstly, we estimate a causal parameter similar to an intention-to-treat effect. Specifically, we estimate the effect of the *availability of PWE* in a firm rather than take-up of PWE by its employees. Thus, we do not have to model selection into take-up of PWE. Moreover, we consider this parameter the most interesting one as it gives the effect of introducing the PWE at the firm level. Secondly, we consider workers who are employed in firms that do not offer PWE initially, thus making them homogeneous *ex ante*, and then exploit the introduction of PWE by some but not by all of those firms. Thirdly, we require that all workers have been with the firm for at least three years by the time PWE is introduced to ensure that workers did not self-select into firms in anticipation of the introduction of PWE.

The second selection problem occurs because firms select into offering PWE. Hutchens and Grace-Martin (2006) address this issue using the US Health and Retirement Study (HRS) and conclude that phased retirement is more likely available in firms with flexible work hours, part-time employment, and job sharing.⁵ This is in line with Hurd and McGarry (1993), who find that particular job characteristics such as the flexibility to reduce hours or move to a less demanding job increase the prospective retirement age.⁶ Again using the HRS, Even and Macpherson (2004) consider both firm- and individual-level selection into partial retirement. Their results suggest that firms providing pension plans are less willing to allow workers to cut hours and that (in line with the studies mentioned before) pension-covered workers are less likely to switch to part-time employment and more likely to switch to full retirement. The latter is true even conditional on the original employer's willingness to allow

⁵ See also Hutchens (2010), who uses the same survey to investigate which types of employees have particularly good chances to be considered for phased retirement in firms offering it at all.

⁶ Pensions and health care insurance are further important predictors of prospective retirement, in contrast to physical and mental job requirements.

a reduction in work hours and various firm and worker characteristics. Hutchens and Chen (2007) combine the HRS with a representative US employer survey conducted in 2001 and 2002 and confirm previous findings that the opportunity of partial retirement depends on both employer and employee characteristics (e.g., whether the company is public or private, worker's age, defined benefit pension plans, and unionization). Furthermore, Hutchens (2003) finds that firm size and growth, as well as the composition of the work force in terms of age, gender, and tenure is correlated with the likelihood to offer partial retirement.

We base identification on the assumption that we observe all relevant determinants of the decision to introduce PWE that are also related to the labour market performance of the firms' employees (so-called conditional independence assumption, CIA, see Imbens, 2004, and Imbens and Wooldridge, 2009, for an in-depth discussion). The survey and administrative data together provide detailed information on job flexibility (e.g., part-time work, flexible working times, job rotation, etc.), unionization and the presence of collective agreements, industry, firm size, firm growth, and various dimensions of the work force structure such as education, occupation, gender, age and tenure, suggesting that we can control for most of the firm-level characteristics that have been identified as being crucial in the literature. Employer pension plans play a negligible role in Germany as most pensions are coming from the public pension insurance. However, we control for other financial incentives to stay with or leave a firm such as equity and profit participation. We additionally condition on important regional characteristics such as geographic region, urbanization, and local unemployment rate, which could affect the introduction of PWE via the composition of the local labour force or firm performance while at the same time influencing individual labour market success.

The third selection problem occurs due to individual selection into the firms. Even if the firm and regional characteristics listed above are held constant, some characteristics of the firms' workers that affect their labour market performance may still differ between firms with

and without PWE. We solve this problem by exploiting the rich set and longitudinal dimension of the employee-level characteristics provided in the administrative data. Besides characteristics such as age, education, occupation, job position, and earnings, workers' labour market histories play a key role in this context because they allow us to implement a design, which controls for certain potentially unobserved confounders. By considering a homogenous sample of firms initially not offering PWE and conditioning on 10 years of pre-treatment labour market outcomes of the firms' employees, time-constant unobserved factors that jointly affect the introduction of PWE and workers' labour market outcomes are controlled for in a similar way as discussed in Huber, Lechner, and Wunsch (2011). Therefore, the CIA is more plausible than in conventional cross-sectional studies that do not make use of pre-treatment outcomes. As regards the latter, due to the requirement that all workers in our sample have been with the same firm for at least three years, our sample is extremely homogenous with respect to short- to medium-run employment histories. On top of that, we condition on 10 years of employment, unemployment, and earning histories of the employees in a detailed way. However, CIA still remains a strong assumption. Therefore, to assess its validity, we exploit that young workers, who are not eligible for PWE and are far from reaching eligibility, should be unaffected by the introduction of PWE. Estimating the effects for the youngest stratum (aged 31-40) serves as some sort of placebo test for the validity of the CIA.

5.3 Estimation

5.3.1 General methodology

We use radius matching on the propensity score to estimate the average effects of the availability of PWE on employees' labour market outcomes. Any estimator based on the CIA is built on the idea of comparing outcomes across units with and without treatment that are similar with respect to observed confounders in order to pin down the causal effect of the treatment. Propensity score matching estimators define similarity in terms of a function of the

probability to be treated conditional on the confounders. In the program evaluation literature, this conditional probability is referred to as propensity score (see Rosenbaum and Rubin, 1983). An advantage of these estimators is that they are semiparametric and therefore more robust than parametric methods, and that they allow for flexible effect heterogeneity.

Specifically, we apply an estimator that takes into account the methodological considerations of Lechner, Miquel, and Wunsch (2011). Compared to standard nearest-neighbour matching this procedure is more precise because it incorporates the idea of radius matching (e.g. Dehejia and Wahba, 2002). Furthermore, the algorithm uses the initial matching weights in a second step of (weighted) regression adjustment, which has two advantages. Firstly, the estimator satisfies a so-called double robustness property: the estimator remains consistent if either the matching step is based on a correctly specified selection model, or the regression model is correctly specified (e.g. Rubin, 1979, Joffe, Ten Have, Feldman, and Kimmel, 2004). Secondly, the regression adjustment should reduce small sample as well as asymptotic biases of matching (see Abadie and Imbens, 2006). Huber, Lechner, and Wunsch (2013) investigate the finite sample properties of this radius matching with bias adjustment algorithm along with many other matching type estimators and find it to be highly competitive.

Concerning inference, Abadie and Imbens (2008) show that for standard matching (i.e. based on a fixed number of comparison observations) bootstrap-based inference may be invalid. However, the matching algorithm used in our analysis is smoother than the one studied by Abadie and Imbens (2008) because it is based on a variable number of comparisons and the regression adjustment. For this reason, the bootstrap is most likely a valid inference procedure in our context. However, the standard bootstrap, which randomly draws employees with replacement, may underestimate the standard errors, because there is a correlation of employees of the same establishment. Therefore, we rely on a block bootstrap that resamples establishments (rather than individuals) along with all employees therein to account for clustering at

the establishment level. To be more precise, inference is based on (i) (block) bootstrapping establishments and individuals 499 times; (ii) computing the bootstrap t-statistics of the respective average effects in each of the samples (normalized by the estimated effect); and (iii) estimating the p-value as the share of absolute bootstrap t-statistics that are larger than the absolute t-statistic in the original sample (see for instance MacKinnon, 2006, for a discussion on bootstrapping symmetric statistics). Since the theoretical results by Abadie and Imbens (2006) and the simulation based results in Huber, Lechner, and Wunsch (2013a) suggest that the estimator is asymptotically normally distributed, bootstrapping the potentially pivotal t-statistic (computed under the assumption that the weights obtained to compute the control group are non-stochastic; see Lechner, 2002) has the advantage of potentially providing so-called asymptotic refinements and thus improving inference. In addition, we also checked the bootstrap distribution of the estimated effects directly (quantile method). The results are similar (available on request).

5.3.2 Results from the estimation of the propensity score

We estimate the propensity score using separate probit models for each of the 12 strata (defined by age, gender, and region). This approach accounts flexibly for heterogeneity in the determinants of the decision to introduce PWE across stratum characteristics. This is important, because the distinct economic situation and workforce/industry composition in West and East Germany is likely to affect the inclination towards PWE. We condition on regional, firm level, and individual characteristics to control for the firm's selection into offering PWE and the staff's selection into the respective firms. The probit specifications are presented in Appendix A.⁷ The coefficients show that firm size (or variables based thereon), industry, organizational features (as recent reorganizations in the corporate structure or payment ori-

⁷ The specifications are the result of the methodological issues discussed in the last section as well as extensive specification tests for normality, heteroscedasticity and in particular omitted variables. The data contain hundreds of variables, a lot of them being highly correlated. We started with a parsimonious specification that included the main confounders that we identified from the literature and theoretical considerations. As a result of the omitted variables tests for all variables in the data, we occasionally added additional variables.

ented towards a collective agreement) and staff-related issues (hard to find skilled workers, staff shortage, high rate of absences) are crucial predictors. Among the individual characteristics, labour market histories and job characteristics (skill level and occupation) are important covariates. Finally, regional characteristics (such as whether the firm is situated in an urban area) are related to the firm's decision to offer PWE as well.

5.3.3 Common support and covariate balancing

Based on the estimated propensity scores we ensure overlap of the distributions in the treated and nontreated samples by excluding treated individuals with scores higher than the maximum among the nontreated and, similarly, nontreated individuals with scores lower than the minimum among the treated. Applying the matching technique outlined above on the common support results in good balancing of the covariate distributions in treated and untreated establishments. This holds not only for the variables directly entering the respective propensity score, but also for those variables not included, in particular the large number of pre-treatment outcomes.⁸

6 Results

This section presents the average effects of the availability of PWE on various individual-level outcomes of the firms' employees up to 6.5 years after treatment (in 2002). We start by investigating take-up of PWE among employees to assess whether it is used in any quantitatively important way such that effects can be expected. We then analyse various individual labour market outcomes. It appears particularly interesting whether the availability of PWE raises the labour force attachment of elderly cohorts. Alternatively, the results in Machado and Portela (2012) suggest that the availability of PWE may accelerate (de facto) retirement, e.g., by workers lowering their regular employment and increasing the likelihood of entering unemployment or withdrawing from the labour force. We therefore estimate the ef-

⁸ Due to the very large number of tested variables, we abstain from presenting the results of the balancing tests. They are available on request.

fects on employment, unemployment, and time out of the labour force. We also look at earnings to evaluate financial consequences for firms' employees. Finally, we also investigate the effects on tenure, because one motivation for firms to offer PWE might be to retain elderly workers for longer than they would do otherwise. Furthermore, a firm that offers PWE might be considered a more attractive employer by all workers, which may lead to higher average tenure in treated firms.

The effects on employees who are not eligible for PWE are interesting as well. On the one hand, as discussed in section 5.2, younger workers should be unaffected. Thus, if we find relevant effects for this group, this raises doubts about the validity of our main identifying assumption. On the other hand, medium-aged workers (41-50) are not too far away from reaching eligibility. The prospect of being able to benefit from PWE later in their life may, for example, increase incentives to stay employed with the same firm.

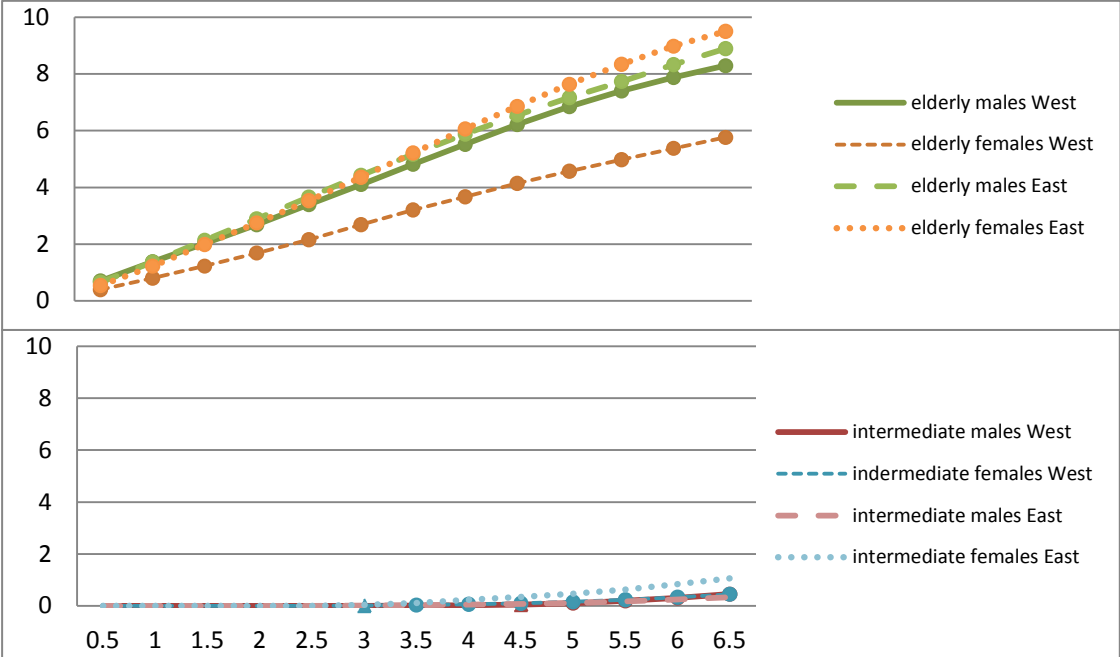
The results presented hereafter refer to the average treatment effects (ATE) on the respective full populations, i.e., on the total of employees both in firms offering and not offering PWE. It is worth noting that the average effects on the treated (i.e., on the employees actually working in establishments with PWE), which are available from the authors upon request, are in general comparable, however, considerably less precisely estimated.

6.1 Take-up of PWE

The first question of interest is to which extent PWE is actually utilized if available in a firm. Figure 6.1 plots the estimated average effects of PWE availability on the cumulative utilization of PWE measured in months over a time frame of 0.5 to 6.5 years after the treatment period (2002), separately for strata consisting of elderly workers (aged 51-60 in 2000) and individuals of intermediate age (41-50 in 2000). PWE take-up is statistically significant on the 5% level for all elderly groups at any point in time, as indicated by the round dots in the lines indicating the effects. Furthermore, PWE take-up is generally higher in the East than

in the West and the differences are particularly large among females. The cumulative time in PWE is on average more than nine months for East German women after 6.5 years, but less than half a year for their West German counterparts. Nevertheless, PWE take-up is economically important among all elderly groups and, as expected, much higher than in the intermediate groups, where the oldest individuals only become eligible after several years. Accordingly, cumulated PWE only starts to rise after 3 years in the intermediate groups and becomes statistically significant for females in the West, although the magnitude of the effect remains small.

Figure 6.1: ATE on cumulative PWE in months



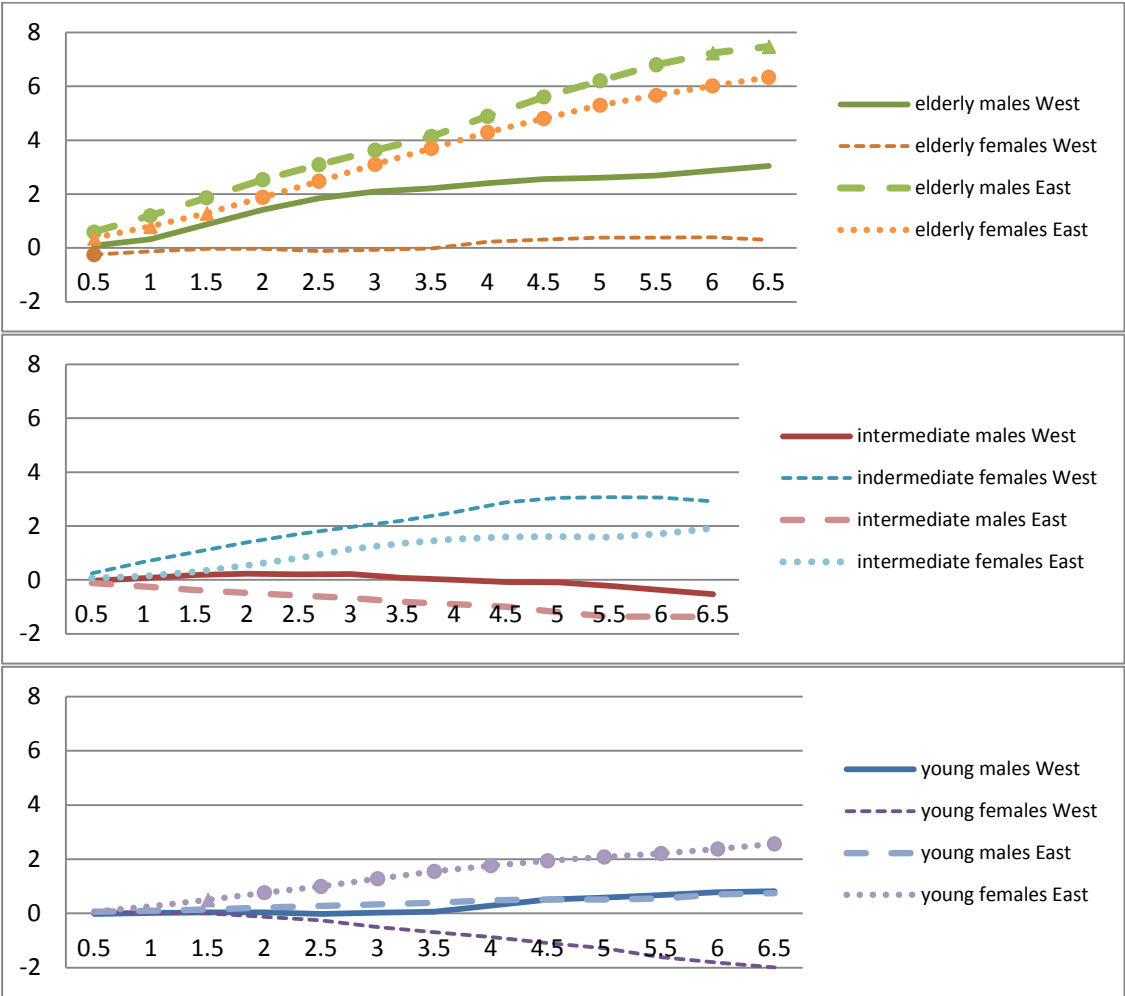
Note: Round dots (triangles) indicate that the effects are significant on the 5% (10%) level. Inference is based on 499 block bootstrap replications.

6.2 Labour market outcomes

Before commenting on the results for potentially affected elderly workers, we discuss the effect for younger employees, for whom we expect no effects if CIA is valid. For none of the five outcome variables considered (employment in Figure 6.2, tenure in Table 6.1, earnings in Figure 6.3, unemployment in Figure 6.4, time out of the labour force in Figure 6.5) we find any effects for younger workers in West Germany, as well as younger male employees in

East Germany. Hence, there is no indication for violation of the CIA for these groups. For younger females in East Germany, however, we do find significant effects for all outcomes, suggesting that the results for elderly females in East Germany might still be subject to some selection bias. The fact that the estimated effects are small in most cases suggests, though, that this bias is not very large. Still, the effects for East German women should be interpreted with some caution.

Figure 6.2: ATE on cumulated regular employment in months



Note: Round dots (triangles) indicate that the effects are significant on the 5% (10%) level. Inference is based on 499 block bootstrap replications.

As the main objective of PWE is to increase the labour market attachment of elderly workers and to retain them in the firm, we start by presenting the effects on cumulated regular employment in Figure 6.2 and on tenure in the original firm in Table 6.1. The latter refers to

the time with the firm after “treatment”, i.e. from July 2002 onwards. For elderly workers, we only find a statistically significant positive impact on cumulated regular employment and tenure in East Germany (effects for western workers are positive as well but not statistically significant at conventional levels). 51 to 60 year old East German men and women in firms that offer PWE accumulate, respectively, 7 and 6 more months of regular employment and stay 7.5 and 10.5 more months with the firm, which originally employed them than workers in firms that did not offer PWE in 2002. Note that since the results for East German men and women are very similar and because of the comparably small size of the effect for younger women, it is unlikely – at least for cumulated employment – that all of the effect we see for East German women is due to selection bias. Thus, in East Germany PWE was indeed effective in increasing labour market attachment of elderly workers and retention rates.

Table 6.1: ATE on tenure in the original establishment in days

Region	Gender	Age	Effect	P-value in %
West	Males	31-40	-91	72
		41-50	-147	56
		51-60	-40	82
	Females	31-40	-204	30
		41-50	10	96
		51-60	-1	99
East	Males	31-40	-101	40
		41-50	-106	41
		51-60	224	14
	Females	31-40	298*	7
		41-50	178	19
		51-60	320***	<1

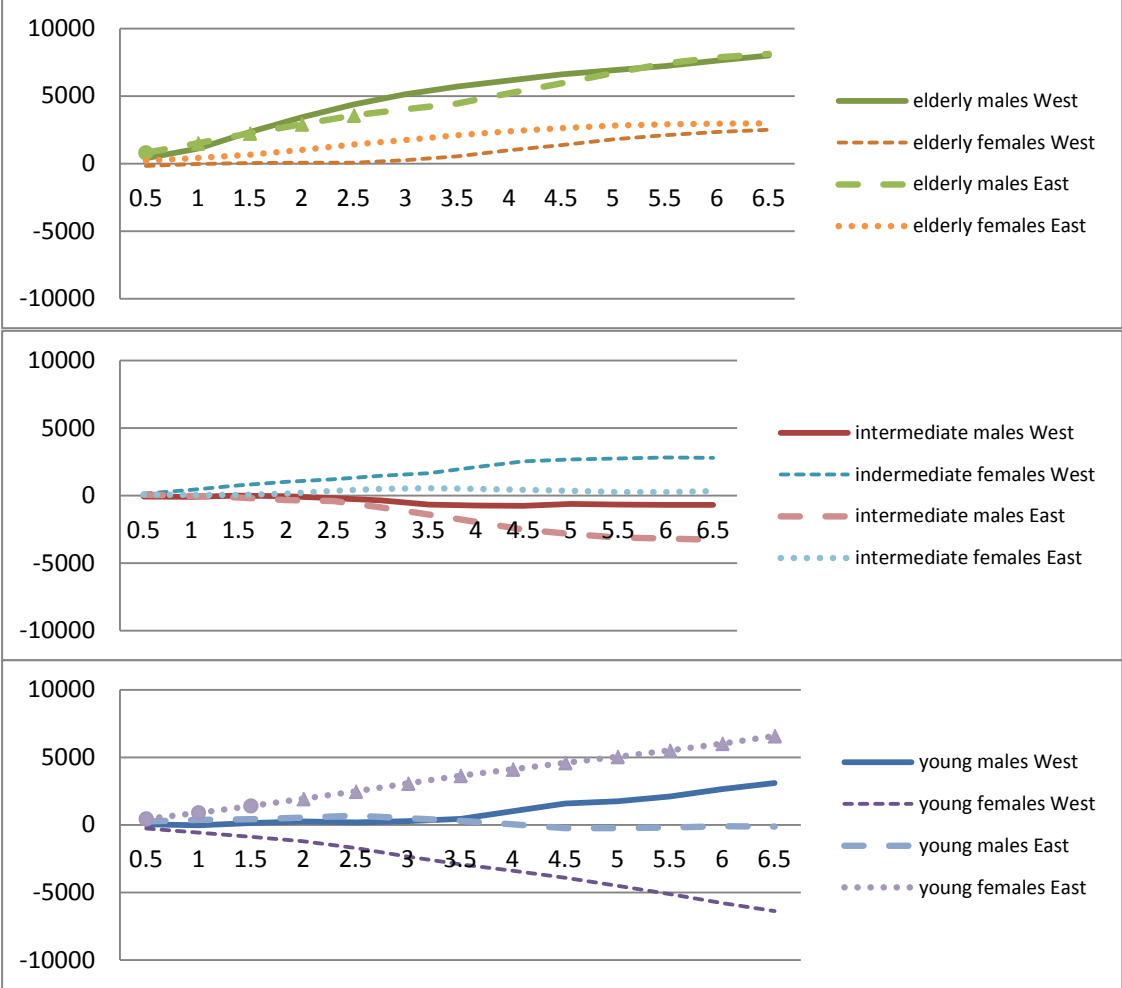
Note: */*** indicates significance on the 10%/1% level. Inference is based on 499 block bootstrap replications.

Tenure refers to the time with the establishment after treatment measured from July 2002. Tenure before that is a control variable.

There is some evidence, though, that elderly workers, including West German ones, benefit in terms of higher earnings. Figure 6.3 shows the effects for elderly workers and they are positive in almost all cases. With a level of 15,000 EUR after 6.5 years, they are particu-

larly large for men, although mostly insignificant at conventional levels. Note that at least parts of the earnings effects are driven by higher employment rates (earnings are coded as zero if the individual is not employed). Again, there are no effects for middle-aged workers.

Figure 6.3: ATE on cumulated earnings from employment in EUR

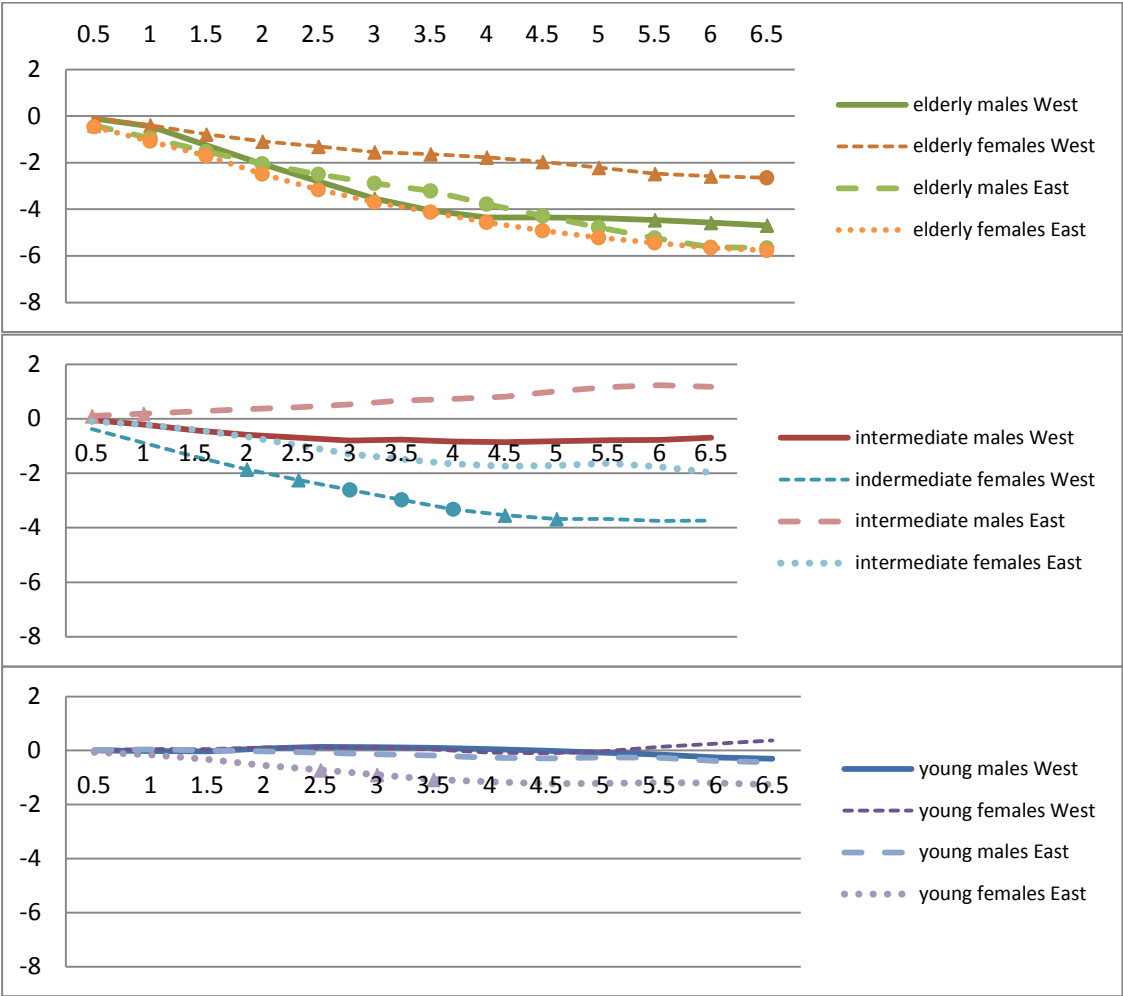


Note: Round dots (triangles) indicate that the effects are significant on the 5% (10%) level. Inference is based on 499 block bootstrap replications.

Another interesting policy question is whether the availability of PWE effectively reduces exits of elderly workers to unemployment. Grogger and Wunsch (2013), for example, show that, in response to particularly generous unemployment insurance payments for elderly workers in Germany, a notable share of elderly workers (voluntarily or involuntarily) exits the labour market via unemployment before early retirement options become available. PWE provides an alternative pathway for an early exit from the labour market, especially with the

block model. Our results in Figure 6.4 indeed suggest that elderly workers in firms that offer PWE accumulate fewer months of unemployment. After 6.5 years, the effects are most pronounced among East German workers, with a reduction of more than 5 months, which is statistically significant on the 5% level. For West German workers the effects are somewhat smaller, but still economically important and mostly statistically significant on the 10% level. As before, we find no effects for workers aged 41-50.

Figure 6.4: ATE on cumulated unemployment in months

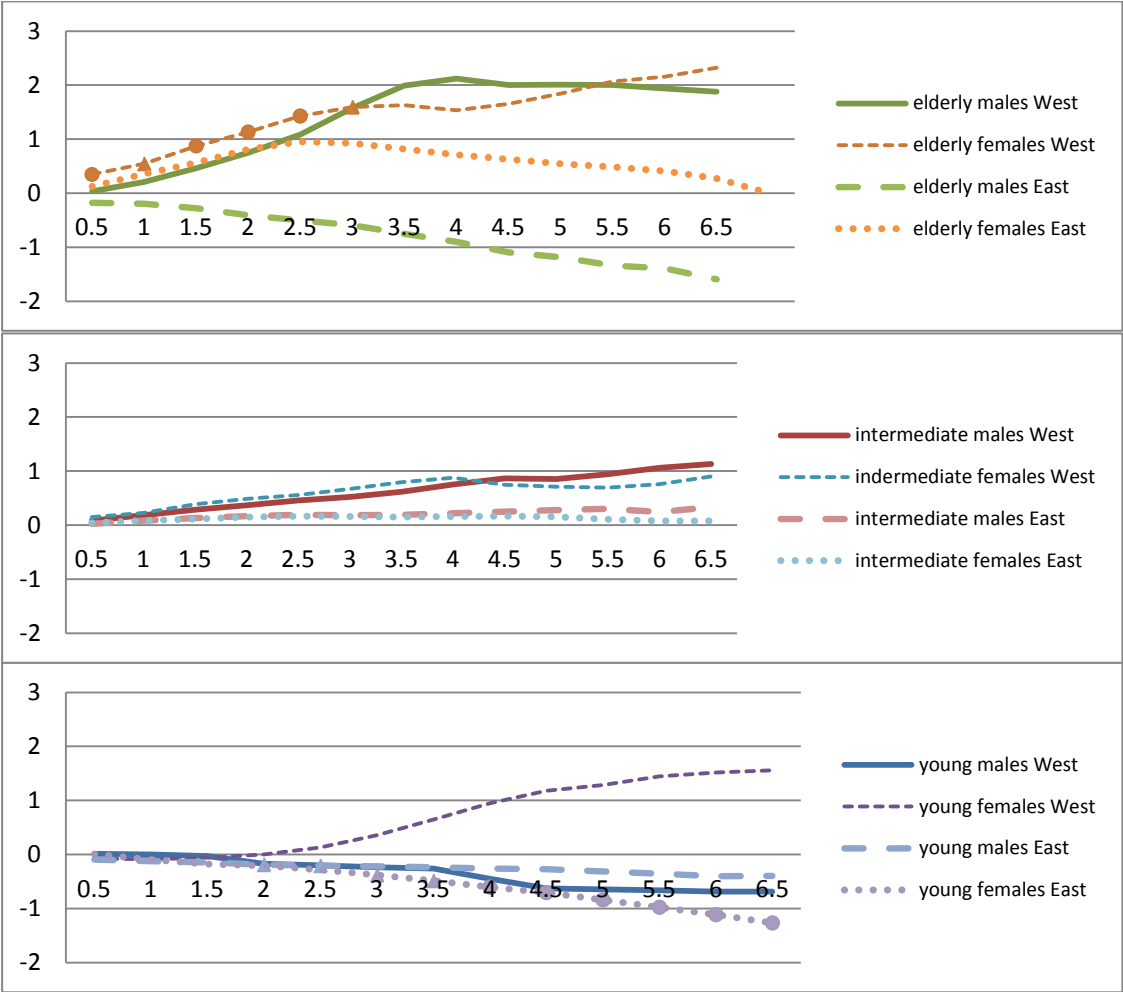


Note: Round dots (triangles) indicate that the effects are significant on the 5% (10%) level. Inference is based on 499 block bootstrap replications.

Finally, when considering the effects on cumulated time outside the labor force in Figure 6.5, there are few statistically significant effects and all of them are economically negligible. The absence of effects on the cumulated time spent out of the labor force suggests that

elderly workers in firms that offer PWE withdraw from the labour market at about the same time and rate as workers in firms without PWE. Thus, this result is contrary to Machado and Portela (2012) who find that a reduction in working hours is associated with earlier full retirement.

Figure 6.5: ATE on cumulated time out of the labour force in months



Note: Round dots (triangles) indicate that the effects are significant on the 5% (10%) level. Inference is based on 499 block bootstrap replications.

7 Conclusion

In this paper, we assess the impact of firms introducing part-time work schemes for gradual withdrawal of elderly employees from the labour market on their employees' labour market outcomes. In contrast to Machado and Portela (2012), we find that the time of complete withdrawal from the labour market is unaffected. However, the availability of PWE is

beneficial in that it considerably reduces unemployment among elderly workers. The overall effects differ between East and West Germany, though. In West Germany, there are gains neither in terms of cumulated employment nor in terms of tenure in the firm. PWE only changes the pathway towards retirement. The time when elderly West German employees leave their jobs is unaffected by PWE. Rather than registering as unemployed and receiving unemployment insurance or social security payment after job exit, elderly employees exit via PWE by entering the non-employment phase of the block model. During this time, they receive payments from their employer. From the perspective of the social insurance system, this is desirable because unemployment insurance and social security payments are reduced.

In East Germany, which is characterized by particularly difficult labour market conditions, PWE is even more beneficial for employees. Positive effects on net cumulated employment indicate an increase in the labour market attachment of elderly workers in addition to reduced exits via unemployment. This results in higher tax revenues and higher social insurance contributions together with lower social insurance payouts. Moreover, firms offering PWE are able to retain their elderly employees longer compared to firms without PWE offers.

Our results suggest that partial or gradual retirement options offered by firms are an important tool to alleviate the negative effects of low labour market attachment of elderly workers in ageing societies, especially when labour market conditions are difficult. Firms should thus be encouraged to offer such schemes.

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Appendix A: Probit specifications for selection into PWE

Table A1: Probit specifications for males in West Germany

	<i>Aged 31-40</i>		<i>Aged 41-50</i>		<i>Aged 51 plus</i>	
	Coefficient	P-value in %	Coefficient	P-value in %	Coefficient	P-value in %
Constant	-6.984	0.0	-7.211	0.0	-5.948	0.0
<i>Firm characteristics</i>						
Log number of employees	0.792	0.0	0.966	0.0	0.902	0.0
501-1000 employees	-0.503	0.0	-0.818	0.0	-0.697	0.0
Share of employees being 55 or older	2.203	0.0	1.323	0.4	0.233	67.1
Share of employees leaving the firm	-1.480	0.0	-1.403	0.0	-0.311	8.1
Share of unskilled employees	-0.387	0.1	-0.366	0.2	0.155	27.4
Single branch firm	0.326	0.0	0.319	0.0	0.222	0.0
High number of absences is a problem	-0.426	0.0	-0.522	0.0	-0.705	0.0
Staff shortage is problem	-0.333	0.0	-0.266	0.0	-0.458	0.0
No working-time accounts	0.000	99.3	0.192	0.0	0.310	0.0
Reorganization of corporate structure	0.617	0.0	0.615	0.0	0.543	0.0
Pay tied to collective agreement	-0.751	0.0	-0.656	0.0	-0.739	0.0
Manufacturing industry	0.439	0.0	0.508	0.0	0.564	0.0
<i>Employee characteristics</i>						
Age	0.006	49.0	0.001	85.0	0.001	89.1
No German citizen	0.289	0.1	-0.111	18.3	-0.014	86.8
University entrance degree (Abitur)	-0.216	3.4	-0.272	0.2	-0.258	1.1
No vocational degree	0.041	59.3	0.034	64.6	-0.019	82.7
Manufacturing occupation	0.226	0.0	0.231	0.0	0.407	0.0
Service occupation	0.153	3.8	0.025	70.9	0.138	3.5
Unskilled worker	0.249	0.1	0.383	0.0	0.291	0.1
Clerk	0.104	20.1	0.196	0.8	0.188	1.3
Half-monthly earnings in EUR	1.060	0.0	0.923	0.0	0.414	0.1
Half-monthly earnings > 1500 EUR	-0.476	0.0	-0.388	0.0	-0.069	47.8
Tenure	0.059	30.6	0.064	24.1	-0.007	92.3
Tenure 7 years	-0.192	12.9	-0.441	0.0	-0.428	0.8
<i>Regional characteristics</i>						
Big agglomeration	-0.653	0.0	-0.629	0.0	-0.650	0.0
Local unemployment rate	0.131	0.0	0.097	0.0	0.080	0.0
Northern Germany	-0.459	0.0	-0.345	0.2	-0.577	0.0
Central Germany	-0.150	0.8	-0.102	7.3	-0.146	3.1
Number of individual observations	4098		4269		3390	
Efron's R ²	0.26		0.28		0.28	

Note: All variables are measured in 2000 or relative to June 30, 2000.

Table A2: Probit specifications for females in West Germany

	Aged 31-40		Aged 41-50		Aged 51 plus	
	Coeffi- cient	P-value in %	Coeffi- cient	P-value in %	Coeffi- cient	P-value in %
Constant	-4.917	0.0	-4.403	0.0	-4.070	0.0
Firm characteristics						
Log number of employees	0.795	0.0	0.678	0.0	0.694	0.0
Share of employees being 55 or older	-0.529	37.4	-0.165	75.5	-1.113	6.8
Share of employees leaving the firm	-0.291	39.5	-1.322	0.0	-0.318	33.9
Share of unskilled employees	-1.154	0.0	-0.711	0.0	-0.624	0.0
Single branch firm	0.058	31.9	-0.058	30.8	-0.013	85.6
High number of absences is a problem	-0.335	0.0	-0.307	0.0	-0.129	10.7
Staff shortage is problem	-0.645	0.0	-0.684	0.0	-0.668	0.0
No working-time accounts	0.050	43.7	-0.109	8.5	-0.241	0.2
Reorganization of corporate structure	0.709	0.0	0.572	0.0	0.298	0.0
Pay tied to collective agreement	-0.677	0.0	-0.454	0.0	-0.386	0.0
Trade sector	-0.281	1.0	-0.015	88.3	0.211	11.0
Service sector	-0.544	0.0	-0.177	4.4	-0.427	0.0
Employee characteristics						
Age	-0.003	73.1	-0.017	4.5	-0.022	5.4
No German citizen	0.298	0.4	0.324	0.0	0.367	0.1
No vocational degree	-0.049	48.6	0.043	50.2	0.040	59.0
Manufacturing, technical, construction occupation	-0.399	0.0	-0.205	2.7	-0.068	55.6
Low-skilled service occupation	-0.516	0.0	-0.370	0.0	0.002	98.2
Other occupation	-0.030	74.8	0.076	38.0	0.143	15.6
Part-time worker	0.515	0.0	0.535	0.0	0.531	0.0
Half-monthly earnings in EUR	0.400	0.0	0.811	0.0	0.751	0.0
Half-monthly earnings > 1500 EUR	-0.330	0.2	-0.369	0.1	0.043	78.7
Tenure	0.203	0.1	0.305	0.0	0.251	0.1
Tenure 7 years	-0.122	24.1	-0.248	2.5	-0.370	1.7
Out of the labour force in last 4 years	-0.067	33.7	0.041	60.1	0.119	23.8
Out of the labour force in last 10 years	0.107	9.9	-0.020	75.3	0.001	98.6
Regional characteristics						
Big agglomeration	-0.454	0.0	-0.462	0.0	-0.421	0.0
Local unemployment rate	0.089	0.0	0.112	0.0	0.122	0.0
Northern Germany			-0.511	0.0	-0.806	0.0
Central Germany	-0.235	0.0	-0.400	0.0	-0.286	0.0
Number of individual observations	3323		3412		2227	
Efron's R ²	0.32		0.31		0.30	

Note: All variables are measured in 2000 or relative to June 30, 2000.

Table A3: Probit specifications for males in East Germany

	Aged 31-40		Aged 41-50		Aged 51 plus	
	Coefficient	P-value in %	Coefficient	P-value in %	Coefficient	P-value in %
Constant	-3.275	0.0	-1.277	0.7	-2.279	0.1
Firm characteristics						
Log number of employees	0.155	0.1	0.029	51.9	0.138	1.1
Share of employees with university or college degree	4.167	0.0	4.554	0.0	3.019	0.0
Share of employees being 55 or older	-0.670	13.0	0.033	93.7	1.946	0.0
No working-time accounts	0.178	0.4	0.280	0.0	0.065	45.5
Share of employees leaving the firm (survey)	-7.419	0.0	-9.973	0.0	-10.950	0.0
No reorganization	0.002	97.7	-0.035	59.8	-0.307	0.0
Looking for staff in future	0.833	0.0	1.071	0.0	1.047	0.0
Hiring skilled workers is problem	0.365	0.0	0.157	0.9	0.164	3.6
Hiring young workers is problem	-0.525	0.0	-0.472	0.0	-0.863	0.0
High number of absences is a problem	0.671	0.0	0.681	0.0	0.560	0.0
Foreign-owned to more than 50%	-0.491	0.0	-0.551	0.0	-0.930	0.0
Trade sector	0.964	0.0	1.097	0.0	0.767	0.0
Service sector	-0.531	0.0	-0.518	0.0	-0.633	0.0
Employee characteristics						
Age	-0.003	71.0	-0.027	0.1	-0.009	37.7
University entrance degree (Abitur)	-0.121	48.1	-0.169	21.1	0.232	22.1
Vocational degree	0.392	0.0	0.139	14.5	0.136	25.3
University or college degree	0.427	4.8	0.312	6.3	-0.099	68.1
Technical occupation	-0.453	0.0	-0.382	0.0	-0.142	8.8
Higher-skilled service occupation	-0.602	0.0	-0.578	0.0	-0.343	0.1
Low-skilled service occupation	0.075	44.7	-0.135	13.6	-0.084	45.0
Other occupation	-0.403	0.0	-0.451	0.0	-0.361	0.3
Skilled worker	-0.378	0.0	-0.301	0.0	-0.116	22.3
Clerk	-0.284	0.8	-0.360	0.1	-0.261	4.9
Half-monthly earnings in EUR	1.118	0.0	1.562	0.0	0.265	20.6
Half-monthly earnings > 1500 EUR	-0.209	8.8	-0.415	0.0	-0.037	76.1
Cumulated earnings from employment in last 10 years	-0.131	25.4	-0.298	2.3	0.105	40.7
Tenure	0.517	0.0	0.523	0.0	0.530	0.0
Tenure 7 years	-0.713	0.0	-0.854	0.0	-0.766	0.0
Unemployed in last 4 years	-0.344	1.0	-0.645	0.0	-0.583	2.6
Unemployed in last 10 years	-0.085	19.5	-0.203	0.2	-0.004	96.8
Out of the labour force in last 4 years	-0.021	82.4	-0.026	77.4	-0.002	98.8
Out of the labour force in last 10 years	0.320	0.0	0.177	0.1	0.113	10.9
Fraction employed 9-10 years before	1.015	0.0	1.014	0.0	1.257	0.0
Regional characteristics						
Rural area	0.271	0.0	0.395	0.0	0.390	0.0
Number of individual observations	4145		4894		2902	
Efron's R ²	0.33		0.36		0.36	

Note: All variables are measured in 2000 or relative to June 30, 2000.

Table A4: Probit specifications for females in East Germany

	<i>Aged 31-40</i>		<i>Aged 41-50</i>		<i>Aged 51 plus</i>	
	Coefficient	P-value in %	Coefficient	P-value in %	Coefficient	P-value in %
Constant	-2.446	0.0	-2.837	0.0	-3.348	0.0
<i>Firm characteristics</i>						
Log number of employees	0.388	0.0	0.373	0.0	0.438	0.0
Share of employees with university or college degree	2.391	0.0	3.184	0.0		
Share of employees being 55 or older	-5.083	0.0	-4.374	0.0	-3.967	0.0
No working-time accounts	0.007	89.1	0.368	0.0	0.177	0.8
Hiring skilled workers is problem	0.835	0.0	0.622	0.0	0.611	0.0
Share of employees leaving the firm (survey)	-2.745	0.0	-2.971	0.0	-3.044	0.0
No reorganization	-0.061	19.7	0.152	0.0	0.181	0.4
Currently looking for staff	0.045	37.2	-0.061	19.6	0.112	8.1
Share of female employees	-0.615	0.0	-0.065	50.8	-0.238	10.9
Pay tied to collective agreement	-0.301	0.0	-0.274	0.0	-0.103	21.1
Trade sector	0.915	0.0			-0.009	91.3
Service sector	0.807	0.0				
<i>Employee characteristics</i>						
Age	-0.020	1.3	-0.009	19.3	0.007	49.1
No vocational degree	0.219	6.6	0.330	0.1	0.133	29.7
University or college degree	-0.093	45.2	-0.277	0.1	-0.071	58.4
Manufacturing, technical, construction occupation	-0.172	12.3	-0.229	0.9	-0.149	28.2
Low-skilled service occupation	-0.259	0.1	-0.042	52.2	-0.079	42.3
Other occupation	-0.688	0.0	-0.594	0.0	-0.740	0.0
Skilled worker	-0.108	28.2	0.175	3.5	0.307	2.2
Clerk	-0.541	0.0	-0.211	2.1	-0.154	27.7
Part-time worker	-0.283	2.5	0.317	0.0	0.301	3.3
Half-monthly earnings in EUR	1.203	0.0	1.073	0.0	0.987	0.0
Half-monthly earnings > 1500 EUR	-0.551	0.0	-0.616	0.0	-0.657	0.0
Tenure	0.172	2.3	0.043	57.6	-0.126	27.2
Tenure 7 years	-0.254	1.1	-0.042	68.6	0.159	32.3
Unemployed in last 4 years	-0.056	63.3	0.035	73.8	-0.079	65.4
Unemployed in last 10 years	-0.070	25.4	-0.189	0.0	-0.205	1.0
Out of the labour force in last 2 years	0.021	86.1	0.283	3.0	0.253	15.8
Out of the labour force in last 4 years	0.008	94.3	-0.105	36.1	-0.140	43.6
Out of the labour force in last 10 years	-0.001	99.2	0.012	80.7	-0.134	5.2
Fraction employed 9-10 years before	0.050	66.4	0.399	0.0	0.459	0.5
Fraction part-time employed in last 10 years	0.337	1.8				
Employment ended due to health problems in past 10 years	0.136	7.1	-0.072	37.5	-0.008	94.3
<i>Regional characteristics</i>						
Rural area	0.290	0.0	0.134	0.3	0.170	1.2
Number of individual observations	4339		4953		2454	
Efron's R ²	0.33		0.27		0.24	

Note: All variables are measured in 2000 or relative to June 30, 2000.