RESEARCH PAPER

Labor supply effects of a subsidized old-age part-time scheme in Austria

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Abstract In this paper we evaluate the impact of the old-age part-time scheme (OAPT) on the Austrian labor market which was a policy to allow flexible retirement options for the elderly with an aim to increase labor supply. According to our matching estimates, employment probability increases slightly; especially in the first two years after entrance into the programme. Furthermore, the programme seems to reduce the measured unemployment risk. However, the total number of hours worked is significantly reduced by OAPT. While the policy is meant to reduce early exit from the labor force by allowing part-time work, our analysis indicates that most workers substitute part-time work for full-time work and thus the overall effect is rather negative.

Keywords Evaluation of labor market programmes · Labor supply of the elderly · Nearest neighbor matching

JEL Classification C31 · J14 · J26

Arbeitsangebotseffekte einer subventionierten Altersteilzeitregelung in Österreich

Zusammenfassung In dieser Arbeit evaluieren wir den Einfluss des Altersteilzeitprogrammes (OAPT) auf den österreichischen Arbeitsmarkt. Das OAPT ist ein Gesetz zur Regelung des flexiblen Renteneintritts mit dem Ziel, das Arbeitsangebot zu erhöhen. Der Schätzung unseres Matching-Verfahrens zu Folge, erhöht sich die Beschäftigungswahrscheinlichkeit geringfügig; besonders in den ersten beiden

Jahren nach Eintritt in das Programm. Weiterhin scheint das Programm das gemessene Arbeitslosigkeitsrisiko zu reduzieren, gleichzeitig wird jedoch das Gesamtvolumen der geleisteten Arbeitsstunden signifikant durch OAPT verringert. Während die gesetzliche Regelung darauf abzielt, den frühen Austritt aus der Arbeitswelt durch Teilzeitarbeit einzudämmen, deutet unsere Analyse darauf hin, dass die meisten Personen Vollzeitarbeit durch Teilzeitarbeit substituieren und somit ein negativer Gesamteffekt auftritt.

1 Introduction

Phased retirement is an often mentioned slogan in policy debates. This retirement option would allow workers to stay with their current employer, but with reduced hours and effort. From a socio-psychological point of view, phased retirement is meant to ease the often sudden change of life pace, allowing a more gradual reduction of responsibilities as well as stress; thus reducing pension shocks and allowing a more fulfilling end of a lifetime of work. On the other hand, phased retirement can help to preserve valuable firm-specific human capital in the workplace: While elderly workers might have trouble to compete with younger colleagues in terms of speed and physical fitness as well as in terms of the length of attention span or the ability to concentrate for longer periods (Skirbekk 2004), in other tasks like verbal or organizational skills elder workers are often better. These are in particular firm-specific skills which are very valuable to the firm. Phased retirement might be a good option to preserve these skills for the firm. In spite of these alleged advantages, phased retirement is rare in most countries (Hutchens and Grace-Martin 2006).

Austria introduced a special subsidy program for phased retirement schemes in the year 2000. While the aforementioned arguments played a role in the discussion of the law,

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labor market policy was important as well. Austria traditionally has had a relatively high unemployment rate of elderly workers together with generally low participation and employment rates of the concerned age group: Given that labor demand is inflexible and does not provide enough part-time jobs for elderly workers who want such phased retirement, introducing subsidies might increase labor force attachment of elderly workers. On the other hand, allowing phased retirement might reduce labor force attachment because it can lead to a form of early retirement.

In this paper we evaluate the Austrian Old-Age Part-Time Scheme (OAPT) using a matching approach looking at employment and unemployment probabilities as well as the number of hours worked. We are using two birth-cohorts for males and females, where we can observe the persons until potential entry into retirement. The remainder of the paper is organized as follows. Section 2 provides an overview of the OAPT scheme. Section 3 presents theoretical consideration and international evidence. Section 4 provides a data description and descriptive evidence on the participation structure. Section 5 discusses the evaluation methodology and the empirical results and Sect. 6 concludes.

2 The old-age part-time scheme in Austria

The Austrian Old-Age Part-Time Scheme[1] provides benefits paid to employers in connection with working time reductions of older employees. The scheme is based on a bilateral agreement between the employer and the employee on a working time reduction of between 40% and 60% of working hours. Eligible workers must have had a full-time job before the subsidized scheme with working hours at least at 80% of a regular full-time employment.

The entry conditions implied a compensatory wage (*Lohnausgleich*) up to a total gross salary of 75% of the compensation before the reduction of working time. Furthermore, social security contributions had to be paid at the same amount as before the working time reduction.[2] The minimum access age was set to 50 years of age for female

employees and to 55 for men, respectively. Eligibility required, moreover, on the part of the worker previous regular employment periods of at least 780 weeks within the last 25 years. While a first version of the scheme required on the part of the employer the hiring of an additional employee (*Ersatzarbeitskraft*), this requirement was abolished later on—in the period we are observing. The subsidy period was fixed at a *maximum* of $6\frac{1}{2}$ years.

Moreover, the second regime of the OAPT scheme provided for a relatively flexible allocation of working time. OAPT employment could be split into a period of full-time employment followed by a non-working period at the end, as long as the agreed reduction of working hours was reached *on average* over the total period—which can be considered as a form of early retirement. The OECD in particular noted this issue: "*To a considerable extent participants in AT have allocated 'part-time work' such that they work full-time during the first years covered by the scheme and cease working during the remainder of this period*" (OECD 2005, 51).

To summarize: the advantage of OAPT for employers is that the firm can reduce the amount of working hours of elderly workers with an equivalent reduction in monthly wage costs; on the other hand, workers can adapt actual working hours closer to optimal hours while most of the reduction in working time is compensated for by the government.

3 Similar policy measures in other countries

The original policy argumentation behind the OAPT scheme was to raise employment incentives for older workers and to defer retirement decisions. The research question underlying the following discussion is, whether and to what extent the Austrian OAPT scheme has a positive or negative effect on older workers' labor supply. In other words, in which way does the part-time scheme determine retirement decisions and the remaining number of hours worked.

In a simple labor supply model decisions are determined by workers' preferences. Under the assumption that employers are indifferent about the number of hours worked by an individual worker, workers are free to choose the number of working hours at a given wage according to their preferences between consumption and leisure. In practice, employers might have preferences regarding the number of hours worked by each employee. Due to fixed employment costs or coordination costs employers might limit their labor demand to a specific minimum number of working hours (see Gielen 2007; Charles and DeCicca 2007). Such minimum hours constraints might be due to some sort of team work in the firm: efficiency will require that all team members are present most of the time; reduced hours of one worker will have negative consequences for the productivity of the others. Supervisory costs could be another reason

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[1]The Austrian old-age employment scheme "*Altersteilzeit*" *underwent* several changes since its introduction in January 2000. The following discussion focuses on the second 'regime', as it was in place from September 2000 to December 2003.

[2]In Austria social security contributions are calculated as a fixed percentage from the gross salary. This gross salary serves as a calculation basis (*Beitragsgrundlage*) for contributions which are split into an employer's and a employee's part (*Dienstgeber- und Dienstnehmeranteil*). Within the old-age part-time scheme social security contributions by the employer still have to be paid in full. The employee's payments are calculated with respect to the new gross salary (including the compensatory wage). The remaining difference to the prior contribution payments has to be paid by the employer.

why reduced hours of some workers are costly to the firm. Finally, issues of work organization, assembly lines or workplace equipment might make it costly to allow part-time work. In such a situation of restrained choice, some workers might choose zero hours and opt for some form of "early retirement" which might be either unemployment or other forms of inactivity, including retirement due to health reasons, etc. A formal schedule of old-age-part-time employment might remedy such problems.[3]

Survey results indicate that especially older workers would prefer to reduce working time (Prager and Schleiter 2006; EEIG 2004). Charles and DeCicca (2007, 252) argue that in the absence of possibilities to reduce working time workers might leave the labor market completely and opt for early retirement. Based on survey data they show that workers, who faced stricter hours constraints at an earlier point of time, were much more likely to be retired at a later point than their unconstrained peers. Thus hours constraints can increase older workers' incentives for early retirement and thus have a negative effect on older workers' labor supply. If this is the case an OAPT scheme can be used as an instrument to reduce hours constraints and, in turn, to boost older workers' labor supply. The OAPT scheme can have a positive effect on older workers' labor supply if they are able to bargain a working time reduction according to their preferences instead of having to leave the labor market completely due to the absence of such a possibility.

The approach presented above requires an existing alternative option for early retirement. If this is not available, i.e. leaving the labor market into early retirement is not possible, it is not clear how an introduction of an OAPT scheme could increase labor supply of older workers. The availability of early retirement options, alongside other dimensions such as health status, depends on the age of the workers. One has to keep in mind that the eligibility age to the OAPT scheme in Austria was age 50 for women and age 55 for men. According to EUROSTAT data the average exit age from the Austrian labor force in 2002 was 59.2 years for women and 59.4 years for men. Within the scope of the 2000 pension reform the access age for early retirement was raised to 56 $\frac{1}{2}$ years for women and 61 $\frac{1}{2}$ years for men. Against the background of relatively low eligibility ages for OAPT on the one hand, and stricter age eligibility for early retirement on the other hand, the OAPT scheme can be considered more as a bridge into (early) retirement. It has to be seen how an increase in hours-flexibility can mitigate this strong incentive for a reduced labor supply.

There is not much research on labor supply effects of age-specific subsidies. Gielen (2007) analyzes the labor market transitions of hours-constrained workers in the UK labor market, i.e. for workers who would prefer to work fewer hours. Based on a competing risk approach she models employment durations of workers over 50 years old. Under the assumption that leaving the labor market is only one possible alternative for hours-constrained workers she differentiates between five destination states: retirement, inactivity (for example unemployment), hours reduction with the current employer and changing employers with or without reducing working hours. Gielen (2007) applies data from the British Household Panel Survey over the period 1991–2004. The dataset comprises information on workers' preferences on working hours assuming the same amount of compensation per hour and on whether workers would prefer to work fewer hours, more hours or continue with the same number of working hours. Additionally, the data contain information on the workers' satisfaction with the number of working hours. Gielen's results indicate that a reduction of hours' constraints could prolong the working lives of older women. Hours-constrained older women having to work too many hours leave the labor market earlier. On the other hand, men working more than the preferred hours tend to be able to adjust working hours with their current employer. In contrast to women over-employment has no effect on male retirement behavior. It seems that men either have a larger bargaining power against their employers or their imbalance in terms of working hours is not so big.

Regarding the 'activation' effect of hours-flexibility, Gielen (2007) differentiates between active working years and total labor supply in hours. As mentioned above, increasing hours-flexibility can prolong labor force participation of over-employed female workers. On the other hand, total labor supply in terms of hours may decrease if there is an opportunity to reduce working hours. Assuming that hours constraints induce older workers to opt for working full-time or not at all, an over-employed worker might leave the labor market completely *or* stay (over-) employed with the same number of working hours. Introducing hours-flexibility might raise the labor supply in comparison to a state where a worker would have left the labor market completely. Conversely, hours-flexibility might have a lowering effect on total labor supply if the person had stayed employed with the same number of working hours instead of decreasing the number of hours worked. The net employment effect depends on the relative size of these effects.

The old-age part time scheme can thus be seen as an instrument to increase the hours-flexibility of older workers. Lowering constraints in working hours might have a positive supply effect in terms of prolonging labor force participation. The net supply effect however depends on alternative labor market behaviors (counterfactually) and therefore is an

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[3]The situation is different, if the worker has fixed employment costs, like e.g. travel costs or—not so typical for our population group—child care obligations: in such a case, part-time work is hampered from the side of the worker.

empirical question. Some European countries introduced a similar form of subsidized part-time scheme for older workers, but the evaluation literature is not very comprehensive. Wadensjö (2006) estimated the effect of the Swedish partial-pension scheme on the total number of hours worked. His results indicate that the positive supply effect—whereby participants work part-time instead of opting for an early retirement route—outweighs the negative effect of workers reducing working time instead of continuing in full-time employment. Ilmakunnas and Ilmakunnas (2006) analyzed the Finish partial pension scheme and found no effects on the timing of retirement.[4]

With regard to the labor market effects of the *German* Old-Age Part-Time Scheme Eichhorst (2006) comes to a rather critical assessment. Similar to the Austrian scheme the German OAPT offers the possibility to allocate 'part-time' work into a full-time period in the first half of OAPT and a leisure period in the second half. According to Eichhorst (2006, p. 11) this 'blocking-model' provides an incentive against a more gradual transition from employment into retirement. In practice the blocking-option encourages older workers to leave the labor market earlier at the beginning of the 'leisure-period'. As in Austria, the German OAPT-scheme requires the hiring of an additional employee. Regarding the intended positive labor demand effect of this requirement, Wanger (2009) points to the risk of dead-weight effects, when extra recruitment would have occurred even without participation in the OAPT Scheme. In 2002 a Part-Time-Scheme for older workers was introduced in *Belgium* (see Devisscher and Sanders 2007; Devisscher 2004). The so-called career-break allowed employees to reduce the number of working hours for a maximum of five years without losing their social security rights e.g. pension benefits of a fulltime work regime. Devisscher and Sanders (2007, 8–9) state "its use has until quite recently been limited to a rather privileged group of persons", referring to the specific participation structure in the career-break scheme—a large share of participants belonging to two-earner households, the scheme being used relatively more in the services sector than in industries and employees of larger companies making more use of career breaks than employees in smaller enterprises. These authors refer to an evaluation of the career break scheme carried out by OSA/Steunpunt WAV in 2006. The results are based on the survey analysis of career paths of career breakers before, during and after their career break. The career paths of career breakers were compared with those of a control group of employees without a career break. The results provide "*no evidence that the activity rate of over 50* [year old]

persons with a career break is higher (one to three years after the career break) than that of a control group of 50-plus employees, rather on the contrary."

Other policy measures concerning employment of elderly workers are employment subsidies or workfare (e.g. Bonin et al. 2003; Lutz 2001), hiring subsidies (e.g. Boockmann et al. 2011) or a layoff tax (e.g. Schnalzenberger and Winter-Ebmer 2009 or Behagel et al. 2008), which will not be discussed in detail here. We present a short discussion of Austrian studies only. Lutz et al. (2005) and Lechner et al. (2007) investigate the effects of active labor market policy in Austria. They report positive employment effects only for females. Both studies report that employment of elderly participants is increased considerably with respect to public employment programs (socio-economic firms). The other programme types showed less favorable results for the elderly. According to Lechner et al. ALMP measures have no positive effect for the elderly. Lutz et al. found above average effects for elderly women, for males the effects of the elderly are below average. Schnalzenberger and Winter-Ebmer (2009) show that a layoff-tax levied on firing elderly workers was, in fact, effective in preventing undue firing of elderly.

4 Data description and descriptive evidence on the participation structure

Our empirical approach is based on the AMDB ('*Arbeitsmarktdatenbank*'). This dataset comprises administrative micro data on labor market episodes since 1997. It combines information from social security records and from registers of the Austrian public employment office (AMS). In principal the AMDB covers all individuals that are insured in the Austrian social security system. Besides other information the AMDB covers the chronological distribution and the type of employment episodes on an individual level. This includes the employees' age and sex, the institutional mode of employment (for example regularly, self-employed or marginally employed etc.). Firm information is only sparse: the Federal state, the industrial sector in which the firm is primarily active and the size of the workforce. Austrian social security accounts contain no information about working time. The ministry of economics and labor provides us with a constructed working time indicator (0–11 hours, 11–19 hours, 20–29 hours, 30–35 hours, and 36 plus hours). The calculation of this indicator is based on the reported social security contribution base. According to the indicator almost all OAPT participants worked full-time before entry into the OAPT as expected. Therefore, we restricted our analysis to full-time workers with more than 30 hours only. Note that the indicator provides no information concerning the working time reduction of OAPT participants as the social security contribution base is unchanged.

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[4]Lachowska et al. (2010) investigate entry decisions of employees at Stockholm University into a phased retirement program there.

Table 1 Structure of OAPT participants

	OAPT-Participants[a]		Employees 50+[b]	
	abs.	*rel.*	*abs.*	*rel.*
Sex				
Males	30,721	53.4	285,930	57.5
Females	26,795	46.6	211,766	42.5
Federal state				
Burgenland	1,435	2.5	12,544	2.5
Carinthia	2,472	4.3	27,279	5.5
Lower Austria	11,797	20.5	78,015	15.7
Upper Austria	13,048	22.7	83,487	16.8
Salzburg	3,404	5.9	35,390	7.1
Styria	5,890	10.2	56,424	11.3
Tyrol	2,578	4.5	34,198	6.9
Vorarlberg	1,934	3.4	20,517	4.1
Vienna	14,958	26.0	134,325	27.0
Industry				
Agriculture and Forestry	478	0.8	5,891	1.2
Energy/Mining	1,979	3.4	9,759	2.0
Manufacturing	18,561	32.3	104,630	21.0
Construction	3,463	6.0	43,999	8.8
Trade	9,646	16.8	79,909	16.1
Hotels and Restaurants	1,109	1.9	21,178	4.3
Transport	1,940	3.4	27,847	5.6
Financial Intermediation	4,513	7.8	22,832	4.6
Business Activities	4,091	7.1	52,248	10.5
Public Administration[c]	9,151	15.9	102,497	20.6
Other Services	2,438	4.2	26,418	5.3
Unknown	147	0.3	488	0.1
Firm Size				
0–10 Employees	10,159	17.7	98,452	19.8
11–50 Employees	9,207	16.0	102,904	20.7
51–250 Employees	14,212	24.7	118,212	23.8
250+ Employees	23,925	41.6	178,128	35.8
Real Income[d]				
Median in EUR	2,677		2,033[e]	
N	57,516		497,696	

[a] All participants of OAPT entering between January 2000 and June 2007

[b] Reference population formed by over-50 year-old employees (Day of record: 31th of May 2006)

[c] Including Education and Health

[d] Expressed in prices of year 2000 earnings

[e] Mean of 50 to 54 years old workers and 55 to 59 years old workers. (Source: Hauptverband der Sozialversicherungsträger)

Source: AMDB, IHS

The AMDB data set had been matched with administrative information for the participants of OAPT. This data contains participants' entry dates, the participation duration as well as anonymized identification numbers for both the individual participant and the employer. The former is deduced from the individuals' social security numbers, the latter refers to the social security accounts of the employing firms.

In 2006 more than 30,000 employees participated in the Austrian OAPT-scheme. The highest take-up was reached in 2004 with the number of participants reaching almost 40.000. According to the Federal Ministry for Labor and Commerce total expenditures for promoting the OAPT-scheme amounted to 455.9 million EUR in 2006. In 2004 the share of OAPT related expenditures (563.5 Mio. EUR) accounted for three quarters of total expenditure spent on active labor market policy for over 45 year old workers (see BMWA 2005). An empirical assessment of this important programme is therefore long overdue.

Table 1 illustrates the structure of OAPT participants relative to a reference population of employees 50 years

and older. The description accounts for gender, Federal province, industry, firm size, firm employment dynamics and real income. Regarding gender, men form the larger part of participants (53.4%). Relative to the reference population of employees aged 50 years and over, however, female participants are marginally over represented among OAPT participants. With regard to regional structure the population size is more or less reflected within the participation structure. With a cumulative share of almost 70% Vienna, Lower Austria and Upper Austria together contain a majority of participants. Compared to the reference population, the latter two regions show a marginal over-representation of OAPT participants. The industry structure indicates that OAPT is most commonly used in the manufacturing sector, trade, and public administration including the health sector and education. Compared to the industry structure of the entire population of older workers manufacturing and financial intermediation are over-represented. In contrast, the share of older workers employed in the public administration is higher than among OAPT participants. A majority of OAPT participants are employed in larger firms with more the 250 employees. Larger firms' share of participants is considerably higher than the share of older workers in larger firms generally, indicating that OAPT is more commonly used in larger enterprises. Regarding the dispersion of participants by real income our results indicate that OAPT is more commonly used by workers with higher earnings. About one quarter of OAPT participants earns more than 3,500 EUR[5] and only 16% less than 1,800 EUR. In 2006 the median income of 50 to 54 years old workers was 1,970 EUR and 2,090 EUR for 55 to 60 years old workers. The median income of OAPT participants was 2,680 EUR. In order to examine the employment dynamics at the firm level we compare firm sizes at the beginning and at the end of the observation period. Therefore we differentiate between firms with a decreasing, stagnating or increasing number of employees over time.[6] The largest part of OAPT participation is from firms with declining employment (42%). Only every fourth OAPT participant works in a growing firm.

5 Evaluation approach and empirical results

We estimate the effect of OAPT on employment, full-time equivalent employment, and unemployment for a four year evaluation period starting with the entrance in OAPT. The

results for three and five year periods are presented as robustness checks. We select the birth cohorts 1943/44 (males), and 1946/47 (females), respectively. Only for these cohorts the observation period is long enough to fully capture post-treatment periods until a potential retirement. The treatment group includes all participants entering the OAPT scheme between 2000 and 2003. For the construction of the control group we select all workers, who were employed at least one day in the period 2000/2001 in the private sector of the Austrian economy. For the control group we simulate a hypothetical start date for enrollment in the OAPT scheme and drop all workers not employed at this date.[7] This procedure leads to a sample of 3,210 participants and 28,651 non-participants (females), and 6,142 and 23,810 (males), respectively. As expected we find considerable differences in the characteristics between participants and non-participants, therefore we apply the matching procedure suggested by Abadie and Imbens (2006, 2011).[8]

Matching estimators are often used in evaluation research (see Imbens and Wooldridge 2009 for a recent survey on evaluation methods). We base our analysis on the prototypical treatment model of the microeconometric evaluation literature, the binary potential outcome model (Rubin causal model). For individual i, $i = 1 \ldots N$, let $Y_i(1)$ denote the potential response of individual i being exposed to the treatment and $Y_i(0)$ the potential response if i receives no treatment, where $D_i = \{0, 1\}$ is the indicator of exposure to treatment.

We investigate the average treatment effect on the treated (ATT), which focuses explicitly on the effects for those the treatment is intended. It is given by $\Delta_{\text{ATT}} = E(Y(1)|D(1)) - E(Y(0)|D(1))$. The first part of the expression can be identified for the treatment group subsample; the second part is counterfactual and not identifiable without invoking further assumptions. The unconfoundedness assumption (i) and the overlap assumption (ii) ensure that the matching estimator identifies and consistently estimates the ATT:[9] For all x in

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[5]All earnings had been deflated to a year 2000 basis.

[6]Based on the average number of employees in the first half of the observation period (2000–2003) compared to the second half (2004–2007). The definition 'stagnating firm' shows an employment variation between ±10%. 'Increasing/decreasing firms' grew/declined at a higher rate.

[7]This is the most natural feature in such timing-of-events studies and also used in e.g. Lechner and Wunsch (2009) or Del Bono et al. (2011). All workers in an active employment status are potential control persons for a worker entering OAPT; in particular matching the exact day of employment for the treatment and control persons guarantees that the control person is also at risk of being treated and has exactly the same macro-economic background.

[8]Other statistical evaluation procedures like the instrumental variables approach or a regression discontinuity design are not appropriate in our case, because, on the one hand, there are no indicators for instrumentation available in the data set, and, on the other hand, the legal situation does not lend itself easily to a sharp discontinuity: while there are necessary conditions like minimum work experience and age, most workers wait with their application until after the OAPT a smooth entry into retirement is possible; thus, the minimum age limit is not really strictly adhered to.

[9]See Abadie and Imbens (2006, 2011) for further details.

the support of X, (i) D is independent of $Y(0)$ conditional on $X = x$; and (ii) $P(D = 1|X = x) < 1 − c$, for some $c > 0$. The unconfoundedness assumption is often controversial, as it assumes that there are no (unobserved) characteristics of the individuals associated both with the potential outcomes and the treatments, besides the observed covariates X. Moreover, the ATT is only identified if assignment of treatments has not affected the outcome of the control group (stable unit treatment value assumption).

In this paper we apply the Abadie-Imbens (nearest neighbor) matching estimator with bias-correction (Abadie and Imbens 2006, 2011). In contrast to simple matching estimators bias-corrected matching estimators are $\sqrt{N}$-consistent and asymptotically normal irrespective of the number of covariates. In a simulation study Abadie and Imbens (2011) show that their estimator performs well compared to simple matching estimators and regression estimators in terms of bias, root-mean-squared-error and convergence rates. In contrast to propensity score matching, the matching is performed on the covariates X.[10] As long as matching (on covariates) is not exact the simple matching estimator is biased. The estimator of Abadie-Imbens uses an adjustment where the difference within the matches is regression-adjusted for the differences in covariate values (see Abadie et al. 2004 and Abadie and Imbens 2011 for details).

Matching is valid only if the assumption of conditional unconfoundedness is fulfilled, which means that the selection bias is only due to observed variables. This assumption is also known as selection on observables or conditional independence. We need to condition on all variables jointly influencing the participation decision and the outcome variables for fulfilling the assumption. Our data set contains a rich set of variables. We have information on socio-demographic variables (gender, sickness days, etc.), labor market history, and firm specific data (industry, employment dynamics, etc.).

Economic theory, previous research and information on institutional settings guide our selection of control variables. The evaluation literature points out that labor market history should be a crucial variable. We therefore included employment days per year (1 to 3 years before entrance in the OAPT), unemployment (3 years before entrance), tenure, and white-collar or blue-collar worker status. Age, health conditions (sickness absence 3 years before entrance) and income are important determinants for participating in the OAPT. As the OAPT scheme is based on a bilateral agreement between employer and employee we include firm size, employment dynamics of the firm and industry. To control

for regional labor market conditions we include regional dummies. We estimate the effects separately for females and males and use exact matching for birth cohorts—as age is the most important predictor of participation. Additionally, the information for the comparison as well as the treatment group is from the same data set and is measured at the same point of time. Given this rich dataset, we can argue that the assumption of unconfoundedness is justified in our case. While the data base for such an analysis is good, we also provide some robustness checks at the end with different matching procedures.

In Tables 2 and 3 we show evidence on the balancing properties of our matching estimator.[11] Whereas in Table 2 absolute means and standard deviations of our control variables are shown, Table 3 presents normalized differences between treated and controls, on the one hand, and between treated and matched controls, on the other hand. The quality of the matches appears very high as the average difference within the matched pairs is very small compared to the average difference between treated and control group before matching.[12] Note, however, that the matching estimator is not robust against unobservable variables which affect simultaneously assignment into treatment and the outcome variable.

Table 4 shows the estimated labor market impact of OAPT. Two output measures for the employment effect are used. First, we consider the impact on days in employment; then the impact on total hours worked is analyzed. We assume that all workers profiting from the OAPT scheme have reduced their working time by 50 percent. Finally we look at the impact on unemployment. Note that workers on a part-time scheme are counted as employed in national statistics during the complete time of their contract—regardless of working hours or blocking of the work load. Our estimates suggest that employment is slightly increased by the OAPT. Over a four year period participants work longer (15 days for males, and 23 days for females). This corresponds to an

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[10]We use the Stata procedure nnmatch (Abadie et al. 2004) in our estimation. The diagonal matrix constructed of the inverses of the variances of each element of X_i is used as metric for measuring the distance between two vectors of covariates. We set the number of matches $m = 4$.

[11]We follow Abadie and Imbens (2011) and use normalized differences instead of the t-statistic to check for the balancing property. Imbens and Wooldridge (2009) argue that increasing the sample size does not make the problem of inference for the ATE inherently more difficult. However, increasing the sample size systematically affects the value of the t-statistic. In contrast, the normalized difference is unaffected by sample size variations. As we use a relative large sample and many variables the t statistic would in practice almost always reject the null hypothesis of equal means of treatment and control group.

[12]The normalized difference exceeds 0.05 only for the female variables income (0.148) and sickness leave (0.056). Imbens and Wooldridge (2009) claim that linear regression methods tend to be sensitive to the specification if the normalized difference exceeds one quarter. Due to the request of a referee we also calculated the often used t-statistic for the null hypothesis of equal means as sensitivity check. We reject the hypothesis for the variables sickness leave (males, females) and real income (females) at the 1 percent level. Note that we use a bias-corrected matching estimator.

Table 2 Matching variables: covariates of treatment and matched controls

	Females				Males			
	Treatment		Matched controls		Treatment		Matched controls	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Employment Year 1	361.2	28.21	362.2	23.71	361.6	25.67	362.4	22.26
Employment Year 2	359.9	34.70	361.2	30.29	360.6	32.66	361.5	29.58
Employment Year 3	359.1	38.40	360.0	35.87	359.2	38.55	360.0	35.87
Tenure (days)	4527.4	3192.22	4365.2	3032.82	4869.1	3734.49	4832.7	3558.14
Birth year 1947 or 1944	0.725	0.45	0.725	0.45	0.587	0.49	0.587	0.49
Unemployment (1–3 years)	0.011	0.06	0.009	0.05	0.009	0.06	0.008	0.05
Sickness leave (1–3 years)	7.232	32.68	4.828	27.60	4.593	25.52	3.071	21.04
Accident benefit	0.008	0.09	0.007	0.08	0.019	0.14	0.019	0.14
Firm Employment Dynamics	2.037	0.68	2.042	0.63	2.024	0.69	2.025	0.66
White-Collar-Worker	0.768	0.42	0.758	0.43	0.697	0.46	0.688	0.46
Federal States (Base: Vienna)								
Unknown	0.008	0.09	0.008	0.09	0.006	0.08	0.006	0.08
Burgenland	0.028	0.17	0.028	0.16	0.019	0.14	0.019	0.14
Carinthia	0.039	0.19	0.039	0.19	0.031	0.17	0.030	0.17
Lower Austria	0.201	0.40	0.198	0.40	0.204	0.40	0.200	0.40
Upper Austria	0.200	0.40	0.196	0.40	0.198	0.40	0.197	0.40
Salzburg	0.064	0.25	0.064	0.24	0.054	0.23	0.054	0.23
Styria	0.099	0.30	0.098	0.30	0.090	0.29	0.089	0.28
Tyrol	0.044	0.20	0.043	0.20	0.040	0.20	0.040	0.20
Vorarlberg	0.024	0.15	0.024	0.15	0.038	0.19	0.037	0.19
Industry (Base: Other Services)								
Unknown	0.003	0.05	0.003	0.05	0.003	0.05	0.003	0.05
Agriculture	0.005	0.07	0.005	0.07	0.013	0.11	0.013	0.11
Energy/Mining	0.009	0.10	0.009	0.10	0.036	0.19	0.036	0.19
Manufacturing	0.236	0.42	0.234	0.42	0.388	0.49	0.394	0.49
Construction	0.051	0.22	0.050	0.22	0.069	0.25	0.070	0.25
Trade	0.189	0.39	0.189	0.39	0.187	0.39	0.184	0.39
Hotels and Restaurants	0.033	0.18	0.032	0.18	0.011	0.10	0.011	0.10
Transport	0.035	0.18	0.034	0.18	0.030	0.17	0.030	0.17
Financial Intermediation	0.073	0.26	0.073	0.26	0.076	0.26	0.076	0.27
Business Activities	0.089	0.29	0.088	0.28	0.070	0.25	0.069	0.25
Public Administration	0.220	0.41	0.225	0.42	0.083	0.28	0.084	0.28
Firm Size (Base: 250+)								
0–10	0.276	0.45	0.276	0.45	0.134	0.34	0.129	0.33
11–50	0.158	0.36	0.155	0.36	0.167	0.37	0.165	0.37
51–250	0.188	0.39	0.185	0.39	0.283	0.45	0.279	0.45
Real Income	2363.131	761.23	2195.5	833.37	2964.7	676.30	2967.5	714.35
N	3066		12264		5893		23647	

increase of the employment probability of 1 and 1.6 percentage points, respectively. However, the treatment effect is significantly positive only in the first two years after entrance in OAPT (see Fig. 1). For the fourth and fifth year we find even negative effects which result in a cumulative negative effect of OAPT on official employment figures once the full five year period is taken into account. Note that this employment measure does not take into account that OAPT participants

Table 3 Normalized differences in covariates: treated versus control and matched controls

	Females		Males	
	Controls	*Matched controls*	*Controls*	*Matched controls*
Employment Year 1	0.131	−0.028	0.146	−0.024
Employment Year 2	0.182	−0.027	0.177	−0.020
Employment Year 3	0.214	−0.018	0.183	−0.015
Tenure	0.219	0.037	0.129	0.007
Birth year 1947 or 1944	0.209	0.000	0.085	0.001
Unemployment (1–3 years)	−0.136	0.029	−0.146	0.023
Sickness leave (1–3 years)	−0.041	0.056	−0.088	0.046
Accident benefit	−0.020	0.002	−0.047	0.001
Firm Employment Dynamics	−0.038	−0.005	−0.029	−0.001
White-Collar-Worker	0.261	0.016	0.178	0.014
Federal States (Vienna)				
Burgenland	−0.010	0.000	−0.072	0.000
Carinthia	0.046	0.002	−0.002	0.000
Lower Austria	−0.030	0.000	−0.061	0.001
Upper Austria	0.107	0.006	0.083	0.007
Salzburg	0.118	0.006	0.131	0.003
Styria	−0.032	0.002	−0.038	0.002
Tyrol	−0.012	0.003	−0.003	0.003
Vorarlberg	−0.113	0.001	−0.103	0.001
Unknown	−0.076	0.001	−0.034	0.003
Industry (Other Services)				
Unknown	0.044	0.003	0.009	0.000
Agriculture	−0.028	0.000	0.005	0.000
Energy/Mining	0.026	0.000	0.030	0.000
Manufacturing	0.169	0.003	0.205	−0.008
Construction	0.084	0.002	−0.127	−0.001
Trade	−0.002	0.001	0.045	0.005
Hotels and Restaurants	−0.089	0.002	−0.072	0.000
Transport	0.003	0.003	−0.145	0.001
Financial Intermediation	0.096	0.000	0.057	−0.001
Business Activities	−0.057	0.003	−0.010	0.001
Public Administration	−0.126	−0.007	−0.133	−0.002
Firm Size (250+)				
0–10	−0.007	0.001	−0.111	0.010
11–50	−0.051	0.006	−0.084	0.004
51–250	−0.017	0.004	0.038	0.006
Real Income	0.571	0.148	0.309	−0.003

Note: The normalized difference is calculated as $\frac{\bar{X}_1 - \bar{X}_0}{\sqrt{S_0^2 + S_1^2}}$, where S^2 is the sample variance of X_i in the relevant subsample. The first column shows the difference between treated and control groups, the second column the difference between treated and matched control group

work only part-time. Our second employment measure indicates that OAPT significantly reduces total hours worked. Over a four year period employment in full-time equivalents is reduced by 29 percentage points (males), and 25 percentage points (females), respectively.[13]

Finally, for unemployment our matching results indicate that unemployment is reduced by the OAPT scheme: Measured unemployment is reduced over a three-to-five year period by one to one and a half month.

[13]Hofer et al. (2008) conducted a survey covering fifteen firms and institutions which participated in the OAPT scheme. We found evidence, that in most cases the participation had been initiated by the

workers' preferences. Therefore, we assume that the described negative employment effects are mostly driven by supply decisions of the involved workers. Demand considerations of the employing firms might be present, but of minor importance.

Table 4 Causal labor market effects of OAPT-scheme: cumulative effects three to five years after programme entrance (SE in parenthesis)

Cumulated effects over . . . years	Male	Female
Employment		
3 years (in days)	61.1 (5.2)	51.3 (7.3)
4 years (in days)	15.1 (7.0)	23.3 (9.9)
5 years (in days)	−35.8 (8.1)	−17.3 (11.7)
Full-time employment[a]		
3 years (in percentage points)	−31.5% (0.42%)	−27.4% (0.58%)
4 years (in percentage points)	−28.9% (0.42%).	−24.7% (0.59%)
5 years (in percentage points)	−26.2% (0.40%)	−22.6% (0.56%)
Unemployment		
3 years (in days)	−26.4 (2.1)	−32.8 (2.9)
4 years (in days)	−32.5 (2.8)	−38.4 (3.7)
5 years (in days)	−37.5 (3.1)	−43.2 (4.5)

[a]Calculated as (difference in days in full-time equivalents) over days in the sample period; we assume that OAPT participants reduce working time by 50 percent
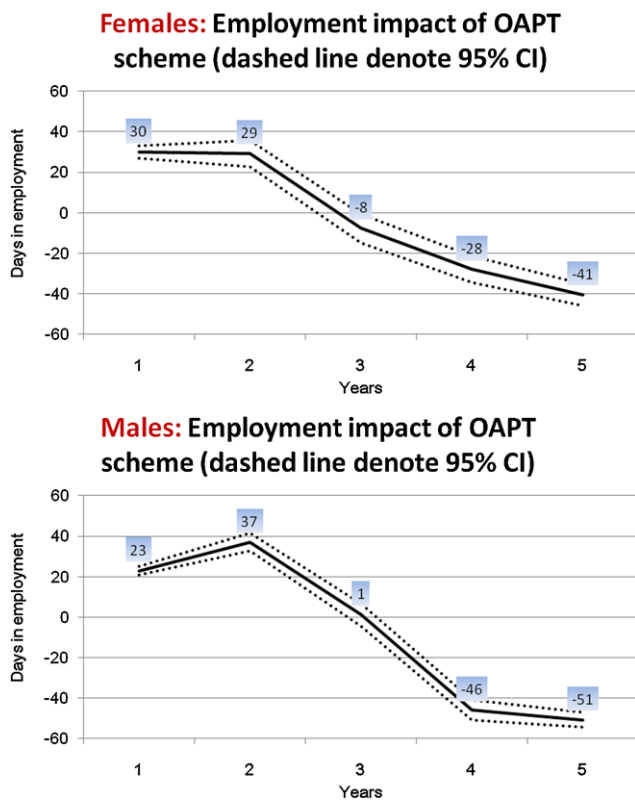
Fig. 1 Employment effect over time by gender (in days per year)

We performed some robustness checks. First, we used traditional propensity score matching. In general, the results are very stable. All results are qualitatively unchanged; however, the effect of OAPT on employment is slightly less favorable. E.g. the impact of OAPT on female employment over the four year period drops from 23 to 9 days and is not significantly different from zero. In a second approach, we omitted firm variables (firm size, industry affiliation) from the matching variables. Again, the results are qualitatively similar; again, less favorable for OAPT. The impact of OAPT on female employment is reduced to 31 days over the three years period, insignificant in the four year period and strongly negative (−55 days) over the five years period.

We can use our matching results to make a back-of-the-envelope calculation to estimate the aggregate effects of OAPT for the age group 50–65 years. We can make use of the share of workers in this age category participating in the OAPT to calculate aggregate employment effects. As the OAPT is primarily reducing working time of the participating individuals, abolishing the scheme would imply that employment in full-time equivalents increases by 1.5 percentage points. On the other hand, the measured unemployment rate would increase by 0.2 percentage points. Given the relatively high public expenditures, OAPT is certainly an inefficient measure to support employment of the elderly.

6 Conclusions

Austria introduced a heavily subsidized old-age part-time scheme in 2000 which became very popular soon. In 2004 almost 40.000 workers participated and expenditures for the scheme amounted to 0.25% of GDP. One aim of the scheme was to increase attachment of older workers to the labor market by providing a more worker-friendly phasing-out of working life. We are using two birth-cohorts for males and females, where we can observe the persons until potential entry into retirement to evaluate the policy. Our results indicate that most workers substituted part-time work for full-time work and simply retired earlier. The labor supply of older workers, measured by the total number of hours worked, decreased significantly. Our evaluation approach

took into account only direct effects on labor supply of the workers in the program; due to the construction of the program, substitution effects are not sensible; general equilibrium effects, on the other hand, are potentially important.[14] Given the large number of elderly workers participating in this program, the reduced labor supply might have some positive repercussions on wages in this age group—provided the elasticity of substitution between elderly and younger workers is reasonably small. Still, considering the large negative effects of the OAPT on working hours, it seems highly unlikely that wage-induced additional labor supply might compensate this first round effect.

Our findings are in line with the experiences of other countries concerning part-time and partial pension schemes. These schemes don't seem to be successful in prolonging working life but rather to act as alternative pathways in early retirement. Given the enormous costs, further reforms in the design of the scheme are necessary. First of all, the entrance age into the scheme should be oriented towards statutory retirement age in order to arrange phasing out of working life around usual retirement age and, thus, actually increasing final retirement age. The current law did not give any incentive to increase employment beyond statutory retirement age; instead the lawmakers were worried that many elderly Austrians did not even reach this statutory retirement age. Second, the blocking option—allowing workers to allocate all their workload at the beginning of the OAPT, which in fact is violating the idea of phased retirement in the first place—should be banned. This would reduce the attractiveness of the scheme but also the deadweight loss.

Of course, the purpose of the policy measure might have been different from the start: to allow workers with long working careers an early retirement option or to allow firms simple and subsidized ways to get rid off less productive elderly workers, which might explain some of the more bizarre features of the policy. Good-practice firm-specific phased-retirement policies do not reduce working time abruptly to half; these policies are typically targeted at workers with hard or stressful working conditions. A minor reduction in working time would go hand in hand with different job titles and tasks to allow a smoother adaptation of capabilities of elderly workers to the workplace.

Executive summary

In this paper we evaluate the impact of the old-age part-time scheme (OAPT) on the Austrian labour market which was a policy to allow flexible retirement options for the elderly with an aim to increase labour supply. The heavily subsidized old-age part-time scheme has been introduced in 2000 and it soon became very popular. In 2004 almost 40.000 workers participated and expenditures for the scheme amounted to 0.25% of GDP.

Methodically we apply the Abadie-Imbens (nearest neighbour) matching estimator with bias-correction. We are using two birth-cohorts for males and females, where we can observe the persons until potential entry into retirement to evaluate the policy. According to our matching estimates, employment probability increases slightly; especially in the first two years after entrance into the programme. Furthermore, the programme seems to reduce the measured unemployment risk. However, the total number of hours worked is significantly reduced by OAPT. While the policy is meant to reduce early exit from the labour force by allowing part-time work, our analysis indicates that most workers substitute part-time work for full-time work and thus the overall effect is rather negative. Given the large number of elderly workers participating in this program, the reduced labour supply might have some positive repercussions on wages in this age group. Still, considering the large negative effects of the OAPT on working hours, it seems highly unlikely that wage-induced additional labour supply might compensate this first round effect. Our findings are in line with the experiences of other countries concerning part-time and partial pension schemes. These schemes don't seem to be successful in prolonging working life but rather to act as alternative pathways in early retirement.

Given the enormous costs, further reforms in the design of OAPT are necessary. First of all, the entrance age into the scheme should be oriented towards statutory retirement age in order to arrange phasing out of working life around usual retirement age and, thus, actually increasing final retirement age. Second, the blocking option—allowing workers to allocate all their workload at the beginning of the OAPT, which in fact is violating the idea of phased retirement in the first place—should be banned.

Kurzfassung

In dieser Arbeit evaluieren wir den Einfluss der Altersteilzeit (OAPT) auf den österreichischen Arbeitsmarkt. Das OAPT ist eine gesetzliche Regelung zur Flexibilisierung des Renteneintritts mit dem Ziel, das Arbeitsangebot der Älteren zu erhöhen. Die im Jahr 2000 eingeführte Altersteilzeit wurde rasch populär. Im Jahr 2004 waren rund 40,000 Arbeitnehmer in diesem Programm und die Ausgaben betrugen 0.25 % des Bruttoinlandsprodukts.

Wir verwenden den Matching-Ansatz und zwar den von Abadie und Imbens entwickelten Matching-Schätzer mit Verzerrungs-Korrektur. Für die Analyse werden zwei

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[14]See e.g. Hujer and Caliendo (2002) for a discussion.

Geburts-Kohorten für Männer und Frauen herangezogen, welche wir bis zum potenziellen Pensionsantrittsalter beobachten können. Der Schätzung des Matching-Verfahrens zu Folge, erhöht sich die Beschäftigungswahrscheinlichkeit geringfügig; besonders in den ersten beiden Jahren nach Eintritt in das Programm. Weiterhin scheint das Programm das gemessene Arbeitslosigkeitsrisiko zu reduzieren, gleichzeitig wird jedoch das Gesamtvolumen der geleisteten Arbeitsstunden signifikant durch OAPT verringert. Während die gesetzliche Regelung darauf abzielt, den frühen Austritt aus dem Erwerbsleben durch Teilzeitarbeit einzudämmen, deutet unsere Analyse darauf hin, dass die meisten Personen Vollzeitarbeit durch Teilzeitarbeit substituieren und somit ein negativer Gesamteffekt auftritt. Aufgrund der hohen Anzahl von älteren Arbeitnehmern in Altersteilzeit könnte das reduzierte Arbeitsangebot zu positiven Lohneffekten bei Älteren führen. Jedoch ist es äußerst unwahrscheinlich, dass das durch die höheren Löhne induzierte zusätzliche Arbeitsangebot den Erstrundeneffekt kompensiert.

Unsere Ergebnisse stehen im Einklang mit internationalen Befunden über Modelle des gleitenden Übergangs von Beschäftigung in den Ruhestand. Diese Programme erscheinen nicht besonderes erfolgreich hinsichtlich der Verlängerung des Arbeitslebens, vielmehr bilden sie oft eine alternative Form des Übergangs in die Pension. Vor dem Hintergrund der hohen Kosten sind Reformen der Altersteilzeitregelung notwendig. Erstens sollte sich das Eintrittsalter in die Altersteilzeit am gesetzlichen Ruhestandantrittsalter orientieren, damit der graduelle Austritt aus dem Erwerbsleben um den Zeitpunkt des gesetzlichen Ruhestandalters erfolgt und damit die Lebensarbeitszeit verlängert wird. Zweitens sollte die Blockvariante der Altersteilzeit, die es ermöglicht zuerst Vollzeit weiter zu arbeiten und danach die Arbeitszeit auf Null zu reduzieren, abgeschafft werden, da sie der Intention eines gleitenden Übergangs in den Ruhestand widerspricht.

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