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Early Retirement Across Europe

Does Non-Standard Employment Increase Participation of Older Workers

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Early retirement across Europe. Does non-standard employment increase participation of older workers? *

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Abstract

In many European countries, the labor market participation of older workers is considerably lower than the labor market participation of prime-age workers. This study analyzes the variation in labor market withdrawal of older workers across 13 European countries over the period 1995-2008. We seek to contribute to existing macro-econometric studies by taking non-standard employment into account, by relating the empirical model more explicitly to optional value model theory on retirement decisions and by using a two-step IV-GMM estimator to deal with endogeneity issues. The analysis leads to the conclusion that part-time employment is negatively related to labor market withdrawal of older men. This relationship is less strong among women. Additionally, we find that part-time employment at older ages does not decrease the average actual hours worked. Furthermore, the results show a positive relationship between unemployment among older workers and early retirement similar to previous studies.

JEL codes: C33, C36, J14, J26
Keywords: early retirement, part-time employment, self-employment, social insurance programs, labor market institutions

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1 Introduction

The aging of the population is an important challenge for most of the Western welfare systems in the near future. While an increasing life expectancy will lead to higher expenditures on pensions and healthcare, there will be fewer younger people who pay taxes and contributions to finance the welfare systems. In this respect, Barr (2006) argues that *"The problem is not that people are living longer, but that they retire too early."* Pestieau (2003) argues that the financial sustainability of pension systems is substantially affected by the low participation rates of older workers. Although the participation rates of older workers have been rising for both men and women in many European countries, the participation rates are still low compared to those of prime-age workers. Furthermore, the developments in the participation rates of older workers vary considerably across countries. In Italy, the participation rate of persons aged 55-64 years increased from 29.5 to 35.5 percent between 1995 and 2008, in Austria from 30.8 to 41.9 percent and in the Netherlands from 30 to 54.7 percent. This study aims to analyze the variation in early labor market withdrawal across countries and over time.

One prominent explanation for the low participation rates of older people is that once older people are unemployed or receive disability benefits,[1] relatively few of them start working again before they reach the statutory retirement age. As a result, such social insurance programs function in practice quite often as an arrangement to smoothen the transition from work to retirement, next to formal retirement programs. Gruber & Wise (2004) and Blondal & Scarpetta (1998) indicate this importance of social insurance programs as early retirement mechanisms based on coherent country-specific micro-econometric analyses. In the last decades of the twentieth century, almost all European countries had strong disincentives to work at older ages because of such social insurance programs (Gruber & Wise, 1998). Since the 1990s, many governments have started to reform welfare state institutions to reduce the disincentives to work as well as encouraging employers to maintain older workers (Casey et al., 2003; Sonnet et al., 2014). Hence, these reforms may have contributed to the increase of participation rates of older workers across Europe.

Another class of factors that may explain the developments in participation rates of older people is the rise of non-standard forms of employment. Chen et al. (2013) observe rapid increases of non-standard employment in many OECD countries over the past decades, especially among people aged 50-64 years. The largest increase has been observed for part-time employment. As older workers generally tend to have a relatively strong preference for leisure (e.g. Kantarci & Van Soest (2008)), they often take up part-time work before full retirement (Morris & Mallier, 2003). Hence, part-time work

[1] Which may be agreed upon by employer and employee.

provides the opportunity to retire gradually by providing a bridge between full-time employment and retirement (Gustman & Steinmeier, 1984; Ruhm, 1990; Quinn & Kozy, 1996; Kim & DeVaney, 2005; Cahill et al., 2006; Ruhm, 2006). Reday-Mulvey & Delsen (1996) indicate the importance of such 'bridge jobs' across OECD countries. Similarly, older people may opt for self-employment because it provides flexibility in working hours such that self-employment may be used as gradual retirement mechanism similar to part-time employment (Bruce et al., 2000; Gu, 2009). Self-employment rates are found to be relatively high among the 50+ population (Zissimopoulos & Karoly, 2009) and should therefore be taken into account in analyzing retirement behavior. Morris & Mallier (2003) show that the high and increasing importance of such non-standard employment opportunities in European countries can be related to the countries' patterns of labor force participation at older ages. They argue that the increases in non-standard employment are both related to voluntary decisions to decrease working hours prior to retirement and in anticipation to declining opportunities in both full-time employment (Dorn & Sousa-Poza, 2010) and early retirement possibilities (Casey et al., 2003). However, whether non-standard forms of employment can explain the cross-national variation in labor market participation of older workers has not been analyzed thus far.

The amount of comparative macro-econometric work on labor participation among older workers is rather limited. Existing studies (Blondal & Scarpetta, 1998; Johnson, 2000; Duval, 2003; Faggio & Nickell, 2007; Blake & Sangnier, 2011) found that generous social insurance- and early retirement programs enhance early labor market withdrawal. Furthermore, they found that also high unemployment rates lead to lower participation rates among older workers. With respect to these empirical analyses at the macro level, we seek to make three contributions. First, we extend the analysis by taking part-time employment and self-employment into account. Second, we strengthen the theoretical underpinning of the macroeconomic empirical analysis of mutually exclusive labor market states and retirement by relating it more explicitly to optional value model theory on retirement decisions. Third, for the analysis of panel data for 13 European countries, we use a two-step GMM estimator to deal with endogeneity issues.

The remainder of the paper is structured as follows. In Section 2.2, we describe the theoretical framework to explain retirement decisions and we discuss the model to be estimated in Section 2.3. Section 3 describes our data and variables and presents the developments in early retirement and non-standard employment across countries and over time. Section 4 presents our estimation results of the pooled time-series cross-country regression analyses. In Section 5, we discuss the robustness of our results based on a variety of sensitivity analyses. Section 6 concludes.

2 Model

2.1 Literature review

A natural starting point for analyzing retirement decisions is the option value model (Stock & Wise, 1990).[2] The application of the option value model has been popular in the literature focusing on substitution effects in retirement pathways. Estimation of the option value model has been primarily focused on country-specific analyses, modeling microeconomic responses to country-specific retirement incentives in national institutions.[3] This approach, however, makes it hard to explain the differences in retirement patterns observed across countries. Piekkola & Deschryvere (2010) are the first to analyze retirement decisions with three countries based on the option value model using micro data from ECHP. The cross-country dimension, focusing on Belgium, Germany and Finland, remains limited however.

Cross-country macroeconomic reduced form approaches by Blondal & Scarpetta (1998), Johnson (2000), Duval (2003) and Blake & Sangnier (2011) are consistent with the option value model although the empirical model is not directly derived from it. Nevertheless, these studies are the first to put the effects of early retirement incentives on early retirement in an international perspective using macro data. Blondal & Scarpetta (1998), Johnson (2000), Duval (2003) and Blake & Sangnier (2011) include approximations of disincentives to work at older ages stemming from early retirement programs including unemployment- and disability-related schemes. Although such a macroeconomic approach is unable to cope with individual and household characteristics and their influence on retirement decisions, it is able to analyze the effects of retirement incentives embedded in national institutions and to explain the observed differences in early retirement across countries.

To underpin our cross-country analysis of early retirement patterns, we extend the classical option value model (Stock & Wise, 1990) with non-standard employment as labor market states. Two important types of cross-country heterogeneity in non-standard employment are part-time employment and self-employment (Chen et al., 2013), especially for persons approaching retirement (Morris & Mallier, 2003).

[2] Or the dynamic programming variant of Rust (1989). The main difference between the two approaches is the way of modeling uncertainty (Belloni, 2008). However, since the actual theoretical modeling of uncertainty is not important in our empirical application, the option value- and the dynamic programming model reduce to one theoretical framework that can be used to study retirement decisions.

[3] Structural estimation applications can be found in, among others, Berkovec & Stern (1991), Rust & Phelan (1997), Heyma (2004), Van der Klaauw & Wolpin (2008) and Gustman & Steinmeier (2005). Examples of reduced form approaches can be found in Brugiavini & Peracchi (2003) and Mastrogiacomo et al. (2004) (using binary nonlinear models), Kerkhofs et al. (1999), Euwals et al. (2010) (using duration models). A multinomial logit approach is taken by, for example, De Vos et al. (2012), Zucchelli et al. (2012), Emmanoulidi & Kyriazidou (2012) and Been & Knoef (2013). The latter three also take non-standard employment into account in the retirement decisions.

2.2 The option value to model retirement decisions

The option value model explains individual retirement decisions by the difference in the expected present value of retiring immediately and the expected present value of postponing retirement. The expected present value is the utility stream, which is an arbitrary function of consumption and leisure possibilities, coming from one of the decisions, corrected for time-preferences that attach different weights to consumption in current and future periods. If the difference in the expected present value of postponing retirement is higher than the expected present value of retiring, the person delays retirement up to the point where the expected present value of retirement is higher than the value one would receive from postponing retirement. In this way, retirement decisions can be attributed to, for example, labor income, income from social insurances, or social security wealth which affect the opportunity costs of retirement (leisure). Evaluating the opportunity costs of several labor market decisions allows the model not only to include the decision when to retire, but how to withdraw from the labor market as well. A person will choose a period of using social insurance before retirement if the expected present value of doing so exceeds the expected present value of the other possibilities.

Following the optional value literature, we assume that persons maximize their current and future utility given their time-preferences (ρ)[4] and preferences for consumption (c) and leisure (l) and constraints that coincide with labor market choices. Since we are interested in retirement decisions in a context with regular employment, social insurance and non-standard employment possibilities, we assume six possible labor market states (j) for older persons: full-time employment (FT), part-time employment (PT), self-employment (SE), disability insurance (DI), unemployment insurance (UI) and early retirement (R). Disability insurance is often assumed to be a substitute to unemployment (e.g. Hassink et al., 1997; Autor & Duggan, 2003; Koning & Van Vuuren, 2010) and, more specifically, as a way to induce early retirement (e.g. Riphahn, 1997; Euwals et al., 2012). Therefore, disability insurance is an important early retirement possibility in many countries (Gruber & Wise, 1998).

Persons compare and reevaluate utility (u) streams coming from these six labor market states (j) in each period (τ)[5] and so maximize their inter-temporal utility given their characteristics that determine utility directly (ϑ) and the current institutional setting (s):[6]

[4] A higher value of ρ indicates a higher weight for current utility streams than for future utility streams such that the individual is relatively time-impatient.

[5] Until the period of full retirement (T) which is assumed to be an absorbing state. Empirically, it is observed that full retirement is not always an absorbing state: older people may re-enter the labor market after full withdrawal (Maestas, 2010). This assumption has, however, no consequences for our empirical reduced form model that is estimated using macro data.

[6] The institutional setting (s) implicitly includes the generosity of social insurance schemes as early retirement routes.

$$U_\tau = \sum_{\tau=t}^{T} (1+\rho)^{t-\tau} u_\tau(c_{i\tau}, l_{i\tau}, j_{i\tau}; s_{i\tau}, \vartheta_{i\tau}) \tag{1}$$

Not only is the labor market state j associated with its own combination of consumption and leisure possibilities, it also enters the utility function directly such that some states can provide more satisfaction than other states.[7] Furthermore, the institutional setting determines to what extent states can be chosen (e.g. eligibility criteria) and how attractive these states are in terms of consumption possibilities (e.g. replacement rates, duration, tax differences) and leisure possibilities (e.g. extra requirements, hours flexibility).

Instead of solving and estimating a structural model for the retirement decision (e.g. Heyma (2004)), we approximate Equation 1 with a linear value function V (Mastrogiacomo et al., 2004). Here, V can be viewed as direct utility received from consumption, leisure, personal characteristics and the institutional setting captured by the different retirement possibilities[8]

$$V_{ij}(\tau) = \vartheta'_{i\tau}\beta_j + Z'_{i\tau}\theta_j + \varepsilon_{i\tau} \tag{2}$$

such that (early) retirement is preferred if

$$V_{iR}(\tau) > V_{ik}(\tau) \tag{3}$$

for

$$k = \{FT, PT, SE, DI, UI\}, k \neq R \tag{4}$$

Here, ϑ is the vector of all observed and unobserved characteristics that describe preferences for consumption and leisure and can therefore be seen as 'taste shifters'. Z includes labor market state-specific variables that indicate the incentives associated with each labor market state given by the institutional framework (s). The error component, ε, is generally assumed to follow a Type I extreme value distribution meaning that Equation 2 is estimated by a multinomial logit model in which the mutually exclusive labor market states $j = k$ can be modeled explicitly with respect to a baseline $j = R$.

Hence, the mutually exclusive labor market states j and the baseline are modeled explicitly by normalizing the coefficients of the baseline to one for identification.

[7] In this way, active states may explicitly provide more utility than inactive states because it may make older workers feel 'useful'. A meta-analysis by Pinquart (2002) suggests positive associations between being employed and having a higher purpose in life at older ages.

[8] It is common in the literature to include an individual specific parameter as well in Equation 2. We omitted this individual specific parameter from the equation since we do not intend to estimate Equation 2 at the micro level using individual specific information.

$$P(j_\tau|\vartheta_{i\tau}, Z_{i\tau}) = \frac{\exp(\vartheta'_{i\tau}\beta_j + Z'_{i\tau}\theta_j + \varepsilon_{i\tau})}{\sum_{q=1}^{J}\exp(\vartheta'_{i\tau}\beta_q + Z'_{i\tau}\theta_q + \varepsilon_{i\tau})} \tag{5}$$

An increase in the probability to use a particular $j = k$ as a retirement route is always relative to, and therefore at the cost of, the baseline $j = R$. Instead of estimating Equation 5, we aim to estimate a macroeconomic analogy to the microeconomic reduced form approximation of the option value model.

2.3 Empirical model

At the macro level, we do not have information on individual choices regarding labor market states j. Only the aggregate of individual choices is observed at the macro level. Therefore, we use information on early retirement, full-time employment, part-time employment, self-employment, disability and unemployment rates in the macroeconomic analogy to Equation 5. Since these rates are no binary indicators of j, as in the multinomial logit case at the micro level, we are unable to use an explicit multinomial logit procedure. Instead, we intend to estimate Equation 6 that explicitly allows for analyzing the mutual exclusiveness between early retirement and the aforementioned labor market states.

$$R_{i\tau} = \beta_0 + \vartheta_{i\tau}\beta_1 + DI_{i\tau}\beta_2 + UI_{i\tau}\beta_3 + SE_{i\tau}\beta_4 + PT_{i\tau}\beta_5 + \gamma_\tau + \delta_i + \varepsilon_{i\tau} \tag{6}$$

Here, R, DI, UI, PT and SE are the early retirement-, disability-, unemployment-, part-time employment and self-employment rates respectively.[9] i now represents a country instead of an individual as in Equation 5. Country-fixed effects and time-effects are captured by γ and δ respectively. These fixed effects capture the unobserved heterogeneity in, for example, the cross-country differences in social acceptance of early retirement. The error term, ε, follows an i.i.d. standard normal distribution. Early retirement is the dependent variable since we are particularly interested in the substitution effects of labor market states with regard to early retirement and not so much in the substitution effects among labor market states in general.

Clearly, R, DI, UI, PT and SE are jointly, and so endogenously, determined in the model. Applying a simple OLS to Equation 6 would yield biased and inconsistent estimates of the coefficients due to the endogeneity in Equation 6. Therefore, we intend to estimate Equation 6 by a two-step procedure as in Equation 7 where ω indicates the error term of the first-stage regression and ε indicates the error-term of the second step regression:

[9] Note that the full-time employment rate is captured by β_0.

$$
\begin{aligned}
R_{i\tau} &= \beta_0 + \vartheta_{i\tau}\beta_1 + DI_{i\tau}\beta_2 + UI_{i\tau}\beta_3 + SE_{i\tau}\beta_4 + PT_{i\tau}\beta_5 + \gamma_\tau + \delta_i + \varepsilon_{i\tau} \qquad (7)\\
DI_{i\tau} &= \pi_{0,DI} + \vartheta_{i\tau}\pi_{1,DI} + Z'_{i\tau}\pi_{2,DI} + \omega_{i\tau,DI}\\
UI_{i\tau} &= \pi_{0,UI} + \vartheta_{i\tau}\pi_{1,UI} + Z'_{i\tau}\pi_{2,UI} + \omega_{i\tau,UI}\\
SE_{i\tau} &= \pi_{0,SE} + \vartheta_{i\tau}\pi_{1,SE} + Z'_{i\tau}\pi_{2,SE} + \omega_{i\tau,SE}\\
PT_{i\tau} &= \pi_{0,PT} + \vartheta_{i\tau}\pi_{1,PT} + Z'_{i\tau}\pi_{2,PT} + \omega_{i\tau,PT}
\end{aligned}
$$

Here, preferences for consumption and leisure, included in ϑ, and the institutional setting related to the labor market state, included in Z, determine the relative attractiveness of the labor market states. Compared to the microeconomic option value model in Equation 2, the relative attractiveness of the labor market states is now expressed as the aggregate of individual choices at the macro level by taking rates.

As suggested by the theoretical framework and captured by Z in Equation 2, a different institutional setting may give a different relative attractiveness of labor market states and therefore influence retirement decisions. For example, higher UI benefits, captured in Z, increase the attractiveness of UI ($V_{iUI}(\tau)$) resulting in a higher aggregate rate of UI. At the same time, the higher UI benefits decrease $V_{iFT}(\tau)$ resulting in a lower aggregate rate of FT. Since the institutional setting is generally considered to be exogenous, the theoretical framework provides us with a set of instruments that can be used in the system of equations (Equation 7) as long as the instruments used in $V_{iDI}(\tau)$, $V_{iUI}(\tau)$, $V_{iSE}(\tau)$ and $V_{iPT}(\tau)$ are not influenced by the aggregate retirement decisions.

2.4 Finding the appropriate estimator

Equation 7 suggests a two-step procedure with instruments for DI, UI, SE and PT. However, the second-stage error terms and labor market state specific first-stage error terms are possibly cross-correlated which would be ignored by a simple two-stage procedure. Ignoring the covariance structure of the error terms results in an inefficient 2SLS estimator. To increase efficiency, a 3SLS procedure could be applied (Zellner & Theil, 1962). 3SLS accounts for both endogeneity (like in 2SLS estimation) and the covariance structure of the error terms across equations in the system (like in SUR estimation). 3SLS estimations are widely applied in economics and they can be found in various contexts.[10]

[10] A small selection of 3SLS applications in economics: Buck & Hakim (1982), Audretsch & Feldman (1996), Burnside (1996), Barro (2000), Glewwe et al. (2001), Burton et al. (2002), Butkiewicz & Yanikkaya (2005) and Brown & Alexander (2005).

Nevertheless, IV-GMM estimation as a 2SLS-estimator may be preferred to 3SLS in cases of heteroskedasticity since heteroskedasticity leads to an inconsistent 3SLS estimator resulting in inconsistent standard errors (Wooldridge, 2002). In the case of IV-GMM, the error terms are i.i.d., but a possible correlation structure among the error terms is not taken into account. Wooldridge (2002) argues that there is generally not much reason to choose 3SLS over a GMM estimator if the assumption of homoskedasticity does not hold. Using a two-step IV-GMM estimator is also preferred to the regular 2SLS estimator as it relaxes the i.i.d. assumptions of the error terms resulting in efficiency gains in a situation of arbitrary heteroskedasticity.

As usual in IV regressions, we need validity and relevance of the instruments to justify our instruments. In a situation with possibly weak instruments, a Fuller-k estimator can be applied which is suggested to be more robust to possibly weak instruments than the IV-GMM estimator as the Fuller-k estimator is median unbiased (Stock et al., 2002). Even in a situation with weak instruments, LIML estimators such as the Fuller-k are almost unbiased (Blomqvist & Dahlberg, 1999). As a consequence, LIML estimators have a relatively large variance and can be regarded as a conservative estimator when dealing with many weak instruments and small sample sizes (Blomqvist & Dahlberg, 1999).

2.5 Instruments

Blondal & Scarpetta (1998), Johnson (2000) and Duval (2003) use several labor market institutions such as unemployment benefit replacement rates, employment protection legislation (EPL) and labor taxes as regressors in explaining early retirement and argue that these labor market states are exogenous in an OLS framework. However, as these studies note, the effect of labor market institutions such as unemployment benefits and EPL on early retirement run through their effect on unemployment rates.[11] Therefore, we apply a two-step procedure using labor market institutions as instruments for the aggregated levels of DI, UI, PT and SE. For identification, the instruments should 1) be correlated with DI, UI, PT and SE (instrument relevance) and 2) be uncorrelated with the error term, ε, in Equation 7 (instrument validity). If these conditions are fulfilled, the instruments are associated with changes in DI, UI, PT and SE but do not lead to changes in R aside from their indirect effect through DI, UI, PT and SE. As we will explain in detail below, labor market institutions associated with DI, UI, PT and SE are theoretically proven to be relevant as well as valid instruments.[12]

For the selection of instruments we follow the literature on the effects of labor market institutions - such as unemployment benefits, employment protection legislation (EPL) and active labor market

[11] This, of course, does not apply to the included variables that indicate the disincentives of postponing retirement such as the implicit tax rate on continued work.

[12] Empirical tests also prove that instruments are both relevant and valid as we will show in Section 5.

policies (ALMP) - on unemployment rates (e.g. Scarpetta (1996), Nickell (1998), Nickell et al. (2005), Elmeskov et al. (1998), Blanchard & Wolfers (2000), Belot & Van Ours (2004) and Bassanini & Duval (2009)). This literature shows that more generous benefits make unemployment more attractive ($V_{iUI}(\tau)$) and so increase unemployment rates. The effects of EPL are somewhat more ambiguous. Nickell (1998) argues that the effects of EPL on the unemployment rate are likely to be small because EPL mainly tends to decrease flows into- and out of unemployment. Nevertheless, decreasing inflows and outflows from unemployment may decrease short-term unemployment and increase long-term unemployment (Nickell, 1998). An excellent overview of the theory and empirics of EPL by Addison & Teixeira (2003) shows that estimations of the effect of EPL on unemployment rates can be both positive and negative. However, Addison & Teixeira (2003) also indicate that most of the effects that are estimated to be significant show that EPL and unemployment rates are positively related. As an additional determinant of unemployment rates, the effects of ALMP spending are generally found to be small in economic terms (Card et al., 2010; Kluve, 2010). Nevertheless, ALMP spending is important to take into account as some countries may have high initial UI benefit levels but also many reintegration measures. Replacement rates of UI benefits, EPL and ALMP spending are proven to be relevant instruments according to the aforementioned literature. There is no *ex ante* reason to belief that there is a direct relationship between replacement rates of UI benefits and ALMP spending and early retirement (validity). However, this does not hold for EPL. Dorn & Sousa-Poza (2010) find that strict EPL leads to higher shares of involuntary early retirement.

A similar approach as Scarpetta (1996), Nickell (1998), Nickell et al. (2005), Elmeskov et al. (1998), Blanchard & Wolfers (2000), Belot & Van Ours (2004) and Bassanini & Duval (2009) - focusing on cross-country self-employment instead of unemployment - has been employed by Torrini (2005), Robson (2003) and Parker & Robson (2004). Torrini (2005) focuses on explaining variation in self-employment rates by cross-country and time differences in tax incentives. Robson (2003) focuses on cross-country and time differences in EPL on self-employment (rates) and Parker & Robson (2004) focus on cross-country and time differences in self-employment due to (dis)incentives of income taxes and unemployment benefit replacement rates. All three papers suggest that labor market institutions, as used in the literature focusing on unemployment, are relevant in explaining self-employment as well. The results suggest that high taxes on labor induce self-employment (Torrini, 2005; Robson, 2003; Parker & Robson, 2004) while high unemployment benefit replacement rates (Robson, 2003; Parker & Robson, 2004) and EPL (Robson, 2003) reduce self-employment. Therefore, the labor market variables (replacement rates of UI benefits particularly) used to instrument the unemployment rate are also expected to be relevant instruments for the self-employment rate. As a tax incentive, we include the implicit tax on

self-employment as an additional instrument for self-employment. We do not use the implicit tax on labor as this variable may also be relevant for the marginal decision to work in regular employment at older ages.

It is harder to find valid instruments for the part-time employment rates as most determinants (e.g. possible relevant instruments) of part-time employment (Buddelmeyer et al. (2008)), such as the average yearly hours worked, the fertility rate, child benefits and female labor supply, possibly also have a direct effect on labor market withdrawal at older ages (e.g. non-valid). However, Buddelmeyer et al. (2008) suggest that EPL is an important determinant of part-time employment from a macro perspective. Based on their findings and earlier work, Buddelmeyer et al. (2008) suggest that strict EPL increases the advantages of hiring part-time employment in firms. This effect can either be direct (e.g. EPL strictly limits the use of part-time employment) or indirect (e.g. to ease the firms' burden of highly rigid employment legislation associated with full-time employment). Either way, EPL seems to be relevant for unemployment, self-employment and part-time employment, but the validity of this instrument is questionable (Dorn & Sousa-Poza, 2010). Therefore, we do not use the level of EPL as an instrument but the difference between EPL for regular and temporary work instead.[13] The difference between EPL for regular and temporary jobs may be relevant for the decision to work part-time according to the indirect explanation of the relation between EPL and part-time employment. This difference may lead to spill-overs between full-time and part-time work given that part-time jobs are generally more often of a temporary nature (OECD, 2002) and because part-time employment is complementary to temporary employment (Buddelmeyer et al., 2008). Additionally, EPL_{diff} may be valid as it is likely that only the level of EPL is important for involuntary early retirement.

Fairly little research has been devoted to the cross-country variation in disability rates. OECD (2009) shows that there is large heterogeneity in disability rates among countries and that such heterogeneity can be explained by cross-country differences in compensation, such as accessibility and generosity of disability benefits (both positively related to disability rates), and (re)integration policies such as vocational rehabilitation programs, subsidized employment and other activation policies that provide incentives to work (all negatively related to disability rates). Furthermore, OECD (2009) argues that UI benefit replacement rates may also be of importance in modeling disability rates since it is a crude measure of alternative benefit options. OECD (2009) finds that higher UI benefit replacement rates are negatively related to disability rates. Following aforementioned study, we instrument disability rates with UI replacement rates and ALMP spending. Furthermore, we use the information regarding the spending on

[13] $EPL_{diff} = EPL_{regular} - EPL_{temporary}$

disability which is publicly available at the macro level.[14] Additionally, we include the replacement rates of social assistance benefits as an additional instrumental variable in the sensitivity analyses as these benefits may be a true alternative benefit option. Social assistance benefits may also be important to include in the analysis as exhausted UI benefits are usually followed-up by social assistance benefits. This is especially relevant for older persons bridging the gap between employment and retirement with UI. Additionally, we are able to use the compensation and integration indices as used in OECD (2009).

A final note on the instruments is that we use the same full set of instruments for each endogenous variable to account for the alternative options.

3 Data and definitions

3.1 Data

To identify early retirement, we use a variable that describes labor market withdrawal of persons aged 55-64 compared to below 55 following Duval (2003).[15] More specifically, the dependent variable is constructed as

$$R = \frac{AR_{25-54} - AR_{55-64}}{AR_{25-54}} \cdot 100 \tag{8}$$

where AR indicates the activity rate. By relating the activity rate of persons aged 55-64 to the activity rate of persons aged 25-54 we take into account cross-country differences in participation of prime-age persons who are not confronted with retirement decisions yet. By using this relative measure, we also correct for within-country cohort differences in participation which is especially relevant among women (Ebbinghaus, 2006). Blondal & Scarpetta (1998), Johnson (2000), Duval (2003) and Blake & Sangnier (2011) explicitly focus on males only. We, however, analyze both men and women in separate analyses. R can be interpreted as the percentage decrease in activity rates of the population aged 55-64 compared to 25-54, e.g. a macroeconomic measure of labor supply at the extensive margin.

For the dependent variable, the study relies on activity rates, defined as the sum of the employed and unemployed workers as a percentage of the population.[16] We use activity rates for both men and women

[14] We use the transformed natural logarithm of per capita disability spending.

[15] We also use different age spans to disaggregate early retirement approximations (Ebbinghaus, 2006). Results are largely robust to this baseline specification of the dependent variable.

[16] According to Eurostat, the activity rate represents the number of persons in the labor force (employed and unemployed persons) as a percentage of the total population of the same age. Using this statistic, it is assumed that persons in unemployment have not retired yet. If one assumes the older unemployed to have retired instead, the employment rate would be a more appropriate indicator to construct the dependent variable (Ebbinghaus, 2006). We follow Blondal & Scarpetta (1998), Johnson (2000), Duval (2003) and Blake & Sangnier (2011) by using activity rates. A sensitivity analysis (Table 5) where employment rates are used instead of activity rates shows that the results are robust.

and for different age groups, which are taken from the Labour Force Survey, provided by Eurostat (2014).

For the independent variables, we use a number of labor market indicators for persons aged 55-64. The unemployment rate is measured as the number of unemployed employees as a percentage of the labor force aged 55-64 and is publicly available as a macro indicator at Eurostat. Disability rates, self-employment rates and part-time employment rates are calculated ourselves using the Labour Force Survey micro data (Eurostat, 2014) as the publicly available macro data are insufficient for our purposes.[17]

In general, constructing internationally comparable disability rates from survey data is hard as Banks et al. (2004) show. There is no internationally comparable data on disability rates among older persons. The OECD provides cross-country rates of disability for people aged 20-64, but the cross-country comparability is questionable (OECD, 2010). To identify disability, we use persons aged 55-64 with no job during the reference week who do not search for a job because they indicate to suffer from sickness or disability.[18] The disability rate is then constructed by relating the total of identified disabled persons to the total of persons aged 55-64 for whom these variables are non-missing.[19]

We identify part-time employment as persons aged 55-64 working as an employee with a part-time job.[20] This excludes self-employed working part-time as we only want to include part-time paid-employment in part-time employment. Part-time employment is standardized across countries with a measure that identifies a person to be in part-time employment if a person's usual working hours are less than the working hours considered to be 'normal'. Normal working hours is considered to be a full-time working week at the national, regional, industrial or unit level. Hence, the part-time employment indicator is a relative indicator that accounts for local standards with respect to working hours.

Self-employment is identified as persons aged 55-64 working as a self-employed in industries other than agriculture.[21] Issues may arise regarding the cross-country measurement of self-employment. The self-employment definition of Eurostat is standardized to a broad definition of all workers who are not in (paid) employment. This includes sole or joint owners of unincorporated enterprises (unless their

[17] Do-files to construct these measures are available upon request.

[18] In LFS: $WSTATOR = 5$, $SEEKWORK = 3$ and $SEEKREAS = 2$.

[19] However, Eurostat acknowledges that breaks in the data are present for $SEEKREAS = 2$ for some countries due to survey improvement. If this is observed for several years in a country and the variable *MAINSTAT* is available for that country, we base the disability rates on the *MAINSTAT* variable instead of basing the rate on the variables $WSTATOR$, $SEEKWORK$ and $SEEKREAS$. In the cases that *MAINSTAT* is not available, we delete the disability rates that are subject to the break from the data set (this occurs in Ireland (2005), France (2003-2008), Portugal (1995-1997) and UK (2005)). Hence, the disability rate variable should be interpreted with caution, although Eurostat confirms that there is no other option to construct disability rates.

[20] In LFS: $WSTATOR = 1,2$, $STAPRO = 3$ and $FTPT = 2$.

[21] In LFS: $WSTATOR = 1,2$, $STAPRO = 1,2$ and $NA11s = 1,2$.

main activity is in paid-employment), unpaid family workers, outworkers and people in self-sufficiency (Eurostat, 2014).[22] However, issues regarding the cross-country comparability of self-employment arise with regard to the question whether to treat incorporated enterprises as self-employment or not (OECD, 2005). Given our set of countries, this comparability issue is small and unlikely to affect the results since only Norway considers the incorporated self-employed to be in paid-employment. We exclude self-employment in agriculture because self-employment is traditionally high in the agricultural sector (Parker, 2004; Torrini, 2005) while agricultural self-employment is unlikely to function as a bridge between full-time work and full labor market withdrawal.

The self-employment rate is measured as a percentage of total employment between the age of 55 and 64, which is the convention in the literature (e.g. Robson (2003), Chen et al. (2013)). The part-time employment rate is measured as part-time employment as a percentage of the total of paid-employment. For part-time employment this implies a percentage of total paid-employment for whom the identifying variables are non-missing. For self-employment this implies a percentage of the total of paid- and self-employment for whom the identifying variables are non-missing.

3.2 Descriptive statistics

Table 1 shows the activity rates of men and women for 15 European countries between 1995 and 2008. For persons aged 25-54, activity rates are generally higher than the activity rates of persons aged 55-64. Furthermore, the table also indicates that the activity rates of persons aged 55-64 have increased over time. Table 2 presents the developments in early retirement among men and women (based on the information from Table 1). Among men, labor market withdrawal is the highest in France and Belgium. In 2008 for example, the activity rate among French men between 55 and 64 years old was 54.9 percent lower than the activity rate among the men between 25 and 54. For women, labor market withdrawal was the highest in Belgium. Across the board, labor market withdrawal between 55 and 64 is more prevalent among women then among men, except for Finland in 2008. Between 1995 and 2008, early retirement declined across all countries. Only among Danish men and Greek women, early retirement increased substantially. The decline was the sharpest in the Netherlands, both among men and women.

The disability, unemployment, self-employment and part-time employment rates for the population between 55 and 64 are presented in Figure 1.[23] The disability rate is especially high in Nordic countries and the Netherlands (about 15-20 percent on average), while disability rates are only decreasing in Finland and the Netherlands. The other Nordic countries seem to have high and persistent disability

[22] This standardized definition of self-employment is also used by the OECD for cross-country comparisons (OECD, 2005).

[23] Disability-, self-employment- and part-time employment rates for Germany are only available from 2002 as the LFS micro data is unavailable before 2002 due to an improvement in the survey method.

Table 1: Activity rates of workers aged 25-54 and 55-64

	Men						Women					
	Activity rate 25-54			Activity rate 55-64			Activity rate 25-54			Activity rate 55-64		
	1995	2008	Change	1995	2008	Change	1995	2008	Change	1995	2008	Change
Austria	93.6	93.0	-0.6	44.0	52.8	8.8	73.1	81.5	8.4	18.7	31.6	12.9
Belgium	92.3	92.3	0.0	34.9	44.4	10.5	67.7	79.0	11.3	13.5	27.9	14.4
Denmark	92.1	93.3	1.1	70.3	66.9	-3.4	83.0	86.4	3.4	40.2	53.0	12.8
Finland	90.8	91.2	0.4	44.6	60.6	16.0	84.4	85.7	1.3	41.4	58.8	17.4
France	95.2	94.4	0.8	36.5	42.6	6.1	77.5	83.4	5.9	27.5	37.6	10.1
Germany	93.1	93.5	0.4	54.4	67.2	13.8	73.3	80.5	7.2	31.5	50.5	19.0
Greece	94.6	94.4	-0.2	61.8	60.9	-0.9	55.2	69.4	14.2	24.7	28.6	3.9
Ireland	90.9	91.3	0.4	64.5	68.6	4.1	54.6	71.8	17.2	20.2	42.2	22.0
Italy	90.4	91.0	0.6	46.4	47.0	0.6	53.4	65.2	11.8	14.1	24.7	10.6
Netherlands	92.4	94.5	2.1	41.1	65.9	24.8	66.0	82.5	16.5	19.0	43.5	24.5
Norway	91.2	91.3	0.1	72.3	75.0	2.7	83.4	85.5	2.1	59.4	64.7	5.3
Portugal	93.5	93.2	-0.3	63.1	63.0	-0.1	73.4	82.9	9.5	33.9	46.6	12.7
Spain	91.7	92.6	0.9	54.0	65.1	11.1	52.6	74.7	22.1	18.5	34.2	15.7
Sweden	90.4	93.1	2.7	68.6	76.5	7.9	86.8	87.6	0.8	61.9	69.0	7.1
UK	92.7	91.7	-1.0	62.4	69.9	7.5	74.1	78.7	4.6	40.7	50.2	9.5
Mean	92.3	92.7	-0.6	54.6	61.8	7.2	70.6	79.7	9.1	31.0	44.2	13.2

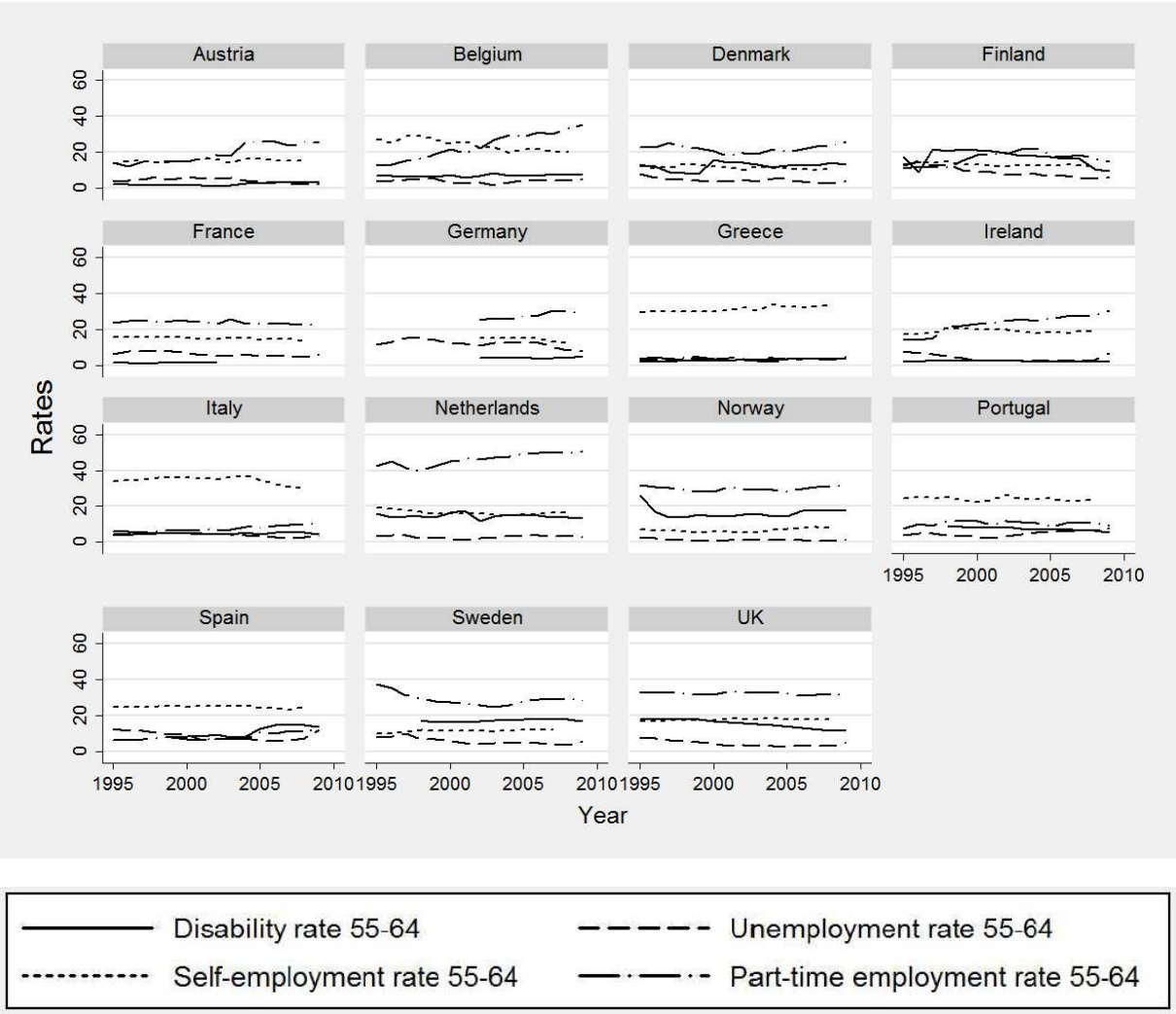
Source: Own calculations based on Eurostat (2014). The first available year for Norway is 2000.

Table 2: Labor market withdrawal of workers aged 55-64 relative to workers aged 25-54

	Men			Women		
	1995	2008	Change	1995	2008	Change
Austria	53.0	43.2	-9.8	74.4	61.2	-13.2
Belgium	62.2	51.9	-10.3	80.1	64.7	-15.4
Denmark	23.7	29.3	5.6	51.6	38.7	-12.9
Finland	50.9	33.6	-17.3	51.0	31.6	-19.4
France	61.7	54.9	-6.8	64.5	54.8	-9.8
Germany	41.6	28.1	-13.4	57.0	37.3	-19.8
Greece	34.7	35.5	0.8	55.3	58.8	3.5
Ireland	29.0	24.9	-4.2	63.0	41.2	-21.8
Italy	48.7	48.4	-0.3	73.6	62.1	-11.5
Netherlands	55.5	30.3	-25.3	71.2	47.3	-23.9
Norway	20.7	18.6	-2.1	28.8	23.7	-4.1
Portugal	32.5	32.4	-0.1	53.8	43.8	-10.0
Spain	41.1	29.7	-11.4	64.8	54.2	-10.6
Sweden	24.1	17.8	-6.3	28.7	21.2	-7.5
UK	32.7	23.7	-9.0	45.1	35.8	-9.3
Mean	40.8	34.2	-6.6	57.5	45.1	-12.4

Source: Own calculations based on Eurostat (2014). The first available year for Norway is 2000.

Figure 1: Disability-, unemployment-, self-employment- and part-time employment rates of persons aged 55-64 over time.



Source: Own calculations based on Eurostat (2014).

rates among 55 to 64 year olds. On the other hand, the unemployment rates are, on average, rather low in these countries (except for Finland) compared to the relatively high unemployment rates in Germany (about 12 percent), Spain (about 9 percent). Moreover, unemployment rates also vary within countries over time.

Self-employment rates are rather stable over time in most countries although Greece, Norway, Sweden and the UK show a slightly increasing trend in self-employment among the 55-64 population over time. Only Belgium and Italy show marked decreases in self-employment. Interestingly, self-employment rates are relatively high in the Southern European countries and in Ireland while, simultaneously, these countries show relatively low rates of disability and unemployment. This may suggest that self-employment is a reaction to a lack of alternatives at old-age.[24]

Part-time employment has been traditionally relatively low in most Southern European countries, although the part-time employment rates have been rising in virtually all countries as shown in the figures. Also in countries with relatively high initial rates of part-time employment, such as Germany and the Netherlands, part-time employment increased between 1995 and 2008. These developments suggest that the decline in early retirement as observed in Table 2 might be related to the increase in part-time employment.

Below, we employ regression analyses to examine such relationships in more detail. Unfortunately, not all instruments are available for all countries. Implicit tax rates on self-employment and social assistance benefits replacement rates are unavailable for Germany and Greece respectively.

4 Results reduced form retirement model

As mentioned in Section 2.4, 3SLS regression may be preferred to IV-GMM regression if homoskedasticity of the error terms and a covariance structure among the error terms is present. A Breusch-Pagan LM Test, an LR Test and a Wald Test indicate that heteroskedasticity is present in the model.[25] Therefore, using a two-step IV-GMM estimator is preferred.

Validity of the instruments is tested using the Hansen's J-statistic.[26] Relevance of the instruments is tested using an F-test in the first-stage regressions.[27] To test the robustness of the results to possibly

[24] This is also more or less suggested by Been & Knoef (2013).

[25] P-value = 0.000 for all three tests implemented with the Stata program written by Shehata (2011). This applies to separate analyses of both men and women.

[26] P-values of the Hansen's J-statistic are reported in the regression tables and show that the instruments are valid in all baseline regressions.

[27] The F-tests of our first-stage regressions in the baseline model (Model 2 in Table 3 and Table 4) reject the null-hypothesis of non-relevance of the instruments at 1%, 5% and 1% level for part-time employment, self-employment and unemployment respectively. The F-tests indicate that the set of instruments is relevant for these endogenous variables in the baseline specification. Regarding disability, we cannot reject the null-hypothesis. However, if we add interactions between two institutional variables, as in Model 4 and 5, the null-hypothesis can be rejected. T-tests indicate that the relevance of a single instrument may

weak instruments, we apply a Fuller-k estimator. The results (not reported here) show that the main conclusions are robust to the Fuller-k estimator.[28]

In all estimations, we use HAC-corrected standard errors, correcting for both heteroskedasticity and autocorrelation which are generally present in macroeconomic retirement indicators (Ebbinghaus, 2006).[29] Based on the results of the Wooldridge (2002) test for autocorrelation in panel data, we reject the null-hypothesis of no first-order autocorrelation (p-value = 0.000).

Table 3 and Table 4 show the estimation results for men and women respectively. A regular fixed-effects regression is used in Model 1. This model indicates that the disability-, unemployment- and self-employment rate increase early retirement while part-time employment decreases early retirement. However, as these variables are endogenous, estimation results are biased and we should use instrumental variables to infer correct relationships.

Model 2 uses the IV-GMM approach proposed in this paper and indicates that a higher unemployment rate among persons aged 55-64 increases the percentage change in activity rates from 25-54 to 55-64, e.g. more people enter early retirement.[30] This applies to both men and women. More specifically, we find that a 1 percentage point increase in the unemployment rate increases early retirement by about 1.6 and 2.5 percentage point among men and women respectively.[31] We do not find significant effects of the disability rate, which may be related to the difficulties of constructing the variable as mentioned in Section 3. Model 3 therefore uses a different series of disability rates.[32] Results are nevertheless robust.

Self-employment is not found to have a significant effect on activity at older ages. Regarding the part-time employment rate, we find that a 1 percentage point increase in the part-time employment rate decreases early retirement by 1.7 percentage points among men. Among women, we do not find such a relationship between part-time employment and early retirement in Model 2. Models 3, 4, 5, 7, 10 and 11 do find this relationship between part-time employment and early retirement among women. The effect is generally smaller among women than among men which may be explained by the different

differ between the instrumented variables DI, UI, SE and PT, but they are included as we tend to keep the set of instruments the same in all first-stage regressions.

[28]The unknown parameter of the Fuller-k estimator is set equal to 4 following Hahn et al. (2004).

[29]Estimations are corrected for autocorrelation by using a Bartlett kernel function with a bandwidth of 2. A common choice for the bandwidth is $T^{1/3}$ with T the time-dimension (Baum et al., 2007). In our case, T has a minimum of 7 and a maximum of 14.

[30]Estimated coefficients of the first-stage regressions that are significantly different from zero are in line with the expected signs.

[31]This is slightly higher than the 0.6-0.9 percentage points found in the preferred model by Blondal & Scarpetta (1998) and lower than the 1.2-9 percentage points found in the preferred model by Duval (2003). Please note that their dependent variable also differs. Duval (2003) uses a similar approach as we do, but employs smaller age-groups in activity rates. Blondal & Scarpetta (1998) only take into account the participation rate of 55-64 year olds.

[32]These disability rates are solely based on the variable *WSTATOR*, *SEEKWORK* and *SEEKREAS* in the LFS micro data without imputing results from the variable *MAINSTAT* and deleting possibly false rates due to breaks in the data.

purposes part-time employment has for men and women over the life-cycle. Part-time employment as gradual retirement mechanism is likely to be more important among men than among women (Peracchi & Welch, 1994).

Please note that estimated coefficients larger than 1.0 do not necessarily reflect an extra effect upon direct labor supply effects as not all variables use the same denominator. Activity rates , unemployment rates and disability rates use the total labor force as denominator, self-employment rates the total of employment and part-time employment rates the total of people in paid-employment. Next to that, the dependent variable is a relative indicator indicating the percentage change in activity of 55-64 year olds compared to 25-54 year olds.

Subsequently, we examine the robustness of the results with respect to different specifications. In Model 4 and 5, we add interactions between the instruments as additional instruments since institutions can interact in their impact on macroeconomic outcomes (Belot & Van Ours, 2004). Results are largely robust except that part-time employment now seems to decrease early retirement among women similar to men. Model 6 indicates that this effect can be primarily attributed to voluntary part-time employment measured as the share of total part-time employment that is part-time employed because of other reasons than that the person could not find a full-time job.[33] So, we define involuntary part-time employment as a consequence of labor demand. A 1 percentage point higher share of voluntary part-time employment decreases early retirement by about 2 and 1.3 percentage point among men and women respectively. These results suggest that people participate longer in the labor force when they can voluntarily choose for a reduction of their working hours. Without the option of part-time employment, more persons would exit the labor market rather than working full-time. Involuntary part-time employment does not lead to less early retirement, because these persons prefer a full-time job per definition. Hence, it is likely that these persons in involuntary part-time employment do not use part-time employment as partial retirement mechanism and prefer continue working (full-time) instead of retiring early.

Model 7 includes the state pension eligible age as an additional exogenous variable. This additional explanatory variable may correct for the precariousness of sustained labor force participation at older ages due to the graying population and the reforms undertaken to improve the sustainability of the pension system. The pension eligible age does not seem to affect early retirement and earlier results regarding unemployment and part-time employment are robust. The insignificance of the state pension eligible age may be explained by the fact that this variable does not vary much within countries over time (see also Blake & Sangnier (2011)). Most of the variation in the variable comes from cross-country

[33] Whether a person works part-time because the persons could not find a full-time job is based on the variable $FTPTREAS$ in the LFS micro data.

variation. If Model 2 is performed on a subsample of countries that have a state pension eligible age that is 65 or above,[34] results of Model 2 are robust for men (not reported here). Significant effects are lost when this is done for women as a consequence of a large drop in observations (not reported here), e.g. many countries have a state pension eligible age for women that is below 65.[35] Blake & Sangnier (2011) did find significant effects of the state pension eligible age on activity rates among older persons. However, they found the effect to be negative among persons aged 55-59 and to be positive among persons aged 60-64. In our case of looking at the aggregate of persons aged 55-64, these effects may cancel out.

Model 8 and 9 include an indicator for the implicit tax rate on continued work at older ages as explanatory variables of early retirement. Model 8 includes the implicit tax rate for the 55+ population and model 9 for the 60+ population. Both indicators are included as approximations of incentives to work at older ages. The implicit tax rate on continued work is an approximation of the importance of official early retirement schemes (Blake & Sangnier, 2011). The implicit tax rate on continued work gives an indication of the marginal benefits of continued working, e.g. the marginal costs of retiring early. Although this concept is different from replacement rates for early retirement, Duval (2003) argues that cross-country differences in implicit tax rates on continued work are good indicators of cross-country differences in the level of generosity of early retirement. Unfortunately, data on implicit tax rates on continued work are highly unbalanced. Therefore, we use an alternative indicator as suggested by Duval (2003).[36]

We construct an indicator of the implicit tax on continued work that is equal to 0 if the implicit tax rate is in the first quartile[37] of the cross-country and time distribution of implicit tax rates. Similarly, the indicator equals 1 if the tax rate is in the second or third quartile and 2 if the tax rate is in the fourth quartile. Unlike Johnson (2000) (0.6-1.7 percentage points), Duval (2003) (0.6-1.7 percentage points) and Blake & Sangnier (2011) (no effect among 55-59 year old persons and 0-0.7 percentage points among persons aged 60-64) we do not find significant effects of the implicit tax rate on continued work. A possible explanation for not finding significant effects of the implicit tax rate on continued work is that the marginal costs of retiring may already be implicitly defined by the alternative labor market options relative to full-time employment. Nevertheless, we still observe that a higher part-time employment rate

[34] Austria, Belgium, Denmark, Finland, Germany, Greece (from 1999), Ireland, Italy (from 2002), Netherlands, Norway, Portugal, Spain, Sweden, and the UK have a state pension eligible age of 65 or above.

[35] Only Denmark, Finland, Germany, Ireland, Netherlands, Norway, Portugal (from 1999), Spain and Sweden have a female state pension eligible age of 65 or more.

[36] Duval (2003) makes a difference between countries with a low, medium and high level of implicit tax rates on continued work and constructs an indicator that is equal to 0, 1 or 2 respectively.

[37] The first quartile of the 55+ (60+) indicator stops at an implicit tax rate of 21.40 (20.3). The fourth quartile begins at an implicit tax rate of 58.2 (74.2). The distribution has a mean and median of 40.9 (47.4) and 44.1 (35.58) respectively. The lowest value in the distribution is 2.80 (-0.15). The highest value is 101.4 (105.1).

decreases early retirement among men. For women, the results of Model 8 and 9 are similar to Model 2. A more practical explanation for not finding an effect of the implicit tax on continued work is the loss of heterogeneity because of constructing the aforementioned indicator. If we would use the original data from Duval, our regressions would end up having only 39 observations. However, specifying a simple fixed-effects model with HAC-corrected standard errors and the implicit tax rate on continued work as the only explanatory variable does show that a higher implicit tax rate on continued work increases early retirement significantly (based on 89 observations).

Model 10 shows the results of the IV-GMM estimation with a different set of instruments. Whereas the previous estimations are based on a set of instruments that include labor market institutions only, Model 10 presents estimation results with a set of instruments that consists of both the labor market institutions and the first lag of the endogenous variables. Also this model indicates that unemployment increases early retirement, part-time employment decreases early retirement and self-employment does not decrease early retirement (no effect among men and a positive effect among women).

Finally, Model 11 presents the estimation results for a specification in which the compensation and reintegration policies of disability insurance are taken into account in the first-stage as these indicators seem to partially explain cross-country differences in disability rates (OECD, 2009). Based on the underlying data of Figures 4.7 and 4.8 presented in OECD (2009), we constructed time-varying indices of compensation and integration policies regarding disability insurance.[38] The main conclusions do not alter by including these instruments that are highly likely to be valid.[39]

So far, we have assumed that the endogenous independent variables can be explained by structural labor market institutions. However, unemployment can also be explained by cyclical effects (Nickell et al., 2005). To account for such cyclical effects, we use labor demand shocks[40] as an additional instrumental variable as well. The results (not reported here) are highly robust to the inclusion of this cyclical instrument.

[38] For an explanation of these indices we refer to Annex 4.A2 in OECD (2009).

[39] The C-statistic confirms that we can assume these indices as well as the DI spending to be exogenous with p-value=0.224 and p-value=0.274 respectively (orthogonality is tested subsequently).

[40] Following Nickell et al. (2005) labor demand shocks are modeled by including the estimated residual ($\hat{\varepsilon}_\tau$) of the following equation as a variable in the first-stage regressions:

$$ER_\tau = \theta_0 + LCG_\tau\theta_1 + RGDPG_\tau\theta_2 + \varepsilon_\tau \tag{9}$$

Where *ER* is the employment rate for people aged 15-64, *LCG* is the growth of labor costs and *RGDPG* is the growth of real GDP. The equation is estimated separately for each of our 13 countries using OLS with Newey-West standard errors to correct for autocorrelation. The results of our baseline specification are robust for different assumed lags of autocorrelation in the labor demand shock equation.

Table 3: Regression results of labor market withdrawal, men 55-64[a]

	Model 1[b]	Model 2	Model 3[c]	Model 4[d]	Model 5[e]	Model 6	Model 7	Model 8	Model 9	Model 10[f]	Model 11[g]
Disability rate 55-64	0.38**	-1.48	-0.08	-0.37	0.16	-2.15	-0.96	-1.54	-2.04	0.23	-0.34
	(0.15)	(2.32)	(1.17)	(0.70)	(0.59)	(3.18)	(1.63)	(2.70)	(2.81)	(0.41)	(0.63)
Unemployment rate 55-64	0.89***	1.61*	2.71**	1.59***	1.51***	1.32	1.33**	1.41	2.00**	1.41***	1.63***
	(0.20)	(0.87)	(1.20)	(0.48)	(0.48)	(1.06)	(0.59)	(1.00)	(0.98)	(0.34)	(0.50)
Self-employment rate 55-64	0.55**	-1.92	-2.19	0.18	-0.53	-2.44	-0.76	-2.34	-2.00	-0.45	0.22
	(0.22)	(1.81)	(1.91)	(0.99)	(1.04)	(2.26)	(1.21)	(2.19)	(2.15)	(0.57)	(1.32)
Part-time employment rate 55-64	-0.44***	-1.70**	-1.92**	-0.91***	-0.79**		-1.25**	-1.69**	-1.68**	-0.82***	-0.92**
	(0.12)	(0.80)	(0.88)	(0.34)	(0.35)		(0.51)	(0.83)	(0.85)	(0.21)	(0.39)
Voluntary part-time employment rate 55-64						-1.96*					
						(1.06)					
State pension eligible age							0.75				
							(3.46)				
Implicit tax rate on continued work 55+ (indicator)								2.00			
								(3.06)			
Implicit tax rate on continued work 60+ (indicator)									4.89		
									(3.89)		
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N x T)	177	144	156	144	144	143	144	144	144	132	122
Hansen's J statistic (p-value reported)[h]	n.a.	0.83	0.85	0.25	0.26	0.83	0.55	0.79	0.68	0.48	0.29

[a] HAC standard errors using Bartlett kernel bandwith=2 to correct for autocorrelation in parentheses. * Significant at the .10 level; ** at the .05 level; *** at the .01 level using t-statistics. Countries included: Austria, Belgium, Denmark, Finland, France, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and the United Kingdom. Germany, Greece and Luxembourg have one or more empty variables. All first-stage regressions include the instruments: UI benefits replacement rate, EPL_{diff}, Implicit tax rate on self-employment, ALMP spending, DI spending, and SA benefits replacement rate.

[b] Model 1 is a regular FE model assuming exogeneity of the regressors.

[c] Model 3 uses DI rates solely based on the micro variables WSTATOR, SEEKWORK and SEEKREAS.

[d] Model 4 additionally includes the interaction between UI benefits replacement rate and EPL_{diff} and the interaction between the implicit tax rate on self-employment and EPL_{diff}.

[e] Model 5 additionally includes the interaction between the implicit tax rate on self-employment and EPL_{diff} and the interaction between the implicit tax rate on self-employment and EPL_{diff}.

[f] Model 10 additionally includes the first lag of the endogenous variables as instruments.

[g] Model 11 additionally includes the DI compensation and integration indices of OECD (2009) as instruments. Indices are unavailable for France and Italy.

[h] Hansen's J statistic H0: valid instruments.

Table 4: Regression results of labor market withdrawal, women 55-64[a]

	Model 1[b]	Model 2	Model 3[c]	Model 4[d]	Model 5[e]	Model 6	Model 7	Model 8	Model 9	Model 10[f]	Model 11[g]
Disability rate 55-64	0.41**	0.76	-0.62	-0.35	0.21	-0.31	3.66	0.91	0.80	0.23	-0.60
	(0.19)	(1.71)	(0.76)	(0.94)	(0.77)	(1.57)	(2.91)	(2.40)	(2.19)	(0.43)	(0.80)
Unemployment rate 55-64	1.43***	2.49***	3.31***	2.43***	2.35***	2.35***	2.13**	2.50**	2.61***	1.55***	2.61***
	(0.24)	(0.89)	(0.77)	(0.54)	(0.54)	(0.69)	(1.50)	(1.19)	(0.98)	0.42	(0.62)
Self-employment rate 55-64	0.74***	0.77	0.30	0.83	1.47	0.62	3.79	0.68	0.70	1.11*	1.84
	(0.22)	(1.44)	(1.19)	(0.90)	(1.00)	(1.17)	(3.71)	(1.76)	(1.68)	(0.62)	(1.45)
Part-time employment rate 55-64	-0.71***	-0.93	-1.54**	-1.15***	-0.81***		-0.44**	-0.92	-0.84	-0.78***	-1.03**
	(0.14)	(0.65)	(0.70)	(0.34)	(0.30)		(0.96)	(0.73)	(0.73)	(0.25)	(0.44)
Voluntary part-time employment rate 55-64						-1.30**					
						(0.61)					
State pension eligible age							2.60				
							(2.39)				
Implicit tax rate on continued work 55+ (indicator)								0.20			
								(4.07)			
Implicit tax rate on continued work 60+ (indicator)									1.64		
									(2.90)		
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N x T)	177	144	156	144	144	143	144	144	144	132	122
Hansen's J statistic (p-value reported)[h]	n.a.	0.31	0.22	0.37	0.28	0.26	0.80	0.36	0.30	0.11	0.13

[a] HAC standard errors using Bartlett kernel bandwith=2 to correct for autocorrelation in parentheses. * Significant at the .10 level; ** at the .05 level; *** at the .01 level using t-statistics. Countries included: Austria, Belgium, Denmark, Finland, France, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and the United Kingdom. Germany, Greece and Luxembourg have one or more empty variables. All first-stage regressions include the instruments: UI benefits replacement rate, EPL_{diff}, Implicit tax rate on self-employment, ALMP spending, DI spending, and SA benefits replacement rate.

[b] Model 1 is a regular FE model assuming exogeneity of the regressors.

[c] Model 3 uses DI rates solely based on the micro variables WSTATOR, SEEKWORK and SEEKREAS.

[d] Model 4 also includes the interaction between UI benefits replacement rate and EPL_{diff} and the interaction between the implicit tax rate on self-employment and EPL_{diff}.

[e] Model 5 also includes the interaction between the implicit tax rate on self-employment and EPL_{diff} and the interaction between the implicit tax rate on self-employment and EPL_{diff}.

[f] Model 10 additionally includes the first lag of the endogenous variables as instruments.

[g] Model 11 additionally includes the DI compensation and integration indices of OECD (2009) as instruments. Indices are unavailable for France and Italy.

[h] Hansen's J statistic H0: valid instruments.

5 Sensitivity of the dependent variable

Section 4 showed that early retirement is increased by higher rates of unemployment and decreased by higher rates of part-time employment. We do not find effects for the disability rate. Self-employment rates are largely insignificant implying that the self-employment rate does not decrease early retirement. The current section provides evidence on the robustness of the results to the use of variations on the measure of labor market withdrawal.

5.1 Employment rates

Firstly, we compare the results of Model 2 using activity rates (similar to Blondal & Scarpetta (1998), Johnson (2000), Duval (2003) and Blake & Sangnier (2011)) to a model that identifies retirement from employment rates (as suggested by Ebbinghaus (2006)). Mentioned earlier in the paper, using activity rates (including employment and unemployment) assumes that unemployment is not considered to be early retirement while using employment rates assumes that unemployment is similar to non-participation at older ages. Table 5 shows that the results are robust for the use of either employment- or inactivity rates in the proposed retirement indicator, although the effect of part-time employment is more pronounced among women now.

5.2 Age-windows

Secondly, we analyze the robustness of the estimation results by using retirement indicators that are disaggregated to smaller age-spans. Table 6 and Table 7 show the results of the disaggregated retirement indicators for men and women respectively. For both men and women, the estimation results of Model 2 in Table 3 and Table 4, which is Model 1 in Table 6 and Table 7, show similar patterns: disability rates are insignificant, unemployment is positive and significant, self-employment is insignificant and part-time employment is negative and significant in most cases.

For men, the magnitude of the coefficients indicates that the effect of unemployment on early retirement is the largest for the 60-64 year olds (Model 3 and Model 6). Regarding part-time employment, we observe that the effects on early retirement are the largest for the total group of men aged 55-64. Nevertheless, patterns vary only marginally between Model 1-6.

Among women, we find similar results: unemployment rate effects seem to be larger for the group of women aged 60-64. Comparing participation of women aged 55-64 and 55-59 to the group of 25-54 did not result in finding significant effects of part-time employment. However, comparing women aged 55-64, 55-59 and 60-64 to a smaller basis (e.g. 50-54, 50-54 and 55-59 respectively) indicates that part-time employment does decrease early retirement significantly.

Table 5: Retirement indicator based on employment rates[a]

	Men	Women
Disability rate 55-64	-0.94	1.69
	(1.88)	(2.54)
Unemployment rate 55-64	2.24***	2.90***
	(0.77)	(0.87)
Self-employment rate 55-64	-1.18	-0.99
	(1.83)	(2.39)
Part-time employment rate 55-64	-1.51**	-1.45**
	(0.59)	(0.70)
Fixed effects	Yes	Yes
Observations (N x T)	149	149
Hansen's J statistic (p-value reported)[b]	0.56	0.41

[a] HAC standard errors using Bartlett kernel bandwith=2 to correct for autocorrelation in parentheses. * Significant at the .10 level; ** at the .05 level; *** at the .01 level using t-statistics. Countries included: Austria, Belgium, Denmark, Finland, France, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and the United Kingdom. Germany, Greece and Luxembourg have one or more empty variables. All first-stage regressions includes the instruments: UI benefits replacement rate, EPL_{diff}, Implicit tax rate on self-employment, ALMP spending, DI spending, and SA benefits replacement rate.

[b] Hansen's J statistic H0: valid instruments.

Table 6: Sensitivity of the results to smaller age windows for the dependent variable, men[a]

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	55-64 to 25-54	55-59 to 25-54	60-64 to 25-54	55-64 to 50-54	55-59 to 50-54	60-64 to 55-59
Disability rate 55-64	-1.48	-0.66	-0.57	-2.78	-0.98	-1.18
	(2.32)	(2.19)	(2.16)	(3.24)	(2.01)	(1.86)
Unemployment rate 55-64	1.61*	1.48**	3.19***	1.72	1.84**	2.55**
	(0.87)	(0.74)	(0.97)	(1.30)	(0.85)	(1.00)
Self-employment rate 55-64	-1.92	-1.45	-2.31	-3.22	-1.58	-2.36
	(1.81)	(1.84)	(2.01)	(2.65)	(2.08)	(1.79)
Part-time employment rate 55-64	-1.70**	-1.57**	-1.72*	-1.99*	-1.48**	-1.52**
	(0.80)	(0.73)	(0.64)	(1.11)	(0.67)	(0.61)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N x T)	144	144	149	144	149	149
Hansen's J statistic (p-value reported)[b]	0.83	0.69	0.59	0.86	0.41	0.55

[a] HAC standard errors using Bartlett kernel bandwith=2 to correct for autocorrelation in parentheses. * Significant at the .10 level; ** at the .05 level; *** at the .01 level using t-statistics. Countries included: Austria, Belgium, Denmark, Finland, France, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and the United Kingdom. Germany, Greece and Luxembourg have one or more empty variables. All first-stage regressions include the instruments: UI benefits replacement rate, EPL_{diff}, Implicit tax rate on self-employment, ALMP spending, DI spending, and SA benefits replacement rate.

[b] Hansen's J statistic H0: valid instruments.

Table 7: Sensitivity of the results to smaller age windows for the dependent variable, women[a]

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	55-64 to 25-54	55-59 to 25-54	60-64 to 25-54	55-64 to 50-54	55-59 to 50-54	60-64 to 55-59
Disability rate 55-64	0.76	1.33	1.53	-1.14	0.77	0.12
	(1.71)	(2.42)	(2.28)	(1.78)	(2.57)	(1.71)
Unemployment rate 55-64	2.49***	1.91	3.89***	2.18***	2.04**	2.77**
	(0.88)	(1.23)	(0.91)	(0.68)	(0.81)	(1.07)
Self-employment rate 55-64	0.77	1.51	-1.97	-0.98	-1.53	-2.32
	(1.44)	(1.89)	(2.25)	(1.46)	(2.26)	(2.02)
Part-time employment rate 55-64	-0.93	-1.12	-1.25**	-1.32**	-1.42**	-1.13**
	(0.65)	(0.84)	(0.63)	(0.54)	(0.64)	(0.52)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N x T)	144	144	149	144	149	149
Hansen's J statistic (p-value reported)[b]	0.31	0.33	0.65	0.36	0.30	0.48

[a] HAC standard errors using Bartlett kernel bandwith=2 to correct for autocorrelation in parentheses. * Significant at the .10 level; ** at the .05 level; *** at the .01 level using t-statistics. Countries included: Austria, Belgium, Denmark, Finland, France, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and the United Kingdom. Germany, Greece and Luxembourg have one or more empty variables. All first-stage regressions include the instruments: UI benefits replacement rate, EPL_{diff}, Implicit tax rate on self-employment, ALMP spending, DI spending, and SA benefits replacement rate.

[b] Hansen's J statistic H0: valid instruments.

5.3 Hours decisions

The estimation results so far suggest that part-time employment reduces early retirement and this seems to be mainly driven by voluntary part-time employment. This would suggest that inducing part-time employment by partial retirement programs increases labor force participation at older ages. However, such partial retirement programs are only efficient if it induces people to work part-time who would otherwise have fully retired. Such programs are inefficient if it induces people to work part-time who would have worked full-time in absence of partial retirement possibilities.

Results in micro studies are ambiguous with respect to the efficiency of part-time retirement options. Support for a positive effect of part-time retirement on hours worked is found by Wadensjo (2006) (using Swedish data), Kapteyn et al. (2007) (using Dutch data) and Kantarci & Van Soest (2008) (using Dutch data). Allen et al. (2001) (using US data) and Ilmakunnas & Ilmakunnas (2006) (using Finnish data) find negative effects on hours.

To address this issue, we construct a macro variable indicating the average actual hours worked by persons aged 55-64. This macro variable measures the number of hours actually worked during the reference week in the main job.[41] Table 8 presents the cross-country trends in hours worked among persons aged 55-64 and shows that the average number of hours worked among the total of men is substantially higher than among women in most countries. On the other hand, the growth in the actual hours worked has increased more substantially among women. Greece, Ireland, Portugal and Norway even have a decreasing trend in working hours among men and an increasing trend among women.

The largest increases in average hours worked for both men and women can be found in Finland and the Netherlands with increases of more than five hours on average. As depicted in Figure 1, these countries also showed relatively strong increases in part-time employment in the period 1995-2008. To test the effect of part-time employment on labor supply decisions at the intensive margin, we use the same analytical framework as in the case of labor supply effects at the extensive margin. Instead of using the retirement indicator based on activity rates, we now use the average actual hours worked as a dependent variable in the regression analysis.

The estimation results indicate that an increase in the unemployment rate of one percentage point decreases the average hours worked by about 0.5 hours among men and 0.6 hours among women. More interestingly, the estimation results show that a higher part-time employment rate not only increases the labor supply of older workers at the extensive margin but that part-time employment does not decrease the average number of hours worked either. A one percentage point higher part-time employment rate increases the average actual number of hours worked by about 0.4 hours among men. The effect is

[41] This variable is based on the *HWACTUAL* variable included in the LFS micro data.

smaller, or even absent, among women, but the results indicate that part-time employment possibilities do not have a negative effect on the total labor supply at older ages.

Table 8: Average number of hours worked, 55-64

	Men			Women		
	1995	2008	Change	1995	2008	Change
Austria	16.0	19.0	3.0	6.0	8.2	2.2
Belgium	12.7	14.6	1.9	3.9	6.6	2.7
Denmark	21.6	22.0	0.4	9.4	14.2	4.8
Finland	9.9	16.8	6.9	9.6	15.2	5.6
France	13.1	13.9	0.8	7.6	9.7	2.1
Germany	18.9	22.6	3.6	8.5	11.7	3.2
Greece	25.7	24.5	-1.2	8.9	9.7	0.8
Ireland	26.0	25.5	-0.5	5.7	10.6	4.9
Italy	17.0	16.7	-0.3	4.6	7.0	2.4
Netherlands	14.1	19.7	5.6	3.4	9.0	5.6
Norway	26.0	23.2	-2.8	14.6	15.8	1.2
Portugal	24.4	21.5	-2.9	12.0	13.4	1.4
Spain	18.4	21.6	3.2	6.0	8.7	2.7
Sweden	20.2	23.7	3.5	15.1	18.1	3.0
UK	20.7	23.5	2.8	9.0	11.9	2.9
Mean	19.0	20.6	1.6	8.3	11.3	3.0

Source: Own calculations based on Eurostat (2014). The first available year for Germany is 2002.

Table 9: Labor supply effects at the intensive margin, 55-64[a]

	Men			Women		
	Model 1	Model 2[b]	Model 3[c]	Model 1	Model 2[b]	Model 3[c]
Disability rate 55-64	0.44	0.36	-0.37	-0.57	-0.02	-0.15
	(0.57)	(0.41)	(0.37)	(0.69)	(0.24)	(0.26)
Unemployment rate 55-64	-0.50*	-0.47**	-0.58***	-0.70***	-0.59***	-0.63***
	(0.29)	(0.21)	(0.19)	(0.24)	(0.14)	(0.14)
Self-employment rate 55-64	0.67	0.35	0.75	0.34	-0.08	0.08
	(0.64)	(0.37)	(0.62)	(0.67)	(0.21)	(0.40)
Part-time employment rate 55-64	0.47**	0.30**	0.38*	0.30	0.22***	0.26**
	(0.20)	(0.12)	(0.20)	(0.20)	(0.08)	(0.13)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N x T)	149	149	149	149	149	149
Hansen's J statistic (p-value reported)[d]	0.87	0.24	0.51	0.38	0.45	0.40

[a] HAC standard errors using Bartlett kernel bandwith=2 to correct for autocorrelation in parentheses. * Significant at the .10 level; ** at the .05 level; *** at the .01 level using t-statistics. Countries included: Austria, Belgium, Denmark, Finland, France, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and the United Kingdom. Germany, Greece and Luxembourg have one or more empty variables. All first-stage regressions include the instruments: UI benefits replacement rate, EPL_{diff}, Implicit tax rate on self-employment, ALMP spending, DI spending, and SA benefits replacement rate.

[b] Model 2 also includes the interaction between UI benefits replacement rate and EPL_{diff} and the interaction between the implicit tax rate on self-employment and EPL_{diff}.

[c] Model 3 also includes the interaction between the implicit tax rate on self-employment and EPL_{diff} and the interaction between the implicit tax rate on self-employment and EPL_{diff}.

[d] Hansen's J statistic H0: valid instruments.

6 Summary and discussion

In many European countries, the labor market participation of older workers is considerably lower than the labor market participation of prime-age workers. However, this gap between older and prime-age workers declined considerably between 1995 and 2008. One of the factors that may have contributed to the decline in early labor market withdrawal is the rise of non-standard forms of employment among older workers. Since non-standard employment provides downwards flexibility in working hours, older workers with a relatively strong preference for leisure could use these forms of employment as a bridge between full-time employment and retirement. Moreover, non-standard employment may be chosen because of less generous social insurance programs that were often used as early retirement routes in the past. The existing empirical literature on the relationship between non-standard employment and labor market withdrawal consists of micro-level studies. To analyze the variation in early labor market withdrawal across 13 European countries, this study extends the models employed in macro-level retirement studies with non-standard employment in addition to social insurance schemes. We regress early labor market withdrawal on part-time employment, self-employment, unemployment and disability rates, instrumented by institutional variables.

Our analysis finds that for men, part-time employment is a substitute for full early labor market withdrawal. The results suggest that this is mainly because of the possibility to reduce working hours as we find that specifically voluntary part-time employment induces labor force participation at older ages. Among women, this effect of part-time employment on early retirement is smaller and somewhat more ambiguous. This might be due to the fact that part-time work plays a different role in the careers of men than in the careers of women. During their prime age, men work relatively more full-time than women, as women tend to combine the flexibility of part-time employment with raising children. Hence, men use part-time employment as a step in a gradual transition from full-time employment to retirement, whilst women do not work more in part-time at the end of their career than before (Peracchi & Welch, 1994).

With regard to self-employment, our results provide no evidence for substitution effects between self-employment among older workers and early retirement. Our finding that part-time employment may function as a substitute to early retirement, whilst self-employment does not, is in line with the findings of other studies on non-standard employment. Results from recent studies at the micro-level (Emmanoulidi & Kyriazidou, 2012; Been & Knoef, 2013) indicate that older workers primarily choose for self-employment as a way to end unemployment and much less as a way to reduce working hours in paid employment. In contrast, part-time employment among older workers usually follows after full-

time employment. In terms of the option value model, our findings suggest that the combination of leisure and consumption while working in part-time gives on average more utility to older workers than retiring early, whereas the combination of leisure and consumption while being self-employed does not. This difference may be owing to several factors. For instance, starting a new business requires a certain investment in terms of working hours, whilst the income is often uncertain.

Furthermore, we find complementary effects between unemployment rates and early retirement of both men and women. Unemployment among older workers contributes to early labor market withdrawal. In contrast, our results provide no evidence for complementary effects between disability rates and early retirement. However, this result should be taken with caution, because the data on the beneficiaries of disability benefits might be troublesome due to cross-country incomparability as well as breaks in the LFS data in some countries.

As a wider implication, our results suggest that facilitating part-time work might contribute to higher labor market participation among older workers at the extensive margin. However, facilitating part-time work could also induce a reduction in working hours among persons who would otherwise have remained working in full-time employment. Our analysis suggests that increases in part-time employment did not have negative effects on the labor supply at the intensive margin across countries. For men, the results even suggest clear positive effects. This indicates that part-time work schemes may actually increase the labor supply at both the extensive and the intensive margin at older ages.

A Descriptive statistics

Table 10: Dependent and independent variables (raw data)

Variable	Obs.	Mean	S.D.	Source
Dependent variables				
Activity rate 55-64 (males)	205	56.89	11.62	Eurostat (2014)
Activity rate 25-54 (males)	205	92.34	1.42	Eurostat (2014)
Activity rate 55-64 (females)	205	36.47	15.17	Eurostat (2014)
Activity rate 25-54 (females)	205	75.01	8.91	Eurostat (2014)
Average hours worked 55-64 (males)	203	19.76	4.31	Eurostat (2014)
Average hours worked 55-64 (females)	203	9.70	3.84	Eurostat (2014)
Endogenous independent variables				
Disability rate 55-65	183	9.53	6.17	Eurostat (2014) (own calculations)
Unemployment rate 55-64	210	5.39	3.12	Eurostat (2014)
Self-employment rate 55-64	202	18.90	7.65	Eurostat (2014) (own calculations)
Part-time employment rate 55-64	202	21.15	11.39	Eurostat (2014) (own calculations)
Voluntary part-time employment 55-64	201	20.47	11.16	Eurostat (2014) (own calculations)
Instrumental variables				
EPL_{diff}	210	0.12	1.24	OECD (2013a)
ALMP expenditure (% GDP)	210	0.90	0.48	OECD (2012b)
DI expenditure (p.c.)	210	880.02	485.32	OECD (2012b)
UI replacement rate	208	60.48	13.00	Van Vliet & Caminada (2012)
SA replacement rate	195	46.30	8.59	Wang & Van Vliet (2014)
Implicit tax rate on self-employment	174	15.76	6.20	Eurostat (2013)
DI compensation index	180	26.36	4.08	OECD (2009)
DI integration index	180	18.69	5.49	OECD (2009)
Additional control variables				
Statutory retirement age (males)	210	64.82	1.58	OECD (2012a)
Statutory retirement age (females)	210	63.23	2.89	OECD (2012a)
Implicit tax continued work (55+)	76	43.14	20.75	OECD (2013b)
Implicit tax continued work (60+)	76	52.49	30.44	OECD (2013b)

Table 11: Pairwise correlation coefficients of endogenous variables and instruments[a]

	DI rate 55-64	UI rate 55-64	SE rate 55-64	PT rate 55-64
EPL_{diff}	0.19	0.10	-0.41	0.44
	(0.01)	(0.13)	(0.00)	(0.00)
ALMP expenditure	0.33	0.23	-0.50	0.44
	(0.00)	(0.00)	(0.00)	(0.00)
DI expenditure	0.70	-0.13	-0.77	0.63
	(0.00)	(0.05)	(0.00)	(0.00)
UI replacement rate	0.28	0.15	-0.43	0.25
	(0.00)	(0.03)	(0.00)	(0.00)
SA replacement rate	0.06	-0.36	0.03	0.00
	(0.42)	(0.00)	(0.69)	(0.95)
Implicit tax rate on self-employment	0.37	0.00	-0.35	0.08
	(0.00)	(0.98)	(0.00)	(0.28)
DI compensation index	0.52	0.04	-0.49	-0.08
	(0.00)	(0.60)	(0.00)	(0.30)
DI integration index	0.43	0.00	-0.78	0.46
	(0.00)	(0.95)	(0.00)	(0.00)

[a] P-value in parentheses.

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