Unemployment Insurance versus Minimum Income - Effects on Working Behavior over the Life-cycle*

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Abstract

In this paper we develop a dynamic structural life-cycle model of labor supply behavior which accounts for endogenous accumulation of human capital and for the effect of the tax and transfer system on work incentives. In addition to income tax, social security contributions and social assistance, we model unemployment insurance benefits which are endogenous with respect to life-cycle employment. Specifically, an individual's recent employment history determines the duration of eligibility to unemployment insurance benefits while the level of these benefits is tied to previous earnings. We use this framework to study the life-cycle employment effects of transforming a traditional welfare state, as is currently in place in Germany, towards a more Anglo-American system in which the period of entitlement to unemployment insurance payments is reduced and payments do not depend on previous earnings.

Keywords: Unemployment Insurance, Life-cycle labor supply, Involuntary unemployment.

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1 Introduction

In nearly all developed countries, governmental transfers provide the largest component of income for individuals out of work. However, the design of transfer programs for the non-working varies considerably across countries, ranging from government managed insurance plans that provide eligible unemployed individuals with time-limited earnings-related insurance payments to social assistance programs that guarantee a universal minimum income.

The theoretical implications of unemployment benefits have been widely studied and are well understood (see, for example, the Handbook chapter by Krueger and Meyer, 2002). Much attention has been given to the effect of the period of entitlement to unemployment insurance benefits on labor supply behavior. Theoretical analysis predicts a stark drop in unemployment when benefits run out. The majority of empirical evidence regarding unemployment benefits relies on the estimation of matching functions using semi-structural hazard rate models, an early study for the US is Meyer (1990). Consistent with the theoretical prediction, these analyzes reveal large peaks in the rate of exit from unemployment at the end of the entitlement period. In addition, there exist several more structural empirical studies that estimate the employment effects of unemployment insurance. These structural models separably identify the hazard rate into employment, the job arrival rate, the wage offer distribution and the discount factor associated with future life-cycle utility. This methodology has been used to study the employment behavior of unemployed individuals who are eligible for transfers (Van den Berg, 1990), uninsured school dropouts (Ferrall, 1997) and the transitions of unemployed into nonparticipation (Frijters and van der Klaauw, 2006). Common to all theses studies is that they focus exclusively on employment behavior of groups of individuals in one particular situation, respectively the transitions of an inflow sample of unemployed, or of school drop-outs and.[1]

In this paper we focus on the employment transitions of both the employed and the unemployed, and analyze the labor supply effects of unemployment benefits in a dynamic structural life-cycle model. The central extension of our approach is the modeling of the work incentives for the employed and the unemployed. This necessitates an generalization of the existing dynamic structural life-cycle models with endogenous human capital accumulation (for example Eckstein and Wolpin, 1989) to incorporate a detailed specification of the tax and transfer system. In particular, along with income tax, social security contributions and social assistance benefits, we account for transfer payments to non-working individuals. These out-of work transfers are endogenous with respect to life-cycle labor supply due to the dependence of unemployment insurance benefits on an individual's employment history and previous earnings. Within the setting of a dynamic structural life-cycle model, individuals are forward looking agents who make their current labor supply decisions so as to maximize their expected life-time utility. In this respect our analysis is in contrast with most previous semi-structural studies of the labor market effects of unemployment insurance payments, where it is typically assumed that individuals are myopic rather than forward looking.

A small number of papers have included a specification of the tax and transfer system within

[1]Several papers consider not only the transition into employment but as well the employment stability of the inflow sample, e.g. Belzil (2001), or Tatsiramos (2008)

a dynamic structural life-cycle model.[2] These include, among others, Wolpin (1992) who models the endogenous accumulation of human capital while accounting for unemployment insurance payments, assumed to be a fixed sum payed to all non-working individuals who have some history of employment. Ferrall (1997) works with a more realistic specification of unemployment benefits, incorporating both a dependence of benefit eligibility on previous employment and the link between the level of unemployment benefits and previous earnings. However, Ferrall (1997) assumes that, after an initial transition from school into employment, job search and labor supply occur in a stationary environment, without the accumulation of human capital. With respect to the modelling of unemployment transfers, our study is most similar to the framework of Adda, Costa Dias, Meghir, and Sianesi (2007). They study the life-cycle employment effects of labor market programmes in Sweden and account in great detail for the institutional setting and the work incentives they provide. They focus in particular on the labor market programs but model as well eligibility for unemployment benefits which depends on the previous working history. In contrast to our setting, once eligible, the length of the entitlement period does not vary with age or the number of employment spells in the past.

The analysis undertaken herein draws on this previous literature and extends it in several aspects. We utilize a realistic specification of unemployment insurance benefits and, in contrast to the papers mentioned above, we also model other features of the tax and transfer system including income tax, social security contributions and social assistance payments. We allow for non-stationarity due to age effects, occurring via preferences, due to wages or to variation in transfer rules according to age, and endogenous accumulation of human capital. Moreover, we allow for heterogeneity in preferences and wages both due to observable and unobservable characteristics.

We use the German tax and transfer system as the benchmark. Two features of the German system of unemployment benefits are particularly interesting. First, transfers to the unemployed consist of two components. Individuals with a sufficient history of employment are eligible to receive time-limited unemployment insurance benefits, offering a replacement ratio of up to 60%. The entitlement period varies by age and the working history. Additionally, non-eligible individuals and eligible individuals in receipt of sufficiently low unemployment insurance benefits receive social assistance, which permanently guarantees a minimum income. Second, over the last two decades several reforms have changed the entitlement periods, working requirements and the level of unemployment insurance benefits. Since these changes partly differ by the age of the recipient, we can use the exogenous variation generated by program reforms as an additional source of identification.

The empirical analysis is based on a five year panel of single men and women taken from the German Socio Economic Panel (SOEP). This data set contains detailed income and demographic information and follows employment behavior on a monthly basis. We use simulated method of moments to estimate the dynamic structural life-cycle model. We allow for a flexible structure of stochastic effects appearing in preferences and wages, including measurement error

[2]Following Rust and Phelan (1997) there exits serval studies which explicitly focus on the retirement decision in a dynamic life-cycle setting and account for the relevant tax and transfer rules.

in wages. Based on estimates of the structural parameters we perform an ex-ante evaluation of a reform of the German system of transfers to non-working individuals. In the specific reform under consideration, unemployment insurance payments are eliminated. Instead, all non-working individuals receive social assistance which provides a universal minimum income, irrespective of previous earnings and working behavior. The results show the removing of unemployment insurance benefits has a substantial positive effect on employment behavior. We find the largest responses for highly educated west Germans with a long history of employment.

2 Model

It is the purpose of this paper to derive and estimate a dynamic structural life-cycle model of employment, non-employment and retirement behavior that accounts for the endogeneity of human capital accumulation and for the effect of the tax and transfer system on work incentives. In addition to income tax, social security contributions and social assistance, we model unemployment insurance benefits which are endogenous with respect to life-cycle employment. To reduce complexities, we only model the life-cycle labor supply of single households without dependent children. We focus on individuals aged 40 years and above which justifies assuming that family composition is constant over the agent's future life. Moreover, it is assumed that men and women over 40 have finished their education and all of the analysis is conditional on educational qualifications obtained prior to age 40 years. Finally, as common in this literature, we make the restrictive assumption that agents do not save and are credit constrained.[3]

Unlike numerous studies focussing on the job search behavior (for example Ferrall, 1997; Frijters and van der Klaauw, 2006) we do not model job search; all individuals receive one wage offer each period and all non-work corresponds to individuals who chose not to accept a job at the wage they were offered.

Job Offers and Net Income

Let $t = \tau_i$ denote the age at which individual i enters the labor market and let T denote the age of compulsory retirement. Individuals aged T^R or older are able to take early retirement while this alternative is not available to younger individuals. Non-employed individuals remain in the labor force and can return to full-time employment in the future. In contrast, early retirement is a fully absorbing state and thus once an individual enters early retirement returning to employment in the future is precluded.[4]

Each period $t = \tau_i, ..., T$, every non-retired individual receives a single offer of a full-time job (f). The wage associated with the job offer received by individual i at time t is denoted $w_{i,t}$. Non-retired individuals younger than T^R must decide between accepting the full-time job, in which case they receive a net income in the current period of $m_{i,f,t}$, and rejecting the offer, in which case the individual is non-employed (n). The non-employed receive a net income in the current period of $m_{i,n,t}$ consisting of out-of work transfers and other non-labor income which

[3] One important exception is French (2005) who allows for savings in a life-cycle model on retirement.

[4] This assumption is in line with the observed behavior of the early-retired individuals in Germany. Hardly any of the early-retired transition into full-time employment.

is subject to income taxation. At ages $t \geq T^R$ the individual has a choice between full-time employment, non-employment, and retirement (r). In practice, the retired receive a pension which depends on the previous earnings and the total working history. We model the pension payments in a reduced form as discussed in more detail below.

We define a period to be a quarter of a year. The data would allow us to model labor supply behavior on a monthly basis however this would markedly increase computational time. Moreover, working with quarters allows us to capture to a reasonable degree of accuracy the dependence of unemployment insurance benefits on the individual's employment history.

In contrast to most previous studies of employment behavior over the life-cycle, we model in detail the effect of the tax and transfer system on working incentives. This study uses the German tax and transfer system as a benchmark. The main features of the German tax and transfer system are noted here while Section 4 below provides a more detailed description together with information concerning recent relevant changes to the system.[5] The individual's net incomes in full-time employment and non-employment take the following form

$$m_{i,f,t} = F_f(w_{i,t}, I_{i,t}; TS_t).$$

Net income in full-time employment depends on the gross wage ($w_{i,t}$), non-labor income ($I_{i,t}$), and the tax and transfer system of the given period (TS_t). The tax and transfer system includes social security payments (SSC), income taxation, and, if net income is sufficiently low, a transfer to raise the individual's income to the minimum income. Net income for a non-employed individual who's last period of employment was at time s is determined as follows:

$$m_{i,n,t} = F_n\left(m_{i,f,s}, El_{i,t}, \max\left\{En_{i,t} - 3(t-s)\right., 0\right\}, I_{i,t}; TS_t\left.\right).$$

The unemployed either receive social assistance (ALG II), which is a permanent minimum income, or they get unemployment insurance (ALG I) which is time-limited and depends on the net income in their most recent job $m_{i,f,s}$.[6] Eligibility to receive unemployment insurance ($El_{i,t}$) depends on the number of months worked in the three years prior to the individual entering non-employment. The months of entitlement to unemployment insurance payments in period t ($En_{i,t}$) depends on employment behavior in the seven years prior to entering non-employment and is monotonically increasing with age. Each quarter of non-employment reduces the individual's entitlement period by three months. Until 2005, eligible individuals who have used their months of entitlement, receive unemployment insurance benefits at a reduced rate. The non-labor income of the non-employed may be subject to income taxation and minimum income transfers are means-tested against non-labor income.

[5] As mentioned above, we restrict attention to single households without children. This greatly simplifies the modeling of the tax and transfer system as family components of the legislation, such as joint tax of married couples, do not need to be considered.

[6] The names of the transfer programs have been changed in course of the transfer reform in 2005. For simplicity we use ALG I to refer to the part of the transfer which is dependent on the previous earnings, and use ALG II to refer to the minimum income component.

Optimal Labor Supply over the Life-cycle

Having received a job offer with a wage of $w_{i,t}$ at time t individual i must decide whether to accept or reject the job offer. By drawing on dynamic programming techniques, our model analyzes optimal labor supply over the life-cycle in a forward looking setting where the individual considers the dependence of payoffs occurring in the future on his current labor supply decision. There are several mechanisms linking today's employment decision with future payoffs. Firstly, habit formation and adjustment costs mean that an individual's current employment behavior affects his preference for employment relative to non-employment in future periods. Secondly, employment today adds to the individual's experience which, assuming positive returns to experience, leads to higher expected future wage offers. Additional intertemporal linkages occur through unemployment insurance benefits. For individuals who do not currently have the maximum unemployment insurance entitlement, employment in the current period increases the duration of entitlement to unemployment insurance payments, thus increasing the value of not working in the future. Finally, wage based rewards due to human capital accumulation mean that current employment leads to higher future unemployment insurance in the case of unemployment.

The individual's life-cycle utility can be expressed in terms of the employment state specific value functions $V_t^j(s_{i,t})$ for $j = f, n, r$. The state variables $s_{i,t}$ consist of all variables affecting the contemporaneous utilities and the offered wage $w_{i,t}$ at time t. At time t, the individual is assumed to know the current value of $s_{i,t}$ but may not know the values of all or some elements of $s_{i,t+k}$ for $k > 0$. However, the distribution of $s_{i,t+1}$ is known to the individual at time t and it is assumed to depend only on $s_{i,t}$. The value function associated with full-time employment is defined as discounted value of the individual's expected life-time utility if he works full-time in the current quarter and makes optimal labor supply are retirement decisions in all subsequent quarters. The value function for non-employment is similarly defined. The value function for retirement is defined as the discounted value of the individual's expected life-time utility if he enters retirement in the current quarter.

Formally, for $j = f, n$ the value functions are defined recursively as follows

$$V_{i,t}^j(s_{i,t}) = \begin{cases} U_{i,j,t}(s_{i,t}) + \delta \mathbf{E}_t \left[\max\{V_{i,t+1}^f, V_{i,t+1}^n\} \middle| s_{i,t}, y_{i,j,t} = 1 \right] \text{ for } t = \tau_i, ..., T^R - 1, \\ U_{i,j,t}(s_{i,t}) + \delta \mathbf{E}_t \left[\max\{V_{i,t+1}^f, V_{i,t+1}^n, V_{i,t+1}^r\} \middle| s_{i,t}, y_{i,j,t} = 1 \right] \text{ for } t = T^R, ..., T - 2, \\ U_{i,j,t}(s_{i,t}) + \delta \mathbf{E}_t \left[V_t^r(s_{i,t}) \middle| s_{i,t}, y_{i,j,t} = 1 \right] \text{ for } t = T - 1, \end{cases} \quad (1)$$

while

$$V_t^r(s_{i,t}) = U_{i,r,t} + \sum_{h=1}^{\overline{T}} \delta^h \mathbf{E}_t [U_{i,r,t+h} | s_{i,t}, y_{i,r,t} = 1] \text{ for } t = T^R, ..., T. \quad (2)$$

In the above $y_{i,j,t}$ for $j = f, n, r$ is an indicator variable taking the value one if the individual was in employment state j at time t and $\overline{T} > T$ denotes the last period of the individual's life. $U_{i,j,t}$ denotes the individual's flow utility associated with employment state j at time t

and will be a function of current income, the individual's socio-economic characteristics and his previous employment outcomes. δ denotes the discount factor. This is a crucial parameter in the life-cycle optimization problem, as it describes how strongly expected future utility affects the individual's current choice. In the empirical analysis we follow the literature and assume an annualized discount factor of 0.95.[7]

The individual maximizes life-cycle utility subject to the household budget constraint. Since in our framework, households neither save nor borrow, the period's budget is simply the state specific net-household income.

Optimizing behavior on the part of the individual implies acceptance of the job offer received at time $t < T^R$ if and only if $V^f_{i,t}(s_{i,t}) \geq V^n_{i,t}(s_{i,t})$ and otherwise she or he will choose non-employment. At $t \geq T^R$ the individual will work full-time if and only if $V^f_{i,t}(s_{i,t}) \geq V^n_{i,t}(s_{i,t})$ and $V^f_{i,t}(s_{i,t}) \geq V^r_{i,t}(s_{i,t})$, will be non-employed if and only if $V^n_{i,t}(s_{i,t}) < V^f_{i,t}(s_{i,t})$ and $V^n_{i,t}(s_{i,t}) \geq V^r_{i,t}(s_{i,t})$, and otherwise the individual will move out of the labor market into retirement.

3 Empirical specification

This section contains a description of chosen specification of the flow utilities, the distribution of offered wages and the treatment of the persistence unobservables, which takes into account the initial conditions problem.

Flow utilities

For the empirical estimation the flow utilities from full-time work and non-employment are specified as follows

$$U_{i,f,t}(x_{i,t}, m_{i,f,t}, \alpha_i, \epsilon_{i,f,t}) = \beta_f + \beta_y \frac{m^{1-\rho}_{i,f,t} - 1}{1-\rho} + \beta_x x_{i,t} + \beta_\alpha \alpha_{ie} + \epsilon_{i,f,t}, \quad (3)$$

$$U_{i,n,t}(m_{i,n,t}, \epsilon_{i,n,t}) = \beta_y \frac{m^{1-\rho}_{i,f,t} - 1}{1-\rho} + \epsilon_{i,n,t}. \quad (4)$$

In the above, β_f, the intercept of full-time employment accounts for the potential disutility for work. The vector of observed individual characteristics $x_{i,t}$ includes $y_{i,f,t-1}$, an indicator of the individual's employment status in the last period, and individual's total labor market experience, measured in quarters, in addition to socio-economic variables. The lagged employment status and experience terms capture intertemporal non-separabilities in preferences due to the combined effects of habit formation and adjustment costs. The unobservables $\epsilon_{i,f,t}$ and $\epsilon_{i,n,t}$ are assumed to be mutually independent and independent over time. Additionally, $\epsilon_{i,j,t}$ for all i, j and t is assumed to have a type I extreme value distribution. At time t individual i knows the current values of $\epsilon_{i,f,t}$ and $\epsilon_{i,n,t}$ but has no information about the future values of these error terms. α_{ie} represents a time invariant individual specific effect, which is known to the individual but unobserved to the econometrician. α_{ie} is assumed to be a random effect and thus occurs independently of observed socio-economic characteristics however, by construction, at $t > 1$ α_{ie}

[7] Previous studies, for example Karlstrom, Palme, and Svensson (2004), mention problems estimating the discount factor in similar life-cycle models.

will be correlated with experience and the individual's previous employment state. Similar to Heckman and Singer (1984), we specify nonparametrically distribution for the random effect. In order to obtain identification, the coefficients on the observed and unobserved individual characteristics $x_{i,t}$ and α_i have been normalized to zero in the flow utility for non-employment.

A reduced form specification of the value function for retirement $V_t^r(s_{i,t})$ is employed. Specifically we assume

$$V_t^r(s_{i,t}) = \gamma_r + \gamma x_{i,t} + \epsilon_{i,r,t}, \tag{5}$$

where $\epsilon_{i,r,t}$ is an error term with the same properties as $\epsilon_{i,j,t}$ for $j = f, n$. The age and experience terms in $x_{i,t}$ capture variation on the individual's payoff from retirement according to the age at which they retire and the dependence of pension payment on life-cycle employment behavior.

Gross Wages

Gross wages are a central component of the model. Indeed, offered gross wages are a major determinant of the current net income from full-time work. Moreover, the gross wage associated with an individual's previous job affects the individual's current income if he is unemployed due to the dependence of AGL I on previous net earnings. In the empirical analysis individual i's log offered wages are assumed to evolve according to

$$\log(w_{i,t}) = \lambda_z z_{i,t} + \lambda_\alpha \alpha_{iw} + \upsilon_{i,t} \quad \text{for} \quad t = 1, ..., T. \tag{6}$$

In the above $z_{i,t}$ are observed individual characteristics that affect wages including age terms, education, region of residence and years of experience in the labor market. The coefficient on experience captures the effect of human capital accumulated via previous employment, on wages. $\upsilon_{i,t}$ is a shock to individual i's wages occurring at time t and is assumed to be independent of observed individual characteristics, to occur independently over time and to be normally distributed with zero mean and a variance σ_υ^2. Individual i is assumed to know the current value of $\upsilon_{i,t}$ but does not know the future values of the time varying shocks to wages. α_{iw} is a time invariant individual specific random effect which is again nonparametrically specified. This random effect is assumed to be independent of the random effect α_{ie} occurring in preferences. However, since wages have an indirect effect on the preferences through net household income, the persistent unobservables affecting the utility of full-time employment relative to non-employment are correlated with the persistent unobservables occurring in the wage equation.

Wages as observed by the econometrician are measured with error. Specifically

$$\log(w_{i,t})^* = \log(w_{i,t}) + \eta_{i,t} \quad \text{for} \quad t = 1, ..., T, \tag{7}$$

where $\log(w_{i,t})^*$ represents the log gross wage observed by the econometrician and $\eta_{i,t}$ is a measurement error assumed to occur independently of the true wage and independently over time. Furthermore, $\eta_{i,t}$ is assumed to be normally distributed with zero mean and a variance σ_η^2.

4 The German Tax and Transfer System

In the following, we will describe the key elements of the German tax and transfer system and how we implement the legislation in the setting of a dynamic life-cycle model of labor supply. Although the general structure of income tax, social security contributions, and of the out of work transfers was unchanged over the years 1995 - 2006, several reforms, discussed in detail below, affected the progressivity and generosity of this system. These reforms are important for this study as they provide an additional, exogenous, source of identification and increase the power of tests for goodness of fit.

Social Security Contributions

In each month, an individual's income from employment is subject to social security deductions for health, unemployment and pension benefits.[8] As shown in the first three columns of Table 1, except for the unemployment insurance, the rates for SSC increased slightly over time. Social security contributions are capped and the upper level of the monthly earnings subject to SSC is higher in West Germany than in the East (e.g. 5200 Euros compared to 4500 Euros in 2005).[9]

Income Tax

In contrast to SSC, income tax is computed on an annual basis. An individual's annual taxable income is defined as the sum of gross income from employment above an exemption thresholds, gross income from assets above a disregard and income from renting and leasing. Moreover SSC up to a maximum amount are deducted. The individual's annual income tax liability is obtained by applying the income tax function to taxable income. The income tax function is a smooth function of taxable income above a further exemption threshold. The exemption threshold increased between 1995 and 2006 while, over the same period, the top marginal tax rate decreased from 53% to 42% (see Table 1). On top of income tax, individuals pay an extra tax (Solidaritaetszuschlag) to finance the cost of German reunification. This extra tax was decreased in 1998 from 7.5% to 5.5% of income tax payments.

Transfer System

Transfers to the unemployed consist of an unemployment insurance component, termed ALG I, which is, depending on the level, paid in addition to or instead of social assistance (ALG II). Individuals entering unemployment who have worked at least one year in the last three years are eligible to receive ALG I. Eligible unemployed individuals receive ALG I payments of 60% of previous net earnings for an entitlement period.[10] The period of entitlement to ALG I benefits at the 60% rate varies between 6 and 18-32 months, depending on age and employment history. Schmitz and Steiner (2007) provide a detailed description of the determinants of the entitlement

[8] In addition to the employee's SSC, the employer contributes the same amount in SSC.

[9] Low earning individuals pay SSC at a subsidized rate. However, since we only consider the full-time employed, the lower bound is of no relevance for our application.

[10] The 60% rate is applicable to single individuals without dependent children. Higher rates apply to individuals with dependent children, see Schmitz and Steiner (2007).

Table 1: Key Parameters of the German Tax and Transfer System

	Social Security Contributions			Income Taxation		ALG I			ALG II	
	Health Insurance in %	Pension Insurance in %	Unemployment Insurance in %	Tax Allowance per Year	Top Marginal Tax Rate in %	Max. Entitlement Period in Months	% of prev. income full ALG I	% of prev. income reduced ALG I	Average West per Months	Average East per Months
1995	7	9.3	3.3	4050	53	32	60	53	564	553
1996	7.5	9.65	3.3	6021	53	32	60	53	571	560.5
1997	7.75	10.15	3.3	6021	53	32	60	53	580	569.5
1998	7.75	10.15	3.3	6156	53	32	60	53	586	575
1999	7.75	9.85	3.3	6507	53	32	60	53	594	584
2000	7.75	9.85	3.3	6876	51	32	60	53	606	596
2001	7.75	9.55	3.3	7200	48.5	32	60	53	617	606
2002	7.75	9.75	3.3	7200	48.5	32	60	53	629	617
2003	8	9.75	3.3	7200	48.5	32	60	53	634	622
2004	8	9.75	3.3	7632	45	32	60	53	643	631
2005	8.5	9.75	3.3	7632	42	32	60	-	653	637
2006	8.5	9.75	3.3	7632	42	18	60	-	658	642

Note: All payments are given in Euro. The rates of the SSC describe only the employee's share. The employers contributes the same amount.

period for eligible unemployed individuals. Over the period of interest the age and working requirements, as well as the entitlement period changed. Most notably, in 2006 the maximum period of entitlement to ALG I benefits at the 60% rate was reduced from 32 to 18 months. Before the year 2005, the amount of ALG I was reduced to 53% of previous net earnings when the entitlement period expired. This reduced ALG I was then a permanent transfer. From 2005 on, the long-term unemployed who have exhausted their entitlement to ALG I at the higher rate receive only the ALG II social assistance payments. For the long-term unemployed with relatively high previous earnings, this reform had a large effect on their out-of work transfers and thus on working incentives.

The amount of ALG II (social assistance) does not depend on previous earnings. Entitlement rules are independent of the previous working history and the transfer is permanent. The transfer consists of a person-related part that varies by region (Bundesland) and of housing benefits that may vary by individual. However, housing benefits only guarantee a reasonable apartment given the number of household numbers. In the last two columns of Table 1 we provide information about the average monthly benefit payments by year and east and west Germany. Note ALG II is means-tested against income from all sources. Thus, if the ALG I payments for an eligible unemployed individual are lower than the ALG II payments, then he receives in addition to ALG I the difference between the two transfers. The same applies to a worker if the earnings from work are lower that the ALG II payments. However, since in this model we focus only on full-time working men the means-testing against earnings from work is of no relevance.[11]

Transfers are not taxed as income in Germany. Instead, ALG I is added to taxable income to determine the individual's average tax rate, which is then applied to taxable income to determine the individual's tax liability. ALG II payments have no tax implications.

Implementation

As previously described, by legislation, income tax is based on yearly income. In our implementation of the German tax and transfer system we calculate net income in the current quarter based on an annualized version of the individual's income in the current quarter. Implicitly we assume that individuals base their labor supply decision in the current quarter on their net income relating to their current gross income and ignore any adjustments in taxes and transfer pertaining to income received previously in the fiscal year. Additionally we assume full take-up of benefits.

5 Estimation Strategy

The parameters of the model are estimated using the Method of Simulated Moments (MSM). In the following we describe the MSM estimation framework and the chosen moments to be used in this application.

[11] For both ALG I and ALG II, there exists a different withdrawal design of additional earnings for the unemployed. Again, since in our model workers can only work full time the withdrawal design does not apply.

MSM

Estimation proceeds as follows. Suppose we have a sample of N individuals and individual i for $i = 1, ..., N$ is observed in T_i quarters. Using the $\sum_{i=1}^{N} T_i$ sample observations, a set of moments pertaining to the endogenous variables, namely wages and employment outcomes, is computed. The vector of observed moments is denoted M^s. The choice of moments used in this application is discussed below in Section 5. Informally, the MSM estimates are those values of the model parameters that match the moments of the endogenous variables in simulated data sets to those moments observed in the sample. More formally, R data sets of the same size and with the same empirical distribution of exogenous individual characteristics as the sample are constructed. Using a particular vector of model parameters, denoted θ, employment outcomes and wages are simulated for each individuals in each of the R data sets. Relevant moments of the simulated endogenous variables in each data set are computed and denoted $M^r(\theta)$ for $r = 1, ..., R$. The metric $J(\theta)$ is constructed as follows

$$J(\theta) = \left(M^s - \frac{1}{R} \sum_{r=1}^{R} M^r(\theta) \right) \widehat{\Omega} \left(M^s - \frac{1}{R} \sum_{r=1}^{R} M^r(\theta) \right)', \tag{8}$$

where $\widehat{\Omega}$ is the optimal weighting matrix, here $1/N$ times the inverse of the covariance matrix of the sample moments. $\widehat{\Omega}$ is estimated using bootstrap resampling of individuals from the original data set. The MSM estimator minimizes the distance between the simulated and the observed moments: $\widehat{\theta} = \text{argmin}_\theta J(\theta)$.

The term $\frac{1}{R} \sum_{r=1}^{R} M^r(\theta)$ appearing in $J(\theta)$ is not a continuous function of the parameter vector θ as small changes in θ cause discrete changes in employment behavior for some individuals. Consequently gradient and Hessian based optimization methods are unsuitable methods for minimizing $J(\theta)$. Instead we use Simulated Annealing in the form suggested by Goffe, Ferrier, and Rogers (1994) to solve for the MSM estimates, henceforth denoted $\widehat{\theta}$. The value of $J(\widehat{\theta})$ provides a natural test of the goodness of fit of the model. In particular, under the null hypothesis that the model is correct with R and all T_i fixed and as $N \to \infty$

$$\frac{RN}{R+1} J(\widehat{\theta}) \xrightarrow{d} \chi^2(dim(M^s) - dim(\widehat{\theta})), \tag{9}$$

and therefore if the p value $1 - F\left(\frac{R}{R+1} N J(\widehat{\theta})\right)$, where F is the distribution function of a χ^2 random variable with $dim(M^s) - dim(\widehat{\theta})$ degrees of freedom, is less than 0.05, then the null hypothesis of a correct specification cannot be rejected at the 5% significance level. Assuming the model is correctly specified, $\widehat{\theta}$ has the following asymptotic distribution

$$\widehat{\theta} \xrightarrow{d} N\left(\theta^*, \frac{R+1}{RN} \left(g \Omega g'\right)^{-1}\right) \quad \text{as} \quad N \to \infty \quad \text{with} \quad R \quad \text{and} \quad T_i \quad \text{fixed}, \tag{10}$$

where θ^* is the true value of θ and

$$g = \frac{1}{R} \sum_{r=1}^{R} \left. \frac{dM^r(\theta)}{d\theta} \right|_{\theta = \widehat{\theta}}. \tag{11}$$

Simulating Data Sets

We now describe the process of simulating wages and employment outcomes. We start with a sample of the same size as the original sample and with the same empirical distribution of observed socio-economic characteristics, initial values of experience and initial employment status as observed for the sample members. For each individual we draw from the distributions of the random effects α_{ie} and α_{iw} conditional on the previously mentioned variables. Additionally, for each individual a value of pervious net earnings is calculated and this quantity is initially used as the basis of the ALG I calculation.

Conditional on the explanatory variables and the random effects, wages and employment outcomes are then simulated for all sampled periods subsequent to the initial period of observation. Specifically, for each individual, a draw is taken from the conditional distribution of wages in the quarter in which the individual was interviewed (see Section 6). The individual's net incomes in full-time work and non-employment are then determined from the tax and transfer rules. Using these net incomes together with draws from the distributions of $\epsilon_{i,f,t},\ \epsilon_{i,n,t}$ each individual's value function associated with full-time work and non-employment can be constructed. The value function for retirement is derived based on the reduced form specification discussed above. These value functions determine the individual's employment choice in the first period of observation. Given the simulated employment outcomes, each individual's experience and previous labor market state from the perspective of the second period of observation are constructed. Additionally, each individual's period of entitlement to ALG I and the relevant net income for ALG I payments in the second period are updated in line with the simulated first period wage and employment outcome. Each individual's wage and employment outcome in the second period of observation can then be constructed in the same fashion as for the first period. This procedure continues recursively until wages and employment outcomes in each period of observation have been simulated.

It remains to specify the distribution of α_{ie} and α_{iw} are conditioned on the initial values of experience and initial employment state, referred to as the initial conditions. As mentioned above, these random effects occur independently of observable socio-economic characteristics. However, by construction α_{ie} will be correlated with previous employment outcomes. Therefore, the distribution of α_i conditional on an individual's employment history at the time of the initial observation depends on previous labor market outcomes. Ignoring this dependence leads to inconsistencies (see Heckman, 1981). In response to this issue, we proceed in a similar vein to Wooldridge (2005) and specify a distribution of the random effects that is conditional on the initial conditions. Specifically,

$$Pr(\alpha_{ik} = 1|IC_i) = 1 - Pr(\alpha_{ik} = 0|IC_i) = \Phi(\pi_k IC_i) \quad \text{for} \quad k = e, w. \tag{12}$$

In the above IC_i is a vector of variables describing individual i's employment behavior prior to the first time he entered the sample, $Pr()$ is a probability and $\Phi()$ denotes the distribution function for a standard normal random variable.

Approximation of Value functions

We approximate the value functions using an adaptation of the method of Keane and Wolpin (1994). We choose two grids of points g_T and e_T corresponding to respectively values of the state variables s_T that are known to the individual at time $T-1$ and values of $s_{i,T}$ which are not known to the individual at time $T-1$. Using these grid points we construct $V^r(g_T, e_T)$, that is the value of retirement for individuals with time T state variables equal to g_T and e_T. We then run the Ordinary Least Squares (OLS) regression of $V^r(g_T, e_T)$ on $Q(g_T)$, where Q is a matrix formed from elements of g_T. This yields an expression for the expectation of the value function at time T given the time T state variables known to the individual at time $T-1$

$$E(V^r(g_T, e_T)|g_T) = Q(g_T)\widehat{\beta}^V_{T\,T}, \tag{13}$$

where $\widehat{\beta}_T$ denotes the OLS coefficient estimates. We then move back to time $T-1$ and for randomly selected values of g_{T-1} and e_{T-1} we construct

$$\begin{aligned} V^f(g_{T-1}, e_{T-1}) &= U_{f,T-1}(g_{T-1}, e_{T-1}) + \delta Q(h(g_{T-1}, e_{T-1}, f))\widehat{\beta}^V_T, & (14)\\ V^n(g_{T-1}, e_{T-1}) &= U_{n,T-1}(g_{T-1}, e_{T-1}) + \delta Q(h(g_{T-1}, e_{T-1}, n))\widehat{\beta}^V_T, & (15)\\ V^r(g_{T-1}, e_{T-1}) &= V^r_{T-1}(g_{T-1}, e_{T-1}). & (16) \end{aligned}$$

In the above $h(g_{T-1}, e_{T-1}, j)$ for $j = f, n$ denotes the time T state variables that are known to the individual conditional on having chosen employment state j at time $T-1$. The last terms equations (14) and (15) are therefore the discounted value of the expectation of time T utility conditional on information known to the individual at time $T-1$, including the individual's employment choice at time $t-1$.

For each vector of grid points, the maximum of $V^f(g_{T-1}, e_{T-1})$, $V^n(g_{T-1}, e_{T-1})$ and $V^r(g_{T-1}, e_{T-1})$ is determined and then, we run another OLS regression of the maximums on g_{T-1} which gives

$$E(\max\{V^f(g_{T-1}, e_{T-1}), V^n(g_{T-1}, e_{T-1}), V^r(g_{T-1}, e_{T-1})\}) = Q(g_{T-1})\widehat{\beta}^V_{T-1}. \tag{17}$$

This process is then applied recursively until $\widehat{\beta}^V_t$ for $t = 1, ..., T$ have been obtained. Thus this method provides a function which computes the expected future value function conditional on information available to the individual in the current period. This function can then be called upon when simulating employment behavior for the purpose of the MSM estimation.

This method of computing expected value functions has several desirable features. Firstly, it is never necessary to compute analytically the expected maximum of next periods state specific value functions. Instead, only the observed maximum for the selected grid points is required and the OLS regression provides the expectation. Secondly, all computation are executed only at selected grid points and not at every point in the state space. This is necessary as the state space is very large. Third, the method yields a function that provides expected value function at any point in the state space, as is required for the MSM estimation as when simulating the moments any point in the state space may be reached for particular trial parameter values.

Chosen Moments

Table 3 in the Appendix lists in the first two columns the moments of the sample that we choose to match when performing the MSM estimation. In addition to the empirical mean we present the standard deviation of each moment, obtained via bootstrapping. We use the mean of the period specific employment rate, as well as the overall retirement rate and the mean and the standard deviation of the wages as moments. Moreover, the correlation between the current employment state and the lagged dependent variable, as well as the correlation between the current and the lagged wage help to identify the persistence in the behavior. The human capital accumulation is mainly identified through three moments on experience. We cannot match directly moments for the preference for net income as income is the transformed function of gross wages. For identification, we make use of the reforms in the entitlement period for unemployment insurance over time, mentioned above. Since the legislation affected individuals differently by age and time, we have exogenous variation which is correlated with the household income. The moments we make use of are the correlation between the entitlement period of an individual with the employment rate, where the entitlement is specified nonparametrically. Preferences, wages and the retirement behavior vary by observed characteristics. The coefficients on individual characteristics are identified through the correlation with the respective independent variables. Overall, we match 53 moments while the model contains 30 parameters. Therefore, we have over-identification and can use a χ^2 test with 23 degrees of freedom to test the goodness of fit of the model.

Missing Wages: Treatment and implications for estimation

Within the MSM framework it is straight forward to deal with missing wage observations. Given the above model and the used data (SOEP), there are three reasons for missing wages. First, wages are observed only in one quarter of each year - the quarter in which the interview was conducted - while the individual's employment state is observed for each quarter. Second, only individuals in employment are asked to report their wage; the offered wage is not observed for non-working individuals. Moreover, according to the model, the non-working individuals differ in their observed and unobserved characteristics as compared to working individuals. Third, some individuals in employment do not respond to all of the survey questions needed to construct the wage measure. Finally, it is the case that particular demographic groups, notably the older and men and women with low educational qualifications, are relatively likely to be survey non-respondents.

The missing wage observations in the quarters without interview do not pose any particular difficulties when constructing the simulated data sets. Given that in the sample we observe wages for employed individuals only in the quarter of their interview, we compute moments for wages only of the individuals who according to the simulation chose employment in this quarter. By matching the observed wages of employed individuals with the simulated wages of individuals choosing employment in the simulation we account for selection into employment based on both observed and unobserved individual characteristics. To account for survey non-response, the empirical moments pertaining to wages are computed by weighting the observed

wages according to observed socio-demographic variables. These adjusted observed moments are then matched to the corresponding simulated moments, which are not subject to survey non-response. In more detail, using the sample observations a logit model is used to estimate the probability of an employed individual to respond to wage related survey questions. The inverse of the predicted probability of survey response is then used as a weight when computing moments of the observed wages. This methodology accounts for survey non-response that varies according to observed socio-demographic variables but assumes that, conditional on observables, survey non-response is random.

It is noted here that the presence of missing wages together with the intertemporal dependencies created by nature of the unemployment insurance rules makes MLE difficult to implement, hence motivating our choice of MSM. Specifically, obtaining the choice probabilities required for MLE would require integration over the distribution of offered wages for non-working individuals and with respect to the unobserved wages of the employed individuals. Moreover, due to the dependence of unemployment insurance benefits on the individual's net income in his most recent period of employment, the net income of a non-working individual may depend on a wage that is unobserved to the econometrician. Thus when integrating with respect to unobserved wages it would be necessary to consider likelihood contributions at the time of the unobserved wage draw and also future likelihood contributions. Such integration makes MLE computationally complex while using MSM, which uses simulated wages and employment outcomes rather than choice probabilities, sidesteps the need to perform such integration. In addition, adjusting for survey non-response when conducting MLE is non-trivial (see Qin, Leung, and Shao, 2002) while, as described in the above, within a MSM framework it is straight forward to accommodate missing wages due to survey non-response.

6 Data and Descriptive Evidence

This study draws on data from the SOEP which is an annual representative sample of over 11,000 households living in Germany containing information about working behavior and socio-economic variables at the individual and household levels.[12] We construct an unbalanced panel of single households with consecutive observations in at least two years between 2002 - 2007 inclusive which yields retrospective information for the fiscal years 2001 - 2006. In our analysis we focus on a specific sample of single households for which we assume that their family composition remains constant over their life-cycle. More precisely, we restrict the sample to singles older than 40 and younger than 66 years. We exclude individuals with primary earnings from self-employment as well as those in full-time education as their labor supply behavior differs substantially from that of the rest of the population of interest. These exclusions yield a sample with 19440 person quarter observations corresponding to 10200 different women and 9240 men.

[12]For a detailed description of the data set, see Haisken De-New and Frick (2005).

Employment behavior

The SOEP includes detailed information about the monthly employment state in the year prior to the interview date. For tractability of the model we group the monthly information for each individual to form quarterly observation of employment status. More precisely, the employment state of the first month in a quarter determines the quarterly outcome. In this analysis we distinguish the employment state only on the extensive margin, i.e. the individual either is full-time employed or is non-employed. The group of non-employed consist of involuntary and voluntary unemployed, as well as of retired. Since the financial incentives and the expected employment behavior of the unemployed and the retired strongly differ, we distinguish between the two states for individuals older than 50 years. In line with the observations, we assume that individuals younger than 50 years can not choose early retirement and that retirement is an absorbing state.

In Figure 1 we show the average participation rate of men and women by age. Both for men and women, participation rates are with over 80% fairly high until the age of 50. Thereafter, the rates monotonically decrease by age, slightly faster for women than for men. By region (Figure 2) we find that the overall average participation rate for both men and women is more than 10 percentage points higher in the western (57%) than in the eastern part of Germany (47%). This difference is in line with the better economic situation in West Germany. The overall pattern by age however is similar in both parts of Germany.

Non-employment is either due to voluntary or involuntary unemployment or it is related to early retirement. As discussed above the financial incentives strongly differ between the two states and early retirement is an absorbing state. Not surprisingly we find that early retirement is increasing after the age of 50 (Figure 3). While for men the retirement is monotonically increasing with age, a relatively large share of single women drops out out of the labor force between 50-55. Interestingly, we find that participation rates of both men and women markedly decrease after the age of 55 even when excluding the early retired (Figure 4). This is in line with the extended entitlement periods for older unemployed after the age of 55. In this sense, the income related transfers with long entitlement periods can be seen as a stepping-stone into retirement for the older unemployed. Figure 5 shows the average entitlement periods by age. The vertical lines indicate at which age there is a change in the entitlement period by age conditional on experience. This descriptive evidence underlines that entitlement is increasing with age, with discrete jumps at ages with legal changes. The drop of the entitlement periods after at the end of the working age is again in line with the stepping stone hypothesis. If individuals decide to move into unemployment before retirement, they use their months of entitlement. Thus when entering retirement, those individuals have no month of entitlement left over, thus reducing the average entitlement period for this sample.

[Figures: 1 - 5 about here]

Gross wages

In addition to the retrospective information on monthly employment states, the data includes the gross earnings of the month previous to the interview date. Moreover, the corresponding working hours including payed over-time work are given and thus we can construct full-time equivalized quarterly gross earnings for the working population. For time-consistency we cannot use the retrospective employment information and the current wage information from the same wave. Instead, we make use of the panel dimension in the data. Since we observe the exact interview day we can exactly match the wage information collected in year t to the corresponding quarter of the retrospective employment information collected in the year $t+1$. For quarters in which employment status is known but the wage is unobserved, we fill-in the missing wages in the MSM estimation as described above.

Figure 6 shows the average gross hourly wages conditional on working for men and women by age. As expected on average conditional wages are higher for men than for women. Over the whole population, median hourly wages of men (16.2) are nearly 2.5 Euros higher than for women (13.8). This wage gap is mainly driven by the wages of older workers. Between the age of 40 and 50 conditional median wage gap is about 1.5 Euro. For the later years, however, we find a stark drop in female wages, while male wages tend to remain fairly constant. The increasing wage gap could be either due to different seniority payments for men and women, or due to selection effects. As shown in Figure 1, employment rates are very low for men and women after the age of 60. We account in detail for this selection effect in the wage estimation, by jointly estimating the distribution of wages and the labor supply model conditional on observable and unobservable characteristics.

[Figure: 6 about here]

Demographic characteristics

In this application we focus on a very homogenous sample of single men and women older than 40 years. Therefore, we condition the dynamic labor supply behavior and the wage process only on few demographic characteristics. In addition to time constant variables such as education, region of residence and country of origin, we observe the age and the time-varying health status. Moreover, the data set includes self-reported information about the initial level of experience. Respondents report their retrospective working history and we use all spells of full-time and part-time work to construct the total years of working experience. The information about the initial state of experience is necessary to modeling the endogenous accumulation of human capital in the life-cycle model.

7 Results

Structural parameters and goodness of Fit

Table 2 shows the MSM estimate of the structural parameters for the preferences and the wage distribution and, the parameters that describe the retirement decision. The parameter estimates

Table 2: Parameter estimates

	Parameter	Std. dev.
Preference Parameters		
Intercept	-6.79	0.51
$y_{i,f,t-1}$	7.49	0.50
west	0.08	0.43
education/10	1.13	0.75
experience/10	0.30	0.10
(min(Age,50)-40)/10	0.14	0.38
(max(Age,50)-50)/10	-2.25	0.32
male	-0.02	0.30
β_y	5.19	0.88
ρ	0.31	0.25
invnorm(prob)	-1.67	0.35
mass point	4.04	1.11
Retirement Parameters		
Intercept	-17.47	1.19
$y_{i,f,t-1}$	0.43	0.57
west	-0.49	0.84
education/10	3.42	1.24
experience/10	2.83	0.28
(max(Age,50)-50)/10	3.83	1.05
male	-1.58	0.88
Wage equation		
Intercept	1.08	0.18
west	0.47	0.07
education/10	1.20	0.09
experience/10	0.18	0.05
(min(Age,50)-40)/10	-0.12	0.12
(max(Age,50)-50)/10	-0.28	0.09
male	0.19	0.05
σ_η	0.01	0.46
σ_ν	0.15	0.06
invnorm(prob)	-1.16	0.39
mass point	0.92	0.19

Note: χ^2 test statistic for goodness of fit is 19.28 with a p value of 0.503.

are broadly as expected.

Net income has a significant positive effect on utility thus implying an increase in work incentives has a positive effect on employment behavior. The concavity parameter ρ is relatively low and not significantly different from zero, which implies that we cannot reject a linear specification for the income term. The negative intercept of full-time employment shows that agents have a disutility for work. We find a significant and positive effect of experience while eduction, region and gender does not affect the choice of full-time work. The strong negative age effect for the over 50s reflects the strong decline in employment rates at the end of working career.

The transition into retirement strongly depend on eduction and experience. These variables are the driving force for the life-cycle earnings which determine the pension of the retired. Moreover, we find a strong age effect for the workers older than 50 years. In the wage equation there are significant positive returns to education and experience, while wages are considerably higher in west Germany than in east Germany and higher for men than for women. We find only small and non significant transitory measurement error in wages.

In the last column of table 3 in the Appendix we show the mean value of all simulated moments. They are very similar to the mean of the observed moments. Finally we note that the model is not rejected on the basis of a $\chi^{2\tilde{}}$test (p-value: 0.503) for goodness of fit.

In Sample Fit

In Figure 7 we present the in-sample fit of the model by age. Based on the estimated parameters, we predict the average participation rates by age and compare those to the participation rates in the data (Figure 1). The predicted and the observed shares at each age are very similar.

[Figure: 7 about here]

8 Policy evaluation: Unemployment insurance versus minimum income

The economic literature (see, for example, the Handbook chapter by Krueger and Meyer, 2002) provides strong evidence that a reduction in the entitlement period has a positive effect on the transition rates from unemployment into employment.[13] In line with this evidence, the German government markedly reduced the entitlement period for ALG I starting from the year 2006. However, despite these changes the German transfer system for the unemployed remains relatively generous, in particular in comparison to the UK- or US-systems of unemployment transfers. In the UK, all unemployed receive a means-tested minimum income when out-of-work regardless of their previous working history.[14] This system certainly provides very different incentives for the employment behavior than the German system currently in place which guarantees at least for a certain period relatively generous transfers for the eligible.

[13] Tatsiramos (2008) shows that the negative employment effect of the unemployment insurance is counteracted by an indirect positive effect of these transfers on the match quality and job stability.

[14] Depending on the previous working history, the unemployed in the UK receive either contribution-based or income-based Jobseeker's Allowance. The two programmes slightly differ in their design but most important in both programmes, the amount of transfers is not related to previous earnings.

In this section we apply the dynamic life-cycle model to estimate the behavioral responses of single households when replacing the German system of unemployment insurance with UK-style transfers for the unemployed. More precisely, we assume that all unemployed regardless of their working history receive only ALG II, the transfers which are not related to the previous earnings.

Previous literature has mainly focussed on the effects of unemployment insurance on transitions of unemployed into employment. In this analysis we will study as well the behavior of the employed, namely their probability not to make a transition into unemployment given the change in the system. As discussed above, in Germany for older workers it is common practice to use unemployment as a stepping stone for retirement. This is in particular attractive for workers with high earnings, i.e. the better educated and those with long working experience which have long entitlement periods. Certainly, for this group a shift from the German to the UK system would have the strongest effect on work incentives.

It is obvious that for a meaningful evaluation of this policy reform a dynamic structural life-cycle with human capital accumulation and the detailed depiction of the tax and transfer system needs to be employed. First, the structural preferences of the agents which are the driving force of the labor supply behavior are more accurately modeled is a life-cycle model than in a static or myopic model of labor supply. Moreover, the human capital accumulation and its effect on wages later in the life-cycle is crucial to determine the change in work incentives between an earnings related unemployment insurance and a fixed minimum income. Lastly, since we take account of the endogeneity of the unemployment transfers due the entitlement requirements we can identify the expected income effect of a change in the transfer system for each individual.

Technically the policy simulation is straight forward. Based on the identified preference for employment and retirement, and the estimated determinants of the life-cycle wages, we can predict the new optimal life-cycle path of employment given the change in the transfer system. More precisely, in the hypothetical transfer reform the work incentives for the unemployed are described with $m^*_{i,n,t}$ instead of the original net-income $m_{i,n,t}$. The only difference between the two scenarios is that in the hypothetical transfer system all unemployed receive AL II, regardless of their working history.

Employment effects

In Figure 8 the employment rates by age before and after the tax reform are depicted. While the general shape of the employment pattern over age remains fairly constant, the level of employment after the reform is higher over the whole age distribution. In Figure 9, we show the employment change in percentage points by age. Up to the age of 50 the average change in the participation rate is relatively constant at about 3 percentage points and thereafter slightly increases. Around the age of 60 there is a large peak with changes of more than 8 percentage points. Towards the end of the working live the average change in the participation rate due to the transfer reform markedly decrease.

[Figure: 8 and 9 about here]

This specific transfer reform induces for all age groups positive employment effects as regardless of age out-of work transfers are reduced, making employment more attractive. However, the change in working incentives is strongly related to age and working experience due to human capital accumulation and to extended entitlement periods. Therefore, we find the increasing employment effect after the age of 50. As discussed above entitlement periods increase with age and often older workers use unemployment as a stepping stone into retirement. The hypothesis of the stepping stone is strongly supported by our simulation as the largest effects are found around the age of 60. After the age of 60 retirement strongly increases and since retirement is an absorbing state, we find on average only very small behavioral effects of the transfer reform.

We find that this transfer reform has as well an effect on the retirement behavior. The reform induces two counteractive effects on the employment rate. First, the incentives for early retirement might increase due to the transfer reform. For the non-employed, the unemployment state becomes less attractive and they might shift into retirement. On the other hand, the non-employed might decide to make a transition into employment since unemployment cannot be used as a stepping stone for retirement. Thus people might stay longer in employment and postpone retirement. According to our simulation, for single men and women younger than 60 years, the positive retirement effect is dominating. In the last years of the working life, the employment effects tend to be higher, retirement is reduced by about 0.5 percentage points.

[Figure: 10 about here]

Fiscal effects

The transfer reform would induce important fiscal effects.[15] First the mechanical effect of the reform leads to lower governmental expenditures as the minimum income is on average markedly lower than the insurance based transfers. Moreover the behavioral effects lead to an important increase in income taxation, in social security contributions, and to a reduction of transfer claimants.

[Figure: 11 about here]

Figure 11 shows that over the whole life-cycle the average net tax payments increase. Net taxes include transfers received by the household as well as income taxation and social security contributions. In line with the employment effects we find the largest increase in net taxes for men and women between 50 and 60.

Employment effects by subgroups

The transfer reform affects the work incentives of the population quite differently. For low educated with a short working history, the differences between the new and the old system are fairly moderate. Either they were not entitled to ALG I before the reform or if they were entitled, the level of ALG I and ALG II was similar. On the contrary for men and women with

[15] We assume that the SSC payed by the employed remains constant even after the reform.

high wages and long working experience the transfer reform has a strong impact on their income out-of work.

In the following figures we separately present the employment effects and the change in average net tax payments by region, education and gender.

[Figures: 12 and 13: about here]

We find the largest effects for men and women with high education living in west Germany. This is not surprising, since this group receives on average the highest insurance based unemployment transfers. Moreover, since they have in general a long working history, they expect long entitlement periods. Thus, a shift to a pure minimum income scheme would induce large work incentives. We find slightly higher effects for men than for women, which is again in line with higher mal wages and longer entitlement periods. Overall, for west Germans with lower education, the effect of this reform is markedly lower. However, especially for men aged about 55 years, we find some sizable effect. Due to their long entitlement periods, there might be high incentive to make a transition to non-employment before retirement - the above mentioned stepping stone effect. In the hypothetical scenario without the relative generous ALG I this option is no longer available.

The differences between east and west Germany are striking. Conditional on the education levels[16], the employment effects in the east are markedly lower than in the west. This is in particular true for the east Germans with low education. The results indicate that a reform of the unemployment transfers would have hardly any employment effect (for men an increase of about 0.5 percentage points for women only less than 0.01). This finding is not too surprising. The low educated in the east often have an interrupted working history, and thus they are not entitled to ALG I or if they are entitled their pervious earnings were not sufficiently high to make ALG I more attractive than the minimum income. Thus the reform has basically no effect on the working incentives.

The group specific effect are of crucial importance for policy makers. Whereas our results suggest that a reform of the unemployment transfers towards a minimum income would induce large positive employment effects both for men and women in the west, in particular for those with high education, this reform has a significantly lower effect in the east. In order to foster employment for the low educated, different reforms seem to be more promising. Haan, Prowse, and Uhlendorff (2008) show that the introduction of a wage related transfer would induce relatively large employment effects over the life-cycle for the low educated east Germans.

9 Conclusion

In this study we have developed a dynamic structural life-cycle model of labor supply behavior which accounts for endogenous accumulation of human capital and for the effect of the tax and transfer system on work incentives. In addition to income tax, social security contributions and

[16]When comparing east and west Germany conditional in education caution is required, since the educational systems in the two parts of Germany used to be quite different.

social assistance, the model incorporates unemployment insurance benefits which are endogenous with respect to life-cycle employment. The empirical analysis is based on a long panel of single households taken from the German Socio Economic Panel (SOEP). We use simulated method of moments to estimate the dynamic structural life-cycle model. In the econometric specification control for unobserved heterogeneity, the non-randomness of the initial state and for measurement error in wages.

Based on estimates of the structural parameters we perform an ex-ante evaluation of a reform of the German system of transfers to non-working individuals. The hypothetical reform is motivated by the UK-transfer system in which all unemployed irrespective of their working history receive only an universal minimum income. The results show the removing of unemployment insurance benefits has a substantial positive effect on employment behavior. *Ceteris paribus*, we find the largest responses for older men and women, the better educated, individuals living in west Germany and for those with a long working experience. The strong labor supply effects for the older highlights that in the current German system ALG I is often used as a stepping stone into retirement. This effect is at at least in west Germany independent of the education level. When ALG I is replaced by the minimum income this effect is markedly reduced. For east Germans with low education, our results indicate that a reform of the unemployment insurance would have no employment effect. In order to foster employment for this group, policy makers need to design different transfer reforms. Since a large share of this group is faced with minimum income out of work in the current system, employment effects could be generated by increasing income in work rather than reducing the transfers out-of work.

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10 Appendix

Figures

Figure 1: Average participation rate by age and gender

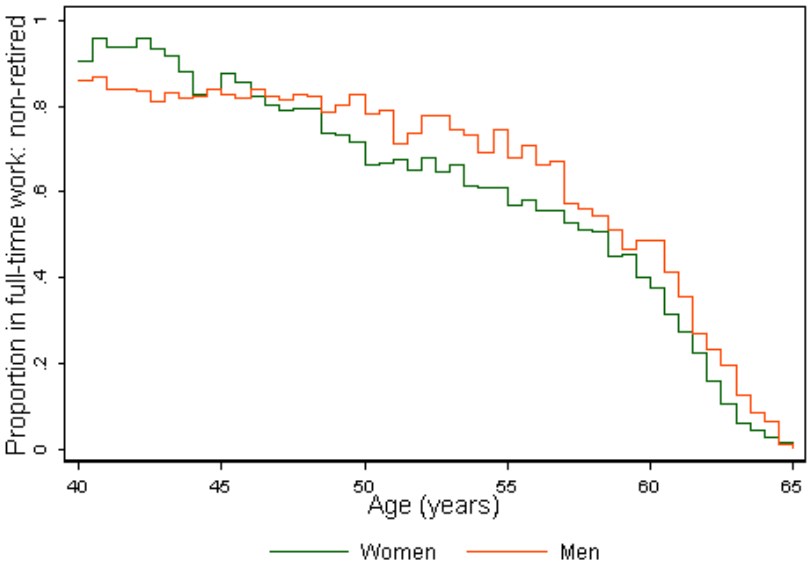

Figure 2: Average participation rate by age and region

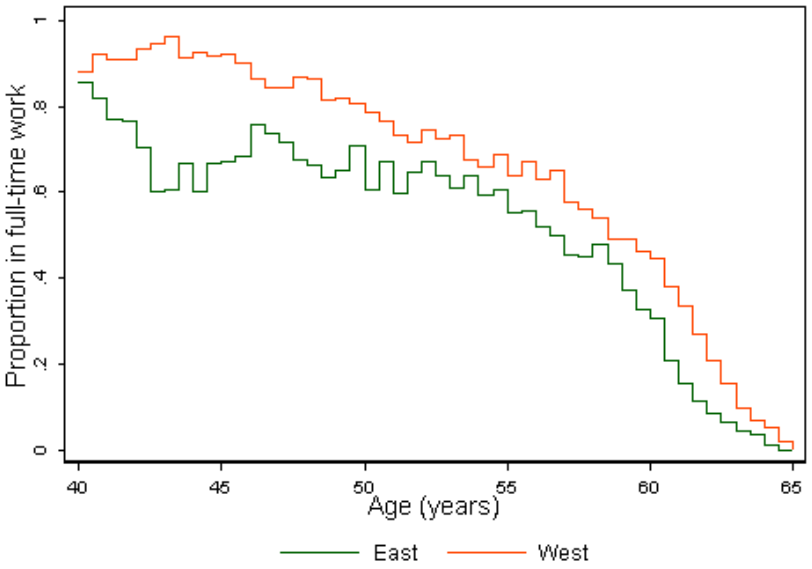

Table 3: Empirical and simulated moments

Variable	Sample Mean	Std. Dev.	Simulated mean
mean($y_{f,2}$)	0.587057	0.020217	0.5815
mean($y_{f,3}$)	0.5825252	0.0204274	0.5653
mean($y_{f,4}$)	0.5643905	0.0206355	0.5506
mean($y_{f,5}$)	0.5466085	0.0205398	0.5462
mean($y_{f,6}$)	0.5407452	0.020156	0.5389
mean($y_{f,7}$)	0.5386132	0.0198867	0.5371
mean($y_{f,8}$)	0.5324083	0.0197885	0.5264
mean($y_{f,9}$)	0.5298621	0.0200856	0.5212
mean($y_{f,10}$)	0.5403467	0.0204498	0.5304
mean($y_{f,11}$)	0.5404576	0.0199719	0.5305
mean($y_{f,12}$)	0.5476182	0.0199336	0.5331
mean($y_{f,13}$)	0.5366134	0.0187531	0.5359
mean($y_{f,14}$)	0.5470274	0.0184575	0.5491
mean($y_{f,15}$)	0.5389868	0.0183243	0.5481
mean($y_{f,16}$)	0.5451234	0.0178088	0.5508
mean($y_{f,17}$)	0.5257342	0.018286	0.5476
mean($y_{f,18}$)	0.541601	0.0188477	0.5539
mean($y_{f,19}$)	0.5501808	0.0188724	0.5576
mean($y_{f,20}$)	0.556304	0.01836	0.5625
mean(retirement)	0.253533	0.013987	0.2473
std. deviation (wage)	0.490075	0.015419	0.5031
mean (wage)	0.365776	0.021696	0.3755
corr(wage$_t$, wage$_{t-4}$)	0.910458	0.015584	0.9208
corr(wage$_t$, wage$_{t-8}$)	0.9029805	0.0161814	0.913
corr(employment$_t$, employment$_{t-1}$)	9.517525	0.033651	9.5697
corr(employment$_t$, employment$_{t-2}$)	9.076669	0.0624876	9.1747
corr(retirement$_t$, retirement$_{t-1}$)	-6.4366	0.173936	-6.3088
std. deviation (experience)	0.98601	0.026569	0.9881
std. deviation (Δ experience)	2.0104	0.026644	1.9932
prob(Δ experience=0)	0.292682	0.023226	0.2965
corr(y_t, no entitlement)	-6.21776	0.1882	-6.3851
corr(y_t, max entitlement 12 months)	2.210604	0.239461	2.2456
corr(y_t, max entitlement 22 months)	1.973015	0.220838	2.2369
corr(y_t, max entitlement 26 months)	1.859168	0.193785	1.8108
corr(y_t,period)	5.430874	0.224966	5.607
corr(y_t,sex)	0.1730824	0.030534	0.2211
corr(y_t,west)	0.2141191	0.0247842	0.1735
corr(wage,west)	0.3250496	0.0452461	0.3221
corr(wage, years of education)	0.4680059	0.0390499	0.4833
corr(wage, age)	-0.060717	0.0421262	-0.006
corr(wage, age^2)	-0.0516887	0.0433417	-0.0254
corr(wage, experience)	-0.0700018	0.0437314	-0.0594
corr(wage, sex)	0.1855736	0.0449803	0.2115
corr(de, west)	0.088696	0.0303413	0.1113
corr(de, years of education)	0.1781088	0.0283514	0.213
corr(de, age)	-0.3394939	0.0236579	-0.3238
corr(dep, age^2)	-0.556458	0.023193	-0.5721
corr(dep, experience)	0.0524254	0.0326826	0.0703
corr(retirement, west)	-0.0428932	0.0304864	-0.0655
corr(retirement, years of education)	-0.062575	0.0291943	-0.0433
corr(retirement, experience)	0.1724653	0.0334672	0.2348
corr(retirement education2)	0.649248	0.0160491	0.6527
corr(retirement, sex)	-0.1909724	0.0300892	-0.1902

Note: The entitlement period is specified nonparametrically with entitlement longer than 26 months being the base category.

Figure 3: Average retirement rate by age and gender

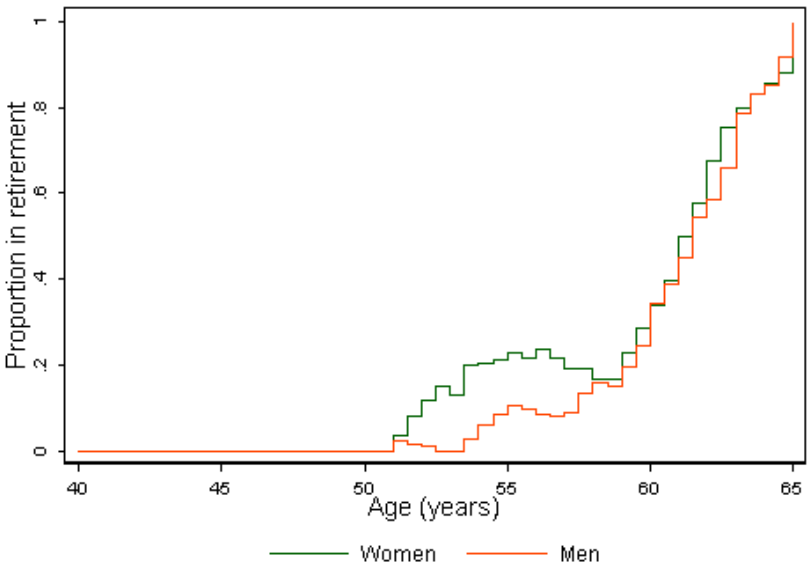

Figure 4: Average participation rate of the non-retired by age and gender

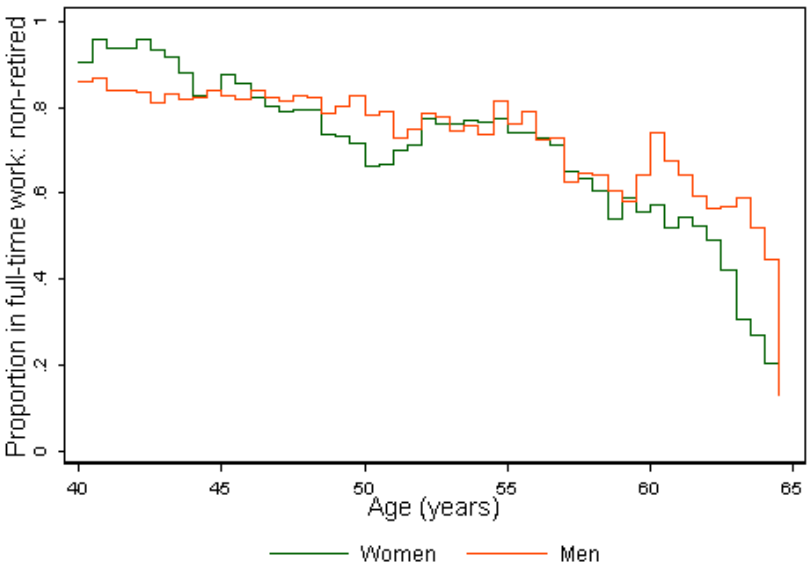

Figure 5: Entitlement for ALG I by age

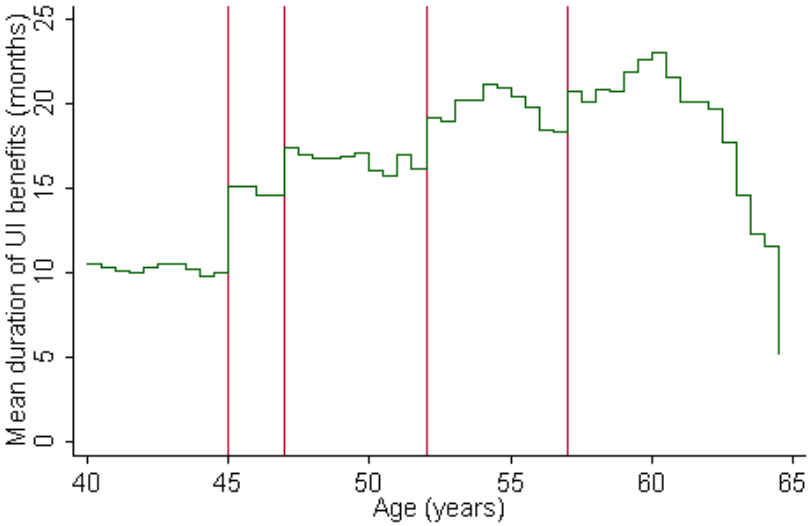

Figure 6: Gross hourly wages by age and gender

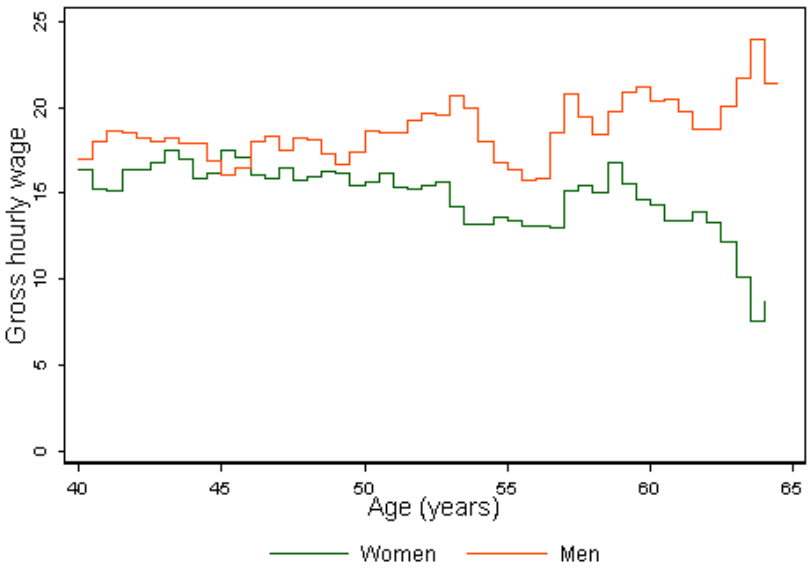

Figure 7: In-sample fit by age

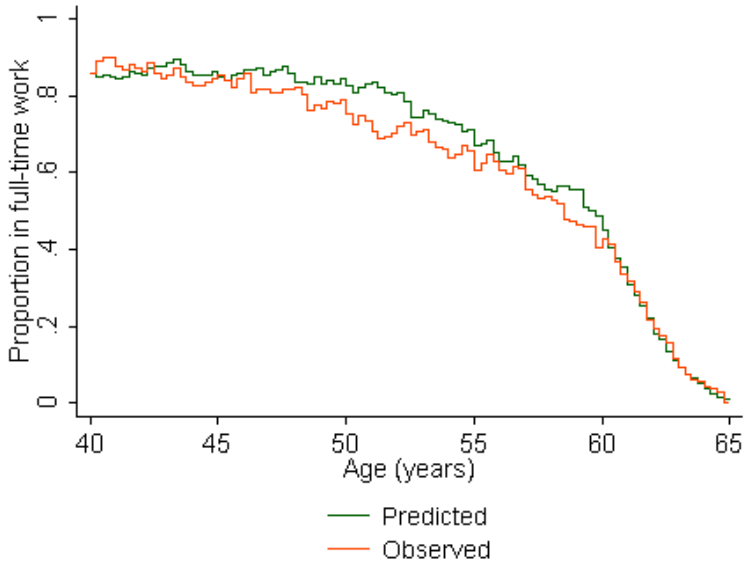

Figure 8: Pre and post policy change employment behavior (sample average)

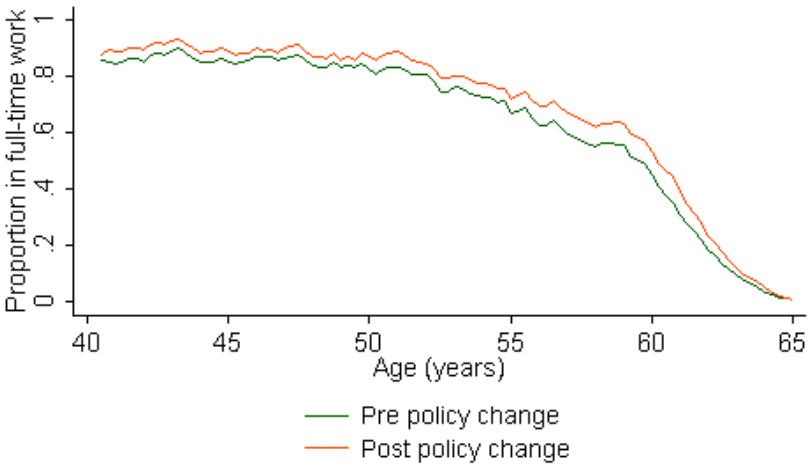

Figure 9: Estimated policy response: Employment (sample average)

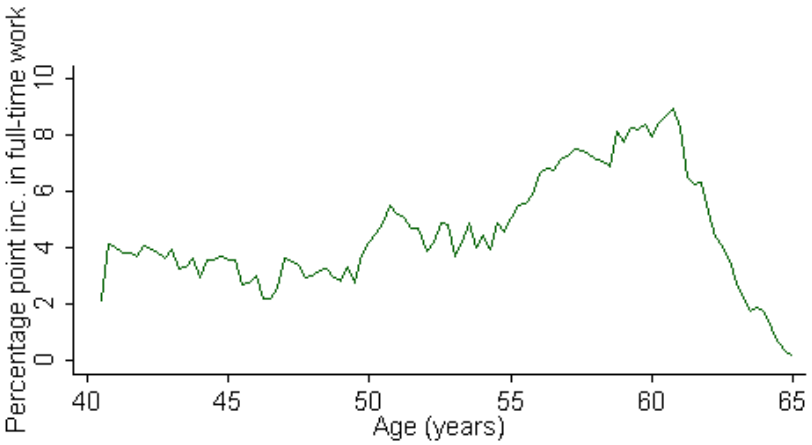

Figure 10: Estimated policy response: Retirement (sample average)

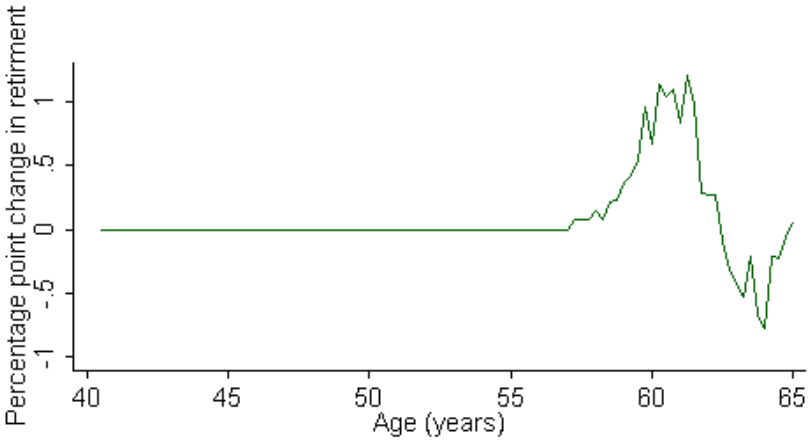

Figure 11: Estimated policy response: Change in net taxes (sample average)

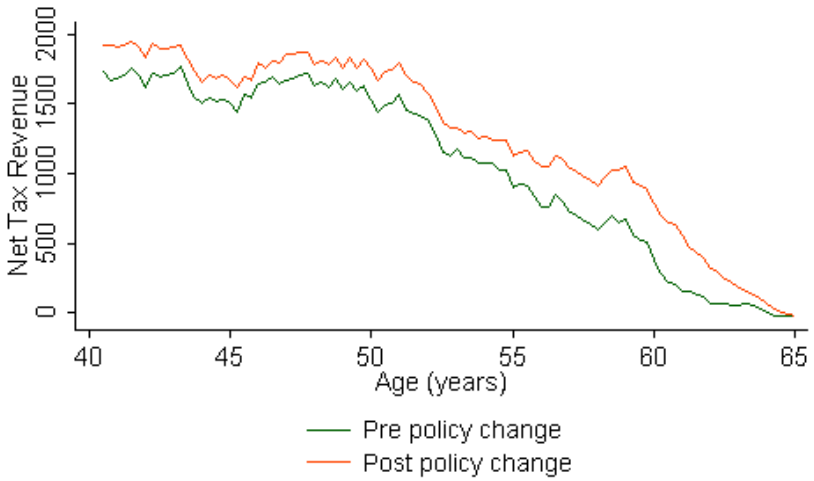

Figure 12: Pre and post employment rates: West Germany

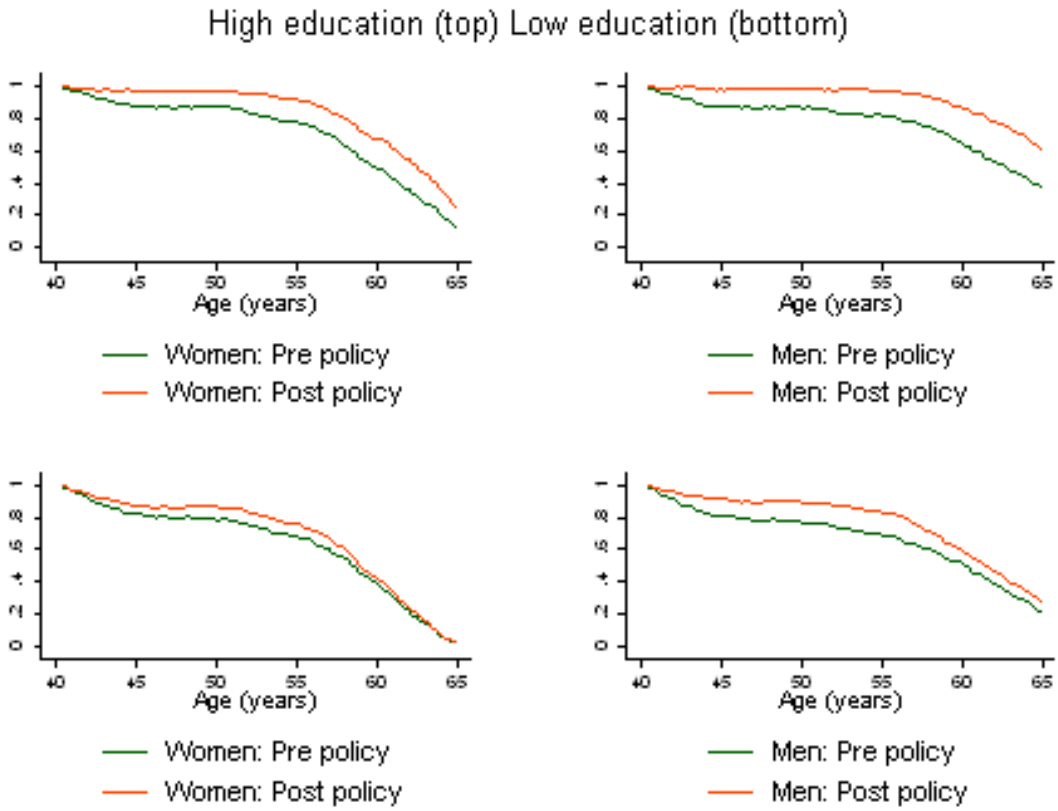

Figure 13: Pre and post employment rates: East Germany